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Small-Area Estimates in Local Governance

Use of small-area estimates in local governance in the development of service-delivery and resource-allocation mechanisms.

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Abstract

The existing decision-making processes informing local resource-allocation mechanisms across Scotland tend to utilise historic or most recent data on life outcomes and deprivation without placing sufficient emphasis on the predictive capacity of the historic time series data. This thesis provides an analysis of spatio-temporal patterns in levels of out-of-work benefits claimant rates in relation to macroeconomic events. It aims to inform resource-allocation and service-delivery mechanisms across Scottish local authorities. The research addresses the utilisation of publicly available neighbourhood-level data sets focusing on evaluating the efficiency of local service-delivery mechanisms across Scotland. Additionally, the thesis considers the importance of spatially aggregated life outcome indicators, service user and expenditure data in the context of informing the development of non-uniform service-delivery mechanisms. The work also addresses methodological and operational issues concerned with the utilisation of small-area data across Scotland in relation to small-area deprivation and local governance.

Lay Summary

Local government across Scotland and internationally have a keen interest in reducing inequality and addressing the needs of deprived communities. Identification of communities that would benefit most from targeted interventions and additional support is challenging due to the data limitations and complex nature of the issues impacting deprived communities across Scotland. Using historic neighbourhood-level data on quarterly rates of Jobseeker's Allowance recipients, the work identifies persistently poor localities across Scotland and assess the impact of the wider economy on deprived communities. The findings are useful in the context of informing local service-delivery mechanisms.

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Chapter 1 – Literature Review

Summary:

The following chapter summarises the relevant literature underpinning the research undertaken and guiding the choice of research question. The chapter commences with a discussion of the philosophical principles concerned with definitions of space and place and progresses to a more detailed analysis of the definition of neighbourhood. The chapter subsequently focuses on how the notion of the neighbourhood is utilised in modern local governance. The focus is subsequently directed at the limitations of the current literature and the existing potential areas of research. The chapter also addresses the relevance of the problem researched to local governance in Scotland.

1.1 Introduction

The main purpose of this chapter is to establish the theoretical framework for the utilisation of spatially aggregated life outcome indicators across local government. The chapter addresses the limitations of the existing literature; it introduces and subsequently evaluates the relevant theoretical and empirical literature concerned with aspects of multilevel governance and the use of small-area data in developing and informing resource-allocation and service-delivery mechanisms. In particular, the literature review outlines the role of performance indicators in the accountability of local governmental structures. The focus is directed at the implementation of spatially aggregated life outcome data in improving performance and informing decision-making systems across local governments in Scotland and internationally.

The chapter also assesses the academic theories and empirical evidence concerned with the use of spatially aggregated life outcome indicators in local governance across Scotland and internationally. In particular, the following literature review is concerned with the analysis of theoretical and policy developments pertaining to the use of small-area estimates in local governance. The focus is directed at the existing examples of utilising small-area data across Scottish local authorities.

In the context of this work, spatially aggregated life outcome data is defined as publicly available neighbourhood-level life outcome indicators. These indicators are constructed using data derived from a variety of administrative systems, such as the Department for Work and Pensions (DWP) or National Health Service (NHS) data. The data points are then aggregated up to the data-zone level, reflecting rates, totals and averages. Subsequent references to aggregated life outcome indicators in effect pertain to publicly available data zone-level data. The concept is discussed in detail in Section 2.2 on the research process.

1.1.1 Scope and Structure

The literature review commences with a discussion of governance and efficiency, focusing on the implementation of efficiency in local governance. The next section addresses the key theoretical principles embodied in the existing governance frameworks across the developed world and establishes a theoretical basis for the ensuing analysis. The section briefly discusses the nature of governance, as well as basic theoretical concepts concerned with the notion of local governance. The distinction between the key forms of the administrative arrangements utilised in this review follows the taxonomy initially proposed by Pollitt and Bouckaert (2011). The taxonomy differentiates between New Public Management, neo-Weberian state, networks, governance and new governance (Pollitt and Bouckaert, 2011).

Drawing on theoretical developments by Frederickson (2007), Lynn (2012) and Robichau (2011), the chapter describes the existing challenges pertaining to the definition of governance. It also refers to the earlier work of Samuelson (1955, 1954), Tiebout (1961, 1956) and Musgrave (1971, 1959) in relation to the notion of the public good. It also reflects on the work of more recent theorists like Watt (2006) and Geuss (2001) with respect to the notion of local public goods in relation to modern governance.

The chapter then focuses on the definition of efficiency as implemented within local government structures across the developed world. Following theoretical developments by Le Grand (1991), the next section briefly introduces the notion of efficiency as understood in modern economic literature. Drawing on empirical work by Behn (2003) and Greiling (2005), the chapter focuses on the role played by performance measures in local governance. In particular, the focus is directed at the relevant theoretical developments surrounding the idea of multilevel governance. The next section moves to a more detailed analysis of the relevant theoretical developments concerned with local governance mechanisms and fiscal decentralisation. In particular, the section draws on the principal writings by Oates (2008, 2005), Tiebout (1961, 1956) and Prud'homme (1995) on the nature of fiscal decentralisation with respect to local governance.

1.2 Notion of Governance

In a discussion of the role of the state in human society, Oppenheimer (1914, p. 12) argues that humans can satisfy their desires by 'work and robbery, one's own labour and the forcible appropriation of the labour of others'. Oppenheimer (1914, p. xxvii) further asserts that the state is 'the basic principle of bourgeois sociology' that manifests itself at the nexus of political and governmental arrangements (Abrams, 1988; Mitchell, 2009). Following Oppenheimer (1914), Abrams (1988) notes that the academic study of the state that attempts to analyse the state as a separate entity is conceptually problematic. Abrams (1988) further notes that the state should be analysed as a nexus of contracts and arrangements, a structure that is manifested in a broad array of political activities.

Jordan et al. (2005) observe that the need to conduct more empirical research on governance is reflected across an increasing volume of relevant publications through a number of social science disciplines. The increasing popularity of the term is mirrored across an increasing number of academic publications that utilise the concept (Hewitt de Alcántara, 1998). Robichau (2011) additionally suggests that the relative popularity of the subject across academic literature can be partially explained by the flexibility of the term.

The word *governance* has a Greek etymology. It originates from the word *kybernan*, which means to direct, steer or pilot a ship (Bell and Hindmoor, 2009; Harper, 9AD). The notion of governance has been used across a multitude of contexts, including the governance of the family in the Elizabethan age and corporate governance in current business literature (Bell and Hindmoor, 2009). Hughes (2009, p. 88) combines the lexical and operational definitions of governance into one definition 'where governance is about running organisations, about steering as in the original derivation, how to organise, and how to set procedures for an organisation to be run'. The ensuing parts of this chapter attempt to differentiate between several key definitions of governance.

In a discussion of the concept of governance, Frederickson (2007, p. 289) points out that 'the concept is imprecise, woolly, and, when applied, so broad that virtually any meaning can be attached to it'. Along similar lines, Lynn (2012, p. 2) asserts that governance 'has become shapeless, a portmanteau accommodating numerous meanings that are often imprecise, inconsistent, or contradictory'. Consequently, any discussion that attempts to introduce a precise definition of governance is burdened with a significant degree of ambiguity and arbitrariness. The practical illustration pertaining to the problematic nature of the definition of governance was provided by Bevir (2009), who outlines approximately 50 different key concepts pertaining to the notion of governance.

In a broad definition of governance, Rhodes (1997, p. 53) proposes that 'governance refers to self-organising, inter-organisational networks'. In relation to service-delivery mechanisms, Rhodes (1996, 1997) specifies that the state ceases to be the major political actor. He argues that the current service-delivery mechanisms rely on networks of actors that are made of public and private partnerships. This literature review follows this argument and focuses on governance understood as the totality of activities pertaining to the aspects of policy development and shaping, not as the nature of specific institutions (Porsche-Ludwig, 2010).

The idea is based on a view of the increasing influence of societal actors on governance. In this context, a governmental institution is defined by its internal capacity to make decisions and external capacity to enforce them (Stoker, 1998). In the context of this reasoning, governance is defined as a totality of structures that includes interest groups and non-governmental organisations responsible for policy delivery. Furthermore, recent academic literature proposes that it is feasible for governance to be delivered without the existence of a government. Rhodes's (1996) hypothesis is that the reduction in the capacity of the British state to deliver services and the ensuing reliance on inter-organisational networks diminished the role of government in governance.

Empirical support for the existence of government-like organisations outside formal government structures comes from research focusing on destabilised regions (Boege et al., 2009; Menkhaus, 2007). Menkhaus (2007, p. 78) provides examples of a 'mediated state[s]' where de facto governance is delivered in the course of a continuous mediation with local power brokers. For instance, in Somalia, governance is realised in the course of maintaining and building relationships with local intermediaries (Menkhaus, 2007). This concept, which is also considered to be strongly rooted in the European and North American political traditions, is pronounced by the proliferation of partnerships between public and private enterprises (Geddes, 2005).

The variety of definitions of governance is reflected in the number of approaches used to describe forms of managerial and governmental arrangements that currently exist. Pollitt and Bouckaert (2011) distinguish between major models of performance improvement across the public sector and identify five broad categories:

New Public Management – The key assumption of this governance model reflects the idea of making government institutions more efficient and consumer-responsive through the implementation of business-like managerial practices. The New Public Management approach assumes the development of coordination mechanisms with the use of business-like key performance indicators and targets.

The New Public Management approach to governance is implemented through the decentralisation of management and focuses on introducing systematic approaches to quality measurement (Greve and Jaspersen, 1999). This is usually reflected in the introduction of performance-related pay scales, as well as encouraging involvement from service users (ibid.). Analysis of past and existing implementation strategies points to a business-like approach to performance management. For example, Reichard (2003) notes that the German *Kommunale Gemeinschaftsstelle* (an association of municipalities concerned with the restructuring of the public sector) implemented New Public Management according to four fundamental principles:

- i. Implementation of a product-oriented approach and reframing all local services as products
- ii. Arranging the service-delivery model around multi-departmental structures and shared responsibility
- iii. Adoption of output-based budgeting relying on performance indicators
- iv. Introduction of target-based contracts between the top management and units responsible for service delivery

Neo-Weberian State – The key assumptions of this model focus on the modernisation of the state to make governance more professional, efficient and responsive to the needs of

citizens. The model acknowledges input from business-like managerial solutions but only in a secondary character. The state remains a distinctive actor with its own rules, methods and culture. The coordination mechanism reflects the imposition of authority and a hierarchy consisting of impartial officials.

Networks – this model assumes improving the functioning of government structures through the establishment of self-organising networks instead of hierarchical market mechanisms. The coordination mechanism is delivered through a network of independent stakeholders. The network method of governance is defined as a ‘persistent and structured set of independent firms (as well as non-profit agencies) engaged in creating products or services based on implicit and open-ended contracts to adapt to environmental contingencies’ (Jones et al., 1997, p. 914). In the context of a network approach to governance, performance is expressed through the nexus of relationships between the elements of the network. An outcome is defined as the ability to adapt to change in the surrounding circumstances (Huberman and Hogg, 1995; Jones et al., 1997). Consequently, the model assumes that a well-performing network is defined by swift interaction of its elements and the ability to adjust quickly to changing circumstances.

Governance – Governance is intricately linked to the *networks* model discussed earlier. The approach aims to deliver greater effectiveness by shifting the emphasis from vertical to horizontal controls. Governance focuses on delivering a more participatory relationship between the government and a wide range of social actors with respect to policy and implementation. The governance approach also highlights shifting emphasis from statute law to more flexible forms of regulation and implementation. Governance assumes passing authority onto task-specific institutions operating on sub- or supra-national levels.

New Public Governance – this model assumes the improving quality of governance through the incorporation of neo-corporatist values (Osborne, 2006). The administration mechanism is delivered with the use of relational contracts and interdependent agents. The implementation of the *New Public Governance* is embodied in the form of a network that blends corporate and public elements to facilitate the introduction of neo-corporatist values into public sector management frameworks (O’Toole et al., 2010).

In a related discussion of the nature of governance, Stoker (1998, p. 17) argues that within Anglo-American political theory, the word *governance* is usually associated with the existence ‘of formal institutions of the state and their monopoly of legitimate coercive power’. Stoker (1998) further hypothesises that modern governance usually:

- a) Refers to a set of institutions and actors that are drawn from but also beyond government.
- b) Identifies the blurring of boundaries and responsibilities for tackling social and economic issues.
- c) Identifies the power dependence involved in the relationships between institutions involved in collective action.
- d) Is about an autonomous self-governing network of actors.
- e) Recognises the capacity to get things done which does not rest on the power of government to command or use its authority.

The academic literature concerned with modern governance suggests that the proliferation of the term across policy and grey literature¹ is often concerned with the need to answer to increasing budgetary cuts and develop service-delivery frameworks that would place less of a burden on public finances (Griffith, 1993; Moynihan, 2005). In this context, governance is synonymous with the development of service-delivery mechanisms that frequently have less significant resources and budgetary requirements than the previous service-delivery mechanisms (Stoker, 1998).

On the example of analysing changes to environmental policy instruments implemented across a selected sample of industrial states and the European Union, Jordan et al. (2005) postulate that modern governance tends to rely on a collaboration of state and non-governmental organisations. To systematically compare and analyse the development of new policy mechanisms, the authors analyse governmental arrangements where non-state actors play a key role in the development of service-delivery mechanisms. The authors further emphasise that there was no transfer of traditional policies to new governance arrangements and that legislation remains one of the key instruments responsible for policy delivery (Jordan et al., 2005). A number of developed democracies have moved to design environmental policies limiting the role of the state and entrusting key elements of delivery to non-state actors (Jordan et al., 2005).

Empirical support for the diversification of governance arrangements across the developed world is provided by the outlook for the initiatives that were introduced after the financial crisis in 2008. Peters et al. (2011) point to the increased pressure to return to centralisation across the UK and Finland as a response to the financial crisis. Centralisation

¹ Grey literature is to be understood here as informally published written material.

has been used as a mechanism to fast-track decision-making. Faster decision-making was of relevance in dealing with external partners such as the IMF and the European Commission, whose political role increased during the aftermath of the financial crisis (Peters et al., 2011).

Increasing centralisation was not the only change that took place after the 2008 financial crisis. The approach taken by the Slovenian government focused on developing a complex network of committees to ensure consensus within government (Peters et al., 2011). A significant change in governance models and approaches can be observed across citizen coproduction and e-governance, which includes utilisation of social media and new technologies. Linders (2012) points to the revival in citizen coproduction taking place as a result of the increasing availability and popularity of social media, improved web connectivity and government efforts to increase participation of community and volunteer organisations.

In an analysis concerned with the regulatory change taking place in the aftermath of the 2008 financial crisis, Ohler (2010) indicates that the notion of objective budgetary stability was introduced into financial legislation across a number of financial systems. For instance, the UK Banking Act 2009 introduced a reference to financial stability within its first objective that that applied to distressed Banks (*Banking Act, 2009*; Ohler, 2010).

Comparable examples exist across relevant international legislation. For instance, the Finanzmarktstabilisierungsgesetz (*Financial Market Stability Law*) explicitly defined a set of procedures aimed at safeguarding the stability of the German banking system (Ohler, 2010). Baker (2010) and Tsingou (2010) hypothesise that the observed change in legislation can be interpreted as an attempt to restrain the influence of the private sector on the regulatory landscape. In particular, Baker (2010, p. 648) assumes that the 2008 financial crisis was to a significant degree caused by regulatory capture – a process that he defines in the following manner:

[r]egulatory capture occurs when bureaucrats, regulators and politicians cease to serve some notion of a wider collective public interest and begin to systematically favour specific vested interests, usually the very interests they were supposed to regulate and restrain for the wider public interest.

Analogous developments took place in the UK. In 2010 HM Treasury (2010, p. 5) noted that:

[t]he Coalition Government inherited one of the most challenging fiscal positions in the world. Last year, Britain's deficit was the largest in its peacetime history – the state borrowed one pound for every four it spent. The UK currently spends £43 billion on debt interest, which is more than it spends on schools in England.

Significant budget cuts imposed on UK local governments contributed to the proliferation of governance arrangements across the British local public sector (Lowndes and Pratchett, 2012). The analysis of funding cuts undertaken by Lowndes and Squires (2001) across English local authorities provides evidence of the impact of budgetary cuts on governance models.

As an example of changes taking place in England, Lowndes and Wilson (2001) propose that the formation of the Sheffield Executive Board (SEB) was motivated by the budgetary cuts. The ambition behind the creation of SEB was to provide collaborative leadership for the city. Consequently, SEB, which is chaired by the leader of the city council, includes members from health, transport, police, higher and further education, as well as representatives from the third sector and faith communities (Lowndes and Squires, 2012).

The perceived loss of legitimacy and diffusion of traditional structures of accountability opened up a discussion about the meritocratic and ethical base for the implementation of alternative governance arrangements across the public sector (Mayston, 1993; Rhodes, 1997). Research concerned with the nature of the transformation that occurred after the 2008 financial crisis focuses on the increasing perception of governments' decreased legitimacy (Peters and Pierre, 1998). Peters and Pierre (1998, p. 225) speculate that '[t]he loss of legitimacy is in part because state actors are excessively clumsy, bureaucratic, and path-dependent and in part because of the control of information and implementation structures by private actors. It appears that whatever the State does it does poorly, while the private sector (for-profit and not for profit) is more effective.'

1.2.1 Efficiency in Local Governance

Understanding the broader notion of efficiency and how the concept, and its origins in business, can be translated into introducing greater efficiency across local authorities, is relevant to understanding the wider implications of the research question. The notion of efficiency in governance is often discussed in the context of its relationship to merit and local public goods (Brennan and Lomasky, 1983; Elsner, 2004; Williams, 1966).

The practical difficulties concerning the imprecise definition of a public good were known before Samuelson's seminal work, discussed below (Burdick, 1911; Simon and Ridley, 1938). In the analysis concerned with the challenges pertaining to the implementation of workload-based budgeting in New York City in the late 1920s, Simon and Ridley note (1938, p. 3) that '[b]efore we can evaluate the work of the city fire department, we must decide just what the function of a fire department is. And we shall shortly see that this task of defining objectives constitutes one of the most difficult tasks in the whole field of measurement.'

On the other hand, Malkin and Wildavsky (1991) dispute the existence of public goods as a separate entity and assert that the idea of public goods is socially constructed. Samuelson's (1958) subsequent deliberations concerning the pricing of public goods similarly recognised inconsistencies across the existing definitions of public goods. Samuelson (1958) points to the need for a more comprehensive definition of public goods that would address not only their peculiar economic characteristics but also provide the necessary components to be aligned with developments in governance.

The ideological ramifications underpinning recent changes across local governments in the developed world are motivated by the ambition to achieve greater efficiency in the delivery of public services (Bovaird and Löffler, 2002; Wise, 2002). The potential to increase operational efficiency was often named as the main reason for the privatisation of local services (Warner, 2010). A discussion on the implementation aspects of efficiency in local government should define the concepts of efficiency and public goods. Additionally, analysis of localised service-delivery mechanisms requires a clear definition of the conception of the local public good.

The theoretical ramifications of public goods draw on the ideas of *merit wants* and *social value* (Buchanan, 1960; Howell-Moroney, 2008). In a significant work concerned with the nature of social values, Schumpeter (1909) argues that social wants are de facto individual wants with values shared by the majority of society. Schumpeter (1909) proposes that society assigns values to certain things, simultaneously altering the individualistic perception of the utility of goods. In a discussion of the notion of social value, Schumpeter (1909, p. 214) notes that '[n]obody values bread according to the quantity of it which is to be found in his country or in the world, but everybody measures the utility of it according to the amount that he has himself.' The idea of social value influenced subsequent theoretical developments concerned with the introduction of the notion of merit goods and merit wants into the public discourse (Sandmo, 1983).

The concept of merit goods was proposed by Richard Musgrave (1971, 1959). Musgrave defines merit goods as positive externalities that are accessible to all members of society in a uniform manner. In a discussion of the normative relationship between conceptions of social wants and merit wants, McLure (1968), drawing on the writings of Musgrave (1959, 1939) and Head (1966), hypothesises that the notion of social wants corresponds with the idea of merit goods on a normative level. By this line of reasoning, provisions of social housing or immunisation programmes can be defined as merit goods.

In this context, policy interventions are explained on the grounds of the right of the informed group to impose their views on their fellow citizens and the market-derived reality of consumer choice that often differs from the idealised conception of consumer sovereignty (Brennan and Lomasky, 1983; Head, 1969, 1966). Contrary to social wants, merit wants do not have to be satisfied in line with the public's demands (D'Amico, 2009). To understand the relationship between social wants and the role played by local government institutions in catering for those needs, it is necessary to reflect on the idea of social choice as well as collective good and implementation of those concepts in governmental activities.

Writings by Franz Oppenheimer (1914) and later theories by Watt (2006, p. 8) assert that local governments are in effect practical solutions with the purpose of delivering local public goods. Local governance is thus seen as a mechanism required to respond to the variability of local needs. As stated by Oates (1972, p. 35),

[f]or a public good – the consumption of which is defined over geographical subsets of the total population [and for which there are no cost advantages to central provision] – it will always be more efficient (or at least as efficient) for local government to provide the [locally preferred] levels of output for their respective jurisdictions than for the central government to provide any specified and uniform level of output across all jurisdictions.

By focusing on the needs of local communities, local governments deliver practical solutions that are more optimal in meeting the requirements of merit wants and total public goods (Helmsing, 2001; Shah, 2006).

This section outlined the broader notion of efficiency as it relates to governance. One of the key points derived from the analysis reflects the notion that increasing the efficiency of government bodies is more complicated than doing so in business entities, in which efficiency is mostly defined in the context of operational costs and capacity to derive income. In business, achieving gains in efficiency starts from understanding the context, gaining insights into the customer base and building intelligence relying on the data gained. For data-rich, profit-driven organisations, intelligence is frequently derived from granular customer-level data reflecting interactions with organisational communication and marketing channels. With the exception of the census and some data flowing through the technical systems of the welfare apparatus, local governments must rely on aggregate statistics. Looking at the data available across Scotland, this thesis argues that it is possible to improve the existing service-delivery mechanisms by capitalising on recent improvements to the available neighbourhood-level data.

1.2.2 Multilevel and Local Governance

In a comparative analysis focusing on the differences between accountability in the private and public sectors, Mulgan (2000) points out that the key difference in accountability for public and private sector bodies is concerned with generally more stringent accountability for public sector bodies, which focus on policy and process, whereas accountability for businesses is mostly concerned with cost efficiency. According to the neoclassical theory of authority, multilevel governance is the optimal response for achieving a balance between the benefits of centralisation and the costs associated with delivering comparable life outcomes across diverse territories (Marks and Hooghe, 2000).

The neoclassical theory focuses on the benefits of centralisation versus the desirability of imposing uniform policies across diverse populations. Decentralisation, which is recognised as one of the most prominent issues in recent political discourse, is considered crucial to the effective implementation of multilevel governance (Barankay and Lockwood, 2007). The benefits of decentralisation reflect the notion that the sheer proximity of responsible government officials to end users of services positively influences the accountability of local governmental structures (Ostrom, 1993).

The importance of decentralisation to effective governance was also recognised by the World Bank, which highlighted decentralisation as one of its key principles for undertaking governance reforms (Burki et al., 1999). The World Bank's research argues that clear cases for the decentralisation of education and health care, as well as road networks, can be made. The arguments in favour of decentralisation include gaining a better understanding of the needs expressed by local communities, as well as a more effective ability to engage local communities in resource-allocation and budgetary processes (Burki et al., 1999).

Despite being recognised as one of the key concepts in modern political discourse, the existing academic literature does not offer a universally acceptable definition of decentralisation (Dubois and Fattore, 2009). Broadly speaking, decentralisation can be defined as a process of 'devolving political, fiscal, and administrative powers to sub-national units of government' (Burki et al., 1999, p. 3). In terms of actual implementation, the approaches to decentralisation differ with respect to its content, affected entities and the nature of the process. In an empirical analysis concerned with the decentralisation processes, Dubois and Fattore (2009) distinguish between the key traits according to which it is possible to categorise processes of decentralisation. These characteristics are listed in Table 1-1 below.

Table 1-1 — Recognised features of decentralisation

Characteristic	Details
<i>Dynamics</i>	<ul style="list-style-type: none"> • <i>Dynamic</i> decentralisation is characterised as a process where decentralisation is embodied in the form of processes concerned with transferring responsibilities to different actors of multiple levels • <i>Static</i> decentralisation reflects legal perspectives where decentralisation is reflected in the emergence of legal entities that are assigned precise aspects of governance
<i>Content</i>	<ul style="list-style-type: none"> • <i>Power</i> – in the context of decentralisation, the effective ability of an entity to make decisions concerning the development of specific policies • <i>Formal authority</i> – in this context, the process of decentralisation is characterised by the transfer of the ‘right to decide’ to different actors • <i>Responsibility</i> – the process is usually embodied in formal tasking of sub-national entities with the delivery of programmes • <i>Functions</i> – this aspect of decentralisation reflects formal recognition of various functions across national and sub-national entities • <i>Resources</i> – the process is reflected in the implementation of budgetary arrangements that distribute sources of funding to sub-national entities
<i>Receiving entity</i>	<ul style="list-style-type: none"> • <i>Sub-national government</i> – in practical terms, the receiving entity of the decentralisation process is often a local government unit • <i>Larger number</i> – the process is characterised by the greater number of actors in existence compared to the central actor at the end of the decentralisation • <i>Periphery and autonomy</i> – this notion corresponds to the assumption that the receiving entities are equipped with a certain degree of autonomy compared to the power-sharing central entity • <i>Proximity to the individual</i> – the concept reflects the notion that the new institutions that receive power as a consequence of decentralisation are closer to the citizen

Adopted from: Dubois & Fattore (2009, p. 708)

The relevant policy literature hypothesises that decentralisation yields gains in efficiency compared with traditional centralised governance (Martinez-Vazquez and McNab,

2003). This thesis will further argue that the existing data offers scope for development of more agile resource-allocation models that would be better attuned to the needs of local communities than the existing processes. Before doing so, the thesis will outline the notion of efficiency as related to governance.

The fundamental work on the provisioning of public goods and, in particular, Tiebout's (1961) assertion on the spatial aspect of service delivery benefits are relevant to the ensuing analysis (Tiebout, 1961, 1956). Tiebout (1956) argues that the movement of citizens between jurisdictions is a prerequisite for the near-optimal provision of public goods and services. Tiebout (1961) hypothesises that delivery of public goods is marked by variability corresponding to the spatial heterogeneity of resources and preferences of communities and that benefits from some services accrue equally to all residents within the region, whereas some services accrue variable benefits across regions (Tiebout, 1961, 1956).

For instance, the army should, in principle, deliver an equal level of protection to all residents across the territory. On the contrary, a new hospital would benefit residents variably with respect to access to emergency hospital services depending on their respective locations and travel distances to the hospital unit. The potential effective implementations of the findings reflect Tiebout's (1956) assumptions about the spatial variability in benefits of service delivery and argue for targeted service delivery that would focus on addressing the vulnerabilities described.

Tiebout's (1956) argument reflects an assumption that the individual's choice of a municipality is influenced by variability in the provision of local goods. For instance, a young family may be willing to relocate to a municipality where expenditure on education is relatively high. Tiebout (1956) concludes his argument with the assertion that the likelihood of achieving the optimal provision of public goods increases with the number of distinct local entities and associated variability of public goods delivery.

Tiebout (1961) further suggests that in a hypothetical example assuming ideal uniformity of incomes across a nation of geographically equal size districts, inequalities in the extent to which residents receive public services would still exist. In his example, Tiebout (1961) uses police protection as an illustration where spillover effects would occur due to true transportation costs. Tiebout (1961, p. 96) concludes that '[t]o the extent that demands differ, a partial solution at the non-national level is offered through the mobility of people to communities when the patterns of service provided suits their tastes.'

Tiebout's (1956) seminal work received substantial criticism. For instance, Bewley (1981) points out that even under assumptions of perfect mobility of residents across the

regions and perfect access to information, Tiebout's public expenditure model would not be optimal. Bewley (1981) notes that Tiebout's work makes a number of unrealistic assumptions, such as the autarkic¹ nature of local governments with respect to the provision of public goods and the ability of local residents to organise themselves into perfectly homogenous communities.

Subsequent analysis of the validity of Tiebout's (1956) approach to equilibrium in public service delivery highlighted further shortcomings in the original model. In particular, lack of sufficient focus on the role of land prices in vertical mobility of population or on the impact of population sizes on the local provisioning of public goods are considered key shortcomings (Konishi, 1996; Westhoff, 1977). As pointed out by Oates (1981, p. 93), 'Tiebout assumed a world of footloose consumers, who move costlessly among local jurisdictions in response solely to fiscal considerations; the Tiebout household is unconstrained by travel costs to a location of employment or by any other nonfiscal ties to a given locality.'

As demonstrated across the following sections, the majority of local government activities taking place across the developed world are concerned with finding solutions to the unsolvable problem of providing all residents with an equal level of service, and to a degree, counteracting market deficiencies. When discussing the localised resource-allocation mechanism, it is necessary to emphasise that the local government structures are seldom faced with the totality of their financial decisions (Weingast, 2005). An example of the negative implications of this policy was observable in Argentina during the late 1980s and in Brazil during the 1990s where lack of financial accountability of sub-national governments resulted in national macroeconomic imbalances (Saiegh et al., 1999; Weingast, 2005).

The relevant policy literature recognises that decentralisation programmes implemented across developed countries are often applied as potential remedies to failed centralisation programmes (Oates, 2005). Oates (1972) hypothesised that fiscal decentralisation is beneficial to governmental structures, as it allows for the development of a service-delivery mechanism that is more responsive to local heterogeneous populations. Oates's (1972) argument utilises the practical implications of the *local public good* concept.

Having discussed the theoretical basis supporting the development of localised service-delivery mechanisms and decentralised governmental structures, the thesis focuses on the development of policy mechanisms used in the actual implementation. The later sections of this literature review additionally highlight the implications of measuring the

¹ In the context of goods production, Bewley (1981) defines an autarkic region as a region where goods production takes place entirely within that region without trade with other regions.

performance of local government structures, as well as difficulties surrounding the development of area-based service-delivery and resource-allocation mechanisms. The purpose of the ensuing analysis is to highlight patterns in the community characteristics that could be later utilised in deploying and informing local service-delivery mechanisms.

1.3 Space and Place

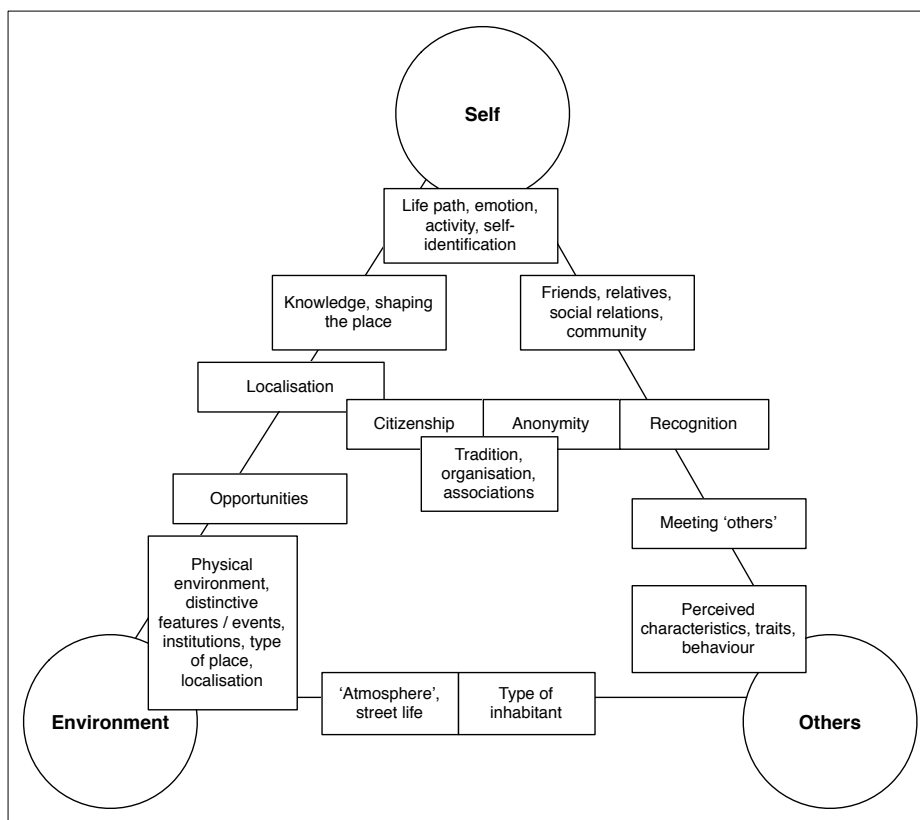
To describe the role of spatially aggregated data and how the concept is utilised across the developed world in relation to local governance, it is first necessary to establish the theoretical and philosophical frameworks within which the notion of space can be understood and introduced into decision-making processes.

As pointed out by Agnew (2011), the academic debate concerning the ontological difference between space and place can be traced back to the nineteenth century. The modern literature on human geography differentiates between the classical geometry approach to space and the sociological notion of place derived from the social significance of the phenomena (Kearns and Joseph, 1993). In this context, space is defined as a physical necessity for the existence of the human interactions that constitute the place (Agnew, 2011; Gesler, 1992). On the most basic level, space can be defined as 'a dimension within which matter is located or a grid within which substantive items are contained' (Agnew, 2011, p. 316), whereas place, according to Agnew (2011, p. 316), can be defined as 'a portion of space in which people dwell together'. On broadly similar lines, Gieryn (2000, p. 464) asserts that a place can be defined as a unique spot in the universe: '[p]lace is a distinction between here and there, and it is what allows people to appreciate near and far'. It is worth emphasising that the literature on the notion of space recognises that the very concept is often utilised inconsistently across numerous academic disciplines as well as in non-academic and political contexts (Massey, 1999).

The conceptualisation of space by Lefebvre (1991) focuses on its sociological significance and assumes the construction of a space derived from its social relevance to the nature of human relationships and interactions. In this context, space is seen as a continuously constructed phenomenon that emerges through the nexus of human contacts and interactions (Massey, 2005). Relph (1976) and Canter (1977) hypothesised that place is created as a function of actions, physical attributes and concepts. More precisely, Lefebvre (1991) defines space as a particular practice of which a 'logical system of relations' is symbolic (Aarseth, 2007, p. 163).

The philosophical developments in conceptualising the social aspects of space influenced methodological approaches to implementing the definition of space across modern geographical research (Buttimer, 1969). It is worth emphasising that the process has profound implications for technical aspects concerned with the development of small-area statistical repositories. The majority of the existing empirical literature concerned with the meaning of space is consistent with Lefebvre's (1991) definition. Gustafson (2001) hypothesises that the notion of place is derived from the categorisation of meanings that corresponds to the perceived characteristics of the environment, self and other; Gustafson's categorisation is summarised in Figure 1-1.

Figure 1-1 — Meanings of place in Gustafson's (2001) research



Adapted from Figure 1, Gustafson (2001, p. 10).

It has been further argued that recent advances in the field of computer science related to the development of cyberspace have introduced an additional dimension to the definition of space (Graham, 1998). On one side of this argument, it is argued that modern technology often negates the traditional understanding of space (Mitchell, 1996). On the other side,

academics like Sawhney (1996) hypothesise that making use of spatial metaphor is the only way to help us understand the concept of space.

On broadly similar lines, Merrifield (1993, p. 516) argues that the problem associated with differentiating space from place originates from the 'failure to engage with the ontological nature of place'. Drawing on the Lefebvre's (1991) framework, Merrifield (1993, p. 527) further asserts that it is possible to differentiate between 'different moments of space – i.e. phenomenological, perceptual and the material'. Consequently, the conceptual relationship between space and neighbourhood draws from both Euclidean and relational approaches to place and considers the practicalities of neighbourhood-level data in their applicability to local governance (Cummins et al., 2007). As the purpose of this work is to analyse the relevance of neighbourhood-level indicators in local governance, this distinction is of importance.

1.3.1 Neighbourhood

Owing to its importance in relation to predicting neighbourhood-level variability across life outcome patterns, the concept of the neighbourhood plays a pivotal role in local governance. The question of the notion of the neighbourhood re-emerges in social and geographical sciences. The broad consensus reflects the idea that a neighbourhood is defined as an organisational unit with distinguishable social and spatial characteristics (Galster, 1986; Hunter, 1979).

The initial work on the understanding of the neighbourhood was concerned with the importance of space in social interaction and the extent to which place exerts an influence on collective instead of individual perception (Galster, 1986). A more pragmatic approach to the definition of the neighbourhood was proposed by Galster (1986, p. 245), who suggests deriving the quantifiable concept of a neighbourhood from the aggregate perceptions of external space.

Galster (2001, p. 2111) advanced his concept further, defining the neighbourhood as a 'bundle of spatially based attributes associated with clusters of residences, sometimes in conjunction with other land uses'. According to Galster (2001, p. 2112), the commodity called 'neighbourhood' corresponds to the following set of characteristics:

- *Structural characteristics* – size and nature of residential buildings
- *Infrastructural characteristics* – shared features of roads, sidewalks
- *Demographic characteristics* – age distribution, family composition, as well as racial, ethnic and religious types
- *Class status characteristics* – shared characteristics, income, occupation, education

- *Tax/public service package* – characteristics corresponding to the localised quality of public service provisions, like schools, the efficiency of local administration, parks and recreation
- *Environmental characteristics* – shared characteristics concerned with the degree of pollution, topographic features
- *Proximity characteristics* – shared qualities of access to major destinations for employment, entertainment and shopping
- *Political characteristics* – the presence of local political networks.

Qualitative research concerned with the role of variance in perceptions of neighbourhoods across residents of different localities in London indicates that respondents define their neighbourhoods through a multitude of characteristics (Bowman, 2001). Some of the residents interviewed by Bowman (2001) define their neighbourhoods through sets of circumstances, such as the prevalence of crime, availability of employment opportunities or physical characteristics concerned with the quality of housing or presence of amenities. In a research study concerned with the perception of neighbourhood-level health across communities of local residents in Canada, Chappel and Funk (2004) find that, similarly to Bowman's (2001) earlier research, residents perceive the overall quality of their neighbourhoods through a multitude of factors mirroring physical characteristics, such as quality and availability of transport links, and also through sets of socioeconomic factors such as perceived levels of income.

Influential work by Putman (2000) emphasised the gradual downfall of community life in America. On similar lines, more recent research concerned with the nature of modern communities argues that traditional way of conceptualising communities as an aggregate of shared values and relationships may not be comprehensive enough to capture the nature of modern communities (Delanty, 2003). For instance, drawing on research concerned with gated communities in Australia, Kenna and Stevenson (2013, p. 422) argue that modern communities are currently defined through a network of shared governance arrangements and are 'something promised by developers and real estate agents but rarely experienced'.

In a life outcome-related sense, the neighbourhood is defined in the context of variability in magnitudes of relationships between space and life outcome patterns (Bernard et al., 2007). Drawing on Giddens' (1984) structuration theory, Bernard et al. (2007) hypothesise that the shared pattern of outcomes in the context of a neighbourhood emerges as a result of diversity in the availability of relevant resources. Accordingly, the authors aggregate resources into five domains: 'the physical, economic, institutional, local sociability, and community

organisation' (Bernard et al., 2007, p. 1839). Consequently, residents of areas characterised by elevated levels of unemployment will experience a lower rate of accessing educational or private resources. Furthermore, as hypothesised by Cummins et al. (2005), the residents of deprived neighbourhoods may be frequently exposed to factors that contribute negatively to health outcomes. The authors assert that there is a statistically significant relationship between neighbourhood deprivation and the presence of a McDonald's restaurant (Cummins et al., 2005).

The notion of the neighbourhood in the context of the diversity of demand has been present in social and political science since the early 1920s (Lee, 1968). From a local governance perspective, the neighbourhood is seen as a distinct community with shared needs, defined resources and potential for change, which, for instance, can be expressed in the form of social capital (Lowndes and Wilson, 2001). Kearns and Parkinson (2001, p. 2105) emphasise the need to develop policies that would meet people's residential expectations and experiences as a key to successful service delivery.

The importance of spatially aggregated life outcome indicators in the context of the overall well-being of residents was recognised by academics, who emphasised the role played by the locus in influencing the regional quality of life (Atkinson et al., 2012; Ballas, 2005). The ideological and rhetorical shift towards more responsive policy-making as well as an emphasis on local decision-making and local accountability have brought focus to the role played by place and local environment in contemporary governance (Atkinson et al., 2012). Modern poverty and inequality reduction policies frequently recognise the role of place as a determinant of personal well-being (Atkinson et al., 2012).

Empirical support for that shift in reasoning comes from the research on the role of space in relation to various aspects of well-being. For instance, in research concerned with the role of green space and well-being, Beck (2012, p. 36) notes that '[p]ublic green spaces have a proven track record in reducing the impact of deprivation by delivering better health and well-being and creating a strong community'. Research undertaken at the University of St Andrews and the University of Glasgow on the role of green space in relation to mortality indicated that health outcomes related to income deprivation in all-cause mortality and mortality from circulatory disease were lower in communities residing in the greenest areas (Mitchell and Popham, 2008).

The work of the World Health Organization (WHO, 2007) on creating age-friendly cities points to the presence of local amenities, social activities and services as factors contributing positively towards elderly mobility and consequently promoting the well-being of elderly

residents (Gilroy, 2012). It should, however, be noted that the role of the neighbourhood in impacting individual well-being is not uniformly accepted. Using data from the British Household Panel Survey and Census from the UK population, Ballas and Tranmer (2011) argue that regional differences in self-reported happiness are not statistically significant once people's characteristics are factored into the model.

In England, the increasing importance of neighbourhood in local governance is associated with the changes introduced by New Labour¹ (Durose, 2009). This approach was reflected in the implementation of the New Deal for Communities (NDC) programme, which sought to engage marginalised citizens and contribute to holistic neighbourhood renewal by focusing on simultaneously addressing social, political and economic issues (Wallace, 2010). The NDC is recognised as being one of the most intensive area-based initiatives; the programme involved 39 partnerships and focused on six outcomes: education, worklessness, health, housing, physical environment and community (Batty et al., 2010; Lawless, 2012).

The available evaluations of the NDC are broadly positive, indicating the positive impacts of the programme on the overall quality of life across the targeted neighbourhoods. Lawless (2012), drawing on research by Beatty et al. (2010), asserts that, to a degree, the programme delivered mutually reinforcing benefits across the six outcomes. Lawless (2012) further emphasises that investments in the quality of housing were related to positive change in the rates of unemployment and crime. Along similar lines, Stafford et al. (2014) in the course of the analysis of biannual repeated cross-sectional surveys collected for the NDC National Evaluation Team and Health Survey for England observed that areas targeted by NDC interventions experienced significant improvements in levels of educational attainment and self-reported health.

The implementation of the NDC had important implications for the technicalities surrounding the development of spatial performance indicators, as the demand was created by the necessity of developing mechanisms to facilitate the suitable location and evaluation of the area-based initiatives implemented. As shown in the following section, performance

¹ Researchers argue as to what extent neighbourhood-oriented policy initiatives were supported by the respective administrations. The general consensus is that policies introduced at the time of Tony Blair gave explicit focus to neighbourhood-focused initiatives emphasizing the need for greater equality in the provision of social services or in employability rates, whereas under Gordon Brown, the focus was directed at economic regeneration, with governmental interventions mostly focused on limiting the effects of the failure of market mechanisms; the focus was directed to a greater extent at the opportunity for people to meaningfully capitalise on market mechanisms (like increasing mobility and moving between neighbourhoods) than on facilitating a permanent change in government spending that would ensure more evenly distributed service provision (Lupton, 2013).

measurement is often a key challenge surrounding the implementation of performance mechanisms. The focus on spatial governance programmes introduces inherent difficulties.

1.4 Performance

The thesis, having discussed the theoretical basis for the utilisation of the concept of neighbourhood in local governance, focuses on the practical aspects of performance management across local governments. The literature on the subject recognises that the increasing impetus for the implementation of the performance models across local governments was often associated with a perceived lack of accountability of government structures.

Drawing on Friedman's (2002) argument, Loughlin (2009) notes in research concerned with the accountability of government structures in the UK and Scandinavia that suboptimal government performance can be partially ascribed to loss of autonomy experienced by local structures. In governance, the notion of performance is rooted in the idea of accountability.

As formulated by Smith (Smith, 1990, p. 53), the 'underlying principle is that those whose capital is used to finance an undertaking should be able to judge the performance of those who act on their behalf and should be able to exercise sanctions when necessary'. Researchers concerned with the subject further emphasise that the implementation of performance-based management is related to the changes to the traditional service-delivery models that are currently more often characteristic of public-private partnerships (Saliterer and Korac, 2013). Taking the example of federal job training programmes, Heinrich (2002) argues that the introduction of elaborate metrics supporting performance management was seen as a way of increasing public accountability by the programme administrators.

The counterarguments to Friedman's (2002) thesis come from the further analysis of factors impacting government efficiency. In an analysis concerned with the determinants of government efficiency, Haunter and Kyobe (2010) provide an overview of recent studies focusing on the role of covariate factors in explaining variability in government efficiency as well as the methodological shortcomings of the existing studies. Haunter and Kyobe (2010) make an initial argument that the conventional methods of measuring government efficiency rely on comparing levels of government expenditure to a range of socioeconomic indicators, like, for instance, achieved levels of educational attainment or mortality rates.

The existing methodological approaches usually tend to quantify government performance and efficiency as a function derived from a wide range of social, economic and

governance indicators such as mortality rates, GDP, levels of educational attainment or performance of countries' public administration (van de Walle, 2006).

Afonso et al. (2005) propose differentiating between public sector performance (PSP), understood as the outcome of public sector activities, and public sector efficiency (PSE), expressed as the outcome of public sector activities relative to the resources deployed. As proposed by Afonso et al. (2005), the common approach to quantifying government performance corresponds to:

Equation 1-1 — Public Sector Performance

$$PSP_i = \sum_{j=1}^n PSP_{ij}$$

Adapted from: Afonso et al. (2005, p. 322 Equation 1)

where

$$PSP_{ij} = f(I_k)$$

with i reflecting countries, j areas of governance and I certain socioeconomic indicators. Consistently, change in public sector efficiency will be expressed as Δ of the previously provided PSP indicator, reflecting the change in the life outcome and socioeconomic indicators utilised initially. The greater the positive effect of public expenditure on any of the selected sub-indicators, the greater will be the envisaged improvement in the PSP indicator (Afonso et al., 2005, p. 323).

Equation 1-2 — Change in Public Sector Performance

$$\Delta PSP_{ij} = \sum_{i=k}^n \frac{\partial f}{\partial I_k} \Delta I_k$$

The shortcomings associated with this approach are mostly concerned with the focus on the indicators utilised being too narrow. Haunter and Kyobe (2010) hypothesise that demographic factors such as high population density improve government efficiency with respect to education and healthcare provision. The related gain is achieved while reducing the unit cost of service delivery through economies of scale.

Recent research concerned with the effectiveness of public spending suggests that levels of expenditure in the public sector are partially explained by the quality of governance (Rajkumar and Swaroop, 2008). Arguably, the increasing focus on the quality of governance is associated with the increasing interest in the effectiveness of public spending (Hwang and Akdede, 2011). In the UK, the focus on the quality of public service was emphasised by John Major in the Citizen's Charter White Paper (Cabinet Office, 1991).

Before progressing to the discussion of the role of a focus on efficiency in shaping administrative governance arrangements, it is prudent to outline the definition of efficiency. The concept of effectiveness was transplanted to political science from economics and, as delineated by Le Grand (1991, p. 425), the conceptualisations of efficiency in modern research can be grouped into three broad categories:

- *X-efficiency* – ‘production of a commodity at the minimum possible cost in terms of the resources used’ or, more generally, outputs divided by inputs.
- According to the notion of *allocative efficiency*, the optimal efficiency of the system is achieved if it is ‘impossible to re-allocate resources in such a way as to make one or more persons better off without making someone else worse off.’
- The conception of *dynamic efficiency* is more ambiguous and mostly relates to the ability of the entity to innovate and consequently reduce costs further. In the context of a nation-state, *dynamic efficiency* is equivalent to the growth rate.

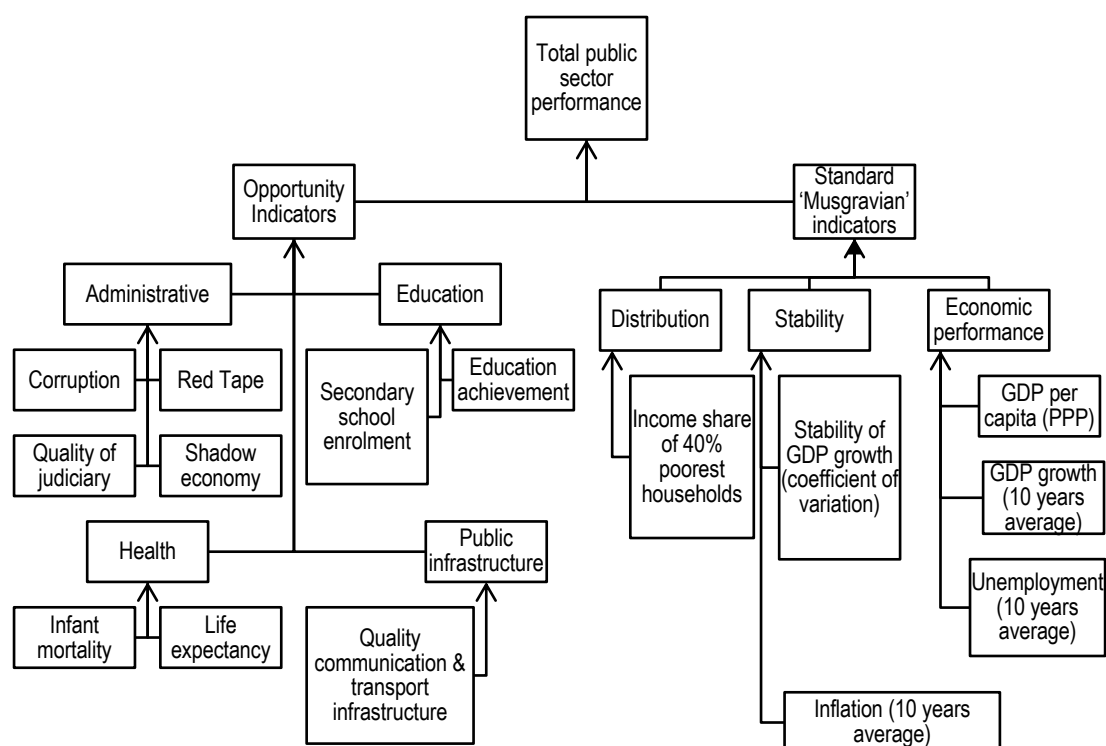
In general, the notion of performance reflects the operationalisation of differentials in efficiency between distinct entities. The common practical implementations of the notion of performance are derived from the incorporation of financial and operational indicators into performance management (Venkatraman and Ramanujam, 1986). Repeatedly, the performance indicators utilised also reflect non-financial indicators such as innovation speed or achieved market share, while financial indicators are traditionally expressed as a monetised activity cost.

Business-driven criteria, such as market share or the ability to launch new products, are not directly transferable to institutions in the public domain (Bovaird and Löffler, 2003, 2002; Löffler, 2001). For example, the market share of public bodies is shaped by the combination of external factors, such as macroeconomic conditions, legislation and the monetary base (Klijn and Teisman, 2003; Lowndes and Sullivan, 2004). Furthermore, public sector bodies are not able to compete in a traditional business-like manner and achieve different market shares. In a paper comparing management in the public and private sectors, Murray (1975) argued that, in historical terms, management techniques in the industry were developed in order to maximise economic efficiency, whereas public sector managerial techniques were used to address the criteria of consensus and compromise.

The criticism of the post-1945 Public Administration approach resulted in a range of models concerned with the evaluation of performance (Ostrom and Ostrom, 1971). Historically, traditional public administration theory postulated uniformity of principles of good governance across diverse systems and separation of government function from politics

(Wilson, 1887). Henkel (1991) observed that the proliferation of performance management techniques led to the creation of the evaluation state, in which managerial decisions are justified against supposedly objective performance indicators instead of political and democratic criteria. That observation is consistent with the more recent research by Kouzmin et al. (1999), who note that the adoption of various performance management and benchmarking techniques became a common occurrence across all of the OECD countries. They conclude that '[b]enchmarked knowledge and information are the fundamental strategic resources of the age' (Kouzmin et al., 1999, p. 139).

In a discussion concerning the evaluation of the performance of public bodies, Afonso et al. (2005) differentiate between standard 'Musgravian' indicators that correspond broadly to the role of the state as an economic entity tasked with the redistribution of income and opportunity indicators, which correspond broadly to the neoliberal understanding of equality (Musgrave, 1969). The details of the framework are provided in Figure 1-2.

Figure 1-2 — Public sector efficiency

Source: Afonso, Schuknecht and Tanzi (2005, p. 324 Fig. 1)

Andrew and Goldsmith (1998) argue that the introduction of performance indicators to local governance is partially explained by the progressive marketisation of the local government sector. The marketisation of public services is usually reflected in the proliferation of contractual arrangements with third-party service-delivery contractors (Andrew and Goldsmith, 1998). Following the conceptualisation proposed by Wolf (1993), Reichard (2002) differentiates between the two approaches towards marketisation of public services in Germany: non-market and market competition.

Non-market competition is often reflected in the form of benchmarking activities, involving different forms of performance comparisons and inter-institutional evaluation (Reichard, 2002). Bovaird and Löffler (2002, p. 10) suggest that '[c]ompared to the realm of national public administration, benchmarking at the local level is methodologically relatively easy and not as politically contentious'. The following sections of this literature review evaluate this statement in the context of the currently available literature on the use of performance indicators and benchmarking indicators across the developed world.

The emphasis on the introduction of performance-based mechanisms across governmental structures provided a political impetus for establishing numerous network-based instruments concerned with the implementation of performance management regimes across government institutions. The increasing emphasis on the development of governance arrangements involving multiple partners from across different sectors has resulted in the emergence of a range of difficulties concerned with internal and external accountability (Flinders and Moon, 2011). Flinders and Moon (2011, p. 653) argue that the concept of accountability works as 'a bridge between the governors and the governed'. The authors further recognise that distortion of hitherto clear lines of accountability may prove problematic. In particular, Flinders and Moon (2011, p. 661) assert that the proliferation of partnerships and inter-institutional regulatory arrangements would result in 'a messy and asymmetrical patchwork of accountabilities between the central government and a range of community groups, private companies and third-sector organisations.'

1.4.1 Local Governments' Performance

The need to develop more efficient ways of allocating public sector resources emerged as a consequence of the macroeconomic events of the 1970s, in particular, the economic crisis of 1973 (Crouch and Pizzorno, 1978). For that reason, the 1970s are considered the key period for public sector reforms (Hemerijck and Schludi, 2000). The ensuing idea of the public sector reform was concerned with the introduction of privatisation programmes and attempts to make public services more competitive and responsive to the needs of local residents as well as financially efficient (Sanderson, 2001; Wise, 2002).

The approaches focused on introducing performance management mechanisms that would make public services more cost-effective and efficient (Green-Pedersen, 2002; Wise, 2002). As a result, business-like paradigms were introduced, changing the way that the performance of governmental institutions was measured and evaluated.

The proliferation of neoliberal ideologies in the 1980s and 1990s introduced a significant change to the delivery of public services across the developed world (Calabrò, 2011). Hartley and Skelcher (2008) claim that this period was associated with the introduction of market-derived performance measures to governmental structures in the Western world through the discourse concerned with the implementation of performance management techniques across the government sector. Behn (2003, p. 586) asserts that performance in the public sector ought to be measured in order to 'evaluate, control, budget, motivate, promote, celebrate, learn, and improve'. In the same paper, Behn (*ibid.*, p. 586) concludes, 'no single performance measure is appropriate for all eight purposes'. The quoted discourse

emphasises the difficulties concerned with the effective implementation of performance measurement techniques across the public sector.

Performance measurement is still recognised as one of the major components driving reform across the OECD countries (Greiling, 2005). In addition, the idea of performance management is widely recognised as a significant element of reinventing the government agenda (Gianakis, 2002). Attempts to address the inefficiency and lack of accountability of governmental structures are continuously being undertaken through the introduction of performance indicators and benchmarking techniques across the developed countries (Behn, 2003; Bowerman et al., 2001; Kouzmin et al., 1999).

For instance, healthcare providers in Sweden and Denmark experimented with the implementation of individual budgets for hospitals. German municipalities developed *Kommunale Gemeinschaftsstelle*, an inter-institutional body concerned with improving local governance through the promotion of competitiveness and performance-based management techniques (Green-Pedersen, 2002; Reichard, 2002). Further examples of introducing business-like paradigms into the public sector structures can be found across a wide range of developed countries (Wise, 2002).

In recent years, it has been possible to observe an increase in interest by the UK government in the use of performance metrics as tools designed to improve the functioning of local authorities (McLean et al., 2007). The importance of well-designed improvements facilitating the evaluation of performance is evident from the volume of spending allocated to local authorities (McLean et al., 2007). In Scotland, the spirit of introducing business-like principles in managing local structures was reflected in recommendations of the Kerley Group,¹ indicating that '[t]he Council must be able to effectively scrutinise the actions of the leadership or Executive and hold it to account for its performance' (McAteer and Orr, 2003, p. 63; Renewing Local Democracy Working Group, 2000).

1.4.1.1 Deprivation and Small-Area Deprivation Indicators

But, since a strict uniformity is nowhere to be observed at first hand in the phenomena with which the investigator is occupied, it has to be found by a laborious interpretation of the phenomena and a diligent abstraction and allowance

¹ The Kerley Group, formally known as the Renewing Local Democracy working group was concerned with 'consider[ing] ways in which council membership could be made attractive to a wider cross-section of the community, and councils could become more representative of the make-up of the community' (Renewing Local Democracy Working Group, 2000, p. 3).

for disturbing circumstances, whatever may be the meaning of a disturbing circumstance where causal continuity is denied.

(Veblen, 1919, p. 162)

Identifying deprived or disadvantaged communities can only be achieved through defining the nature of local deprivation in a manner that facilitates measuring the concept with the available data. The literature differentiates between absolute and relative deprivation (Hagenaars and Praag, 1985). Absolute deprivation is defined as insufficient access to resources, independent of the general welfare level in society (Hagenaars and Praag, 1985). In this context, an absolute poverty line, which serves as a demarcation between people recognised as poor or solvent, is frequently determined in monetary terms reflecting the inability to acquire basic resources such as food and clothing (Foster, 1998; Rainwater and Smeeding, 2003).

The early definitions of absolute poverty, such as those proposed by Rowntree (2000) and Orshansky (1965), focused on the cost of items such as food, clothing or fuel (Hagenaars and Praag, 1985). The ensuing attempts to establish internationally recognised absolute poverty lines focused on deriving a figure reflecting the necessary amount to procure basic goods. For example, in 2015, The World Bank determined the nominal poverty line to be \$1.90 per day. Ray and Lancaster (2005) estimated an absolute, expenditure-based, poverty line for the Indian population using the nutrient prices data. In this context, absolute deprivation is defined as an inability to meet the basic dietary requirements necessary for a healthy existence (Ray and Lancaster, 2005).

The absolute definition of poverty accounts for other aspects of being poor, such as social participation and exclusion. Townsend (1987, p. 125) 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'. The spectrum of items and circumstances that may be taken into account in determining whether deprivation can be said to exist is vast. Townsend (1979) differentiates between difficulties accessing food, clothing and housing and subpar employment, educational or environmental conditions. Further forms of deprivation listed by Townsend (1987) focus on the potential inability to fulfil societal obligations and to participate in customary community or family events.

The variability across standards of living does not necessarily have to be observed across the existing population for deprivation to arise. Townsend (1987) observes that deprivation may be measured against an expected standard of living that society would be expected to attain given a better distribution of resources and necessary changes to the

society's institutions. Various approaches to deprivation are reflected in a multitude of deprivation indices that were developed to measure different aspects of deprivation (Morris and Carstairs, 1991).

The measures of deprivation use the notion of the sociology of class (Krieger et al., 1997). In this context, the notion of multiple deprivation assumes that it is possible to combine a number of conceptually distinctive measures and derive an aggregate indicator that would characterise discernible life outcomes (Wright, 1993). Krieger et al. (1997) further hypothesise that the currently available evidence emphasises the need to develop comprehensive indicators measuring health and well-being outcomes in the context of socioeconomic status.

Indices of deprivation are a particular case across life outcome indicators, as their construction incorporates a number of conceptually distinctive indicators. The statistical process underpinning the construction of such measures is usually fairly complex and involves dimension reduction, like Principal Component Analysis, or more sophisticated GIS-based techniques like Multicriteria Analysis (MCA), proposed by Bell et al. (2007), or a GIS-based Order Weighted Average applicable to spatial data. In recent years, indices of deprivation became widely recognised as necessary tools for local policymakers and government administrators (Noble et al., 2007).

The relevant academic literature attests that indices of deprivation are used extensively across developed countries in the implementation of area-based policies and facilitate the development of resource-allocation mechanisms (Decancq and Lugo, 2013). Further evaluation of the grey literature pertaining to policies employing disaggregated measures of deprivation suggests that life outcome indicators have been successfully implemented in local and national governments across Canada, New Zealand and South Africa (Bell and Hayes, 2012; Noble et al., 2010; Salmond and Crampton, 2012). In the UK, the successful utilisation of multiple indexes of deprivation in policy is reflected in policies such as *Formula Spending Share (FSSs)* and its predecessor *Standard Spending Assessment* (Deas et al., 2003). FSSs were developed in order to allocate the funding across English local authorities to each service area for which the authority was responsible (West, 2009).

A number of existing deprivation indices were influenced by Townsend's (1987, 1979) research on multiple deprivation. Townsend (1987) hypothesised that the use of measures of deprivation could be significantly improved by the development of aggregate variables reflecting a wide range of characteristics. The argument is supported by the academic literature concerned with the nature of poverty that recognises its multidimensional character (Baud et al., 2008; Bourguignon and Chakravarty, 2003).

The use of Area-Based Deprivation Indices as a proxy for individual socioeconomic status creates a wide range of technical challenges (Schuurman et al., 2007). The history of British Area-Based Deprivation Indices (ABDIs) can be traced back to the 1530s when London parish clerks were required to submit weekly bills of mortality (D. Gordon, 2003). The bills played a crucial role in understanding the development of the plague and its implications for the city's economic and demographic conditions (Robertson, 1996).

The indices of deprivation are broadly defined as aggregates of indicators that when meaningfully compiled, produce a composite measure of a distinguishable phenomenon (Øyen, 2006). Spicker (2004, p. 437) indicates that in order to meet this requirement, the indicators utilised need to have the following qualities:

- a) *Validity* – indices *should* measure what they are supposed to measure. The practical implementation of this concept is that the topics measured should be correlated with each other but not too significantly. Too strong a correlation would imply that the index's components are measuring the same phenomenon.
- b) *Reliability* – the notion *is* important for policy implementation and reflects the practical applicability of the index. In practical terms, the index is considered reliable if it consistently measures a given phenomenon and facilitates the capture of relevant changes in society.
- c) *Quantification* – the construction of the index frequently assumes a linear mathematical relationship. The assumption of a linear relationship between indicators corresponds to the notion of incommensurate indicators cancelling each other out when introduced to an indicator. Usually, challenges like these can be solved in the course of the technical manipulation of variables.
- d) *Inclusion of relevant and exclusion of irrelevant factors* – The creation of a reliable index assumes the *inclusion* of indicators that are relevant and significant to the phenomenon that a given index is supposed to measure. Similarly, the choice of indicators is often determined by the availability of data and external requirements. For example, percentages of benefit claimants may be the only available proxy indicator for income deprivation; however, indicators reflecting benefit uptake are susceptible to changes in legislation and accompanying administrative procedures.
- e) *Weighting* – it is assumed that the factors that constitute the indexes must be given the appropriate *weights*. The weighting depends partly on appropriate quantification but also on normative judgement.

- f) *Norms and values* – The existing deprivation indices tend to conceal norms and values. For example, *indices* concerned with measuring the long-term effects of unemployment focus on emphasising disadvantage in the male population, which is more prevalent in these figures. The choice is often deliberate, e.g. the Press Freedom Index makes an explicit assumption about its normative dimensions. Analogously, various common measures of financial inclusion will also make explicit or implicit assumptions about the sufficient levels of individual disposable income.

Currently, ABDIs are widely recognised as important policy tools and are often used to inform local resource distribution mechanisms across the developed world (Schuurman et al., 2007). In particular, deprivation indexes are considered to be effective measures that accurately report the circumstances of the most socioeconomically deprived or socially disadvantaged people (Tunstall and Lupton, 2003).

In a neighbourhood-level analysis of relationships between benefit uptake and behavioural patterns, Gillham et al. (1998) identified statistically significant relationships between employability and the prevalence of antisocial behaviour. Additional research concerned with the predictive capacity of indices of multiple deprivation suggests that future patterns of deprivation cannot be robustly modelled with the use of the index data only (Walsh et al., 2010). Walsh et al. (2010) argue that robust analysis requires additional input corresponding to national macroeconomic and social characteristics.

In the example of analysis variability in deprivation across UK cities, Walsh et al. (2010) conclude that differences in life outcome patterns observed across British localities cannot be explained by socioeconomic status alone. In the course of analysis of a relationship between levels of income deprivation and mortality patterns on small-area levels, Walsh et al. (2010) hypothesise that elevated levels of mortality in Glasgow are not wholly caused by poverty but are influenced by a number of heterogeneous factors, such as local nutritional or health habits.

A related study demonstrated that poorer health outcomes observable in Scotland could not be explained by elevated levels of deprivation alone (Hanlon et al., 2005). The nature of measures employed by the comparative indices of multiple deprivation can be partially blamed for the observed differentials in health outcomes (George, 2010). The introduction of variables measuring additional aspects of well-being, such as nutrition, could alter the results and shed additional light on the present different patterns of health outcomes (George, 2010). Analytical shortcomings of the deprivation indices are further exacerbated by the insufficient focus on the role played by past adverse life events (Donnelly, 2010). For example, adverse childhood experiences are known to correlate with later poor health outcomes and a local

prevalence of those can be reflected in greater health deprivation. On similar lines, the literature suggests that the choice of the domains incorporated into a number of existing indices of deprivation is very often arbitrary (Messer et al., 2006).

1.4.1.2 Use of Indicators in Governance

This section seeks to address the question of international and national differences in the use of the spatially aggregated data across local governments. The existing research frequently recognises that government performance evaluation mechanisms are characterised by methodologically heterogeneous approaches to measuring the success and failure of service-delivery mechanisms (Behn, 2003; Wise, 2002). In an analysis concerned with the use of performance indicators across the UK, Smith (1990) observes that the initial cases of using performance indicators mostly attempted to incorporate financial data, aiming to deliver performance assessments cognate to the performance reporting usually delivered across businesses.

The previously provided analysis of the relevant publications concerning the use of neighbourhood-level data in local governance indicates the existence of similar projects internationally (Sawicki and Flynn, 1996). For example, the National Neighbourhood Indicators Project was launched by the Urban Institute in the US in 1995 and utilised principles similar to those associated with the Scottish Neighbourhood Statistics (NNIP, 2014).

The performance management models implemented across local government structures in these countries differ significantly with respect to the extent to which performance indicators were implemented through a variety of local government structures. For example, the implementation of performance management in the UK and Sweden is considered to be deep and robust when compared to the more casual approach in Japan (Bovaird and Löffler, 2003). The research literature concerned with the implementation of performance indicators recognised the difficulties relatively early (Bovaird and Löffler, 2003). Numerous implementations defined the performance of government institutions in relation to the measure of *quality* in service delivery, giving focus to performance measuring metrics such as Balanced Score Cards I and II or metrics derived from data on customer expectations (Bovaird and Löffler, 2003; Norreklit, 2000; Zeithaml et al., 1990).

The practical requirements for the performance indicators were outlined in the Department for International Development-funded World Bank initiative to develop a set of unambiguous quantitative and policy-relevant indicators for governance (Knack et al., 2003). In their evaluation of aspects of governance indicators, Knack et al. (2003, p. 5) hypothesise that the indicators used to evaluate governance should be:

- a) *Generated through a transparent process.* In practice, this implies that the development of indicators should be reproducible in the course of a documented process. In addition, the data from which the indicators are derived should come from sources that are politically acceptable.
- b) *Available across many countries.* Broad country coverage is necessary for testing relationships between indicators and valued outcomes. This criterion further reflects the requirement for the indicators to be comparable across countries.
- c) *Of high quality and accurate.* This criterion is concerned with the indicators being measured and expressed in a consistent manner and reflecting what they are supposed to measure.
- d) *Specific.* This assumption reflects the idea that indicators should measure a precise aspect of a government institution or a defined life outcome output.

The relationship between the value of the robustness of performance indicators and the quality of governance is widely reflected across both the academic and the grey literature (Moynihan et al., 2011). Yang and Holzer (2006) recognise that robust performance measurement has direct implications with respect to improving citizens' life outcomes. This approach is justified in the context of principal–agent accountability that assumes the relationship between principal and agent where the principal is defined as the owner of the capital who exercises control over the agent (Mayston, 1993). In the context of this argument, accountability is perceived as the capacity of a system to generate actionable knowledge where the performance of agents can be meaningfully judged by their principals and, consequently, enable the principals to exercise sanctions over the agents (Smith, 1990).

Public sector operations are characterised by much less precisely defined accountability lines compared to private sector bodies (Smith, 1990). Business operates a much simpler accountability model. The most significant communication between parties in business is company's annual financial statement delivered to investors, who are principals and management agents. In public sector, accountability models are multi-layered and consists of local, national electoral cycles and internal processes.

More relevant and noteworthy attempts to measure performance relating strictly to public sector institutions took place in subsequent years when local authorities were faced with the duty of annual reporting (Mayston, 1993). Hence, it is not surprising that a proliferation of the use of the performance indicators took place in the 1980s. Smith (1990, p. 53) notes that '[f]ew of those working in the UK public sector can have failed to have noticed the explosion in the use of performance indicators in the 1980s'. The idea underpinning the use of performance

indicators across government institutions reflects the desire to introduce business-like accountability paradigms across public sector bodies in the UK (Smith, 1990).

Drawing on the research undertaken by Tyack and Hansot (1986), Gormley and Weimer (1999) hypothesise that the idea of introducing performance management on a local government level can be traced back to the 1840s when the Massachusetts state legislators, in collaboration with the local educational reformer, devised a system of comparison between public schools as a method of inducing performance improvements across the local educational sector. More structured attempts to introduce performance management were observable in the 1920s, when the New York Bureau of Municipal Research incorporated budgetary procedures that utilised workload measures (Simon and Ridley, 1938).

The attempts to formalise and standardise the use of performance data across the British public sector can be traced back to 1978 when HM Treasury (1978) released guidelines on the use of standardised performance indicators across national industries. Due to the pecuniary character of the activity undertaken by the industries included in the performance framework, the measurement process was relatively straightforward, as it did allow for the construction of a framework that would mostly focus on the outputs and prices (Smith, 1990). The implementation of the New Deal for Communities and the resolutions of the Commission on the Future of Delivery of Public Services in Scotland emphasised the role of the neighbourhoods in developing service delivery and resource-allocation mechanisms that would positively contribute to neighbourhood regeneration and redevelopment (Batty et al., 2010; Christie et al., 2011; Lawless, 2004).

The assumption that institutional actors can meaningfully influence patterns of social behaviour finds its reflection in the literature on modern governance and approaches towards evaluating the effectiveness of governmental structures. The notion finds its reflection in the approach to performance management with expectations that successful service delivery and programme implementation are observable in corresponding changes across the relevant life outcome indicators (Hope, 2004).

The academic literature on the role of performance management in public sector entities further suggests that the evaluation of specific services in the context of a dislocated service-delivery mechanism alone is not sufficiently comprehensive (Bovaird and Löffler, 2007). Drawing on earlier research by Boaz and Nutley (2003), Bovaird and Löffler (2007) also suggest that the quality-of-life outcomes are seen as an important public issue by politicians and decision-makers. That notion finds broader reflection in policy developments that attempt to utilise life outcome indicators in governance.

The wider applicability of research on life outcome indicators was recognised by key political institutions, such as the Organisation for Economic Co-operation and Development (2011). The leading policy initiative related to the importance of life outcome data in policy-making was concerned with the introduction of the *OECD Better Life Index* (Kasparian and Rolland, 2012). The OECD's (2011) index assumes the creation of an index that would provide decision-makers with a comprehensive tool to measure the quality of life. In line with similar indices developed internationally, the initiative recognises that describing the quality of life by using macroeconomic measures is short-sighted, as it does not address the comprehensiveness of current policies (Ravallion, 2012).

An analogous development concerned with measuring the performance of governmental structures across the globe was developed by the World Bank (Kaufmann et al., 2009). *The Worldwide Governance Indicators* project aims to measure six dimensions of governance across 200 countries and territories. The project captures six dimensions of governance:

- a) *Voice and accountability* – this domain is concerned with measuring citizens' ability to select government institutions in the course of processes described as democratic.
- b) *Political Stability and Absence of Violence/Terrorism* – this domain attempts to capture the likelihood of government being destabilised in the course of undemocratic and/or unconstitutional means.
- c) *Government Effectiveness* – this domain captures indicators of quality of public services, independence of public service from external pressures.
- d) *Regulatory Quality* – this domain is concerned with governmental ability to deliver policies and regulations that facilitate the development of private enterprises.
- e) *Rule of Law* – this domain is concerned with agents' confidence in property rights and quality of contract enforcement.
- f) *Control of Corruption* – this domain reflects the extent to which public power and governmental institutions are used to facilitate private gain.

The relevance of life outcome indicators is recognised in the policy and decision-making of the European Union. For example, the annual report of the Social Protection Committee (2014, p. 19) states that '[t]he definition of the EU poverty and social exclusion headline target is based on a combination of three indicators – the at-risk-of-poverty rate, the severe material deprivation rate, and the share of people living in very low work intensity (quasi-jobless) households'. Along similar lines, a few other policy lines are defined in relation

to the corresponding indicators and measures. The prominence of the role played by the measurable life outcome indicators is further emphasised by the existence of the Indicators' Sub-Group with the Social Protection Committee (2015). The Indicators' Sub-Group is tasked with establishing a framework of indicators to measure the progress of the EU Member States towards agreed objectives of reducing inequalities and increasing social protection and inclusion (Social Protection Committee, 2015).

In particular, the current understanding of modern governance recognises that successful service delivery should be attuned to the diverse needs of the existing social strata (Keefer and Khemani, 2005). Social stratification can be measured in a number of ways giving focus to the availability of public/private recourses, aggregated monetary characteristics of neighbouring households, aspects of a local economy or a number of other factors (Musterd, 2005).

The science of measuring the quality of life is recognised as an emerging scientific discipline relevant to policy-making and governance (Schipper and Levitt, 1985). In addition, the role played by life outcome indicators in governance is highlighted by the changes to the procedural and administrative arrangements surrounding the development of governance mechanisms (Bovaird and Löffler, 2007, 2003). The diffusion of clearly defined lines of accountability, the involvement of multiple partners, as well as attempts to implement principles of business-like performance management in creating service-delivery mechanisms created the technical need for wider utilisation of life outcome indicators across the governance structures.

This argument is further supported by the recent developments in the policy literature concerned with spatially aggregated life outcome indicators and the utilisation of these in the context of measuring inequalities. The development of measures of deprivation corresponds to increasing awareness of social inequalities across the political spectrum and the notion that spatial variation in living conditions across European countries is a function of progressing social inequality (Andersen and van Kempen, 2003).

1.4.1.3 Challenges in Utilisation of Small Area Data

The utilisation of spatial data in local governance is fraught with technical challenges (Fotheringham and Wong, 1991). Following from the discussion on the nature of the neighbourhood, any policy approaches aiming to utilise small area data have to recognise that

the concept of neighbourhood is context-dependent and, as such, its implementation will have an impact on the results. As pointed out by Sperling (2012, p. 219), 'social science literature is replete with an unquestioning use of these geographies [census small areas] to measure neighbourhood effects, despite evidence that the use of alternative spatial scales and techniques can deliver very different results'.

For example, the Modifiable Areal Unit Problem (MAUP) is frequently recognised as a source of statistical bias in spatial analysis (Fenton, 2013; Gehlke and Biehl, 1934; Horner and Murray, 2002). The term MAUP was coined by Openshaw (1984, p. 3), who observed that at the time there were 'no rules for areal aggregation, no standards, and no international conventions to guide the spatial aggregation process' and that 'the areal units (zonal objects) used in many geographical studies are arbitrary, modifiable, and subject to the whims and fancies of whoever is doing, or did, the aggregating'.

Openshaw (1984, p. 3) points to the combinatorial nature of the problem that emerges from the multitude of possibilities of creating geographies. Following Keane (1975), Openshaw (1984) notes that the resulting number of combinations for n areas to be grouped into k regions depends on the contiguity constraints imposed on the way areas are merged together.¹ In a totally unconstrained situation, any area may be grouped with another area; in a maximally constrained situation, only physically contiguous neighbours can be grouped (Keane, 1975).

Admittedly, MAUP impacts not only human geography but also other domains that incorporate small-area data, e.g. Wong (2009) observes that even a small change in neighbourhood boundaries can lead to a significant change in higher-level aggregate statistics. This can have profound implications for local service-delivery and resource-allocation mechanisms. Hart et al. (2005) postulate that inappropriately defined geographies can have a determinantal impact on the picture of the available resources. By comparing statistics on the availability of generalist physicians per 100,000 population derived using two area classification methodologies, Urban Influence Codes² (UIC) and census tract version of the

¹ In combinatorics, this is described as a Stirling number of the second kind and can be expressed by the equation: $S(n, k) = \frac{1}{k!} \sum_{i=0}^k (-1)^i \binom{k}{i} (k-i)^n$. For instance, $n = 10$ regions could be grouped in $k = 5$ regions in 42,525 combinations. Naturally, any practical process of creating high-level geographies will impose a number of constraints on contiguity, demography and other characteristics, limiting the number of combinations. Nevertheless, the number of possible combinations will still remain significant.

² The Urban Influence Codes taxonomy is a county-based taxonomy that builds on the Office of Management and Budget definition of metropolitan and non-metropolitan populations (Hart et al., 2005). The taxonomy is often used to perform analysis of population density trends in non-metropolitan areas (United States Department of Agriculture, 2019a).

rural-urban commuting area,¹ (RUCA) Hart et al. (2005) point to significant differences. The UIC figure is significantly higher at 46.4 per 100,000, compared to 38.5 per 100,000 derived using the RUCA taxonomy.

Another common example of how a variable approach to developing spatial taxonomies can impact the ensuing research and policy decisions comes from the development of urban/rural taxonomies. Hart et al. (2005) observe that, depending on the incorporated definition, 10% to 28% of the US population could be classified as rural. In the 2000s, that amounted to 29–79 million. This discrepancy can have a profound impact on local and national decision-making practices. Rural communities are recognised to be more vulnerable in terms of access to services or availability of employment opportunities and are frequently the focus of government support programmes (Cloke et al., 1995).

In the UK, policies such as the Rural Development Programme for England or the Scottish Rural Development Programme are heavily dependent on spatial taxonomies for facilitating the identification of rural geographies (European Agricultural Fund for Rural Development, 2019). The rural taxonomies created are subsequently used to allocate funding streams to selected localities. In a discussion of the existing literature on the geography of opportunity, Lens (2017) observes that analytical results classifying geographies as deprived differ and are determined by the arbitrary utilisation of geographies, e.g. census tracts in the United States, that do not have any specific social meaning.

In relation to spatial analysis, statistical bias is defined as a quantitative misrepresentation of the true phenomena due to artificially constructed borders that define statistical regions (Griffith, 1983). Taking the example of a meta-analysis of commuting distances, Horner and Murray (2002) note that the choice of methodology to aggregate geographies may have significant implications on the conclusions obtained. The statistical results are also impacted by MAUP, e.g. in the context of regional safety modelling and traffic analysis, Xu et al. (2014, p. 110) observe that '[spatial taxonomies] with a higher number of zones tend to have an increasing number of significant variables, more stable coefficient estimation, smaller standard errors, whereas [they have] worse model performance'.

The role of small area demographic projections is particularly relevant to localised service delivery mechanisms that account for “density of demand” (Bradshaw and Muller,

¹ Rural-Urban Commuting Area Codes classify U.S. census tracts using measures of population density, urbanization and daily commuting (United States Department of Agriculture, 2019b). The classification contains two levels, differentiating between metropolitan, micropolitan, small town and rural commuting areas based on the size and direction of commuting flows (United States Department of Agriculture, 2019b).

2004, p. 303). Decisions on locations of fire, police stations or hospitals are made on the basis of anticipated user need (Bradshaw and Muller, 2004). Demographic forecasts are recognised as an important component in predicting future service demand.

In local governance, demographic projections are used to inform a variety of decisions concerned with service delivery, planning and responding to increase or decrease in housing demanding (Sorensen, 2012; White and Murdock, 1998). National Records of Scotland (2020) produces sub-national projections for Scotland on a regular basis suggests a variety of cases on how projections can be used including: central and local finance allocation, informing local and national policy, and influencing decisions on local service allocation, such as provisions of nurseries or day care centres.

Booth (2006) differentiates between extrapolation, expectation and theory-based structural modelling as approaches to delivering demographic forecasts. Extrapolative demographic forecasting methods focus on identifying regular patterns and extending those in the future without incorporating exogenous variables (Booth, 2006). Structural modelling focuses on forecasting demographic trends using underlying data socio-economic data, whereas forecasting approaches driven by expectations incorporate expert or survey-derived knowledge relevant to demographic trends (Booth, 2006). Incorporating survey's data on women future birth expectations or experts' opinion on changes in demographic trends are examples of deriving demographic trends using expectations data.

Each of the of the outlined approaches is pronounced by a number of distinct challenges. Keyfitz (1987) described undertaking demographic forecasts as task that is 'impossible yet unavoidable'. Tayman (2011) postulates that forecasting error grows in a linear fashion the horizon length and that it is impossible to, in advance, assert direction of forecasting error. Projections for small areas for long horizons are burden with relatively high forecasting error. Across 30-year horizon, forecasting error for US census tracts was 54%, significantly higher than 36% on a county level and 18% on a state level (Smith et al., 2005).

Traditionally, forecasting models have been developed for countries and large areas enabling to deal with components of population change in an age-specific context (Chi and Voss, 2011). The necessary volume of data is frequently unavailable on a small area level rendering traditional forecasting methodologies less useful. Second, a majority of methodological approaches to demographic forecasting ignore any potential neighbourhood effects and aspires to forecast population change for areas in isolation. Considering that financial planning is the primary motivation behind demographic forecasts utilisation of long-term small area forecasts becomes problematic. Considering the above and incorporating

recent developments in small-area forecasting this thesis proposes to focus on clusters of geographies that share common vulnerability characteristics, not on isolated neighbourhoods.

1.4.1.4 Approaches to Spatial Resource Allocation in the UK and Worldwide

The challenges involved in applying spatial patterns to resource allocation are not a recent phenomenon. Ottensmann (1979) observed that the differential allocation of resources through sub-areas has implications for the equity and efficiency of service delivery. The problem of spatial service delivery is mostly considered in relation to spatial equity in resource allocation as related to the notions of spatial access and spatial externalities (Talen and Anselin, 1998).

The ambition behind the introduction of neighbourhood-level initiatives is concerned with improving the quality of life of the local communities. As noted by Lupton (2003, p. 7), 'poor areas exist because the poor exist'. In relation to the effectiveness of neighbourhood- and area-based initiatives, Lupton (2003, p. 8) remarks, 'the only way to transform the fortunes of poor areas is to transform the fortunes of the poor, by redistributing economic gains and not just by creating them'.

A standard measure of access frequently used in political science pertains to the count of the number of services per geographic unit, such as ward, neighbourhood, local authority, etc. (Talen and Anselin, 1998). This approach to quantifying access frequently does not account for other factors impacting access, such as distance or travel distance and travel costs, which are important in understanding the spatial equity of a particular service delivery (Talen and Anselin, 1998). Bennett (1984) defines spatial equity as equal treatment of equally deserving residents, irrespectively of their place of residence.

This implies that communities with specific needs residing in a given locality should receive the same support as communities with the same needs that reside in another locality. Resource allocation when analysed from a spatial perspective focuses on answering the question of whether the services are 'located equitably with respect to the population or the group in the population for whom the service is provided' (Truelove, 1993, p. 19). It is worth remarking that the definition of equity in the context of service delivery is complex, and the existing literature does not point to one that would be uniformly accepted.

Lucy (1981, p. 448) focuses on definitions of equity that are applicable to spatial service delivery and differentiates between five approaches to equity accounting for 'equality, need, demand, preference, and willingness to pay'. Equality in the context of service delivery draws on the assumption that everyone should receive identical service. In practice this is unobtainable, as it is impossible to distribute, schools, parks, hospitals and other service

delivery points in an equidistant manner from everyone, accounting for travel costs and time (Lucy, 1981).

In contrast, the need approach to equity in service delivery assumes an unequal distribution of service purposely due to the variability in the needs of local residents. The need approach is driven by the assumption that 'unequals should be treated unequally' (Lucy, 1981, p. 448). A successful application of the need-based model in service delivery requires the ability to define a need. The existing service-delivery mechanisms that account for likely variability in needs utilise proxies reflecting population characteristics that may be indicative of deprivation. For instance, a locality with a prevalence of ethnic minority residents may be considered more vulnerable and, consequently, be prioritised across a number of support programmes.

The demand approach to equity in spatial service delivery focuses on addressing two elements: responding to perceived usage and complaints (Lucy, 1981). In principle, equitable service delivery where decisions are driven by demand will prioritise delivering against localities that are most likely to utilise the service provided to a significant extent. For instance, popular parks and recreational areas may benefit from more funding than less frequently visited geographies. Vocal communities may receive more services than communities which are more reticent in voicing their concerns. Preference, which is the fourth category identified by Lucy (1981), assumes delivering services to localities where communities made their views known by expressing preferences in the course of a consultation. The final approach to operationalising equity in service delivery proposed by Lucy (1981) reflects a willingness to pay. In that context, services are delivered as a priority to communities that are willing to pay for them.

In the US, census small-area data was first used to measure public health conditions at the request of New York City in the 1900s (Anderson et al., 2012). Despite the fairly long international history of the utilisation of small-area data in the context of local service delivery, in the UK, an unsophisticated approach to identifying localities characterised by relatively high deprivation when compared to other areas remained dominant. In an analysis of the role played by geo-demography in service delivery, Longley (2005, p. 59) postulates that '[t]he archetypical public-sector application of the 1980s and 1990s was the deprivation indicator, which ascribed composite census indicators to areas that "contained" deprivation'. Longley further observes that: 'many researchers became rather disillusioned with the remit of and potential of small-area indicators, and a partial withdrawal of urban geography from policy analysis was an unfortunate consequence'.

Developments such as an increasing focus on evidence-based policy, improvements in spatial data infrastructures and dissemination of the census data from 2001 helped to make spatial data a more integral element of the policy development processes (Maguire and Longley, 2005). This relatively recent change in trends can be observed in the increase in popularity of neighbourhood research, area-based policies and utilisation of spatial data in local policy-making.

In the UK, the advent of the New Localism agenda brought an additional focus on neighbourhood-level data (Wilson and Game, 2011). In particular, the neighbourhood is recognised as a place where local and government agencies can engage citizens and improve accountability (Lowndes and Sullivan, 2008; Pratchett, 2004). In particular, the neighbourhood was seen as a vehicle facilitating community empowerment. During a speech delivered at the New Local Government Network Annual Conference, David Miliband (2006) referred to the neighbourhood as a solution, facilitating empowering communities and citizens. Miliband's (2006) address identified the neighbourhood as a level where local authorities should focus their efforts in order to regain accountability and deliver according to the needs of local communities.

The idea of using the neighbourhood to refocus resource allocation governance on a level closer to communities tends to dominate thinking about how the needs of local communities can be met most effectively (Bailey and Pill, 2011). In the UK, programmes that focused on specific neighbourhoods aimed at addressing the multifaceted challenges experienced by those localities have been in operation since the 1960s (Carpenter, 2006). The ideas underpinning the development of area-based policies reflect an assumption about the positive mutual reinforcement of life outcomes on a neighbourhood level (Steele, 2010). The scholarly interest in the relationship between neighbourhoods and life chances gained popularity during the last 20 years (Andersson et al., 2007). In particular, Andersson and Musterd (2005) hypothesise that the development of area-based policies is related to the expansion of new governance arrangements across local structures in Europe.

Spatial correlations between life outcomes and mortality data were observed as early as the eighteenth century (Kearns, 1993). Gordon (2003, p. 179) notes that significant relationships between gradients in socioeconomic status and mortality rates are noticeable in an analysis of eighteenth-century English data. It is also worth noting that one of the first maps of deprivation was produced as early as 1894 (D. Gordon, 2003). Analogously, researchers argue that trends in societal deprivation are pronounced not only by the coexistence of adverse life outcomes but also by historical consistency (Horrell et al., 2001). The positive correlations between negative life outcome indicators are well-known and extensively researched

phenomena (Black et al., 1982; Townsend, 1987). In particular, the academic literature was concerned with highlighting strong relationships among various measures of socioeconomic deprivation and health-related outcomes (Krieger et al., 1997). A number of studies indicate that different indicators concerned with measures of socioeconomic development are considered to impact health outcomes on a neighbourhood level (Diez Roux, 2001).

Empirical support for the importance of the role of neighbourhood characteristics in life outcomes is widely discussed across the existing research and focuses on dropout rates, childhood achievement, welfare-to-work transition rates and social mobility (Galster et al., 2007; Overman, 2002; van der Klaauw and van Ours, 2003). For instance, Ham and Manley (2010), in a research study concerned with evaluating neighbourhood housing tenure on employability, conclude that levels of social renting are correlated with employability patterns. The literature concerned with the development of area-based policies criticises the existing policies for being too narrowly focused on specific definitions of deprivation (Chatterton and Bradley, 2000).

With time, the approach to utilising neighbourhoods in resource-allocation programmes changed from an initial narrow view of using a neighbourhood as a remedial focus point for disadvantaged small areas to a tool used more widely in strategic planning and resource allocation (Benington, 2006). The shift in focus is partially motivated by the ‘double devolution’ strategy aiming to shift the decision-making process closer to local communities (Lowndes and Sullivan, 2008; Miliband, 2006).

The aspiration behind the ‘double devolution’ was to shift power “from Whitehall and Westminster to local government, and from there to neighbourhoods, communities and citizens (Hilder, 2006, p. 239). The idea of ‘double devolution’ was proposed in response to recognition of limited decision-making powers of British local government. Arguably despite serving populations larger than in most of other countries British local government was not sufficiently empowered to make a significant difference to key areas of service delivery, like policing and health. The scientific recognition of the role played by the neighbourhood in this context is key to designing resource and service-delivery programmes.

The neighbourhood effect can be defined as a ‘process of local influence whereby the characteristics of a proximate social milieu are believed to influence and compound the ways in which people think and act’ (Dear, 1999, p. 8). The neighbourhood effect manifests itself in the aggregate of characteristics relating to the way the residents of a neighbourhood are treated by external actors (Tunstall et al., 2014). For instance, research concerning the role of the neighbourhood in relation to labour market performance demonstrates that residents from

deprived neighbourhoods are less successful when compared to those from less deprived neighbourhoods (Ham and Manley, 2010; Tunstall et al., 2014).

Relevant criticism concerned with the development of area-based programmes focuses on a lack of clarity in relation to the definition and operationalisation of a neighbourhood (Sampson et al., 2002). Research lends further support to this argument and suggests that the validity of econometric models developed with the use of the neighbourhood-level data can be further enhanced by the introduction of indicators reflecting the perception of neighbourhood boundaries by local residents (Furtado, 2011). In the course of a multivariate analysis applied to georeferenced data from Brazil, Furtado (2011, p. 2839) asserts that incorporation of the variables corresponding to 'a cognitively perceived neighbourhood' contributes positively to the robustness of the econometric models derived.

The criticism concerning area-based policies pertains to the challenges with understanding the concept of the neighbourhood and its implications for patterns of life outcome indicators (Andersson and Musterd, 2010). Andersson and Musterd (2010) note that there are substantial gaps in understanding the role of neighbourhood characteristics for the future nature of life outcome indicators. In particular, it is recognised that neighbourhood-level data reflect the notion that any neighbourhood-level measurable outcomes are heavily affected by the bias associated with the selection of indicators utilised, which usually correspond to census variables or similar microdata that is available on a small-area level (Mooney et al., 2014).

One of the gaps concerns the scale of the neighbourhood and its relationship to the nature of life outcome patterns. In a statistical sense, the size of the neighbourhood is also relevant with respect to the association strengths observed among selected indicators. In an analysis of sub-samples of the American Housing Survey, Hipp (2010) argues that selected sets of socio-demographic characteristics measured on a micro level are stronger predictors of residents' levels of satisfaction with the neighbourhoods than comparable measures sourced from areas of greater size.

Recent research concerned with the role played by neighbourhood size in relation to behaviour suggests that the size of a neighbourhood can have implications for the behaviour of individuals, particularly with respect to cooperation (Ifti et al., 2004). Further support for the existence of a significant relationship between neighbourhood size and behavioural patterns comes from the research undertaken by Holloway and Lapar (2007) concerned with the propensity of neighbourhoods to engage with markets. Suggesting that a significant role is

played by the diffusion of local knowledge, researchers conclude that the size of a neighbourhood is a significant predictor in estimating similarities in market decisions.

Sampson et al. (2002) point out that the 'study of neighbourhood effects, for better or worse, has become something of a cottage industry in the social sciences'. Criticism related to the role of the neighbourhood effect is concerned with the lack of sufficient understanding of the heterogeneous impact of the neighbourhood effect on neighbourhood residents. Galster et al. (2010) argue that the neighbourhood effect affects different social and demographic cohorts to variable degrees. Drawing on research conducted in Sweden, the authors hypothesise that male residents are affected by the neighbourhood socioeconomic composition to a much greater extent than female residents (Galster et al., 2010). The researchers also hypothesise that differences in the uniformities of the effects are noticeable, with the neighbourhood-level effect being more consistent in the case of the female residents (Galster et al., 2010).

In relation to resource-allocation programmes across Europe, initiatives like Urban I and Urban II utilised neighbourhood quality-of-life indicators as key metrics in focusing resource allocation and revitalisation efforts (Carpenter, 2006). The Urban I Community Initiative funded by the European Commission was in operation from 1994 to 1999. At the cost of EUR 900 million, the initiative supported over 100 programmes across 15 European Union Member States with an average expenditure per programme being EUR 5.7 million (Carpenter, 2006; GHK, 2003).

Neighbourhood-level data played a pivotal role in selecting the regions that benefited from Urban I funding. The funding allocation criteria prioritised programmes that focused on addressing regional problems pertaining to high unemployment, bad housing conditions and local scarcity of social amenities (GHK, 2003). The focus on the neighbourhood and the ability to build capacity at a sub-local level was recognised as one of the strengths of the programme (GHK, 2003).

The programme objectives that were concerned with addressing regional disparities incentivised applicants to provide the relevant background information and highlighted challenges in the data availability. As noted in a subsequent evaluation, 'there was a severe paucity of readily available [life outcome] data at the neighbourhood level on such indicators' (GHK, 2003, p. 4). This realisation worked as an impetus to commence a number of studies aimed at improving neighbourhood-level data collection practices and commence a number of longitudinal studies concerned with gathering sub-local data (GHK, 2003).

In modern UK governance, examples of utilising neighbourhood-level data in informing local resource allocation can be traced back to the 1960s (Dabinett, 2001). Despite this relatively long history, numerous area-based initiatives have been criticised for their unimaginative allocation of resources. As noted by Carpenter (2006, p. 2145), the fact that ‘governments continue to need to plough resources into often the same deprived areas, with only mixed success, raises the question of whether ABIs [area-based initiatives] actually make a difference’.

The common denominator for area-based initiatives and incorporating the idea of the neighbourhood in resource-allocation practices is an overly simplistic utilisation of neighbourhood deprivation as a mechanism informing resource allocation (Carpenter, 2006). The implementation of the above-described Urban I Community Initiative in the UK was mostly concerned with promoting the spatial concentration of resources in selected urban neighbourhoods. In particular, the programmes implemented under Urban I were concerned with targeting ‘peripheral urban areas (37 per cent of all programmes), inner cities (32 per cent), historical city centres (19 per cent) and mixed areas that combined a variety of these three characteristics (12 per cent)’ (Carpenter, 2006, p. 2148).

Resource delivery was realised through a partnership approach involving local communities and local authorities. Contrary to the French, German and Spanish implementation of programmes under the Urban I initiative, which preferred an integrated approach, the British approach to the programme was community-focused. This variability in focus was later reflected in the variable approaches to programme evaluation. In the UK, programmes commenced under the Urban I initiative were considered successful if they managed to increase community involvement in the implementation of urban regeneration projects; Germany’s definition of the success of programmes commenced under the Urban I initiative aimed ‘to promote a truly comprehensive and integrated approach, especially through including economic objectives and activities in existing strategies’ (Carpenter, 2006, p. 2152).

1.4.2 Scottish Context

The localism agenda implemented in England emphasised the role of the neighbourhood in local governance. In particular, the focus on the neighbourhood was introduced into local governance in line with the four principles of:

- a) Neighbourhood empowerment
- b) Neighbourhood partnership
- c) Neighbourhood government

d) Neighbourhood management

(Lowndes and Sullivan, 2008).

The relevant academic literature recognises that there are no unanimously accepted guidelines on how the principles of focusing on a neighbourhood in local governance ought to be implemented. For instance, Griggs and Roberts (2012) hypothesise that due to the absence of real budgetary powers, the neighbourhood management systems often fail to exert an impact on the nature of local aspects of service delivery. In Scotland, a desire to give communities formal budgetary powers found its way to the existing legislation (*Community Empowerment (Scotland) Act*, 2015). The purpose of the act was concerned with empowering community bodies through land ownership (Scottish Parliament, 2014). In addition to making changes to the Community Rights to Buy Land, the act made a number of provisions giving Scottish communities rights to participate in local service delivery and contribute towards achieving local outcomes (Campbell et al., 2014).

Sinclair (2008) hypothesises that Scottish local governance is characterised by intense collaboration between local councils and the Scottish Government. The statutory requirement requiring local authorities to establish Community Planning Partnerships across Scotland is considered the most significant aspect of the public sector reform in Scotland (Sinclair, 2008). According to Sinclair (2008), the establishment of the Scottish Community Planning Partnerships is recognised as the most remarkable achievement of the Scottish public sector related to local governance.

The recommendations of the Commission on the Future Delivery of Public Services report are consistent with the wider international trend of allocating greater fiscal responsibility to local governments for local service delivery, with corresponding flexibility (Christie et al., 2011; Courchene, 2008). The publication of the report by the Commission on the Future Delivery of Public Services emphasised the importance of localism and neighbourhood-level analysis concerned with life outcomes in the context of informing local service-delivery mechanisms across Scotland (Christie et al., 2011). The recommendations are consistent with similar efforts currently being undertaken across the service-delivery landscape in the UK and a number of EU Member States. For instance, the Total Place project undertaken in England contextualised the service-delivery landscape in the light of the spatially disaggregated expenditure data and local life outcomes (Communities and Local Government, 2010).

Scottish Local Authorities and Community Planning Partnerships are facing a challenge in understanding disaggregated data and applying that information in the context of service-delivery models. Additional requirements to meet fiscal challenges resulting from the

global financial crisis are forcing local governments across Europe to address the nature of the reactive services and improve efficiencies.

The landscape of Scottish local government is facing challenges common to multi-agency local strategic partnerships. Efficient collaboration within formal structures, sufficient understanding of the role played by multiple agencies and adequate use of data are some of the commonly named challenges across the partnership evaluation literature (Rosenbaum, 2002; Salmon, 2004). The policy assumptions underpinning the formation of the Community Planning Partnerships in Scotland highlighted the need for the development of a robust evidence base facilitating the definition of community priorities (Audit Scotland and Accounts Commission for Scotland, 2012; Scottish Office, 1998).

Gaining a robust understanding of the needs of local communities and developing the ability to alter local life outcome patterns is necessary for the effective functioning of the Community Planning Partnerships (Sinclair, 2008). The Auditor General's (2011, p. 30) report concerned with the role of Community Planning Partnerships in facilitating local economic development indicates that 'limited evidence of a systematic approach to the collection and analysis of relevant economic indicators' and 'limited or inconsistent use of comparative information' are key points that should be addressed in order to ensure the effective functioning of the CPPs.

The importance of utilising suitable indicators when focusing on the performance of the partnership was further emphasised across Audit Scotland evaluations concerned with the Community Planning Partnerships. For example, the audit report concerned with the impact of Orkney CPP reads: '[a]ssessing the impact of Orkney's CPP is difficult. In some areas it is not clear whether the CPP's activities are having a positive impact, as the indicators it monitors do not provide a clear or timely indication of progress' (Audit Scotland, 2014, p. 29). The Scottish Borders Community Partnership was criticised for not using the performance data consistently: the earlier Audit Scotland (2013) evaluation reads 'there are major gaps in performance data and the content and format are not presented in a way that is user friendly'.

The overview of the existing relevant decision-making mechanisms and the corresponding reporting outputs across Scottish councils indicate that the available neighbourhood-level data is often underutilised. The existing analytical examples point to the data zone-level information being utilised mostly in the context of deriving descriptive statistics with an emphasis on the utilisation of the most recent data in the descriptive analysis to highlight deprived communities.

1.4.2.1 Local Government Benchmarking Framework

The analysis provided within the Local Government Benchmarking Framework (LGBF) only briefly mentions sub-local life outcome variability. The majority of the indicators that constitute the LGBF framework utilise local authority-level indicators for which there are no suitable sub-local equivalents (The Improvement Service, 2017a). Sparse references to neighbourhood-level data are made in the context of awards gained by children from 20% of the most deprived areas with respect to the 5/6+ awards, as well as tariff scores cross-tabulated by the Scottish Index of Multiple Deprivation quantiles.

The methodological aspects of the LGBF project, which is undertaken in collaboration with the Scottish local authorities, are determined by the publicly available data as well as councils' capacity to source the necessary data internally. However, it is noticeable that the wealth of data existing on a sub-local level does not find its way to the report. The LGBF framework refers to the local authority-level data in the context of the 50-odd indicators. The framework further acknowledges that the selection of indicators utilised is not exhaustive and that the ensuing analytical activities, which are respectively undertaken across the remaining Scottish local authorities contribute to a better understanding of the performance variability between local authorities. The LGBF acknowledges that '[t]hey do not supply the answers. That happens as councils engage with each other to drill down and explore why these variations are happening' (The Improvement Service, 2017b, p. 3).

The analysis of the LGBF reports demonstrates that variations across life outcome patterns could be observed across years. Considering the fact that the LGBF is a key project concerned with measuring performance across Scottish local authorities, the absence of neighbourhood-level data concerned with spatial disparities across life outcome indicators is disconcerting in the context of developments providing insight into the variability of performance of local authorities.

1.4.2.2 Local Authority Models

Subsequent in-depth analysis of resource-allocation models available across Scottish local authorities indicates an inconsistent approach to the utilisation of small-area data. There is no consensus on how small-area data are utilised in local governance. To an extent, it can be hypothesised that the variable needs of local communities do not permit the development of a uniform approach. However, it can be hypothesised that certain patterns should be observable across councils with similar socio-demographic characteristics. For instance, the existing research indicates that comparable levels of deprivation should be identifiable across

all neighbourhoods sharing socioeconomic and demographic characteristics, irrespectively of their exact location within the country.

For instance, the Aberdeen City Council website refers to data zone–level data on over¹ 100 occasions; however, none of the references available at the time of checking pointed to inferential models or predictive analysis. Evidence gathered from across the rural councils points to similar conclusions, with the majority of the data zone–level data being utilised in the context of historical analysis, mostly with reference to deprivation figures in the context of the SIMD. Noticeably, the analysis available through the Highland Council website to a great extent points to the population and demographic estimates. The results for are summarised in Table 1-2.

¹ Search performed on Monday, 18/12/2017, not omitting similar results within the aberdeencity.gov.uk domain. The exact search results may differ depending on the search settings, changing website content and the efficiency of Google’s indexing mechanisms.

Table 1-2 — Small Area Data Usage across Scottish Councils

Council	Number of results
<i>Aberdeen City Council</i>	135
<i>Aberdeenshire Council</i>	99
<i>Angus Council</i>	48
<i>Argyll and Bute Council</i>	246
<i>City of Edinburgh Council</i>	225
<i>Clackmannanshire Council</i>	16
<i>Comhairle nan Eilean Siar</i>	60
<i>Dumfries and Galloway Council</i>	67
<i>Dundee City Council</i>	137
<i>East Ayrshire Council</i>	141
<i>East Dunbartonshire Council</i>	60
<i>East Lothian Council</i>	161
<i>East Renfrewshire Council</i>	80
<i>Falkirk Council</i>	31
<i>Fife Council</i>	59
<i>Glasgow City Council</i>	9,290
<i>Highland Council</i>	107
<i>Inverclyde Council</i>	117
<i>Midlothian Council</i>	39
<i>Moray Council</i>	87
<i>North Ayrshire Council</i>	20
<i>North Lanarkshire Council</i>	191
<i>Orkney Islands Council</i>	40
<i>Perth and Kinross Council</i>	17
<i>Renfrewshire Council</i>	19
<i>Scottish Borders Council</i>	76
<i>Shetland Islands Council</i>	115
<i>South Ayrshire Council</i>	77
<i>South Lanarkshire Council</i>	131
<i>Stirling Council</i>	16
<i>West Dunbartonshire Council</i>	121
<i>West Lothian Council</i>	69

1.4.2.3 Scottish Government Resource-Allocation Models

Public data infrastructure developed in Scotland gained international recognition with respect to the wealth and availability of information (Scottish Government, 2020). Overall, the Scottish Government policy literature does not make explicit recommendations as to how the data should be utilised in the context of local service delivery characteristics and planning; however, consideration is given to future potential uses that should account for sub-local estimates. Most of the policy documents that refer to the data zone-level data are concerned with the Scottish Index of Multiple Deprivation. Significant attention is paid to the underpinning demographic and socioeconomic data zone-level characteristics and construction of the index.

The neighbourhood-level data is mostly analysed in the context of describing historical variability in life outcome patterns and providing various local summary profiles, that judging by the context, serve as background/introductory papers to various programme and work meetings. It is noticeable that, in policy documents, it is uncommon to incorporate more advanced statistical methods concerned with evaluating the effectiveness of local policies in the context of reducing neighbourhood-level variability across life outcomes.

As expected, the observed reluctance to utilise sub-local information cannot be ascribed to a sole cause. Practice indicates that probable explanations can be ascribed to a wide range of factors, accounting for the availability of the relevant skills as well as the policy-making aspects associated with the utilisation of small-area data. In particular, the decision-making aspect deserves further consideration. Similarly, with related work relying heavily on quantitative methodology, the work undertaken in this thesis is subject to methodological challenge. The existing analytical outputs support a substantial number of local policies utilising small-area statistics, which mostly tend to focus on the analysis of historical trends and descriptive analysis of the most recent figures. It remains unclear whether the existing situation is a consequence of conscious methodological choice or analytical resource constraints. The question of whether the relative scarcity of analysis concerned with forecasting constitutes a significant impediment to the effectiveness of local policy implementations merits further discussion. In particular, analysis of the existing relevant grey literature indicates that the vast majority of resourcing and planning decisions are motivated by the analysis of historical trends or analysis of most recent data snapshots. In particular, analysis of the existing literature suggests that the predictive potential of neighbourhood-level data available across Scotland remains underutilised across Scottish local government policies. As a consequence, the existing policy approaches are predominantly reactive and focus on responding to pre-existing challenges. The following thesis aims to highlight this

potential and demonstrate that policy-relevant findings can be derived from analysing neighbourhood-level data in a predictive context.

1.5 Research Objectives

Following the recommendations of the Commission on the Future Delivery of Public Services report (Christie et al., 2011), this research project is concerned with providing a practical methods approach to answering the question of the role of place in relation to the effectiveness of community planning and utilisation of neighbourhood-level data in the development of local service-delivery and resource-allocation models. Consistent with the arguments outlined in the previous section, the following study aims to deliver an in-depth approach to the utilisation of small-area data in identifying vulnerable and persistently deprived communities and subsequently informing service-delivery mechanisms. In particular, the research aims to address the shortcomings of the existing approaches by demonstrating the analytical and decision-making potential that can be derived from the small-area datasets available across Scotland.

By focusing on the role played by external factors, the study proposes to engage with Wildavsky's (1979) claim of over-reliance on isolated measures as sources for policy development. The proliferation of policy developments in a crowded policy landscape frequently results in the development of policies created without a direct connection to the phenomenon that they are supposed to resolve (Page, 2009). Dery (1998) develops this argument further, suggesting that the development of new policies frequently lack originality and are focused on absorbing other policies.

An analysis of the decentralisation literature and the corresponding research on the role of local governments in service-delivery mechanisms makes evident the existence of a need to develop robust decision-support tools that measure the impact of local government institutions on the life of local populations (Barankay and Lockwood, 2007; Faguet, 2004). The importance of the research focusing on the role of life outcome indicators in relation to local governance was further recognised by a number of international organisations, including the Organisation for Economic Cooperation and Development (Kasparian and Rolland, 2012; Löffler, 2001). More specifically, it is widely recognised that full accountability of public sector organisations can only be achieved when appropriate indicators facilitating the measurement of performance impact on the community level are available (Boyne et al., 2002).

1.5.1 Problem Statement

According to Wolf (1979, p. 107), '[p]olicy formulation properly requires that the realised inadequacies of market outcomes be compared with the potential inadequacies of non-market efforts to ameliorate them'. Following this line of reasoning, it is justifiable to state that negative market outputs must be balanced against positive policy interventions. The negative market output of environmental damage, e.g. pollution, is balanced by positive governmental action expressed in taxation, licensing fees and superimposed limits (Wolf, 1979). As the government activity is of a non-market character, and consequently is financed by non-price resources, effective evaluation of performance is problematic, as it relies on quantifying wider social gains (Le Grand, 1991).

In a discussion of the role of information in policy decision-making, Wildavsky (2018) differentiates between a problem and difficulty and postulates that a problem exists in an inalienable relationship to a solution and organisational context. This work borrows further from Wildavsky's (1979) work by addressing the deficiencies of modern management information systems (MIS). Wildavsky (2018, p. 110) notes that 'modern management information systems, by dwelling excessively on goals, have become fixated on objectives'. This approach can have adverse implications in terms of policy implementation. Wildavsky (2018, p. 119) further argues that 'movement on any indicator can be maximised provided society is willing to ignore all other indicators'.

The statement has further relevance to the remaining elements of this thesis, which demonstrates that the current, overly narrow, focus on the available deprivation data does not fully capture the nature of vulnerabilities across Scottish neighbourhoods. A narrow focus on information in isolation leads to the sectorisation of public space and growth of the public sector (Wildavsky, 1979). This is symptomatic of what Wildavsky (1979) defines as policy being its own cause. A focus on indicators in isolation, without incorporating information in a wider context, results in policy development being undertaken with isolation. That detachment from reality is a consequence of policies being developed independently of the relevant data providing context.

Despite the extensive theoretical literature concerned with the introduction of performance indicators across the public sector, it is noticeable that the existing management mechanisms are characterised by a persistent lack of a transferable body of evidence on measuring the performance of service-delivery mechanisms. In a recent work concerned with comparison across a selected sample of developed countries on the efficiency of public administration and service delivery, Jonker (2012, p. 12) notes that '[i]t proved very difficult to

find suitable indicators for the culture and public administration sectors. Together, these nine sectors cover the lion's share of public expenditure.'

Jennings et al. (2017) drew on Wildavsky's (1979) earlier point that insufficiently informed crime policy development results in penal populism. Jennings et al. (2017) argue that changes in crime rates are mirrored in public support for tougher sentences. In particular, following Wildavsky's (1979) earlier work, the authors assert: '[i]ncreased use of prison and harsher sentencing, therefore, reflected popular support for government being tough on crime' (Jennings et al., 2017, p. 27). The authors further suggest that an understanding of crime dynamics should be developed in tandem with gaining an understanding of the other factors contributing to variability in crime rates, such as the macroeconomic context.

Osborne and Gaebler (1993) argue that policy realisation should be undertaken by market-responsive public bodies that would compete for the provision of citizens. This concept is very much related to earlier writings by Tiebout (1956). The extent to which the introduction of competition into public service delivery models is desirable remains a contested issue. The analysis shows that the impact of market-based reforms on healthcare provision is mixed (Gaynor et al., 2010). Taking the example of public transport, Amaral et al. (2009) hypothesise that the introduction of market-based reforms across London and French¹ public transport networks resulted in improvements, with more efficient transport services.

The extent to which it is possible to replicate comparable success across other areas of public services, such as healthcare, remains a matter for further research. For instance, Porter and Teisberg (2004) hypothesise that the existing nature of competition in the US healthcare market does not benefit patients, as the past healthcare reforms introduced competition across healthcare providers in a manner that did not facilitate better service delivery to customers. The authors argue that 'reform efforts have not resulted in meaningful competition at the level of specific diseases and conditions – the level at which value is created in medicine. With competition at the wrong level, all the system participants – consumers, providers, employers, and insurers – have acted counterproductively' (Porter and Teisberg, 2004).

The ability to effectively measure performance is crucial to the successful implementation of business-like efficiency paradigms across public sector organisations. In a

¹ Due to the regulatory nature of public transport arrangements, the paper focused on French public transport, excluding Paris, and English urban transport across London only. At the time of writing of the paper, urban public transport activities outside London were not regulated. Similarly, in France, public transport in Paris is operated by a public entity and subject to a particular legal regime (Amaral et al., 2009).

paper concerned with the difficulties surrounding the measurement of performance in the public sector, Thiel and Leeuw (2002) hypothesise that the introduction of business-like performance management methodologies and the reliance on indicators across local governments are challenged by the performance paradox. The performance paradox is defined as a simultaneously occurring negative change in the value of an indicator and a positive, corresponding change, in the outcome.

The example of measuring the performance of the police force illustrates this phenomenon. A time-series analysis of the crime rate may indicate a decrease in the number of arrests, suggesting a decrease in police performance as a potential explanation. However, diminishing sentencing/detection rates may occur as a result of effective crime prevention or a number of other factors related to crime prevalence. Consequently, a diminishing detection rate may de facto indicate an increase in community safety, not a deterioration in the performance of the local police force (Thiel and Leeuw, 2002).

In an earlier study, Bouckaert and Balk (1991) point to a number of common challenges associated with measuring performance across the public sector. For instance, the authors observe that the increasing number of organisations concerned with protecting human rights is correlated with the increasing number of human rights violations (Bouckaert and Balk, 1991). With respect to the UK, the authors hypothesise that: 'Northern Great Britain seems to have more fires than other European countries because it has a better statistical technique of measuring fires' (Bouckaert and Balk, 1991, p. 231).

The purpose of the following work is to explore the vulnerability of Scottish neighbourhoods to external macroeconomic events and persistent levels of deprivation. In the context of this work, the notion of a neighbourhood is exploited and named as a focal point for capturing the 'totality of outcomes' experienced by a community (Jarvis et al., 2001, p. 39). In the example of the previously introduced performance paradox, the neighbourhood-level data are exploited to address this issue by expanding the base of indicators utilised and highlighting other variables that could indicate a genuine improvement in life outcomes.

With respect to the practical applicability of the findings obtained, the research offers an additional dimension of deprivation by directing the focus at neighbourhood-level data and exploring the analytical potential of small-area performance indicators. Recent developments in spatial analysis, such as Geographically Weighted Regression (GWR), indicate that spatially aggregated small-area data can be a valuable carrier of information for resource-allocation mechanisms (Ali et al., 2007). In particular, it is recognised that the standard approaches to the analysis, which provide only a total measure of the observed space, are incapable of

assigning the necessary importance to the spatial variation of the observed phenomena (Ali et al., 2007; Brunsdon et al., 1998).

Practical support for the policy-relevant uses of spatial statistics comes from the work undertaken by Sridharan et al. (2011) on spatial heterogeneity in area-level deprivation and mortality across Scotland. Sridharan et al. (2011) hypothesise that targeting health resources at geographies that are affected by the coexistence of health-predictive negative life outcomes may prove an efficient public health strategy.¹ Further support for this line of reasoning is provided by the research on the spatial distribution of persistent poverty across US counties undertaken by Partridge and Rickman (2007). In the course of the Geographically Weighted Regression analysis, the authors were able to identify localities that were at a particular disadvantage with respect to the selected measures reflecting the employability potential of the resident population and economic variables, such as job growth or average levels of educational attainment (Partridge and Rickman, 2007). The conceptual base for the notion of a neighbourhood is rooted in Heidegger's (1968) idea of nearness. Consistent with Tobler's (1970) first law of geography, one expects that the occurrence of spatio-temporal proximity will result in the increased probability of an aggregate of shared characteristics occurring simultaneously.

In a life outcome-related sense, a neighbourhood is defined in the context of the variability in magnitudes of the relationship between the space and the life outcome patterns (Bernard et al., 2007). Drawing on Giddens's (1984) structuration theory, Bernard and colleagues (2007) hypothesise that on a neighbourhood level, consistent life outcome patterns

¹ It could be added that diversified spatial application of resources by a public sector body may contribute positively to the overall notion of equality. It was noticed that county courts in Virginia, US, were characterised by different sentencing patterns, with northern counties being marked by a higher number of prison sentences being issued for the same type of crimes. The response of a District Court was to introduce the guidance that would induce the county judges to sentence more uniformly across the State with the use of an algorithm ascribing a score depending on the severity of a crime and the accused's conviction history. It was later noticed that sentencing patterns were correlated with the availability of penitentiary resources. Judges residing in counties located at a significant distance from the local prisons were less keen to issue prison sentences, as that would force detainees to serve the punishment in a remote prison often located in another state (Texas in most of the cases), hampering their ability to maintain relationships with relatives and, consequently, making their return to society even more difficult. On the contrary, judges residing in counties with local prisons available were keener to pass prison sentences, as this would not force the detainee to serve the punishment in a remote location. Consequently, the introduction of spatially aggregated data reversed the perspective on the local sentencing patterns. The application of uniform guidance would not lead to equality in sentencing but to a situation where a given percentage of detainees would be forced to face a harsher sentence by punishment in a remote correctional facility, hindering their ability to maintain relationships with relatives. (Source: conversation with Sanjeev Sridharan, Associate Professor from University of Toronto during the Scottish Health Informatics Programme event hosted at the Dundee University on 19th September 2012).

emerge as a result of spatial heterogeneity across available resources. The authors classify resources into the domains: 'the physical, economic, institutional, local sociability, and community organisation' (Bernard et al., 2007, p. 1839). As hypothesised by Cummins et al. (2005), the residents of deprived neighbourhoods may frequently be exposed to factors negatively contributing to adverse health outcomes.

The notion of the neighbourhood in the context of diversity in demand has been present in social and political sciences since the early 1920s (Lee, 1968). From a local governance perspective, the neighbourhood is seen as a distinct community with shared needs, defined resources and potential for change, which, for instance, can be expressed in the form of social capital (Lowndes and Wilson, 2001). Kearns and Parkinson (2001, p. 2105) emphasise the need to develop policies that meet local communities' expectations as a key to successful service delivery. The importance of the spatially disaggregated life outcomes in the context of the overall well-being of residents was recognised by academia, emphasising the role played by the locus in life outcomes (Ballas, 2005; Ballas and Tranmer, 2011).

1.5.2 Research Questions

Local governance in Scotland is facing operational challenges pertaining to the efficient use of performance indicators that have arisen due to the reform of public sector performance. This was highlighted across the Audit Scotland (2013) reports concerned with CPP evaluation. The analysis undertaken indicated that the manner of utilising neighbourhood-level data across CPPs is frequently limited to rudimentary descriptive analysis of the most recent data and does not account for the analysis of historical trends or forecasting.

Further analysis of the research concerned with performance evaluation across Scottish local authorities poses a number of relevant questions pertaining to the efficient and acceptable use of performance indicators in governance. The publication of the Christie report (2011) in Scotland emphasised the need for the local authorities to engage productively with the notion of place and neighbourhood-level inequalities. This is reflected in the proposed research question:

Can small-area Scottish data be used to identify the existence of areas that are particularly vulnerable to adverse macroeconomic events and characterised by persistent, elevated levels of deprivation?

For operational purposes, the leading research question is broken down into a set of sub-questions that will be answered in the course of the following research.

- a) *Do the currently available small-area data allow for the identification of localities that are at risk of being disproportionately affected by multiple deprivation?*

The question explores the nature of the statistical and data quality requirements associated with the development of small-area estimates. In particular, the question focuses on:

- i. Whether the existing publicly available Scottish small-area datasets can be utilised to identify persistently vulnerable localities?
 - ii. Whether it is feasible to use the existing neighbourhood-level data to deliver analysis consistent with the recommendations of the Commission on the Future Delivery of Public Services report and focus on persistently deprived communities that are also at a higher risk of impact from adverse macroeconomic events?
- b) *How do exogenous macroeconomic events impact neighbourhood-level JSA rates across Scotland over time?*

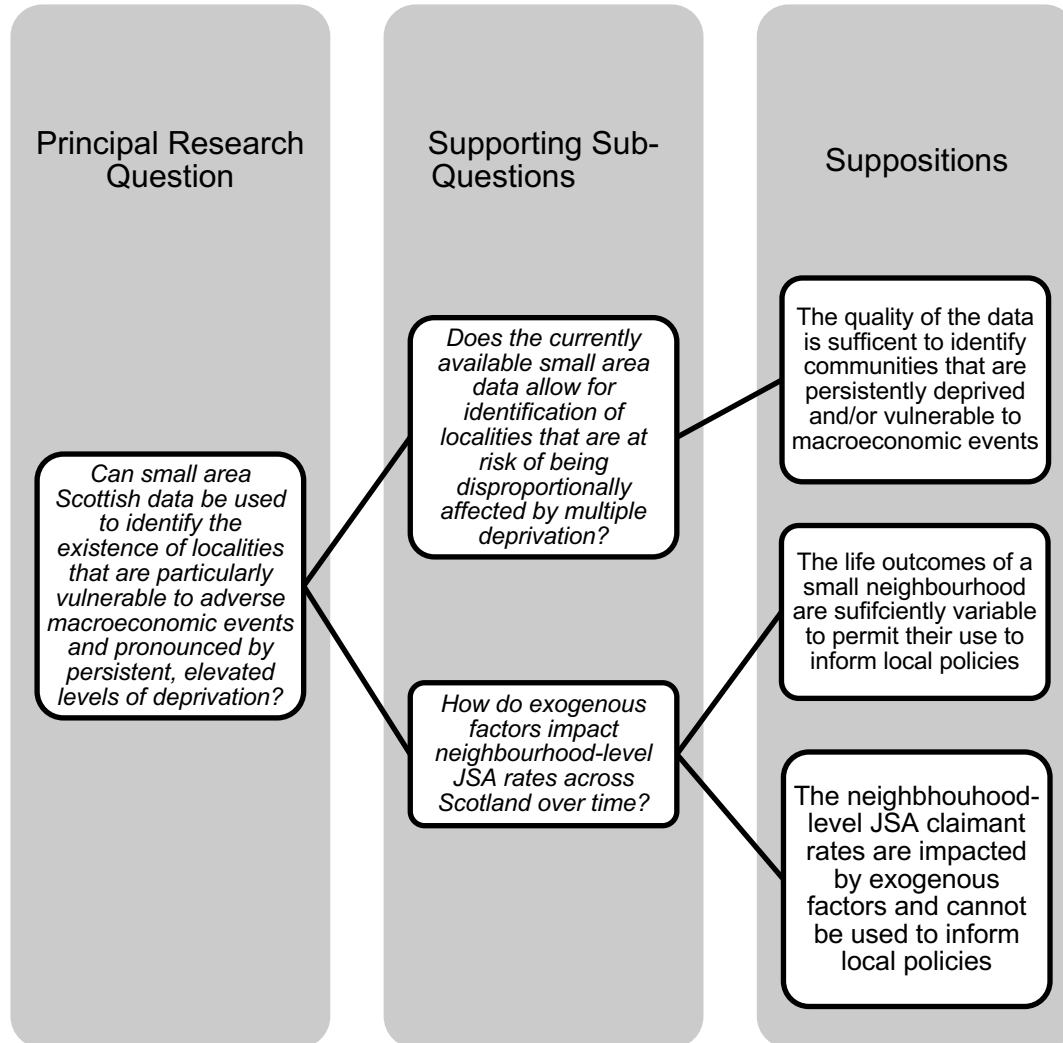
This question will focus on the relationship between neighbourhood-level JSA rates and adverse macroeconomic events. In particular, the question will explore to what extent change in neighbourhood-level out-of-work benefit claimant rates can be explained by macroeconomic events. The findings from the question will be used to evaluate the hypothesis on whether the neighbourhood-level data can be meaningfully used to identify communities that are at a higher risk of impact from adverse macroeconomic events.

1.5.3 Hypotheses Development

As outlined in the previous section, the guiding research question is concerned with the usability of small-area estimates in informing local governance resource-allocation and service-delivery models across Scotland. Following the assumptions stated in Chapter 1 —, the purpose of this work is to evaluate the analytical potential of Scottish small-area estimates in identifying neighbourhoods that are persistently deprived and those that are vulnerable to adverse macroeconomic events. As the problem posed by the leading research question is concerned with the practical usability of the small-area data, the question operationalisation draws from the idea of a non-directional hypothesis understood as the existence of a statistically significant difference between comparable aggregates of entities (Tiemann et al., 2010). In the context of this work, the proposed research sub-questions are broken down into hypotheses by attempting to evaluate and focus on assessing whether the available dataset meets the required analytical standards.

The technical aspects of the proposed research draw heavily on the methodological theory concerned with the research in the area of the data quality with an emphasis on the utilisation of small-area data. The process of hypothesis validation assumes a detailed exploration of each of the outlined assumptions, which are further summarised in Figure 1-3.

Figure 1-3 — Analytical Process Outline



1.6 Summary

This chapter outlined the key theoretical assumptions concerned with the use of spatially disaggregated life outcome indicators in the context of Scottish local governance and internationally, referring to more generic principles. An analysis of the relevant research literature concerned with the nature of governance indicated a lack of consistency in the definition of the concept. Following the approach by Pollitt and Bouckaert (2011), this chapter assumes the existence of five overarching categories: New Public Management, Neo-Weberian State, Networks, Governance and New Public Governance. The models differ with

respect to the roles of external actors, like the private service providers, and with respect to the extent to which they internalise corporate and business-like practices. For the purpose of further discussion, this chapter utilised the conceptualisation by Stoker (1998), in which governance is defined by the existence of formalised institutions that can make decisions and enforce them.

The emphasis is also directed at the policy mechanisms underpinning the development of multilevel governance structures. In the context of this work, the notion of multilevel governance reflects various degrees of administrative and fiscal decentralisation. In the course of this work, the notion of local governance is operationalised in a way that reflects the degree of administrative and fiscal decentralisation. The existence of sub-national fiscal and administrative competencies is considered to be a necessary condition for effective local governance.

It is noticeable that the key definitions of efficiency utilised in business research, such as *x-efficiency*, *allocative efficiency* and *dynamic efficiency* are not considered directly applicable to government structures and public sector service-delivery mechanisms (Le Grand, 1991). Changes across governance arrangements and the progressive marketisation of government services contributed to the discussion of the validity of the performance models used and suitability of indicators that are subsequently used to inform related performance management processes. In line with the arguments by Afonso, Schuknecht and Tanzi (2005), this chapter recognises that the efficiency of government activities can only be adequately evaluated by using complex models reflecting the totality of governmental activities.

Following the recent methodological developments in the use of life outcome indicators across policy and governance and the corresponding increasing importance of quantitative methodologies, this chapter further argues that performance indicators are starting to play a pivotal role in local governance (Porter, 1996). Consistent with the World Bank's recommendations, this chapter recognises that for the use of performance indicators in governance to be viable, they have to meet a number of requirements, such as being gathered in the course of a transparent process, pertaining to clearly definable concepts and displaying a satisfactory degree of accuracy (Knack et al., 2003).

Consistent with the theoretical principles underpinning political developments that utilise spatially aggregated data such as the *OECD Better Life Index*, it is argued that life outcome indicators can be meaningfully and productively used in governance (Boaz and Nutley, 2003; Bovaird and Löffler, 2007; Kasparian and Rolland, 2012). This chapter

recognises that the use of life outcome indicators in performance management exerts a positive impact on the accountability of governmental structures.

The analysis then turns to a discussion of indices of deprivation that play a particularly important role in the development of resource-allocation and service-use mechanisms across local governments throughout the developed world. An analysis of the policy literature pertaining to the use of indicators concerned with different measures of deprivation indicates that a vast number of successful area-based policies were developed independently in Canada, New Zealand and South Africa (Bell and Hayes, 2012; Noble et al., 2010; Salmond and Crampton, 2012).

Chapter 2 – Methodology

Summary:

The purpose of the following chapter is to introduce the methodological principles and outline the technical details of the research process. The chapter commences with a discussion of the development of the research hypotheses that are derived from the guiding set of research questions. Aspects pertaining to the data availability and the relevant analytical steps concerned with arriving at an answer to each of the analysed problems are discussed in the ensuing sections.

2.1 Introduction

The following chapter outlines the methodological approach to the analysis of the principal research question and the ensuing set of research hypotheses. The chapter commences with an outline of the principal research question and subsequently progresses to the development of sub-questions. Thereafter, the chapter discusses the set of falsifiable hypotheses that were developed for the purpose of making the research operational.

In line with the research stages outlined, the first section of this chapter considers the requirements associated with the statistical quality of the spatially aggregated data sets in the context of the small-area data having the potential to generate information relevant to local service-delivery mechanisms. In particular, this section focuses on the technical requirements pertaining to the use of small-area estimates in governance. It additionally outlines the methodological details associated with evaluating the quality of spatial data relevant to local governance, with an emphasis on the Scottish context.

This chapter also considers the relevant academic literature on data quality as well as more generic methodological literature on the use of spatial statistics in governance and the available empirical evidence associated with the significance of small-area statistics in local service-delivery and resource-allocation models. In order to evaluate the role played by small-area data, this section outlines the assumptions underpinning the empirical research on the Scottish subset of the data concerned with the issues relevant to the spatial data analysis. The chapter further focuses on providing an account of the research steps concerned with exploring whether the present data qualities of available small-area estimates are of practical applicability to the decision-making process across local governments, with a focus on Scotland.

In the following sections, this chapter addresses the methodological requirements associated with utilisation of small-area estimates in research on life outcomes, such as the impact of exogenous and endogenous factors on neighbourhood-level life outcomes. The chapter subsequently focuses on the nature of the available data. In line with the proposed set of initial research questions, the first section of the chapter focuses on the methodology underpinning the research on the quality of the data requirements associated with the spatial data and the corresponding national and sub-national differences in the use of the spatial life outcome indicators in the context of the multi-agency partnerships and development of service-delivery and resource-allocation models applicable to local governance in Scotland and internationally.

The chapter also addresses the related methodological requirements concerned with the analysis of the relationship between the role played by small area-level data in decision-making and the nature of the multi-agency partnerships. Further emphasis is placed on the comparative analysis of the data management systems utilised to distribute small-area statistical information across the governmental structures and the relationship of such systems to decision-making processes. Drawing on work concerned with the importance of information in the effectiveness of multi-agency operations, this section focuses on the role played by spatial datasets (Baud et al., 2009; Sloper, 2004).

In this context, the chapter addresses the relevant technical aspects associated with the development of small-area datasets and explores the relationship between small-area data quality and decision-making. In addition, this section further focuses on the increasing trend towards the development of big data systems across governments and the relationship of this development with decision-making. Attention is then directed at how the idiosyncratic characteristics of the big datasets, such as heterogeneity and fuzziness, impact the applicability of small-area data to the relevant local authority decision-making processes (Stough and McBride, 2014).

This chapter further summarises the existing ways of analysing spatially aggregated life outcome indicators that can be effectively used by local governments in order to aid decision-making, gain legitimacy and inform resource-allocation mechanisms. The section is concerned with answering the question of whether spatially aggregated data can be successfully used in addressing inequalities by facilitating the introduction of more adequate resources and distribution processes? In particular, this section focuses on the relationship between the uses of spatially aggregated life outcome indicators and aspects of service delivery. Finally, this chapter considers the methodological requirements concerned with analysing the susceptibility of neighbourhood labour markets to exogenous factors, taking publicly available data across Scotland as an example. The analytical steps outlined are concerned with answering to what extent the distribution of life outcome indicators on a neighbourhood level would be affected by the impact of exogenous factors corresponding to major macroeconomic events.

2.1.1 Theoretical Background

A substantial amount of social and political science research relies on inductive or deductive approaches to hypothesis testing (Whicker, 1986). For the sake of clarity, it may be useful to introduce the basic characteristics of these two paradigms and how they are utilised in this research. In general, the existing understanding of deductive reasoning is rooted in the

Popperian idea of the nature of scientific progress. In his landmark work, *The Logic of Scientific Discovery*, Popper (2002) asserts that scientific progress takes place in the course of falsifying erroneous hypotheses (Ormerod, 2010). In particular, Popper (2002) asserts that for a scientific hypothesis to have credence, it must be falsifiable. Further work concerned with the subject, particularly by Platt (1964) and Lakatos (1976), provided a direct link between the role of hypothesis testing and scientific discovery (Klayman and Ha, 1987).

Consistent with more recent arguments presented by Klayman and Ha (1987), Platt (1964) noted that the pace of scientific progress across diverse scientific disciplines is proportionally related to the overall quality of the methodological rigour of the discipline. In particular, Platt (1964) emphasises that methodological rigour plays a significant role with respect to hypothesis formulation and evaluation. As later emphasised by Van Belle (2006, p. 299), Platt (1964) stresses the need for 'placing hypothesis testing inside the context of a larger scientific method'. Platt (1964) further argues that the key to scientific progress is associated with the ability of a researcher to focus not on the problem but on the methodological intricacies of the specific question. Van Belle (2006, p. 300) supports this reasoning with a simple calculus of probabilities, emphasising the decreasing probability of two poor data sources being 'wrong in the same way'.

A successful operationalisation of political science research is frequently contingent on the effective development of metrics and indicators. In particular, the difficulty surrounding the development of classical, falsifiable hypotheses in political science is partially explained by the challenges surrounding the development of metrics that are used in political research (Bernstein et al., 2000). The problem is particularly pronounced in the context of research concerned with international relations and political science, where there are concepts like the quality of governance or degree of democratisation (Bernstein et al., 2000).

The development of robust life outcome indicators is particularly relevant in the context of evaluating the performance of government structures, whether on a local or a national level (Krumwiede, 1998). The relevant academic literature concerned with the implementation of performance metrics across the public and the private sectors recognises that challenges surrounding the formation of robust indicators are common (Cavalluzzo and Ittner, 2004). In particular, research on assessing the performance of government institutions recognises that the existing indicators reflecting degrees of deprivation or local resource availability imply value judgements with respect to the relevance of the observed statistical phenomena and by categorising local residents as poor or deprived (Alkire and Foster, 2011; Sen, 1976).

The importance of value judgements in the development of deprivation indices is particularly relevant in the context of multidimensional deprivation indices (Alkire and Foster, 2011). For instance, the formal recognition of poverty as a multidimensional phenomenon, emphasised in the Human Development Report 1997 by the United Nations Development Programme (1997) and the 2000/2001 World Development Report by the World Bank (2001), established the practice of developing multiple deprivation indicators focused on the heterogeneous and multidimensional nature of poverty.

The established practices of developing multidimensional poverty indicators often rely on aggregating metrics corresponding to a single variable across multiple life domains like health, educational attainment and assets/income. A unified metric that usually corresponds to aggregate values derived from quantified values attained within each of the domains is then proposed (Decancq and Lugo, 2013). Wide-scale research conducted among the global poor by the World Bank provided empirical support for the multidimensional nature of social deprivation and, to a great extent, justifies the methodological approaches underpinning the construction of the numerous deprivation indices (Narayan, 1999). The fact that poverty manifests itself across various non-monetised life outcomes, such as relatively shorter life expectancy or access to education is now well recognised across the social sciences (Duclos et al., 2006).

Despite substantial empirical support for the multidimensional nature of deprivation, the absence of a uniformly accepted definition poses challenges with respect to the technicalities of various deprivation indicators, mostly pertaining to the inclusion of specific measures and the weights utilised. Traditionally, a high weighting is ascribed to measures corresponding to socioeconomic indicators such as benefits uptake or localised labour market characteristics. In particular, initiatives such as the Stiglitz-Sen-Fitoussi Commission emphasised the need to develop more comprehensive measures accounting for more diverse aspects of poverty than the usually employed income and asset indicators (Stiglitz et al., 2008). As a consequence, wide-scale research programmes, such as the Oxford Poverty & Human Development Initiative (2015), emphasised robust elaborate deprivation measures focusing on living standards and health-related measures having a direct bearing on the lives of the most deprived communities across the globe.

The technical aspects of the research discussed are marked by challenges similar to those occurring across the majority of spatial econometric studies and a variety of cognate research projects utilising spatial data sets. The increasing popularity and usability associated with GIS have contributed to this trend (Goodchild, 2015). In an analysis of the last two decades of developments in GIS, Goodchild (2015) notes that particularly significant progress

was made with respect to developing mechanisms to facilitate data visualisation and accessibility of GIS analysis. Nevertheless, as noted by Arbia (2006), the methodological aspects of the spatial econometric models are seldom considered outside the specialised literature concerned with spatial statistics. Waller (2014) notes that the proliferation of GIS technologies and the increase in the availability of spatial data across the public and the private sectors have made spatial analysis more popular across a number of disciplines.

With the GIS industry estimated to bring around \$270 billion in annual revenues globally, the increasing proliferation of GIS tools and accessibility of spatial data make evident the relevance of spatial statistics across a wider spectrum of academic disciplines concerned with research on human behaviour and other extra-academic applications, business and governance being prime examples (Kerski, 2014). Through its particularly strong focus on local communities, modern local governance presents itself as a field where the practical considerations surrounding the use of spatial econometric models are of relevance to the efficiency of decision-making processes. This is predominantly relevant to participatory decision-making models concerned with planning that utilise GIS technologies to convey the relevant information to non-expert audiences and engage local communities in decision-making processes (McCall, 2003).

Recent technical developments concerning the utilisation of microdata in spatial econometric research offer new approaches to incorporating information on spatial distances in political and sociological research (Dubé and Brunelle, 2014). For example, the labour mobility study undertaken by Boschma et al. (2009) utilised single person-level data across 101,093 job movers, incorporating regional industry information. Comparable research exploiting large-scale spatial datasets introduced the need to conceptualise the notion of spatial distance in a more creative way, giving focus to the continuous nature of the relationships analysed (Baldwin et al., 2012).

Recent developments in spatial econometrics have introduced more sophisticated spatial econometric models, incorporating not only measures of the structural proximity between observations but also measures of interaction between distinguishable spatial units (Beck et al., 2006). The importance of interactions between units of analysis in political science was further emphasised by Ward and O'Loughlin (2002). The authors note that most political research that has a spatial focus of some form utilises datasets marked by 'the absence of true independence in the relationships among the actors, issues, and domains of political life' (Ward and O'Loughlin, 2002, p. 211). Considering the statistical paradigms emphasising

interchangeability of the observations,¹ this renders the development of robust spatial econometric models particularly difficult.

The choice of theoretical paradigms reflected across several research projects utilising spatial data and related to the political context is impacted by the debates on major developments in GIS, spatial statistics and the role played by information in decision-making. For example, a substantial amount of discourse in political research is concerned with the role played by spatial correlation in deriving scientific conclusions from the analysis of geographic phenomena. In particular, the assessment of the difficulty caused by the existence of spatial autocorrelation in developing econometric models varies tremendously (Anselin and Cho, 2002a, 2002b; King, 2002).

The criticism concerned with the implementation of spatial econometric models in research on economics and politics is frequently associated with the choice of datasets. As pointed out by Gibbons and Overman (2012, p. 174), '[q]uestions of identification (i.e. does an estimated correlation imply that x causes y?) have been addressed by asking which spatial processes best fit the data'. Further, a commonly encountered difficulty associated with the development of robust modelling approaches utilising neighbourhood-level data pertains to the philosophical and econometric challenges surrounding the formulation of hypotheses from neighbourhood-level data, which is frequently conceptualised as Manski's (1993) reflection problem (Gibbons and Overman, 2012).

According to Manski (1993, p. 532), the reflection problem arises when 'a researcher observing the distribution of behaviour in a population tries to infer whether the average behaviour in some group influences the behaviour of the individuals that comprise the group'. In spatial econometrics, and in particular in models utilising neighbourhood-level data, Manski's reflection problem is associated with inferring 'whether an individual is affected by the behaviour of their group, or by the characteristics of their group when group behaviour depends on the characteristics of the group?' (Gibbons and Overman, 2012, p. 178). Considering the above-discussed points, the following research project focuses on the consistency of observed patterns in the spatial distribution of life outcomes across Scotland on a neighbourhood level and the implications of the phenomena observed for the dynamics of Scottish local governance with an emphasis on the relevance to decision-making processes concerned with local resource-allocation and service-delivery models.

¹ An interchangeable sequence, also described as an exchangeable sequence, is characterised by the equal likelihood of any order of samples occurring, as defined by Barlow and Irony (1992). De Finetti (1979) proposes a definition of exchangeability as independence with unknown probability.

2.2 Research Process

The following section provides an outline of the methods selected, as determined by the nature of the research questions and associated hypotheses. The research methods outlined in the subsequent sections focus on distinctive aspects of the role played by small-area estimates in local governance, with an emphasis on selecting methodological tools that would enable us to answer:

- a) Whether the statistical quality of the currently available neighbourhood-level data lends itself to model development that could be incorporated into robust models informing local service-delivery mechanisms?
- b) In line with the findings derived from the first question, whether it is possible to discern between the role played by the exogenous and endogenous factors that influence the distribution of the small-area indicators on a neighbourhood level?

The ensuing process of hypothesis evaluation utilises the available small-area data in order to provide the desired answers for the suggested questions in the course of the formal and exploratory statistical analysis. As discussed in the previous section concerned with the methodological theory underpinning the research, the initial analysis is of an exploratory character and borrows from the research paradigms concerned with data quality but also focuses on the nature of the decision-making and resource-allocation mechanisms across local governments.

However, contrary to the bulk of the research concerned with the role of evidence in governance, which focuses on the way research results are used and how they impact the political decision-making processes, the proposed research project focuses not on the evaluation of the existing characteristics pertaining to the historical aspects of the decision-making processes but on assessing the potential impact of the particular analysis and data types on future decision processes (Tenbenschel, 2008).

2.2.1 Data availability

The methodological approach outlined focuses on assessing the relevance of the spatial data in the context of utilising the currently available datasets with the aim of improving the efficiency of local resource-allocation and service-delivery mechanisms. In the context of the above assertion, the focus of analysis has to be directed at those qualities of spatial data that are conducive to asserting whether the given dataset constitutes an accurate and truthful representation of reality and whether this has a positive impact on the nature of the decision-making process (Longley, 2008). Following the assumptions outlined above concerning the

usability of small-area estimates, the research undertaken focuses on publicly available small-area datasets across Scotland. At the time of sourcing the relevant data, the main hub for publicly available small-area data in Scotland was Scottish Neighbourhood Statistics.

The Scottish Neighbourhood Statistics programme was initially developed by the Scottish Executive/Government, in order to facilitate access to small-area information that would be used by a variety of public sector bodies in planning, facilitating resource-allocation mechanisms and monitoring (Williams and Fraser, 2005). The technical implementation of the programme relied on the idea of providing wide access to an ample amount of information on various life outcomes derived from the administrative data. Similar to the majority of the spatial administrative data sets available internationally, the Scottish Neighbourhood Statistics website provides access to indicators that are derived from a postcode or individual-level indicators (Ma et al., 2012).

The production and dissemination of administrative data usually rely on sourcing individual data from the data creator and subsequently creating spatial aggregations of the data using statistical geographies (Folsom et al., 2014). This practice used to be employed by the Scottish Neighbourhood Statistics, which provided public sector partners with data return templates that were subsequently populated with the relevant records. The Scottish Neighbourhood Statistics website is considered a key, publicly visible element of the programme. The website provides access allowing users to:

- Download predefined reports on subjects of interest, usually including tabular summaries of commonly referenced indicators pertaining to numbers of life outcomes, like levels of educational attainment, demography, benefits uptake
- Define advanced reports reflecting custom selection of indicators and geographies
- Rudimentary visualisation tools of the available data with the use of maps and charts

(Scottish Government, 2008).

A sample report that can be generated by the Scottish Neighbourhood Statistics website is provided in Table 2-1. As illustrated, the presently available reporting system provides access to several life outcome indicators across a number of levels of spatial aggregation corresponding to the administrative, political and statistical geographies used. Analogous reports can be compared for a customised selection of indicators and geographies.

Table 2-1 — Extract from the sample standard SNS report

	<i>Interme diate Geogra phy: S020007 12 Drumch apel South</i>	<i>Community Regeneratio n Local: Drumchapel & Annie sland & Garscadden / Scotstounhi</i>	<i>Commun ity Regener ation CPP: Glasgow City ROA</i>	<i>Multi- Member Wards: Drumch apel / Annie sland</i>	<i>2011 Scottish Parliame ntary Constitu ency: Glasgow Annie sland</i>	<i>Community Health Partnership: West Glasgow Community Health & Care Partnership</i>	<i>2006 Local Health Autho rity: Glasg ow & Clyde</i>	<i>2006 Health Board: Greater Glasgo w & Clyde</i>	<i>Scotl and</i>
<i>Total Population : 2013</i>	3410	37422	309825	28889	74075	148131	59655	113793	5327 700
<i>Total Population - Children (%): 2013</i>	24.34	20.59	17.93	19.2	18.43	13.49	16.17	16.87	17.11
<i>Total Population - Working Age (%): 2013</i>	60.53	64.29	65.88	65.05	64.62	73.05	68.34	65.09	63.08
<i>Total Population - Pensionab le Age (%): 2013</i>	15.13	15.12	16.19	15.75	16.95	13.46	15.49	18.05	19.81
<i>Percentag e of total population who are income deprived: 2005</i>	39	34	36	31	24	21	25	19	14
<i>Percentag e of working age population who are employe ment deprived: 2008</i>	24	25	26	21	18	14	17	15	12
<i>Total Income Support claimants: 2012Q04</i>	265	2105	16780	1370	2880	4340	21770	35840	1111 80

In accordance with the Open Data Strategy launched by the Scottish Government (2015), the Scottish Neighbourhood Statistics data are now available through a new dissemination mechanism¹ providing more advanced data interrogation mechanisms with the use of the SPARQL Protocol and an RDF Query Language interface. In addition, the website offers a wide range of tools suitable for data development work. The data utilised in this analysis can be sourced via the new dissemination mechanism following the instructions available through the website.

2.2.1.1 Data Zones

The key concept underpinning the dissemination of data through the Scottish Neighbourhood Statistics is associated with the development of purpose-built statistical geographies – data zones. The development of data zones in Scotland is very much a product of the recent major technological achievements in spatial statistics, GIS and data technologies that make small-area estimates easier to produce and implement in user-friendly software products available to decision-makers (Kingston et al., 2000; O’Looney, 1997). Recent advances in spatial data visualisations associated with increased accessibility and affordability of computational power and data systems facilitating storage of large data sets provide impetus to a number of projects concerned with the development of spatial data systems (Andrienko et al., 2005). The practicalities pertaining to the development of neighbourhood-level data sets are often determined by the availability and accessibility of the relevant administrative datasets, as well as the requirements of future data users, which are taken into consideration in justifying the associated data collection processes.

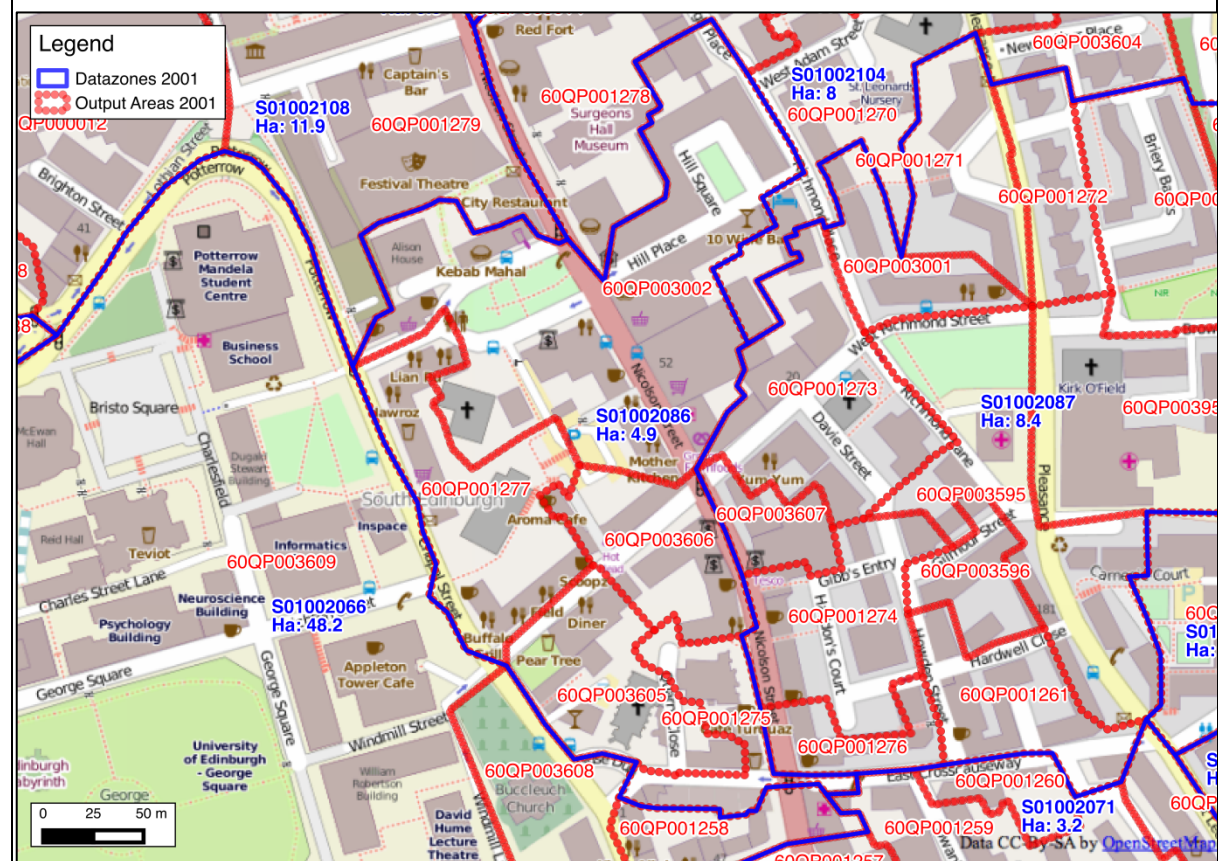
The literature on the development of small-area estimates emphasises the importance of small-area design methodology to subsequent analysis utilising small-area data (Fotheringham et al., 2000). The challenge is demonstrated in the case of the modifiable areal unit problem, where the analytical quality of the data is affected by the shape of statistical geographies (Fotheringham et al., 2000; Haynes et al., 2007). Understanding the principles underpinning the construction of statistical geographies utilised in this research is relevant to asserting the analytical validity of the results obtained. In the example of the geographical framework underpinning the Scottish Neighbourhood Statistics, it is possible to characterise a set of key procedural elements associated with the development of small-area administrative data systems. With respect to the production and dissemination of small-area data, the Scottish Government advocates that the data should be constructed on the smallest possible

¹ The repository is accessible at: <http://statistics.gov.scot/>.

levels of aggregation, facilitating subsequent aggregation to higher-level geographies (Flowerdew et al., 2007, 2004). The report on the construction of data zones also assumes that data zones should be coterminous with local authority boundaries (Flowerdew et al., 2004).

Example results of the process described are illustrated in Figure 2-1. The visualisation shows that the output areas are usually coterminous with the data zone boundaries. The output areas are geographically smaller and coterminous with the data zone boundaries. The neighbourhood boundaries are a function of the availability of small-area data, the capacity at the disposal of GIS analysts tasked with the development of geographies, and the procedural and administrative requirements imposed on technicians and analysts tasked with the development of small-area geographies.

Figure 2-1 — Relationship between 2001 Census Output Areas and 2001 Scottish Data Zones



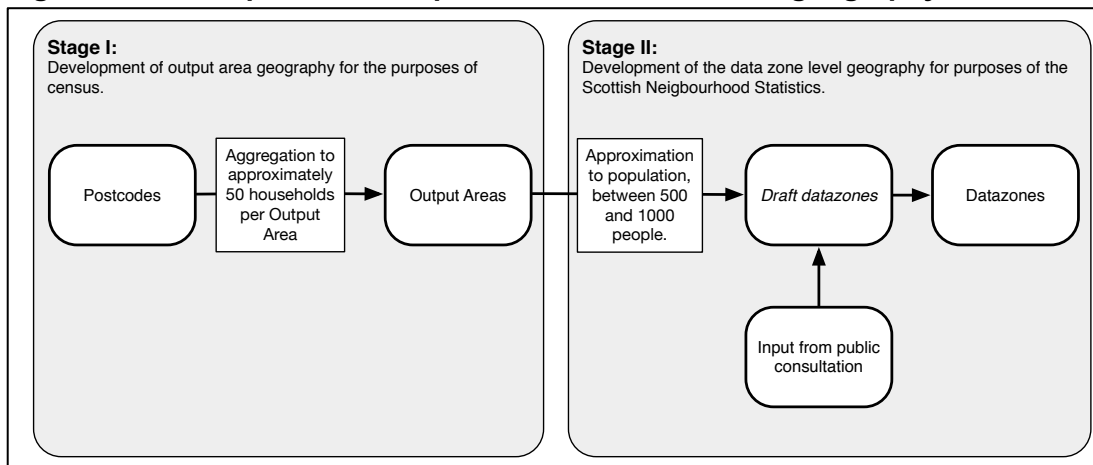
Data sources: *Scottish Neighbourhood Statistics (2010)*, *General Register Office for Scotland (2006)* and *OpenStreetMap © contributions*.

Analysis of the relevant grey literature concerned with the development of small-area statistics indicates that the construction of statistical geographies usually utilises the smallest available administrative or postal geographies. For example, the Scottish data zones were

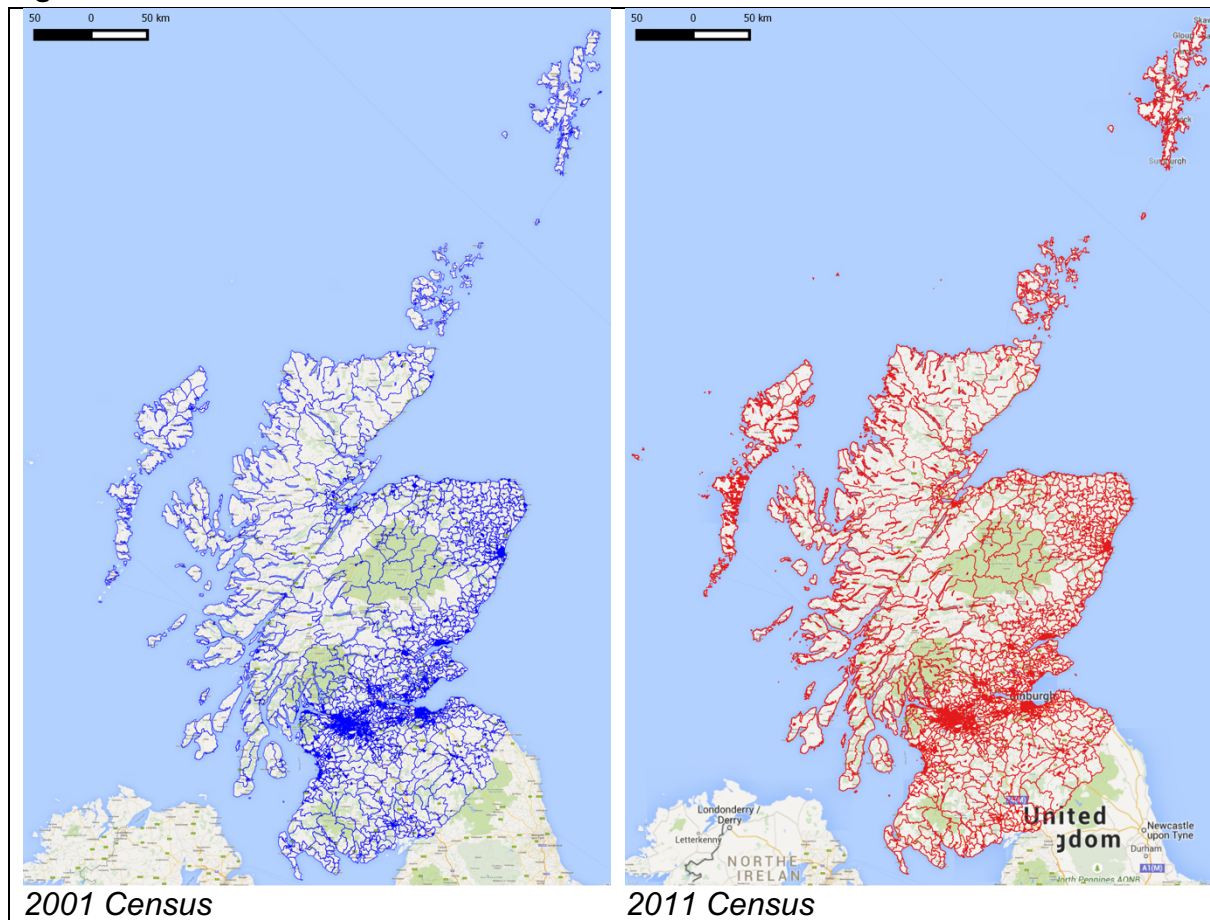
constructed with the use of census geographies that were initially derived from postcode areas (Flowerdew et al., 2007, 2004). The process of utilising postcode geographies for the purpose of developing statistical geographies is common across the public sector and private bodies concerned with the development of administrative and statistical geographies.

The simplified process of developing data zone–level geography is illustrated in Figure 2-2. The illustration of the process makes it worth exploring to what extent the notion of place represented in philosophy is reflected in the developmental work associated with one of the most significant spatially aggregated data sets in the country.

Figure 2-2 — Simplified development of data zone–level geography



The altered spatial distribution of Scottish data zones, reflecting the updates following the 2011 Census, is additionally visualised in Figure 2-3. As shown in the figure below, it is observable that the data zones that cluster more narrowly around the Central Belt are characterised by a smaller geographical size, which is associated with higher population density.

Figure 2-3 — Distribution of data zones across Scotland

A comparative analysis of the methodologies used in small-area development points to a common set of methodological assumptions reflected across these methods. Drawing on the methodology underpinning the construction of data zones and similar systems internationally, it is possible to outline a set of principles essential to the development of statistical geographies underpinning the construction of small-area data systems internationally. The principles, which are summarised in Table 2-2, are usually concerned with the compactness of shape and consistency of demographic characteristics of the small-area data produced. Most of the existing methodological approaches are guided by the ambition of creating small-area geographies with homogenous internal socioeconomic and demographic structures.

Table 2-2 — Characteristics of small-area systems in examples of Scottish data zones

Characteristic	Example
<i>Demographic consistency</i>	Geographies are designed to meet standards with respect to population sizes. Scottish data zones are designed to have a population between 500 and 1,000 residents.
<i>Compact shape</i>	Geographies are designed to be compact in shape and encompass small, geographically homogeneous areas.
<i>Homogeneity of social composition</i>	The data zones are designed to correspond closely to the actual communities on the ground with respect to social cohesion.
<i>Existence of community of interest</i>	The requirement corresponds to the above-outlined idea reflecting the homogeneity of social composition with the focus being placed on specific communities, such as the elderly or ethnic minorities.
<i>Accordance with other boundaries of local significance</i>	An emphasis is placed on designing data zones to be consistent with the Local Authority and ideally Multi-Member Ward boundaries.
<i>Accordance with prominent features in the local environment</i>	Data zones are designed not to cut through natural boundaries, like rivers.

Adapted from the work of Flowerdew (2004, p. 11)

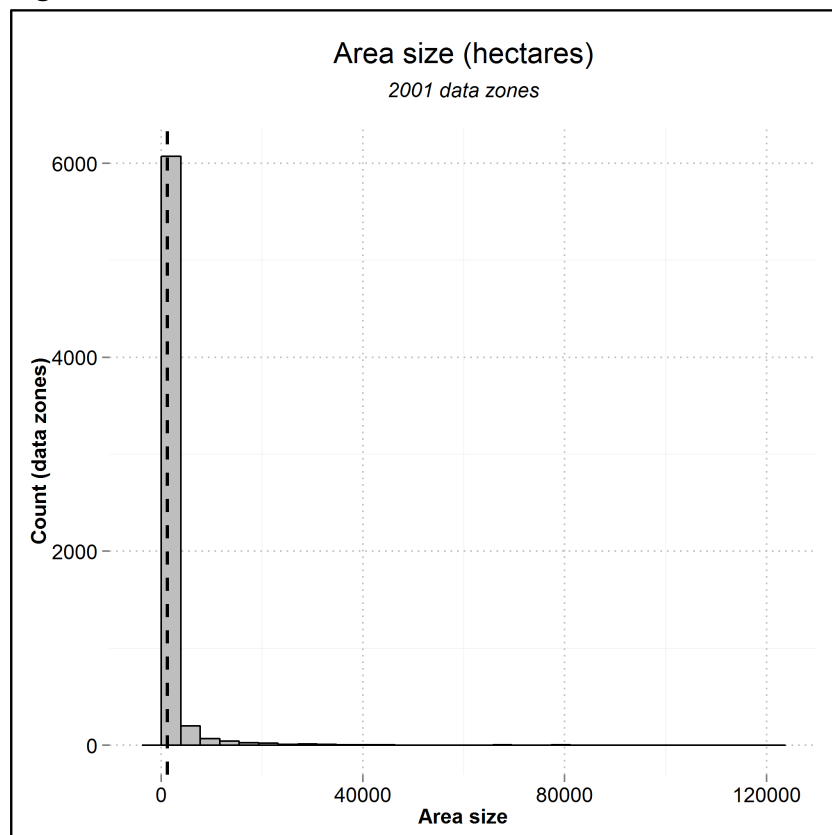
The demographic and geographic characteristics of Scottish data zones derived from 2001 census data are summarised in Table 2-3. It is noticeable that data zones are marked by small mean population sizes with low standard deviations, suggesting a high degree of consistency with respect to demographic characteristics. Initial descriptive statistics derived from the data on geographic size indicate wider dispersion. The observed characteristics occur as a consequence of emphasising socio-demographic consistency over geographic uniformity of data in the process of developing data zone boundaries.

Table 2-3 — 2001 Scottish data zone characteristics

Variable	Observations	Minimum	Maximum	Mean	Median	Standard Deviation	Skewness	Kurtosis
Area (hectares)	6505	1.24	115963.2	1198.95	23.05	5904.07	9.59	116.04
Population Counts	Total Population	0*	999	738.49	742	140.18	-0.36	0.28
	Working Age		5973	472.98	435	214.58	6.12	91.03
	Children		2852	140.15	126	82	8.79	209.86
	Pensionable Age		324	79.82	76	37.68	0.78	1.17

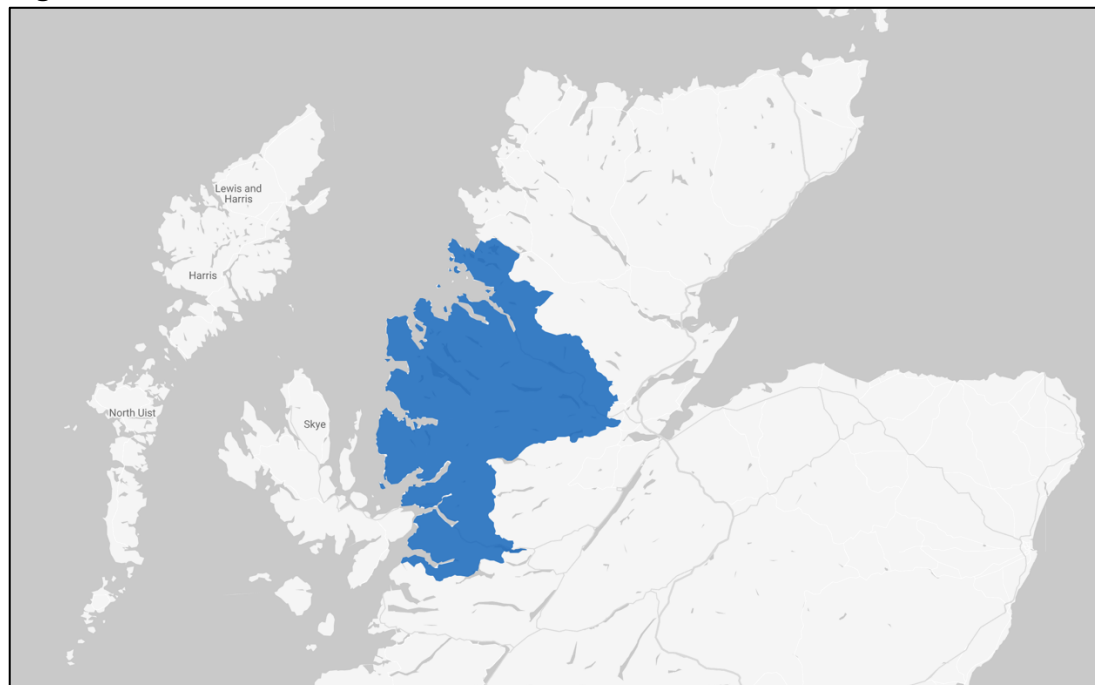
* A zero population reflects an unlikely occurrence where a specific geography depopulated as a consequence of architectural developments. The design of data zones is assumed to reflect desired population sizes, so geographies with population sizes under a few hundred are highly uncommon across the available data.

The following figures serve as visual representations of the variables listed in Table 2-3. Figure 2-4 provides a histogram of area sizes in hectares. Consistent with the initial design assumptions underpinning the development of data zones, it is observable that 80% of the geographies in the data set have a size under 25 hectares.

Figure 2-4 — Area size across 2001 data zones

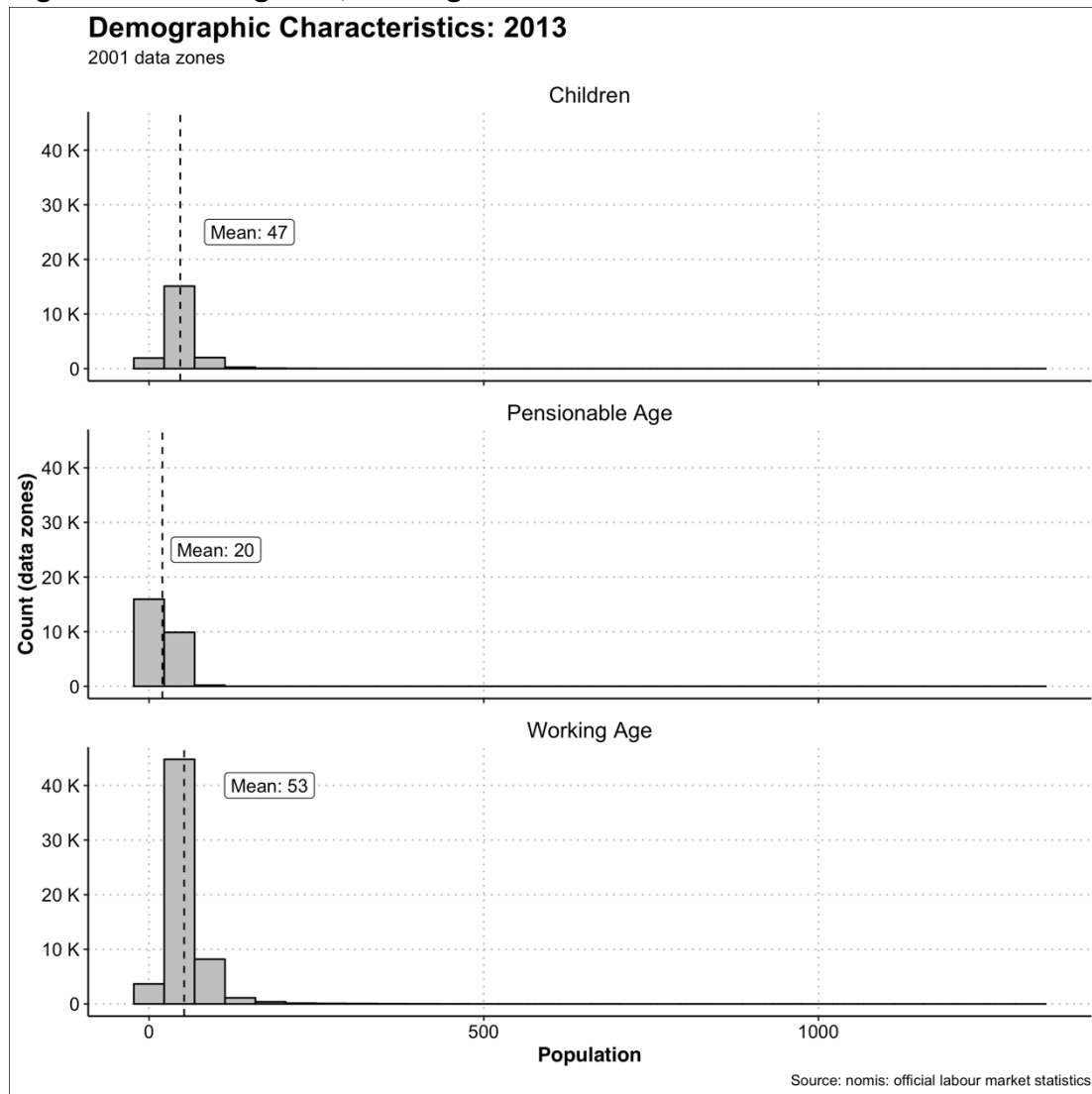
The area size characteristics of the 2001 data zones are skewed by the presence of sparsely populated geographies across Northern Scotland. Figure 2-5, showing boundaries for the S01003915 data zone, illustrates that occurrence.

Figure 2-5 — data zone S01003915 in 2001



The academic literature recognises that approaches to defining space have wide-reaching implications across a number of research concepts. For example, commonly used definitions of rural/urban geographies differentiate between the two using population size and density (Halfacree, 1993). This occurrence is visualised in Figure 2-6, which shows that the majority of data zones have a relatively small population.

Figure 2-6 – Histograms, 2013 age cohorts for 2001 data zones



The geo-demographic characteristics of Scottish data zones can additionally be characterised by using the Urban/Rural classification developed by the Scottish Government (2012a), which provides six classifications, as summarised in Table 2-4.

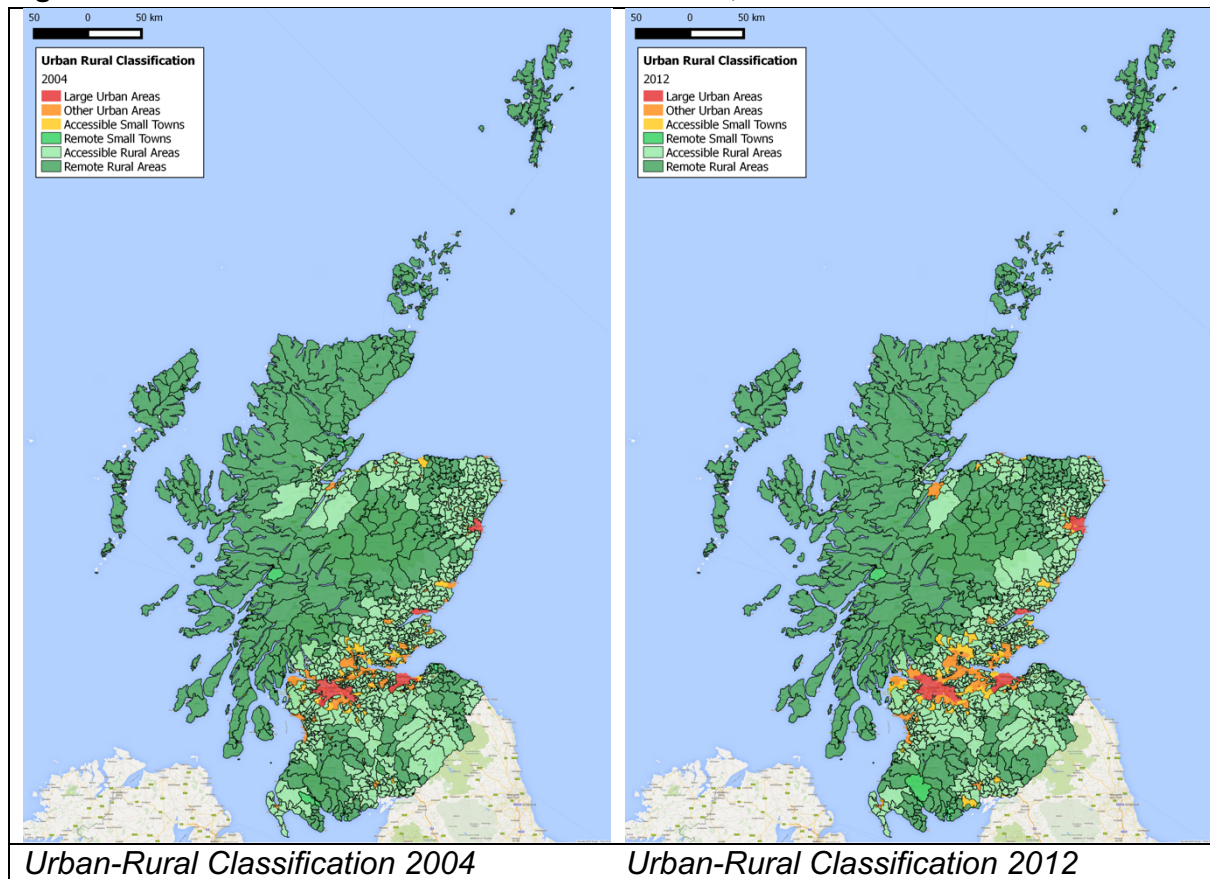
Table 2-4 — Scottish Government data zone classification

Class	Class Name	Characteristics
1	Large Urban Areas	Settlements of over 125,000 people.
2	Other Urban Areas	Settlements of 10,000 to 125,000 people.
3	Accessible Small Towns	Settlements of between 3,000 and 10,000 people, and within a half an hour drive time of a Settlement of 10,000 or more.
4	Remote Small Towns	Settlements of between 3,000 and 10,000 people, and with a drive time of over 30 minutes to a Settlement of 10,000 or more.
5	Accessible Rural Areas	Areas with a population of fewer than 3,000 people, and within a 30-minute drive time of a Settlement of 10,000 or more.
6	Remote Rural Areas	Areas with a population of fewer than 3,000 people, and with a drive time of over 30 minutes to a Settlement of 10,000 or more.

Adapted from: Scottish Government (2012a, p. 5 Table 2.2)

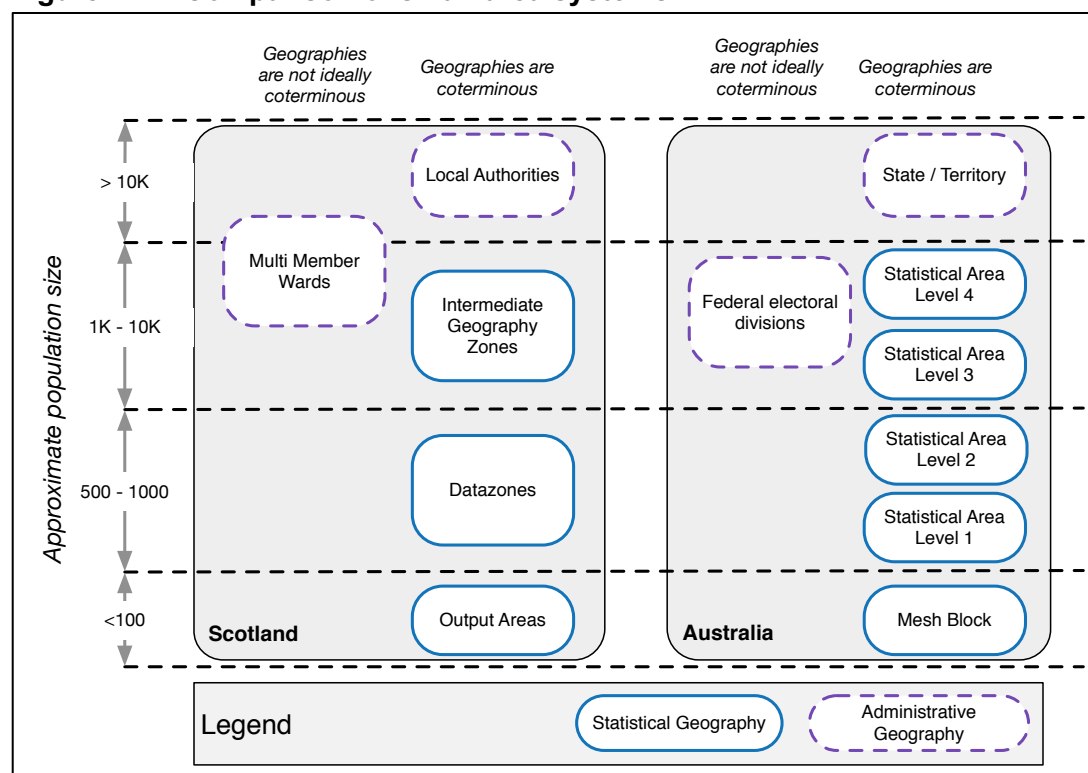
The distribution of urban and rural data zones is visualised in Figure 2-1. It is observable that urban data zones cluster more narrowly within the vicinity of the Central Belt, whereas the majority of Northern Scotland is dominated by more sparsely populated rural geographies.

Figure 2-1 - 2004 and 2012 urban/rural classification, data-zone level



An overview of cognate data systems available internationally enables us to highlight the key procedural characteristics associated with the development of neighbourhood-level data systems. For example, the Australian system for neighbourhood-level data was constructed reflecting similar methodological assumptions. The Australian Bureau of Statistics (2011) uses Statistical Area Level 2 (SA2) geography to disseminate socioeconomic and life outcome data on a neighbourhood level. Analogously to the statistical geographies available in Scotland, the Australian system of statistical geographies corresponds to administrative and political boundaries, as demonstrated in Figure 2-7.

Figure 2-7 – Comparison of small-area systems



The purpose of this section is to introduce the methodological principles underpinning the construction of data in relation to the ensuing analysis and informing the development of service-delivery and resource-allocation models. The emphasis is being placed on the currently available approaches to the definition of a neighbourhood that are applied across local and national governments. The section also outlines how the methodological approach utilised to construct data zones' impacts is related to resource-allocation mechanisms.

At the time of finalising this thesis, the majority of the small-area life outcome data available across Scotland was disseminated using the 2001 data zones. Data zones which were updated with 2011 figures are at the moment used to disseminate demographic figures produced independently by the National Records of Scotland and to share the relevant 2011 Census data. Consequently, the research outlined will utilise 2001 data zones, as the available data period is sufficient to observe significant changes in neighbourhood-level variability of Jobseeker's Allowance rates. When discussing the potential applicability of the findings, it is worth introducing changes to those geographies that took place as a result of the microdata from Scotland's 2011 Census.

The delivery of the Census in Scotland is governed by the 1920 Census Act (*Census Act 1920*, 1920). In the UK, the Census has been carried out every ten years since 1801, with

the exception of 1941, and is regarded as the most reliable data source on the population (Office for National Statistics, 2011). It is widely recognised that census data have a significant impact on small-area statistics (Morphet, 1992). As discussed in the previous sections, the process of deriving small-area estimates usually implies capitalising on the core small-area data gathered in the course of the census.

The update to the data zone boundaries was justified on the grounds of accounting for the demographic changes occurring due to the population mobility (Scottish Government, 2013). It is natural that, with time, the link between the geographic boundaries and the population on the ground becomes eroded. This is of relevance to small-area geographies, where a minor change in the total population may have an impact on relative figures.

The data zone boundary update also addressed changes to the demographic structure that took place in the course of urban redevelopment. For example, a well-known case across the local Scottish public sector pertains to the data zones in Glasgow City that consisted of a set of tower blocks. The tower blocks were subsequently demolished, leaving the previously drawn statistical geographies with no resident population. In terms of the data collection and dissemination, that occurrence initially used to lead to bizarre results being available, as the automatic generation of the data returns still lead to certain results being produced for that geography.

In an analysis concerned with the impact of the Census 2011 small-area data on the accuracy of the Small-Area Population Estimates, it was observed that for two-thirds of data zones, differences in revised population estimates were smaller than 50 people per geography (National Records of Scotland, 2014). Revising previously available small-area estimates over a decennial period resulted in a minor total correction of 45,100 residents or 0.9% of the Scottish population (National Records of Scotland, 2014). The reasons for the differences in estimates are mostly associated with the demographic impact of new housing developments, demolitions and other changes to the residential neighbourhood structure, as well as capturing migration in the local population, most of which is done through capturing general practice registrations.

2.2.2 Data Analysis

The following section outlines the details of the research process, accounting for the distinct analytical steps undertaken in order to answer the research questions. As informed by the principal research question, the purpose of this work is to evaluate the role of small-area data in relation to informing the development and management of resource-allocation and

service-delivery models applicable to local governance in Scotland and internationally. The following research focuses on the applicability of the information derived from the small-area data to the service-delivery and resource-allocation decision-making processes. In particular, the research focuses on the ability of the small-area data to supply information that would facilitate the development of more effective service-delivery and resource-allocation models across local governance. In this context, the quality of the information that is derived from the small-area estimates, as well as susceptibility of the small-area life outcomes to exogenous factors, are considered paramount to evaluating the practical applicability of the small-area estimates.

The following research process commences with a comparative analysis of the relevant developments pertaining to the use of small-area data in local governance across the developed world, with a focus on Scotland. The purpose underpinning the initial part of the analysis is concerned with providing a context for the existing ways of applying small-area data to decision-making processes. In particular, the analysis characterised in the first stage aims to evaluate the hypothesis about the relevance of publicly available small-area repositories to decision-making and resource-allocation mechanisms available across Europe. Second, the research progresses to the contextualisation of findings in relation to the relevant decision-making processes where information derived from the small-area estimates is a key element supporting decision-making. The outline of the research stages accounting for the details of each of the suggested processes is given in Table 2-5.

Table 2-5 — Proposed research stages

Stage	Objective
Stage I	To assess whether the currently available small-area data is of sufficient quality to provide the information relevant to developing alternative service-delivery and resource-allocation models that would be applicable to local governance
Stage II	To assess whether the impact of the exogenous factors renders the distribution of small outcomes unusable from the perspective of providing information that would be conducive to local governance

The ensuing analysis focuses on the quality requirements of the small-area datasets in the context of the practical applicability of that data to local decision-making. Considering the previously discussed focus on local service-delivery and resource-allocation models in relation to answering to the needs of deprived communities, the proposed research process focuses on exploring whether the presently available small-area datasets in Scotland make it possible to identify communities where life outcome characteristics would justify prioritisation in terms of service-delivery and resource-allocation mechanisms.

Bearing in mind the assumptions underpinning the development of resource-allocation and service-delivery models, the analysis proposed in Stage I is concerned with evaluating whether the currently available data enable identification of the communities where the underlying characteristics of life outcome indicators would justify a change in the existing resource-allocation and service-delivery mechanisms. Following the guidelines on the development of robust indicators, the proposed analysis intends to 1) evaluate whether it is possible with the available data to differentiate across community characteristics, and 2) utilise that knowledge in informing service-delivery and resource-allocation models (Smith, 1990; Spicker, 2004).

The analysis focuses on evaluating the impact of the selected exogenous indicators on historical trends in the distribution of benefits uptake on a small-area level. In particular, the aim behind the proposed analysis is to focus on the sensitivity of the available small-area data to change in macroeconomic circumstances. The analysis undertaken during the second stage explores the question of neighbourhood-level outcome patterns being shaped by macroeconomic events. In particular, the question is concerned with exploring to what extent changes in life outcomes observable across neighbourhoods showing similar patterns in the distribution of life outcomes were impacted by the 2008 financial crisis.

The outlined research plan focuses on assessing whether the currently available small-area data in Scotland can be used to meaningfully identify communities that would benefit from alteration to the existing service-delivery mechanisms and whether it is possible to estimate the extent to which life outcomes across deprived neighbourhood are a function of exogenous macroeconomic factors. Consequently, the proposed methodology assumes conducting analysis in steps and subsequently engaging with each of the concepts outlined in order to provide the relevant insights. The outlined analytical process commences with a breakdown of the presently available neighbourhood-level data available across Scotland. The focus will be directed at the publicly available statistical repositories, which utilise small area-level datasets, such as data zones and output areas.

The relevant small-area datasets are subsequently examined in the context of the data quality issues discussed in Section 2.2.1. The emphasis is put on the evaluation of the available data in the context of gathering the relevant information on deprivation across communities. In particular, the focus is directed at the aspects directly concerned with the role of the small-area data quality in relation to decision-making across local governments. In addition, challenges pertaining to the variability of the small-area demographic estimates, as well as the availability of current data to describe deprived communities on the ground accurately are analysed. For consistency, a summary of the proposed analytical process is given in Table 2-6.

Table 2-6 — Analytical process outline

Stage	Objective	Analysis
<i>Stage I</i>	To analyse the relevant small-area Scottish data in the context of providing meaningful information on the existence of persistently deprived communities across Scotland	(1) Selection of the neighbourhood-level indicators conducive to measuring socioeconomic deprivation (2) Assessment of the data obtained in the context of the analytical data quality (3) Analysis of the data obtained for the purpose of identifying persistently poor geographies
<i>Stage II</i>	To assess the impact of exogenous factors on the neighbourhood-level distribution of life outcomes in the context of neighbourhood vulnerability to macroeconomic shocks	(1) Identification of the relevant time-series data (2) Selection of the relevant exogenous indicators (3) Evaluating whether the selection of persistently poor geographies remains consistent in the light of the macroeconomic changes observed

The available data are evaluated in the context of identifying persistently deprived neighbourhoods and the extent to which patterns of life outcomes are impacted by exogenous macroeconomic factors. The focus of the analysis is directed at the communities that are identified as persistently poor in the context of the suggested analysis of the relevant life outcome indicators. Following the guidelines on quality neighbourhood-level indicators, the publicly available small-area datasets across Scotland are evaluated in the context of the relevance and quality of the information that they contribute to the local decision-making process.

The analysis of the practical usability of the available data relies on the assertion that the social indicator can be defined as ‘a statistic of direct normative interest which facilitates concise, comprehensive and balanced judgements about the condition of major aspects of a society. It is in all cases a direct measure of welfare and is subject to the interpretation that if it changes in the “right” direction, while other things remain equal, things have gotten better, or people are “better off.” Thus statistics on the number of doctors or policemen could not be social indicators, whereas figures on health or crime rates could be.’ (U. S. Department of Health Education and Welfare, 1970, p. 97)

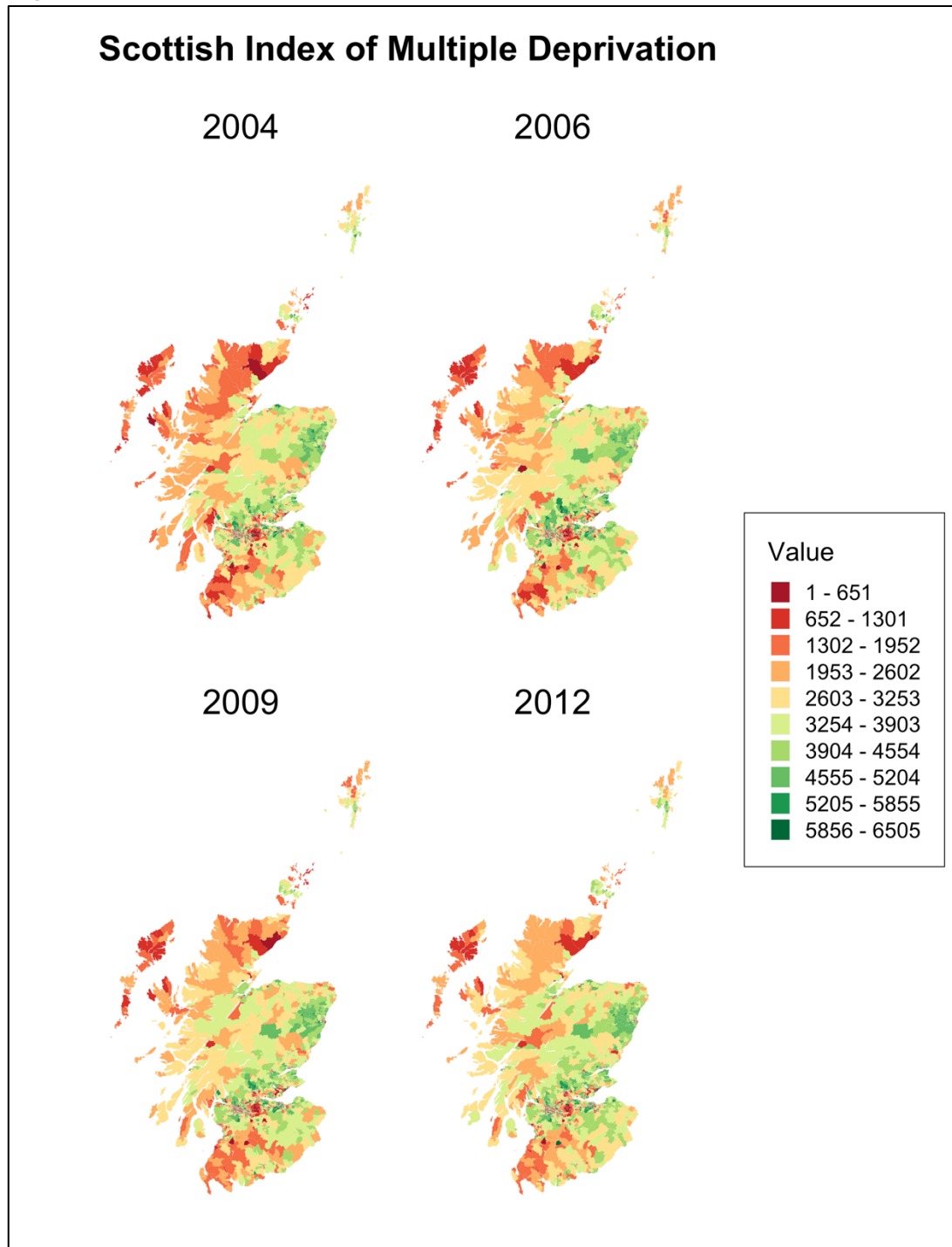
In this context, the role of neighbourhood-level life outcome indicators in governance is concerned with providing information that would enable decision-makers to assert whether the observed changes in life outcome distribution are desirable and consistent with current policy goals. For the indicator to provide meaningful information, it has to be considered valid.

In practice, the validity of an indicator is defined as the ability of the indicator to measure what it is supposed to measure.

Concerning the neighbourhood-level life outcome indicators that are concerned with measuring interaction with the system, this can be achieved in a straightforward manner. For example, the rates of Jobseeker's Allowance claimants are by their very nature valid, as they measure a precisely defined phenomenon. The indicators concerned with poverty and deprivation are more ambiguous, as, in effect, the choice of variables used to describe deprivation reflects a number of assumptions about the nature of poverty. Consequently, the implemented notion of deprivation is bound to a specific implementation.

This phenomenon is observable across the existing approaches to deprivation that are expressed statistically, as in the case of the Scottish Index of Multiple Deprivation. The Scottish Index of Multiple Deprivation was developed by the Scottish Government (2012b) in order to assist local public sector bodies in identifying areas of comparably higher deprivation with respect to the selected life domains, like health or education, or with respect to the aggregate measures reflecting multiple deprivation. The index utilises the data zone-level framework for statistical geographies across Scotland and provides neighbourhood-level data for each of the 6,505 Scottish neighbourhoods, with each neighbourhood consisting of approximately 350 households. The neighbourhoods are ranked from the most deprived, ranked 1, to the least deprived, ranked 6,505. The ranks are provided separately for the SIMD domains and separately for the SIMD rank. The spatial distribution of the 2012 iteration of the Scottish Index of Multiple Deprivation is visualised in Figure 2-8.

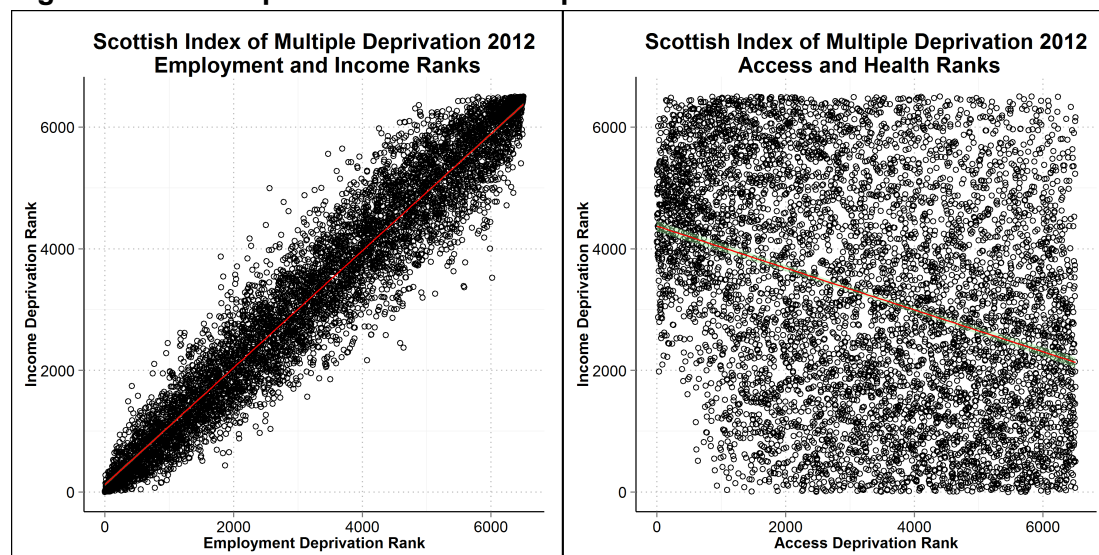
Figure 2-8 — Scottish Index of Multiple Deprivation 2004–2012



On the example of the Scottish Index of Multiple Deprivation, it is observable that the domains of the index correlate with each other with variable strength. For instance, the correlation between the employment and income domains of the index is strong, whereas the correlation between access and income domains is significantly weaker. This phenomenon is visualised in Figure 2-9. The charts illustrate the idea that identifying deprived neighbourhoods

implies making a value judgement with respect to quantifying neighbourhood-level deprivation. For example, in the case of neighbourhood-level indicators concerned with measuring employment and health deprivation, it is noticeable that the strong correlation observed between health and socioeconomic neighbourhood deprivation indicators will frequently result in the same regions being identified as being marked by elevated levels of deprivation.

Figure 2-9 — Comparison of relationships within the SIMD 2012 ranks



Consequently, the analytical capacity of neighbourhood-level data to identify localities marked by significant levels of deprivation is determined by methodological choices concerning the quantification of poverty (Ravallion and Bidani, 1994; Sen and Hawthorn, 1987). As poverty and deprivation are most frequently defined in socioeconomic terms, their respective levels can be quantified with the use of administrative datasets pertaining to the levels of benefits uptake.¹

Therefore, the observed *fitness* or *usability* of neighbourhood-level data is determined by the set of a priori assumptions pertaining to the expectations of what the high-quality data should demonstrate. The subsequent analysis focuses on the fitness of the data in relation to the traditionally defined deprivation characteristics, like material and health deprivation, in the context of making data usable across local governments (Øyen, 2006; Townsend, 1987).

¹ In an analysis concerned with the nature of persistent poverty across the European Union, Whelan et al. (2002) indicate that multiple deprivation patterns are also found across patterns of social exclusion, greater exposure to environmental problems and so forth. The following thesis focuses on socioeconomic deprivation, measured by using Jobseeker's Allowance rates.

2.2.2.1 Statistical Quality Requirements of Spatially Aggregated Data

As previously discussed in relation to using spatial data for measures of deprivation and inequality, the quality of spatial data is of relevance to government activities associated with identifying communities marked by greater likelihoods of experiencing negative life outcomes. The importance of spatial data quality in relation to identifying deprived communities is emphasised by the implementation of area-based governance initiatives. The majority of area-based policies focused on using data to focus on communities marked by particular deprivation characteristics, like elevated unemployment rates or shorter life expectancy (Andersson and Musterd, 2005; Chatterton and Bradley, 2000; Rhodes et al., 2005).

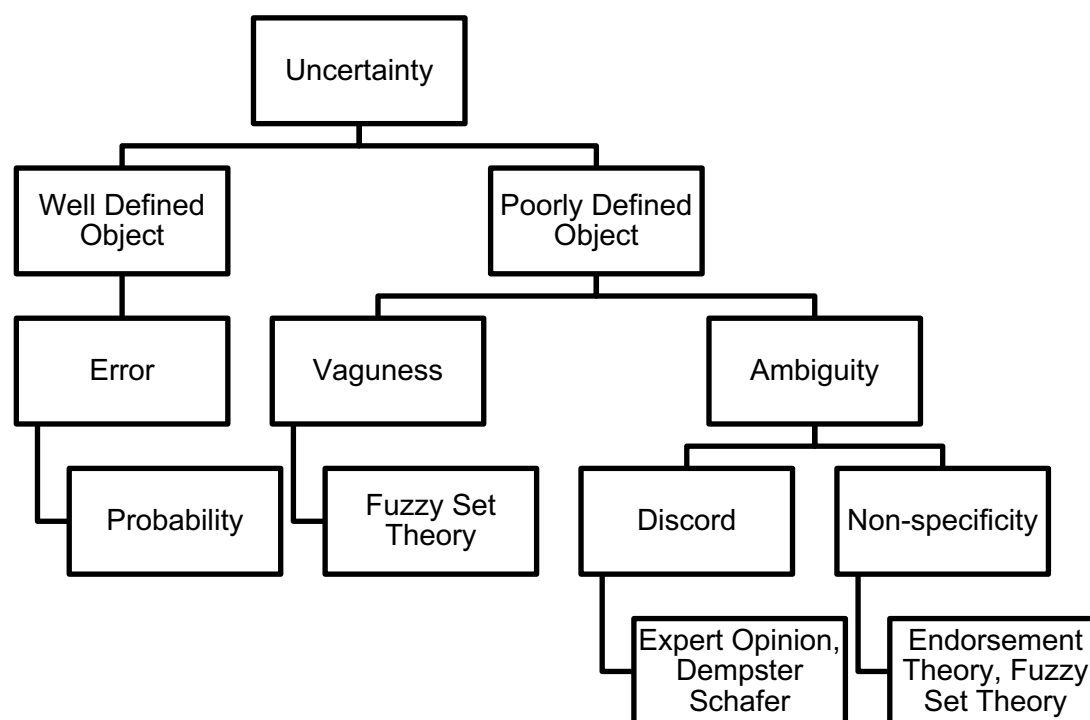
As pointed out by Rhodes et al. (2005) in an analysis of the effectiveness of area-based policies in the UK, the ability to deliver meaningful and informative evaluation is often constrained by the quality of the data available. For example, the actual nature of the deprivation and poverty seldom correspond exactly to publicly available statistical geographies and often may cut across artificial boundaries. The spatial dimension of vulnerability and the ability to identify relevant communities are recognised as crucial to effective implementation of decentralisation strategies. In an example of changes made to a social assistance programme, van Berkel (2006) hypothesises that the merit of decentralisation is associated with the ability of sub-local entities to identify populations in need effectively and respond more accurately to local needs than in centralised systems. Their argument is crucial to this requirement being fulfilled. In particular, it is recognised that decentralisation combined with increasing efficiency in resource allocation yields better results in terms of service delivery. Taking an analysis of mental health provision in Finland as an example, Pirkola et al. (2009) argue that decentralisation of the mental health service provision is justifiable in the context of achieving an improvement in efficiency that is associated with delivering services in a manner that is more attuned to local needs than the currently available methodologies.

The increased proliferation of advanced business intelligence systems across the private and the public sectors and the incorporation of these in decision-making processes make evident the need to exercise greater control over data quality (Sadiq, 2013). Along similar lines, the relevant literature on data quality recognises that the increasing popularity of data management systems across the corporate world resulted in an overall improvement in the quality of decision-making (Hedgebeth, 2007).

Concerning spatial data quality, Fisher (2006, p. 45) asserts that 'the principal issue of geographic uncertainty is the possible mismatch of understanding of what is to be, or has been

measured, as between the data collector and any users'. In the context of spatial data quality, the notion of error is concerned with verifying how well the data measured meets the actual phenomenon on the ground (Chrisman, 1991). It is possible to distinguish between two meanings of data quality: the first is concerned with the absence of errors and the second attempts to reflect how well the data meet user requirements (Devilleers et al., 2007). The broad characteristics of the uncertainties associated with spatial data are summarised in Figure 2-10.

Figure 2-10 — A conceptual model of uncertainty in spatial data



Adapted from Fisher et al. (2006, p. 45 Fig 3.1) following Fisher (1998) and Klir and Bo (1995).

Uncertainty in the context of a spatially represented object depends on the properties that allow for its clear separation from other objects in the dimension of interest (Fisher et al., 2006). In a classical sense, a fuzzy dataset contains the class of objects where group membership can be presented as a grade, not as a binary value (Zadeh, 1965). With respect to GIS, the development of fuzzy datasets took place in order to handle uncertainty (Robinson, 2003). In the context of GIS analysis, the implementation of fuzzy datasets does not follow classical Boolean algebra with the law of an excluded middle as its main paradigm (Robinson, 2003). In a crisp dataset, membership of an object in the class follows binary logic. As given in Equation 2-1, the object can belong or not to class 1 or 0.

Equation 2-1 — Representation of the Data in the Crisp Data Set

$$A(x) = \begin{cases} 1 & \text{for } 5 < x \leq 17 \\ 0 & \text{for otherwise} \end{cases}$$

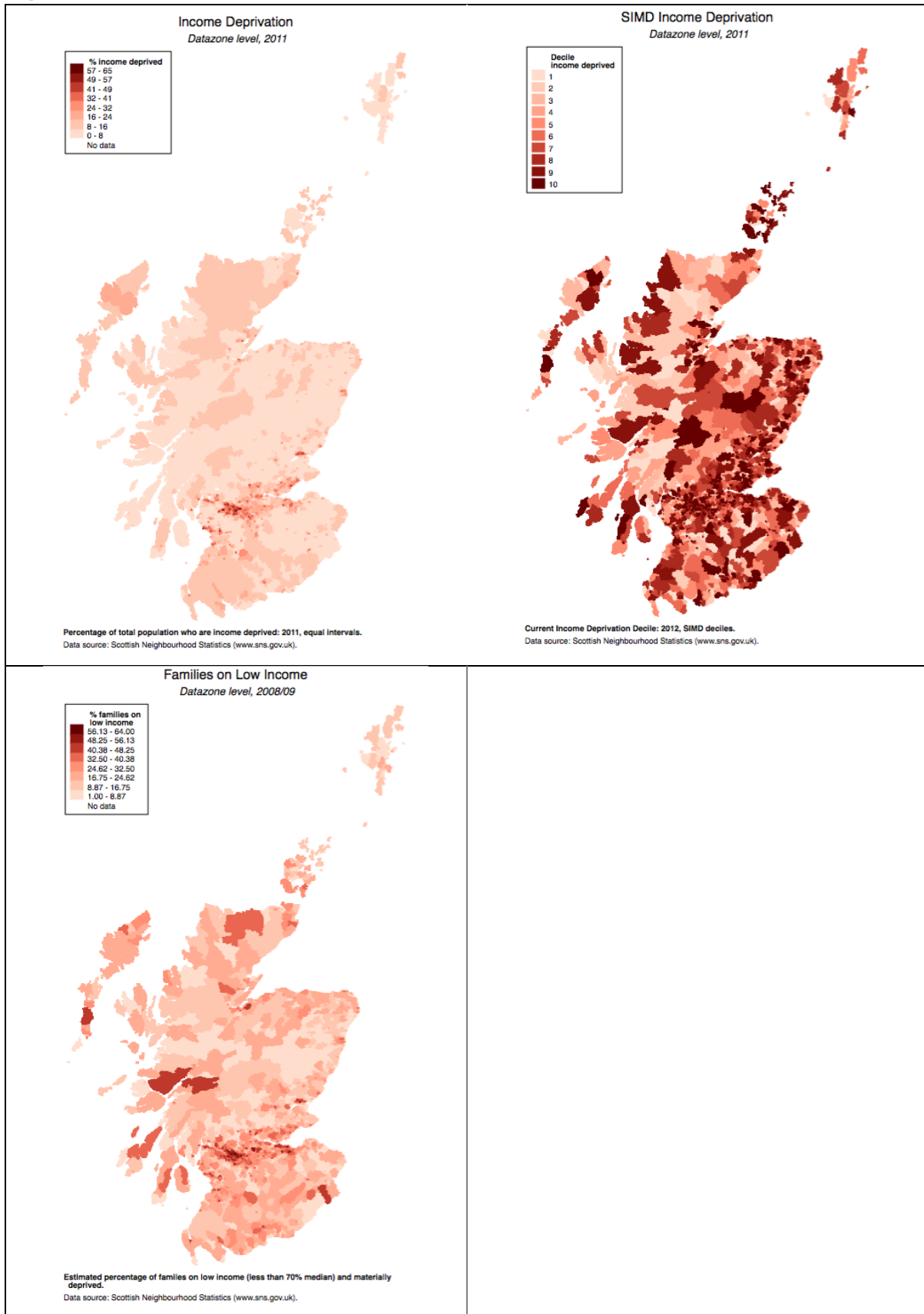
Adapted from: Robinson (2003, p. 6 Equation 1)

With respect to Equation 2-1, the notion of a *crisp* data set is rooted in set theory and is best defined through an example of its difference to the fuzzy approach. Assuming that a set is defined 'as a collection of objects together with a rule determining membership in the set', the difference between crisp and fuzzy sets is best explained through the example of a common implementation, such as a set-theoretic classification of health and diseases (Clive et al., 1983, p. 319). The main difference in the implementation of these two concepts boils down to the differences in classification results (Clive et al., 1983).

In practice, a crisp set methodological approach classifies an outcome following Boolean logic. In the example utilised of a patient's classification, this would usually imply categorising a patient as having an illness or being healthy. With respect to the fuzzy set, that classification usually reflects a score. In the context of an illness classification, the illness is expressed as a continuum that spans from perfectly healthy to terminally ill.

The sample of Scottish data used in measuring deprivation and analysing neighbourhood patterns of adverse life outcomes is visualised in Figure 2-11. The respective definitions of *need* or *risk* are frequently expressed variably, depending on the methodological choices reflecting the use of indicators. The practical implications of that process can be easily illustrated in the example of the difficulties surrounding the mapping of various currently available life outcome indicators. Figure 2-11 depicts a comparison of the percentage of income-deprived residents mapped on a small-neighbourhood level. The *Income Deprivation* map illustrates the number of income-deprived residents as a percentage of the total population; the *SIMD Income Deprivation* illustrates the percentage of income-deprived residents according to the decile; and the *Families on Low Income* map focuses on the per neighbourhood percentage of families on a low income. In this simplistic example, the maps that purport to describe closely related phenomena provide variable results reflecting a number of methodological choices underpinning the development of the indicators and the analysis undertaken.

Figure 2-11 — Measures of income deprivation in Scotland



The problem of data vagueness as related to spatial data is highlighted by the utilisation of statistical geographies in analysing neighbourhoods. The rudimentary choropleth maps presented above clearly illustrate the challenge posed by vagueness when attempting to represent social phenomena spatially. All of the maps provided correspond to a certain definition of socioeconomic deprivation and illustrate how the location of the most deprived communities depends on the methodological nature of the indicator utilised.

In the case of social statistics, two key concepts pertaining to data quality are *spatial heterogeneity* and *spatial autocorrelation/spatial dependence* (Demšar et al., 2013). In practical terms, the concept of spatial heterogeneity implies that the processes observed are not necessarily the same across each of the observed locations (Demšar et al., 2013). The notion of spatial autocorrelation is widely recognised as having a profound impact on the quality of spatial analysis (Dale and Fortin, 2009). Across the social sciences, the problem of spatial autocorrelation is often discussed at length in the modern literature concerned with spatial statistics (Getis, 2007).

Spatial autocorrelation reflects the notion of spatial dependency, where observations drawn from nearby locations are dependent on each other (Fotheringham, 2009). It is possible to differentiate between positive and negative spatial autocorrelation, with negative dependencies being observed less commonly (Ord and Getis, 1995). Positive spatial autocorrelation indicates that the values of measured phenomena increase with the spatial proximity of the data points, whereas negative spatial autocorrelation denotes the reverse relationship, where the similarity in the phenomena decreases in relation to the increasing proximity of the data points (Fotheringham, 2009). In practice, the notion of spatial autocorrelation reflects the assumption that the 'relationship between the nearby units of the same variable need[s] to be identified if research questions were to answered accurately' (Getis, 2007, p. 492).

The following section will focus on analysing the practical aspects of utilising spatially aggregated datasets in governance as well as exploring issues associated with the use of spatially aggregated data in local governance focusing on Scotland. The research utilises previously outlined publicly available small-area statistical repositories such as the Scottish Neighbourhood Statistics and NOMIS. The methodology focuses on the analysis of statistical characteristics concerned with the publicly available small-area estimates. The precise nature of the analysis that will be completed in the course of this work is concerned with:

- a) Analysis of the publicly available data across Scotland in the context of sourcing information on the spatial nature of deprivation and assessment in the context of the commonly accepted definitions of deprivation.
- b) Analysis of the selected sub-sample of indicators in the context of analytical capacity to derive information facilitating the identification of persistently deprived communities that would benefit from changes attuned to their needs in the design of resource-allocation and service-delivery models.

Despite the apparent importance of small-area estimates to local governance and decision-making, the available research concerned with assessing the relevance of small-area estimates is scarce (Baker et al., 2013). When discussing the applicability of the small-area datasets to local governance, it is necessary to elaborate on the consistency of population structures within the small-area estimates. The research on the demographic aspects of the small-area estimates suggests that they are vulnerable to changes in the population (Cai, 2007). The population estimates are utilised as denominators for multiple indices and rates and consequently constitute a pivotal element in developing the relevant performance measures (Lunn et al., 1998).

The accuracy of the available small-area estimates is particularly relevant in the context of local governance, where local authorities are often interested in devising programmes catering to the needs of vulnerable populations, and having robust estimates of the relevant demographic cohorts is paramount to ensuring that the proposed changes to resource-allocation and service-delivery mechanisms cater to the required communities (Lunn et al., 1998). For example, migratory flows on a small-area level are recognised as a source of inconsistencies in the population change (Taylor and Biddle, 2010). Migration rates on a small area level be of 'explosive nature' (Smith and Shahidullah, 1995, p. 69). Development of a housing estate accommodating 50 residents in a locality of 650 residents could constitute relative significant change in demographic structure that is seldom observed on a national level.

In the example of the Australian census estimates, Taylor and Biddle (2010) assert that the variable population density observable on a small-area level had a significant role in the cohorts of the individual population being overcounted and undercounted, depending on the nature of the local demographic characteristics.

In a wider discussion of the nature of data quality, Wang and Strong (1996) propose three ways the problem of the data quality can be conceptualised in practice, differentiating between intuitive, theoretical and empirical approaches to describing data quality. The intuitive

approach to data quality emphasises the validity of the data in the context of a specific domain, accounting for subject matter expertise. For instance, an economist working with small-area benefits uptake data may require the available indicators to reflect a complete array of benefits available in the system. Historical analysis of the changes in those indicators across UK neighbourhoods indicates that it is possible to observe shifts in the rates of benefits claimants across various categories, depending on the legal and procedural context pertaining to the implementation of welfare mechanisms. Consequently, accurate small-area benefits uptake analysis would require incorporating various indicators, as a single variable analysed in isolation would not provide a comprehensive picture of benefits uptake, or, more widely, poverty affecting communities.

Commonly utilised approaches to analysing data quality focus on potential deficiencies in the data collection mechanisms. For example, the Information Services Division (2015), which functions as an NHS Scotland directorate responsible for collecting and disseminating health statistics in Scotland, provides a range of indicators pertaining to hospital admission rates. Some of the available indicators enable differentiation between specific reasons for hospital admissions, like admissions related to drugs or alcohol misuse, particular conditions like cancer or respiratory disease, or events like accidents (Scottish Neighbourhood Statistics, 2010). It is feasible to envisage a situation where a person after having consumed an alcoholic drink has an accident at home and breaks a leg or, alternatively, a situation where a cancer patient may be misusing drugs. Such overlaps pose a challenge to researchers and introduce an unavoidable ambiguity to statistics. Classifying each occurrence accordingly forces practitioners to decide on primary reasons for admission.

Consequently, the indicators utilised may not be fully representative of the phenomena and result in undercounting/overcounting of the actual instances. This fact is recognised within the supporting methodology documentation pertaining to the Scottish Neighbourhood Statistics. For example, with respect to drugs misuse-related hospitalisations, the website reads that: 'Caution is necessary when interpreting these figures. The recording of drug misuse may vary from hospital to hospital, where drug misuse is suspected but unconfirmed it may not be recorded by the hospital' (Scottish Neighbourhood Statistics, 2010). This reflects an awareness that the given phenomena may be coded inconsistently due to definitions of the actual indicators and explanations of how the data should be collected.

The empirical approach to data quality focuses on the suitability of the actual analytical tasks that are undertaken by the data consumers. In this context, the evaluation is concerned with the practicalities surrounding the requirements of delivering informative and useful analysis. For example, if the data consumer is interested in conducting a time series analysis

of neighbourhood-level crime rates across Scotland, but only three periods in the actual estimates are available, then the validity of undertaking a time series analysis (even on panel data) is questionable, as the scarcity of time points makes it difficult to assert the nature or lack of actual trends.

In a discussion concerned with data quality parameters, Veregin (1999, p. 177) states that '[t]he meaning of "quality" depends on the context in which it is applied'. In the traditional understanding of spatial errors in data quality, an error is defined as an incongruity in the way that a given set of attributes is represented in a spatial data model. This approach to error flows from the philosophical assumption that the data visualised on the map corresponds to the truth that can be discovered in the course of the spatial data visualisation (Chrisman, 1991). Chrisman's (1991) argument on the subject assumes that the production of error is innate to any form of data visualisation and/or analysis.

The challenges pertaining to data quality are not always causally related to the statistical nature of the datasets utilised but are often causally related to the use of particular datasets in local decision-making. As the purpose of this work is to explore the fitness of spatial data for informing decision-making across local governments in Scotland, it is crucial to explore how the perceived data quality fits the requirements of the associated decision-making process. Following the dichotomisation suggested by Devillers et al. (2007), this section distinguished between the two approaches to data quality:

- 1) *Internal quality* – which restricts the quality of the data to an internal set of characteristics, mostly associated with the absence of errors
- 2) *External data quality* – which focuses on how the data fit the user's analytical needs

It is worth specifying that the increasing importance of data quality in the public sector is reflected in the relevant legislation (Batini and Scannapieca, 2006). In particular, the *Data Quality Act* introduced by the United States Congress in 2001 emphasised the "quality, objectivity, utility, and integrity" of all federal information' (Anderson, 2002, p. 1). The reception of the legislation across the research community has been mixed. For example, Herrick (2004) argues that the *Data Quality Act* mischaracterises the role of science in the decision-making process and attempts to force an unscientific approach that would be inconsistent with the underpinning philosophy of objectivity into the data collection and analysis process. In this context, Herrick's (2004) criticism of the Data Quality Act (DQA) is rather valid, emphasising

the politicisation of the use of data in the light of the concurrent legislative and political goals (Lacko, 2004).¹

In the context of this research, the relevance of the DQA pertains not to its actual content or whether it is solely a political instrument used by a group in the US Congress to exercise a certain degree of control over the future nature of the legislative process but with the fact that the concept of data quality is recognised as a sufficiently important notion to be considered as the basis for the validity of proposed policies and future legalisation. Irrespective of whether the DQA misrepresents the notion of scientific quality or the validity of data-driven policies, it grants a new gravity to the hitherto purely scientific and mostly academic notion of data quality and scientific validity.

2.2.2.2 Role of small-area estimates in addressing legitimacy deficits in local governance

The following section is concerned with exploring the role played by small-area estimates in developing evidence-based policy with an emphasis on local government. An international comparative analysis focusing on local decision-making models and the role of communities in decision-making processes emphasises the importance of relationships with local communities in ensuring effective governance. In the analysis concerned with the nature of intern-institutional relations in the UK following the democratic reform implemented by New Labour, Raco and Flint (2001) observe an increasing emphasis being placed on the implementation of mechanisms enabling local communities to participate in local decision-making processes.

The process is observable across a number of participatory budget programmes that provide local communities with opportunities to exercise control over parts of local budgets (Irvin and Stansbury, 2004; Sintomer et al., 2008). Consequently, the operational ability to identify distinctive communities and their respective needs effectively becomes a vital factor in successful community engagement programmes. As outlined by Mohan and Mohan (2002), the ability to *place the social capital*, which can be defined as an ability to identify communities' needs and potential, becomes paramount to devising effective community engagement strategies.

¹ The particularly robust criticism of the aforementioned US Congressional Act was proposed by Lacko (2004) who notes that, potentially, the actual purpose of DQA is concerned with giving the conservative faction the ability to undermine evidence concerned with environmental legislation. Consequently, it is assumed that the very existence of the act provides the possibility for the proposed legislation to be struck down on grounds of the scientific analysis not meeting artificial *data quality* standards.

The need to describe communities on the ground accurately is reflected in the importance of the technical aspects concerned with evidence-based policy-making. It is also observable that the use of data in governance corresponds to the increasing trend in the use of evidence in governance and decision-making. In a ministerial address to the Heads of Agencies and Members of the Senior Executive Service, Rudd (2008) claimed that 'evidence-based policy-making is at the heart of being a reformist government'. The theme later found resonance across the Australian civil service. The Australian Productivity Commission¹ recognised evidence-based policy as a key element defining the government's capacity to deliver reforms and yield efficiencies (Banks, 2009).

The use of the life outcome measurements in performance in governance was championed by a United Nations Development Programme that identified 165 indices measuring different aspects of governance such as gender equality, corruption or civil liberties (Löwenheim, 2008). More recent developments in the use of small-area statistics in governance suggest that an increasing number of governmental and quasi-governmental bodies use small-area estimates in their decision-making processes. The literature on the subject indicates that spatially aggregated indices of deprivation are successfully used as policy tools in New Zealand, South Africa and Canada (McIntyre et al., 2002; Pampalon et al., 2008; Salmond and Crampton, 2012). In recent years, interest in the use of small-area estimates in the development of the resource-allocation mechanisms in governance has increased (McIntyre et al., 2002). For example, tools like the New Zealand Index of Deprivation (NZDep) or the Vancouver Area Neighbourhood Deprivation Index (VANDIX) are widely used as resource-allocation tools (Bell and Hayes, 2012; Salmond and Crampton, 2012).

It is worth emphasising that the existing literature concerning the development of spatial indicators of deprivation was, to a great extent, developed in the United Kingdom, where the tradition of utilising small-area estimates in the development of resource-allocation mechanisms was particularly strong in the health sector (Carstairs, 1981). As outlined in the previous section, the increased use of indicators is generally associated with the proliferation of the audit culture (Shore, 2008). The approach of applying frameworks of indicators to an assessment has a long tradition in international governance (Take, 2012). In the absence of transnational democratic mechanisms, international institutions have developed a long tradition of working with indicators as a means of gaining legitimacy.

¹ The Australian Productivity Commission is a governmental review and advisory body concerned with aspects of microeconomic and social policy.

The grey literature concerned with the utilisation of small-area estimates across local government structures is considered the main data source. In the context of this analysis, grey literature is defined as ‘that which is produced on all levels of government, academics, business and industry in print and electronic formats, but which is not controlled by commercial publishers’ (Farace, 1999, p. 71). This method will involve analysis of relevant developments concerned with the use of small-area estimates in the development of resource-allocation mechanisms across local government structures internationally, and, in particular, the research process associated with the evaluation of the characteristics concerned with the development of resource-allocation mechanisms.

The importance and applicability of small-area estimates in local governance are particularly evident in Scotland. The reasons for that state of affairs are manifold, and are due to a number of factors mostly concerned with elevated levels of deprivation when compared to the rest of the country but also with the phenomenon of the *Scottish effect* (Sridharan et al., 2011, 2007). The Scottish effect is best understood as an unexplained excess in mortality rates and overall higher negative health outcomes across Scotland when compared against health outcomes observed across regions with similar levels of deprivation across the rest of the country (Hanlon et al., 2005; Sridharan et al., 2007).

For instance, through an analysis of mortality and deprivation indicators between 1981 and 2001, Hanlon et al. (2005) argue that Scotland became less deprived when compared to the rest of the country; however, the observed mortality rates were 12% higher in Scotland and rose to 15% higher in 2001. In measuring deprivation, Hanlon et al. (2005) draw on the methodology proposed by Castries and Morris (1991) and utilise data gathered on a postcode-sector level. This score is derived through the use of a suite of standardised indicators reflecting male unemployment, overcrowding, car ownership and social class derived via occupational classification.

The existing explanations for the occurrence of the Scottish effect range from methodological ones to those concerned with the idiosyncratic nature of Scottish communities. With respect to the methodological approach, the argument assumes that the crude indicators utilised to derive comparative deprivation scores do not capture the subtle nature of deprivation across Scottish neighbourhoods. In particular, the argument assumes that the indicators capture the deprivation more accurately in England than in Scotland and, consequently, do not offer a robust base for comparison (Sridharan et al., 2007). The argument assumes that the impact of deprivation on poor life outcomes is exerted not only by the specific neighbourhood but also by the proximity of the deprived neighbourhoods (Sridharan et al., 2007). This is to say that the ease with which one can escape deprivation and experience

better circumstances may have an impact on the associated observed adverse negative health outcomes.

With respect to the underpinning methodological foundations, the following section draws on the principles that guide research projects based on the analysis of grey literature with an emphasis on relevant local government publications. The following analysis is guided by the principles associated with decision-making research and focuses on the role of geography and neighbourhood-level data in modern governance. The research objective is to engage with the question of ‘maps and mapping [being] aspects of governmental rationality’ and explore whether a more in-depth understanding of spatial data can prove informative in the context of understanding the spatial distribution of life outcomes (Crampton, 2004, p. 41). This aspect of the research draws on the work of Rose and Miller (1992) concerned with the role of technology influencing modern political reality and governance. The analysis attempts to utilise a technical approach to governance that focuses on government as an attempt to problematise a set of issues that it attempts to address (Rose and Miller, 1992). In particular, the research explores the extent to which small-area estimates become part of the operational machinery of governance, comparable to modern political and sociological theories constituting part of the ‘intellectual machinery’ of modern governance (Rose and Miller, 1992, p. 182).

The subsequent analysis focuses on the nature of spatial life outcome indicators, as well as their potential applicability to forecasting the demands of local communities in anticipation of macroeconomic changes. Additionally, this section is concerned with the analysis of practices concerned with the use of small-area estimates in governance. With respect to the utilisation of neighbourhood indicators, this section will answer how different small-area data are used across national and sub-national decision-making systems. In this enquiry, this section will look at the national and international practices concerned with data usage, such as the development of data collection and retention mechanisms, the nature of indicators collected or the channels by which the data enter the decision-making process. The data used in the project are sourced from the publicly available statistical repositories that disseminate small area-level life outcome data. In particular, the research process assumes undertaking the analysis according to the steps outlined in Table 2-5.

The following analysis also accounts for the summary of the trends characterising increased demand for small-area estimates and for quality data characteristics needed to develop such systems (Datta and Ghosh, 2012). The research process makes use of a number of analytical steps concerning verifying the suitability of neighbourhood-level data to improving resource-allocation and service-delivery mechanisms. The research commences with

evaluating whether the historical data utilised contain indicators that would be conducive to measuring spatial deprivation. The emphasis is being placed on the relevance of the available data to the discussed measures of deprivation. In particular, the available data are considered in the context of the:

- a) Relevance of the available indicators in the context of the characterised measures of deprivation as well as the principles discussed underpinning the construction of meaningful small-area indicators.
- b) Ability of the selected data to identify deprived communities clearly.

With respect to the first aspect of the analysis, the content of the available information is assessed in the context of the previously discussed definitions concerning the various aspects of multiple deprivation. Initially, the way of aggregating the indicators is analysed in the context of the ability to deliver conceptual measures corresponding to the commonly accepted measures of deprivation. The emphasis is put on the availability of the relevant socioeconomic data as well as neighbourhood-level intercorrelations of selected indicators that would allow for the desired identification of localities that could potentially benefit from more attuned resource-allocation and service-delivery mechanisms. Subsequently, the data are analysed in the context of the technical qualities concerned with the validity, readability and derived capacity to deliver the relevant quantifiable information. Additional attention is directed at aspects pertaining to the norms and values associated with the indicators, as well as the applied weighting.

2.2.2.3 Exogenous and endogenous factors in life outcomes across small areas

The following section considers the methodological principles underpinning the analysis of the role played by exogenous factors in impacting the neighbourhood-level life outcome distribution in Scotland. In particular, this section considers the extent to which small-area estimates can be seen as reflecting the variability of local policies and to what extent the observed changes in life outcome distribution correspond to the impact of macroeconomic policies. The ambition underpinning the research undertaken within the following section is concerned with evaluating whether it is possible to utilise the small-area data in order to assert useful statements in the context of the impact exerted by exogenous factors. The hypothesis that is being verified in this research is concerned with whether the observed variability can be explained on the grounds of changes in macroeconomic indicators. If the analysis would indicate that the totality of neighbourhood outcomes is determined by national or international macroeconomic events, then whether the estimates can be successfully employed in informing local policies would be questionable.

With notable exceptions, such as the work by Partridge and Rickman (2007) on the effectiveness of labour market interventions across neighbourhoods defined as persistently poor in the United States, most of the academic research and grey literature focuses on the impact of new initiatives or policies on neighbourhood-level indicators without attempting to account for the extent to which the observed change is caused by exogenous factors occurring at a national level, such as crises or nationwide changes to tax or labour legislation. By capitalising on the wealth of small-area data available across Scotland, the following analysis sheds light on the dynamic taking place among neighbourhood-level outcomes, exogenous factors and local policies. In particular, the analysis undertaken is concerned with answering whether the selected indicators identified are potentially relevant measures in the light of macroeconomic changes observed. The assumption underpinning the utilisation of neighbourhood-level data in relation to local policies reflects the notion that the data has to be of sufficient granularity in order to enable usable intelligence to be derived and subsequently incorporated into the decision-making process. The assumption underpinning the research outlined in this stage verifies whether the life outcome characteristics identified in the course of this preliminary analysis can be feasibly incorporated into the measurement of the potential impact exerted by any potential alterations to the local resource- and service-delivery mechanisms. The analysis focuses on the extent of the variability in life outcome indicators occurring as a function of the exogenous factors.

The proposed analysis is intended to contribute to the existing understanding of the impact of local policies on changes in life outcomes on a neighbourhood level by providing an analysis of the role played by exogenous macroeconomic factors. Rhodes et al. (2005) argue that the difficulties surrounding the assessment of the effectiveness of area-based policies mostly pertains to the lack of understanding of the mechanisms of how policies should exert a change on neighbourhood-level life outcome characteristics. Rhodes et al. (2005) also assert that it is possible to differentiate between common types of approaches to area-based policies, such as the focus on the economic and property aspects of neighbourhoods prevalent in the 1980s or the focus on particularly disadvantaged groups that dominated the area-based policies of the 1990s.

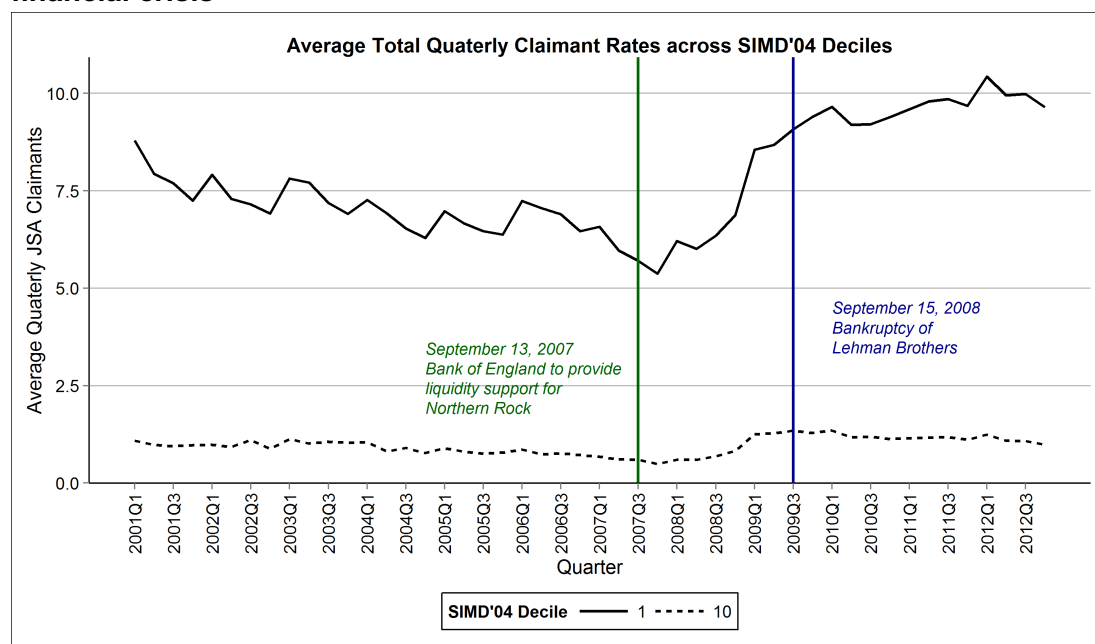
Following Pawson and Tilley (1997), Rhodes et al. (2005) hypothesise that the main obstacle to delivering meaningful evaluations was concerned with the inability to assert what outcomes a given intervention should deliver. Rhodes et al. (2005) further note that evaluations are dominated by the focus on the process instead of focusing on the impact of specific policies on the changes in neighbourhood-level life outcome indicators. The role of the impact of exogenous factors in relation to localised policies was initially researched by Partridge and

Rickman (2007), who evaluated the effectiveness of the local labour market interventions in the context of neighbourhoods marked by persistent poverty. The research defined a number of counties as characterised by persistent poverty. The utilised operational definition of persistent poverty characterised a 'persistent high poverty county as having a poverty rate greater than 20% in each of 1979, 1989 and 1999' (Partridge and Rickman, 2007, p. 202). The created subset of geographies is subsequently analysed in the context of the changes across life outcome indicators following the implementation of local policies. Partridge and Rickman (2007) further hypothesise that the circumstances that can be observed across counties defined as persistently poor are similar to those that can be observed in relation to the existence of poverty traps across developing economies.

The detailed analysis of the role played by neighbourhood characteristics in relation to the socioeconomic status of residents across China undertaken by Fang and Zou (2014) points to a significant role played by neighbourhood characteristics in perpetuating poverty traps. In particular, the authors point out that spatial disadvantage can lead to the perpetuation of chronic poverty across local communities. Fang and Zou (2014) additionally indicate that a multitude of factors affecting local communities, such as over-reliance on insecure employment, hinder local asset accumulation and lead to the perpetuation of poverty.

In a more precise sense, the notion of a poverty trap on a neighbourhood level is associated with the geographical capital available to the household (Jalan and Ravallion, 2002). The notion of geographical capital is fairly complex and may be concerned with the spatial varieties in the local infrastructure, e.g., the quality of roads and public transport links as well as the spatial distribution of life outcome characteristics such as spatial variability in local levels of literacy (Kraay and Raddatz, 2007).

In the context of the outlined work, the proposed analytical process will focus on the role of exogenous factors in affecting the characteristics of persistently poor geographies. In particular, the process is concerned with assessing whether the selection of persistently poor geographies remains constant in the light of exogenous factors. For example, Figure 2-12 summarises a monthly time series analysis of quarterly data pertaining to the rates of Jobseeker's Allowance claimants across Scottish neighbourhoods disaggregated according to the 2004 iteration of the Scottish Index of Multiple Deprivation, with a selected sample of events pertaining to the financial crisis being highlighted in Figure 2-12.

Figure 2-12 — Neighbourhood-level JSA Claimants across Scotland during the financial crisis

It is observable that the rate of JSA claimants measured on a data-zone level increased following the major events of the financial crisis. The first decile in the chart corresponds to the most deprived neighbourhoods, with the SIMD scores from 1 to 651, whereas the least deprived neighbourhoods have scores corresponding to 5,856–6,505. The subsequent questions that will be answered in the course of the forthcoming analysis are concerned with the consistency of elevated poverty rates across Scottish neighbourhoods. The analysis proposed at this stage is concerned with undertaking a more detailed evaluation of the impact of exogenous indicators on the previously selected indicators that would characterise the communities as persistently poor. The evaluation is concerned with verifying the hypotheses:

- H_1 – The directional hypothesis assumes that persistently poor geographies are impacted by exogenous factors to a greater extent than geographies not marked by persistently high levels of JSA claimants.
- H_0 – The null hypothesis assumes that changes in levels of JSA claimants across persistently deprived geographies are not impacted by exogenous macroeconomic events to any greater extent than the remaining geographies across Scotland.

The research assumption is that the failure to falsify H_1 would, in effect, render the data less useful from the point of view of improving efficiency as related to the service-delivery and resource-allocation models. For the same reason, the rejection of H_0 would imply that utilising

neighbourhood-level data would prove informative in the context of identifying neighbourhoods marked by persistent patterns of deprivation.

Following the discussion of the existing related research in the literature review, consideration was given to the utilisation of similar analytical approaches, namely Geographically Weighted Regression (GWR) and space-time modelling approaches. GWR was introduced to quantitative geography literature by Brunson et al. (1998, 1996). In GWR, 'the nature of the model [is] alter[ed] over space to reflect the structure within the data' (Brunson et al., 1996, p. 281). In GWR, a subset of the data proximate to model calibration in geographical space is used instead of variable space (Wheeler and Páez, 2010). The spatial coordinates pertaining to area centroids or the actual data points are used to obtain the weights reflecting the degree of spatial dependency between observations used (Brunson et al., 1996; Wheeler and Páez, 2010).

The utilisation of the weighting matrix is a key feature that differentiates the GWR from a traditional linear regression model. The data utilised in this work is of a spatial nature; however, this does not apply to the macroeconomic indicators utilised. In the context of the official macroeconomic statistics, the macroeconomic indicators are concerned with Scotland. The business performance data reflect the performance of businesses, as determined by several factors. These may be concerned with the performance of companies across Scotland but also with the exposure that these businesses have across the UK, Europe and World. The regional relevance of the business and macroeconomic indicators utilised is reflected in employment and the role that those businesses play in the Scottish economy; however, they do not translate directly to the data zone-level geography utilised. Consequently, an aspatial modelling approach had to be utilised in order to answer this part of the research question.

Chapter 3 – Analysis

Summary:

This chapter offers a detailed summary of the analysis undertaken. Drawing on the theoretical assumptions discussed in the previous chapter, the chapter outlines each of the analytical steps involved in addressing the proposed research questions to analyse spatial variability in benefits uptake. In addition, the chapter offers a preliminary descriptive analysis of the data utilised.

3.1 Introduction

This chapter provides a detailed account of the analysis undertaken concerned with the identification of persistently deprived neighbourhoods, as well as with the impact exerted by exogenous indicators on neighbourhood-level life outcome indicators. In particular, the section focuses on the analysis of the spatio-temporal characteristics of the Jobseeker's Allowance rates across Scottish neighbourhoods in the context of identifying persistently poor localities and assessing vulnerability to exogenous macroeconomic indicators.

The following analysis commences with a review of the relevant available local labour market indicators that are conducive to answering the set of leading research questions on the variability of neighbourhood-level outcomes in relation to macroeconomic changes as well as on consistency in life outcomes. As the purpose of the work undertaken is to suggest an analytical approach that would be usable from a local service-delivery perspective, the review focuses on the statistical quality of the indicators, as well as on the procedural aspects surrounding the accessibility of the data. Consistent with the ambition of making the findings useful and applicable to local governance, the emphasis is placed on the availability of the indicators, with the focus on the publicly available data.

Following the previously outlined methodological assumptions, the research commences with a descriptive analysis of variables that are considered pertinent to characterising the relevant socioeconomic characteristics of Scottish localities as well as encapsulating key exogenous indicators. On data availability, the key limitations of the analysis are, to a great extent, determined by the technical limitations pertinent to the available datasets. The data availability issues become apparent when complex concepts of poverty and deprivation have to be operationalised in the use of the publicly available statistics, which, in the main, reflect simple metrics of benefits activity. As shown in the following discussion, the operationalisation of often complex concepts requires simplification due to technical and operational limitations pertaining to the data collection and retention processes used by the Scottish Government. In particular, users of publicly available datasets agree that the transactional costs associated with data collection often prove prohibitive in the context of generating elaborate small-area statistics.

With the exception of Census and similar wide-scale projects concerned with generating data on a national scale, the majority of the available neighbourhood-level life outcome data are derived from information that is sourced from various operational, administrative datasets. In practice, this implies that the notions of poverty and deprivation are operationalised through records of interactions with the welfare system. As subsequently

observed in section 3.1.1 on the availability of the poverty indicators, with respect to the practical applications, concepts such as income deprivation simply reflect *spatially aggregated* measures pertaining to counts of the observed interactions with the welfare system.

The following analysis is undertaken across two sections that complement each other but are methodologically independent. Section 3.1.3 describes the analysis concerned with identifying neighbourhoods that are marked by elevated levels of poverty. The analysis assesses the data against the three criteria, which reflect the levels of deprivation being higher across a selected sample of neighbourhoods, the consistency of the observed phenomena across time and, as a final criterion, the consistency of the observed phenomena across space, respectively, accounting for the proximity of geographies marked by consistently elevated rates of JSA claimants.

The following section summarises the descriptive analysis of relevant qualities of the data in the context of the changes observed on a sample of exogenous indicators. The analysis exploits the previously utilised data and evaluates the elevated values identified in the context of the change occurring across a selection of indicators reflecting the exogenous factors. The analysis employs analytical techniques traditionally reserved for big data analysis and attempts to fit multiple regression models for the available data and then progresses to evaluating the spatial dependencies across the observed results.

3.1.1 Available Local Labour Market Indicators

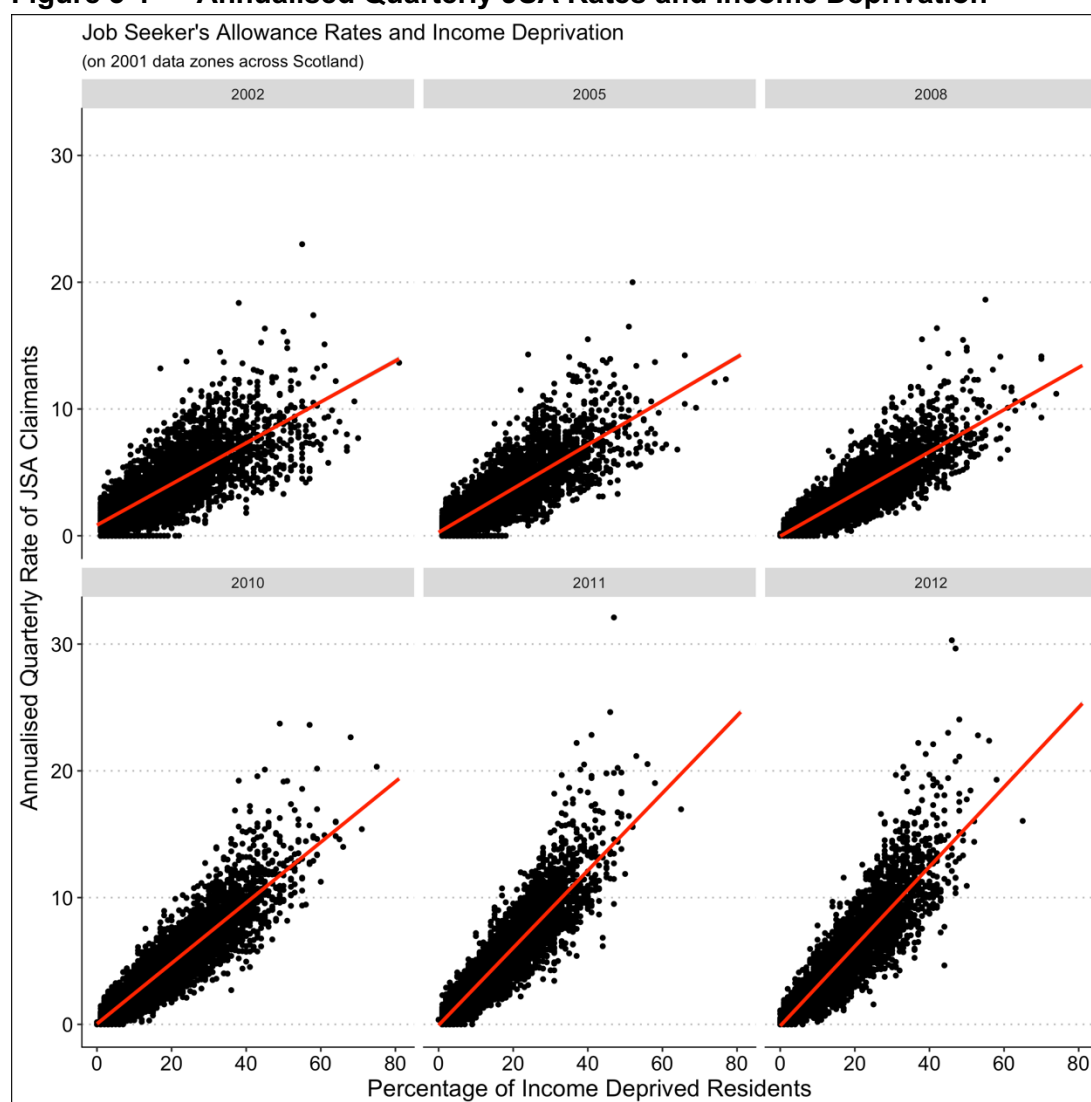
The availability of neighbourhood-level poverty indicators is determined by a number of factors mostly reflecting technicalities pertaining to the data collection as well as demand expressed by public sector bodies and frequent consumers. The resources available and variable prioritisation of data development exercises across the public sector bodies influence the quality of the indicators disseminated through the publicly available statistical repositories. Most of the available income and poverty data are derived from the data collected by the Department of Work and Pensions and reflect counts corresponding to various benefits rates. For example, the income deprivation indicator produced by the Scottish Government (2012c) was developed by using benefits uptake indicators pertaining to counts of persons claiming one of the following benefits:

- Number of Adults (aged 16–59) receiving Income Support or Income-based Employment and Support Allowance
- Number of Adults (aged 60 plus) receiving Guaranteed Pension Credit

-
- Number of Children (aged 0–15) dependent on a recipient of Income Support, Jobseekers Allowance or Employment and Support Allowance
 - Number of Adults receiving (all) Jobseeker’s Allowance
 - Number of Children (aged 0–15) dependent on a recipient of Jobseeker’s Allowance (all)
 - Number of Adults and Children in Tax Credit Families on low incomes

The double-counting of recipients across the selected indicators is excluded, and the data are aggregated on a neighbourhood level into scores that are subsequently ranked. In effect, the income deprivation measure is strongly correlated with a range of out-of-work benefits for which statistical data is publicly available. This occurrence is visualised in Figure 3-1. Figure 3-1 illustrates the relationship between the annualised quarterly JSA claimant rates and the percentage of the income-deprived residents in a data zone across the available years.¹ The fitted line corresponds to a simple linear model. Each point represents annualised quarterly JSA values and income deprivation values for a single data zone during the selected year.

¹ For the period 2008–2010, income deprivation figures are available for the fiscal years 2008/2009 and 2009/2010; for the remaining periods, the data is expressed with use of calendar years. For the purpose of this visualisation, the data were aggregated to calendar years. It is worth noting that the relationships observed do not change significantly if explored on quarterly or half-year intervals.

Figure 3-1 — Annualised Quarterly JSA Rates and Income Deprivation

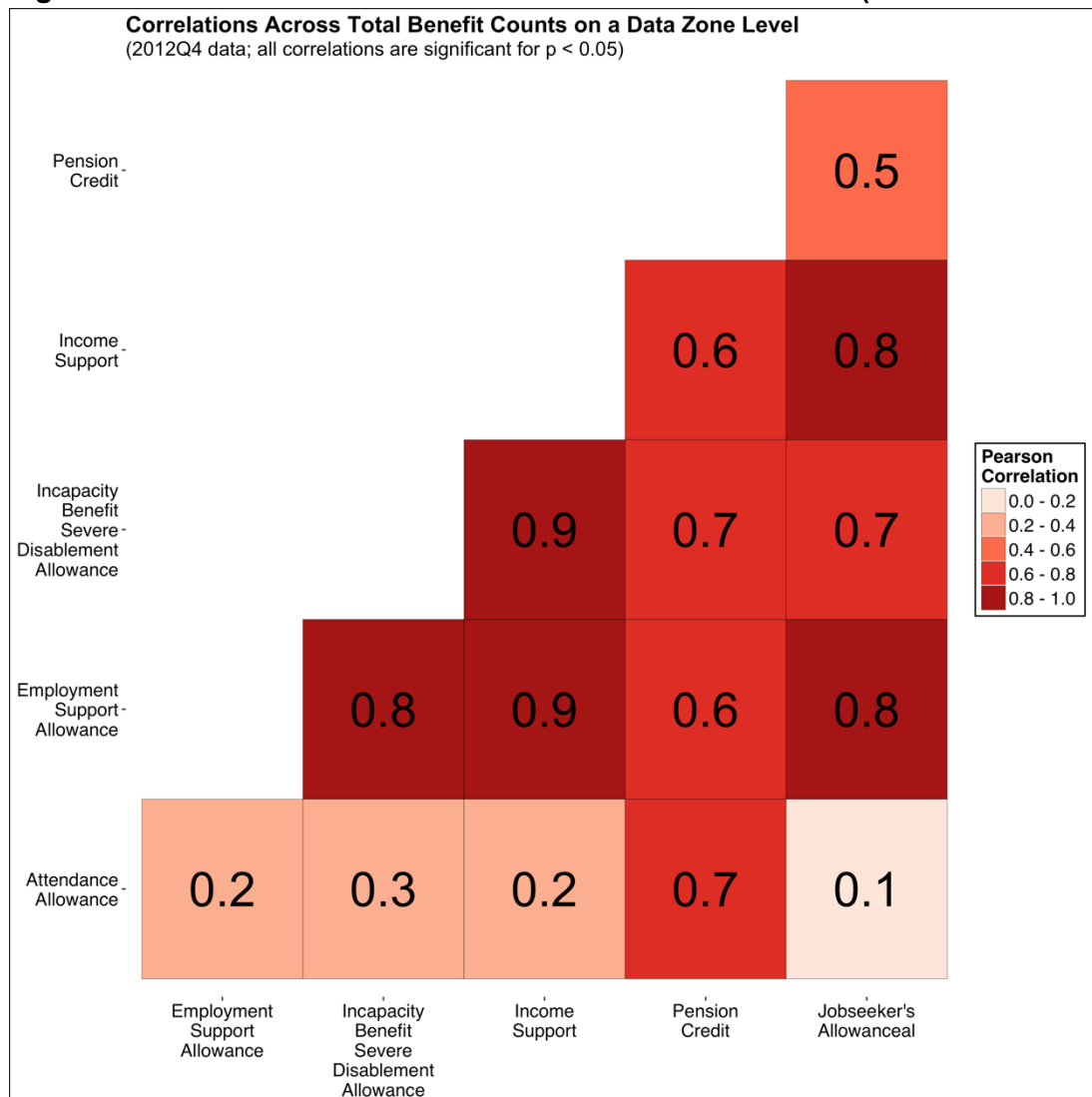
It should be further observed that the correlation presented is not limited to the Jobseeker's Allowance and Income Deprivation indicators, as analogous relationships can be observed across numerous other indicators utilising the benefits uptake data. This occurrence can be explained by the nature of the welfare system in the UK, where the criteria justifying the selection for one indicator are simultaneously sufficient for a recipient to claim benefits across the remaining benefits provisions.

The neighbourhood-level data available across the administrative data systems in Scotland provide access to a number of additional indicators reflecting various interactions with the welfare system. For example, NOMIS, a labour market data service maintained by the Office for National Statistics provides access to benefits uptake neighbourhood-level indicators pertaining to counts of claimants of Income Support, Jobseeker's Allowance, Pension Credits,

Disability Living Allowance (previously known as the Severe Disablement Allowance) and Employment Support Allowance.

As visualised in Figure 3-2, some of the benefit counts expressed on a data-zone level are strongly correlated with each other. This phenomenon can be further explained in the context of the criteria governing eligibility for benefits. Comparable administrative criteria that are used to assess eligibility for one benefit are usually used across the remaining benefits provisions. Consequently, strong correlations between the benefit claimant rates across various allowances are observable at the neighbourhood level and in individual data.

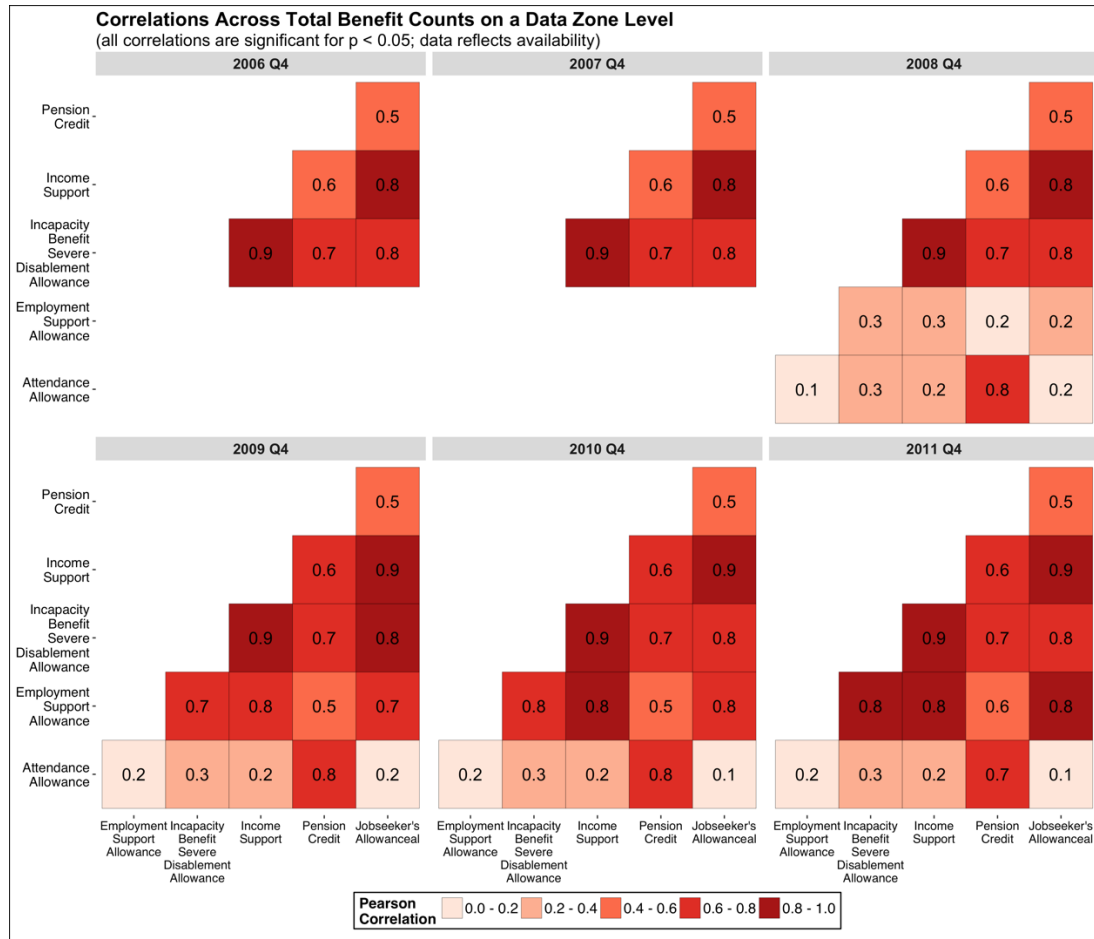
Figure 3-2 — Correlation Coefficients for total benefit counts (selected benefits)



An initial analysis of the relevant dependencies on the historical data indicates that comparable relationships can be observed across the years for which data are available. As illustrated in Figure 3-3, it is further observable that the neighbourhood-level counts of Job

Seeker’s Allowance are strongly correlated with the remaining available benefits, such as Income Support or Incapacity Benefit/Severe Disablement Allowance.¹ The observed occurrence simplifies the process of identifying the relevant life outcome indicators, as one can be confident about the validity of assumptions emphasising strong interdependencies across the small-area measures of deprivation.

Figure 3-3 — Benefit claimant counts correlations across years

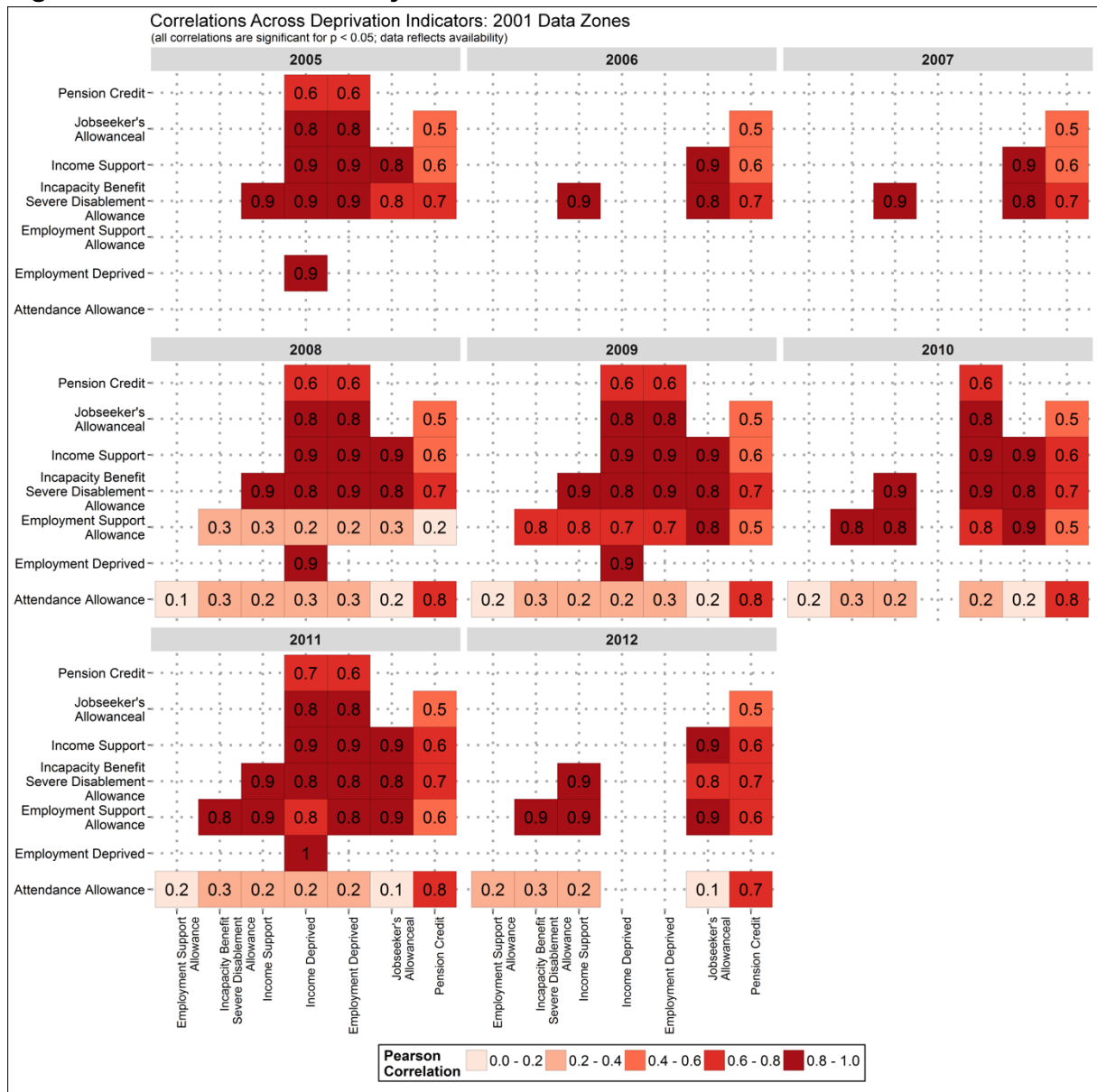


For the sake of illustrating the strength of the observed relationships across the available data systems, it is worth expanding the analysis across the additional time-series data. It can be seen that strong positive relationships are observed across the remaining benefits uptake indicators. The correlation heat map provided in Figure 3-4 illustrates that the neighbourhood-level rates of benefits uptake expressed as counts

¹ Due to the legislative change concerned with the distribution of this benefit, the Incapacity Benefit/Severe Disablement Allowance is reported as one measure.

of diverse benefits for which data is available on a data-zone level are frequently strongly correlated across the available data.

Figure 3-4 — Correlation of Key/Combined Benefits and Benefit Counts



With the exception of the Attendance Allowance, which correlates weakly with the remaining variables, it can be hypothesised that the strong positive relationships observed above indicate that the available benefits uptake statistics, in effect, are proxies for overall eligibility, which can be explained on the grounds of poverty. As shown in the subsequent sections of this analysis, this finding is important in the context of introducing the data into the regression models, as the indicators are marked by a strong degree of multicollinearity, as in effect they describe the same characteristic.

The data visualised above reflect the availability of statistics and represent the most pragmatic approach to aggregating the figures across the available time series intervals. Indicators such as income or employment deprivation are produced routinely by the Scottish Government every couple of years, accounting for the available resources as well as additional developments in the Scottish data landscape (like updates to small area–level demographic estimates). As the process of collecting the key benefits uptake indicators is less resource intense, the data are more robust and reflect quarterly intervals, with the available data being up to date.

3.1.1.1 Selection Criteria

The above-outlined strong relationships between the selected benefits uptake indicators have to be accounted for in the subsequent sections concerned with the data analysis. In practice, the assumption can be made that, considering the strong correlations observed between the analysed selection of the poverty indicators, it is not necessary to include all of the selected indicators in a regression model as, to an extent, they describe the same phenomenon. Considering the previously outlined associations, it appears to be justified to focus more on the benefits uptake indicators that are not strongly correlated with each other and emphasise the statistical qualities of the data as one of the decisive criteria for selection of variables for further analysis.

The key point behind the analysis undertaken was to outline the strength of the relationships between the various benefits uptake indicators. The working hypothesis explaining the observed occurrence assumes that the consistency across the observed relationships can be explained by the procedural and legal characteristic of the welfare dependency system, where different benefit regimes have similar eligibility requirements. Consistent with the assumption that the utilised benefits uptake indicators often reflect similar phenomena, the analysis progresses to use the Jobseeker's Allowance as a dependent variable, as it can be observed that the Jobseeker's Allowance is a good proxy for the remaining indicators. Furthermore, considering the strong correlations between JSA and other benefits uptake indicators, selected variables would have to be dropped due to collinearity.

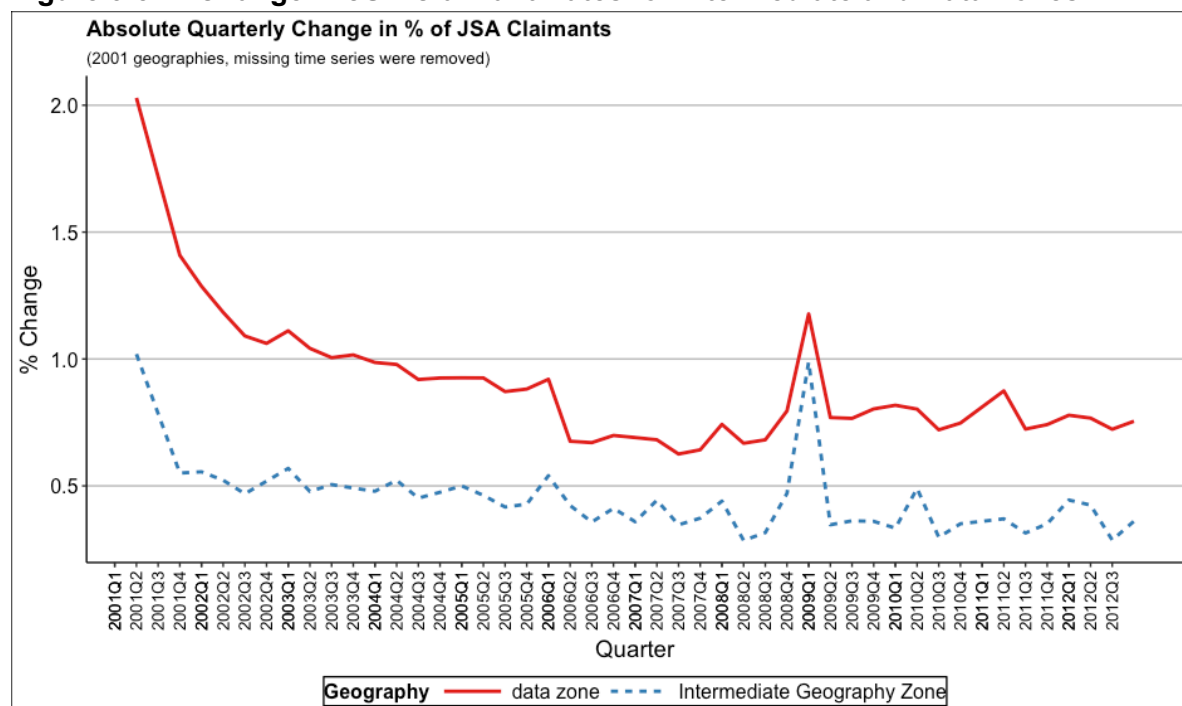
The reasons behind the choice of Jobseeker's Allowance as a dependent variable are both technical and conceptual. From a conceptual perspective, Jobseeker's Allowance provides a robust proxy for the remaining indicators that utilise JSA as a key component. In addition to the valid conceptual characteristics, the technical qualities pertaining to the Jobseeker's Allowance are robust when compared to other available indicators. Contrary to the remaining indicators available across the benefits uptake systems, JSA is collected at

regular intervals in a robust and consistent manner, which positively influences the quality of the derived models.

In a research report concerned with the utilisation of small-area income measures, Fenton (2013) distinguishes between four dimensions that can be ascribed to each of the small-area poverty measures. These dimensions, respectively, correspond to how well a measure encompasses space and time, the epistemic and statistical qualities of the indicator and finally, the theoretical and normative coherence of the measure. As illustrated in the discussion of the role of the Modifiable Area Unit Problem, the results of the analysis are, to an extent, influenced by the technical characteristics of the data and the data availability (Horner and Murray, 2002). By the same token, we might expect that the analysis is by using an alternative spatial framework. With respect to that point, Fenton (2013) further highlights that the main consideration concerned with the small-area size of the geographies reflects the notion of the small area being more volatile compared to the higher-level geographies.

This point can be easily illustrated by using the change rates for benefits counts across Scottish neighbourhoods. A comparison of quarter-on-quarter relative changes in total counts of JSA claimants across Scotland for data zones and Intermediate Geography Zones indicates that the relative average change on a data-zone level was always more strongly pronounced when compared to average change on an intermediate zone level. This phenomenon is illustrated in Figure 3-5.

Figure 3-5 — Change in JSA Claimant Rates for Intermediate and Data Zones



It is observable that the change in Jobseeker's Allowance rates across Intermediate Geography Zones was always lower than the observed change across the data zones. The variability of rates emerges because of smaller population sizes. The differences in variabilities for the indicators utilised are summarised in Table 3-1. These preliminary conclusions emphasise the necessity of incorporating analytical mechanisms in the model that would be sensitive to those characteristics. Greater volatility observed in the small-area data prompts the user on the data-zone level to exercise caution when asserting conclusions on the basis of the observed volatility.

Table 3-1 — Comparisons of distribution for quarterly difference in JSA rates

Geography	Mean	Standard Deviation	Maximum	Minimum	Variance	Coefficient of variation
<i>Data zone</i>	0.89	0.25	2.03	0.63	0.06	0.28
<i>Intermediate Geography Zone</i>	0.45	0.14	1.02	0.28	0.02	0.32

The conclusions derived from the above-described preliminary analysis of the variability of the small-area level in the example of the benefits uptake data across the Scottish data zones provide preliminary recommendations that should be considered in the ensuing research work. In particular, the practical nature of the *poverty* data available across Scotland implies making use of the benefits uptake data. This choice has two significant analytical implications:

- a) Any measure of poverty will, in effect, reflect a degree of interaction with the benefits uptake system. Following the research discussed in the previous sections of this thesis, it is worth emphasising that deprivation and poverty are multifaceted phenomena and utilising small-area statistical data results in a somewhat limited picture of the actual circumstances. This thesis further shows that it is possible to deliver statistically sound and practically applicable findings using that data. Nevertheless, it is necessary to acknowledge that the picture presented is limited by the constraints of the available data.
- b) Second, the procedural nature of the benefits uptake system results in a significant degree of intercorrelation between the indicators utilised. This is beneficial from an analytical point of view, as we can be more confident that the selected sample of indicators will be indicative of a more comprehensive picture of the benefits uptake. On the other hand, it further emphasises the previous point – what is measured, in effect, pertains to spatially aggregated likelihoods

of interaction with a system and can be treated as a conceptual proxy for poverty and/or deprivation, only with that caveat always present.

The key time series characteristics pertaining to the small-area measures utilised are concerned with the comparability of the results obtained across time for the geographies utilised. In the context of the spatial data, the comparability of measures across time is affected by numerous factors. In particular, it is recognised that changes to the administrative boundaries of geographies that are used to disseminate the data (Norman et al., 2003). This is particularly strongly pronounced in the case of geographies that are routinely adjusted following population flows. In the context of data zones, the changes to boundaries usually take place following the availability of new census data.

The comparability across time is further affected by the conceptual changes to the data supporting the development of relevant measures. This can be easily observed in the context of the changes to the benefits uptake data in the UK that followed the welfare reform. As outlined in the report by the Department for Work and Pensions (2010), the introduction of the Universal Credit will have a significant impact on the nature of the collected and disseminated benefits uptake data. Following the legal changes to the welfare reform system, it is important to emphasise that not only the rules according to which benefits are allocated to claimants are changing, but also that the very nature of the indicators themselves will be modified.

Consequently, the introduction of the welfare reform changes will result in a set of transfer indicators¹ being developed, as well as the new Universal Credits metrics gradually replacing the old ones. The quoted examples of changes concerned with the welfare reform data provide an illustration of the risks associated with time series analysis utilising administrative data. It is common that administrative indicators, which are mostly created as counts of various interactions with the system, are affected by changes in legal and political contexts. It is noticeable that the changes are concerned with the range of more complex indicators that make use of the benefits uptake data.

In addition to the changes occurring as a consequence of legal and procedural developments pertaining to the welfare system, the comparability of indicators is further affected by changes to the methodological structure of the data. In an informative example, Dibben et al. (2007) observe that the cross-time series comparability of measures is also often affected by methodological developments concerned with the construction of the indicators selected. As previously discussed, deprivation indicators utilise benefits uptake data and are

¹ These indicators will be used as interim measures providing counts of claimants receiving benefits via the old and the new systems (Department for Work and Pensions, 2013).

more attuned to assessing poverty-related aspects of socioeconomic deprivation, with issues pertaining to financial vulnerability or more broadly defined financial risk not being well captured in the available data. This should not necessarily be seen as a shortcoming of the available benefits uptake indicators, but simply as a function of the available data and the methodology utilised.

In a comparative analysis of the existing techniques used to measure the prevalence of poverty on a small-area level, Fenton observes that the existing indicators are frequently used for purposes other than their original ones. For instance, indicators created for the purpose of allocating resources are used to indicate how localities have changed over time (Fenton, 2013). Following Simpson (1995), Fenton (2013) notes that the technical construction of indicators that were designed with a specific purpose in mind makes them suitable for a specific usage and may prove misleading if applied outside the original context. In a discussion concerned with the utilisation of the Index of Local Conditions (ILC) designed by the Department of Environment, Simpson (1995, p. 24) argues that the construction of the index does not allow for it to be used as a measure of deprivation: '[r]esearchers looking for an index of deprivation should not touch the Index of Local Conditions unless they wish to play politics to win corn for areas with which their own income is associated'.

In particular, Fenton (2013) notes that the normative and theoretical coherence of poverty measures, such as the threshold used to distinguish 'poor' from 'non-poor', have direct implications for the implementation of specific social policies and allocation of resources across communities recognised as deprived and non-deprived. This thesis expands the existing normative understanding of small-area data by focusing on local labour market vulnerability as a potential dimension.

In addition to the normative aspects of the information utilised, viable utilisation of the small-area data is also determined by the numerical quality of the sourced information. Verran (2010) points out that the high numerical quality of obtained deprivation measures is achieved in the course of the data being unambiguous and pertaining to phenomena that are clearly countable. In the light of this statement, indicators that do not correspond precisely to phenomena that are easily countable but utilise vaguer concepts would be considered numerically deficient.

The methodological criteria utilised underpinning the selection of the indicator follow the previously discussed relevant qualities of the spatial data, as well as reflecting the methodological requirements of the data with respect to the information carried. Table 3-2 provides a summary of the set of criteria pertaining to the technical qualities of the indicators

as well as the conceptual validity of the suggested data evaluated in the context of the proposed research. The conditions enumerated in the section on the technical quality reflect previous deliberations on the quality of spatial statistics, as well as the practical relevance of specific characteristics in relation to the proposed analytical methodology. It is recognised that the proposed criteria may be:

- a) *Crucial* – if the proposed indicators do not meet specific criteria, the analysis is infeasible, rendering the proposed indicator inapplicable.
- b) *Desired* – it is recognised that if the indicator meets this specific criterion, it would be of relevance to the work undertaken. However, the absence of the precise criterion in the indicators does not render the indicator unusable in the context of the proposed work.

Table 3-2 — Indicator selection criteria

Quality	Criterion	Definition	Importance
<i>Technical qualities</i>	Cross-time comparability	It is expected that the selected variable will be most conducive to undertaking time series analysis. In terms of practical evaluation of the data, the emphasis is placed on the consistency of the definition utilised in the development of the indicator. The emphasis is also being placed on the availability of the data across time series periods, with a preference for indicator present over a longer time series.	Crucial
	High numerical quality	The analysis recognises that the high numerical quality of the indicator will positively impact the analytical quality of the result. Consequently, the emphasis is placed on the measure being unambiguous and precisely defined.	Desired
	Spatial consistency	In line with the previously discussed qualities of the spatial data, it is assumed that the indicator utilised would be consistent across geographies available in the dataset.	Desired

Quality	Criterion	Definition	Importance
<i>Conceptual qualities</i>	Pertinent to deprivation	The conceptual quality of the indicator should be evaluated on the grounds of the indicator delivering information about the levels of deprivation. The information can be carried directly by a purpose-built indicator or be a function of strong correlation with acceptable measures of deprivation.	Crucial

The degree to which the datasets utilised meet the qualities listed in Table 3-4 is crucial to the quality of the final analysis generated by this analysis. For example, as the main purpose of the work is to focus on historical change across selected sets of life outcomes, the small-area data used should be comparable across time. In practice, the high-quality time series indicators assume that the same phenomenon is being measured in a consistently comparable manner across the observed period.

In addition, with respect to data from multiple sources, it is important that synchronisation across the variable time series is achieved (Batini and Scannapieca, 2006). The notion of information quality is more elusive and depends on the 'actual use of data' (Wand and Wang, 1996, p. 87). Data that are recognised as delivering high information quality in one context can be recognised as being of insufficient quality in another. Furthermore, the academic literature concerned with the subject recognises that there is no clarity with respect to the definition of data quality across disciplines (Lee et al., 2002). Lee et al. (2002, p. 134) distinguish between four aspects of data quality that pertain to information quality:

- a) *Intrinsic information quality* – the notion of intrinsic information quality is defined as pertaining to the accuracy, reliability, numerical precision and believability of information
- b) *Contextual information quality* – contextual information quality is defined as pertaining to the empirical aspects of the relevant data; it is usually defined in the context of the added value generated by the information, as well as its importance and relevance to the undertaken research
- c) *Representational information quality* – is usually associated with the ease with which specific information can be interpreted and understood and broadly corresponds to the absence of confusion pertaining to the specific data set
- d) *Accessibility* – is often simply defined in terms of ease of access and ability to source the relevant data conveniently. In principle, proprietary datasets or highly confidential

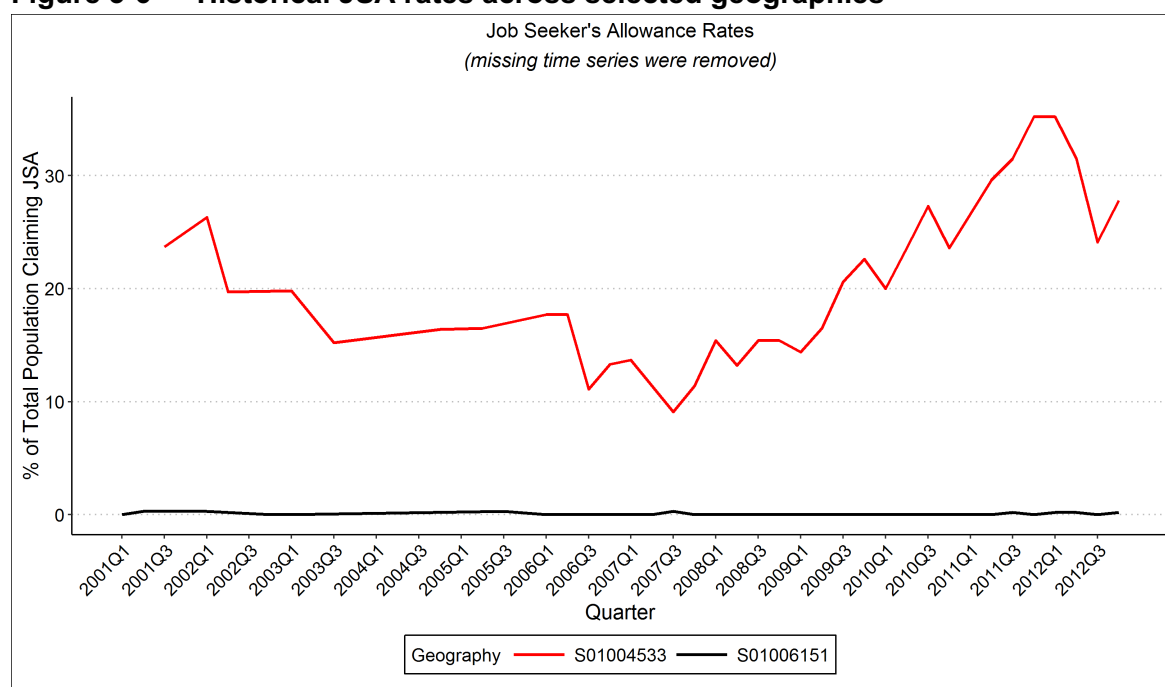
datasets where access is limited are of low accessibility, whereas publicly available data are usually defined as being universally accessible

3.1.2 Jobseeker's Allowance – Descriptive Analysis

The policy imperative behind the introduction of Jobseeker's allowance in October 1996 was concerned with more rigorous enforcement of eligibility regime (Manning, 2009). The change in benefit name from Unemployment Benefit to Jobseeker's Allowance emphasises shift in policy from providing income to those who do not work to supporting those who are actively looking for work. A significant decline in claimant rate was observed following the introduction of Jobseeker's Allowance, with the seasonally adjusted fall in November 1996 being the highest recorded at the time (Sweeney and McMahon, 1998).

Following the previous discussion of the overall principles of data quality, the following analysis looks closely at the Jobseeker's Allowance to explore the technical qualities of the indicator. The analysis focuses on the distribution of the Jobseeker's Allowance in Scotland, accounting for the historical trends and spatial distribution. The purpose of the section is to introduce the reader to the concept of the JSA analysis that can be undertaken with the use of the publicly available benefits uptake data in Scotland.

An initial descriptive analysis of the distribution of the data zones across time indicates that, in the case of the available data, 657 data zones would be within 18–20 quintiles with respect to the quarterly rate of Jobseeker's Allowance across the whole period available in the dataset. The consistency of these outcomes can be easily visualised with the use of two sample geographies, which, followed through time, illustrate concurrency where consistently high values can be observed. Both neighbourhoods were selected according to the highest and lowest average in the percentage of JSA claimants. Analogous conclusions can be observed when looking at the historical rates of JSA claimants per the first iteration of the Scottish Index of Multiple Deprivation. As visualised in Figure 3-7, it is observable that early selection by the SIMD scores also results in consistent outcomes across the JSA rates.

Figure 3-6 — Historical JSA rates across selected geographies

The Scottish Index of Multiple Deprivation is frequently utilised in the context of providing background information for the distribution of certain life outcome indicators across other life outcome indicators. For instance, the SIMD data is frequently used to provide a basis for cross-tabulation across other indicators, such as educational attainment measures. The analytical challenge pertaining to this approach is mostly concerned with the methodology underpinning the construction of the SIMD, which considers a vast number of indicators from across a multitude of life outcome domains including, health, unemployment and educational attainment.

Depending on the context in which the ensuing data is being utilised, a potentially more meaningful approach may involve utilising specific domain data, such as looking at the income domain to provide information on the distribution of educational attainment across the most and least deprived geographies. Considering the above, the ensuing analysis looks at the distribution of JSA rates across the SIMD domain with the aim of providing a general overview of the JSA variability within SIMD domains.

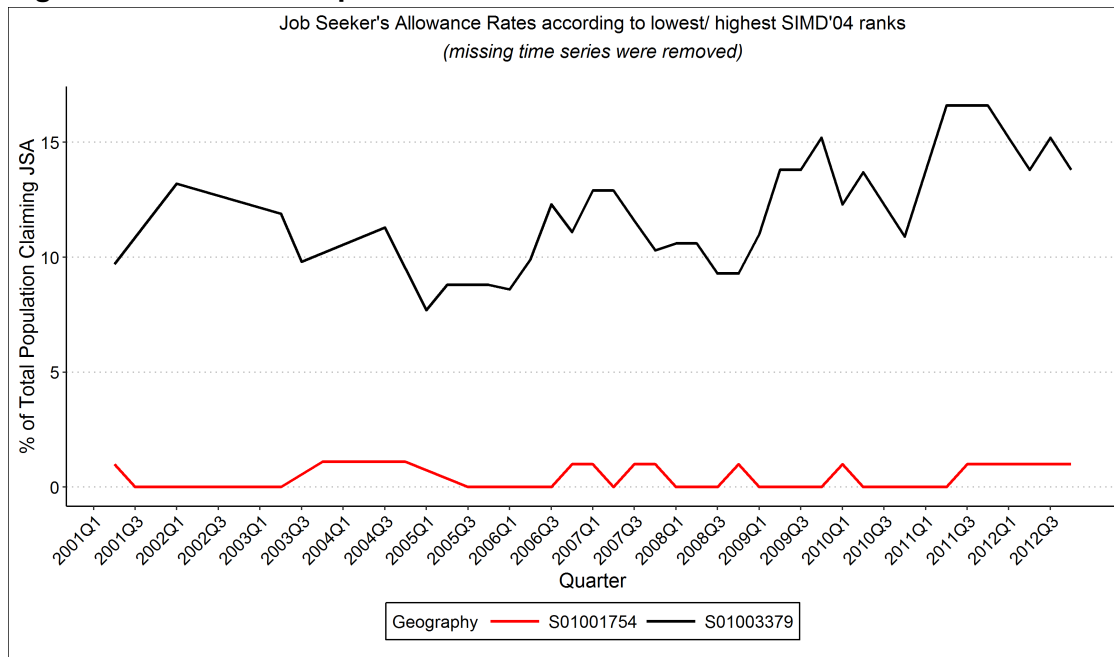
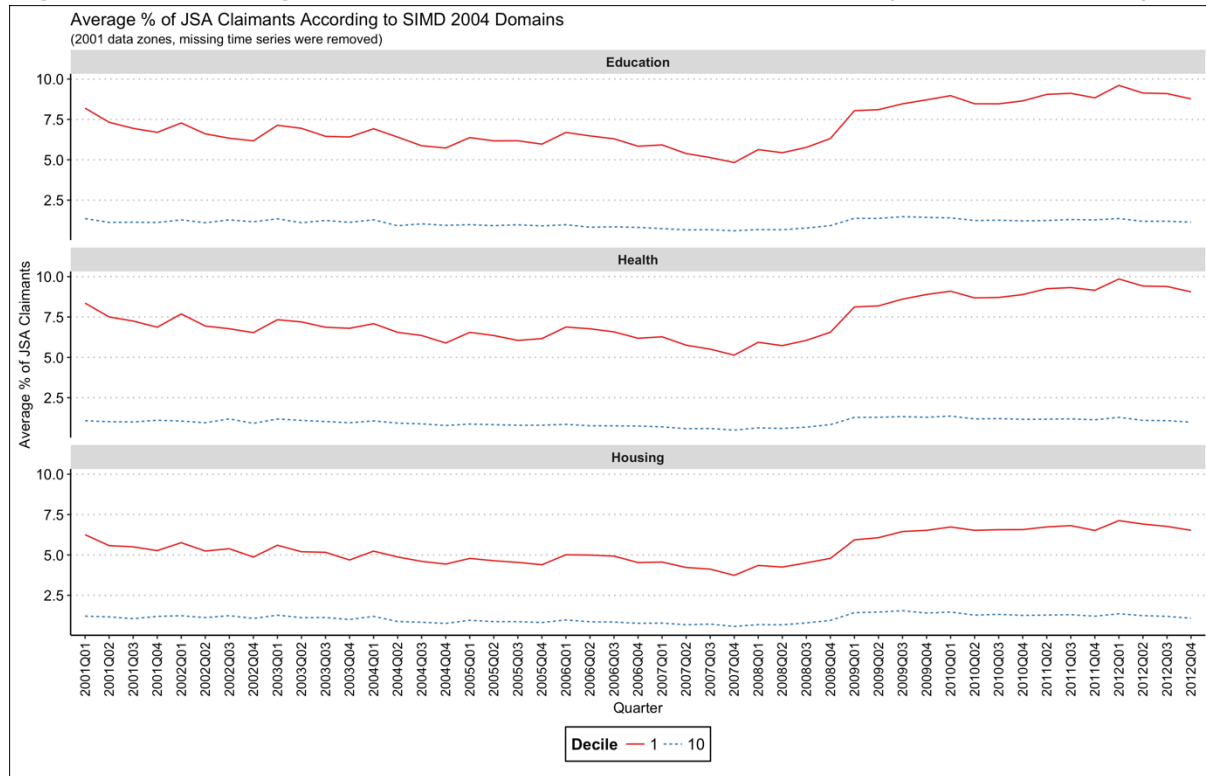
Figure 3-7 — JSA rates per SIMD'04 scores

Figure 3-8 provides further insights into the distribution of average JSA rates disaggregated by the SIMD'04 decile. The average is constructed across cohorts derived from the SIMD'04 education, health and housing domains. From the visualised trends it is observable that variability in the JSA rates observed in the most and least deprived geographies across selected domains is fairly consistent in terms of the prevalence of benefits uptake, with the most deprived geographies in terms of educational attainment according to the 2004 iteration of SIMD being characterised by significantly higher unemployment rates compared to a subset of data zones characterised by lack of educational deprivation. A similar relationship is observable across the health and housing domains.

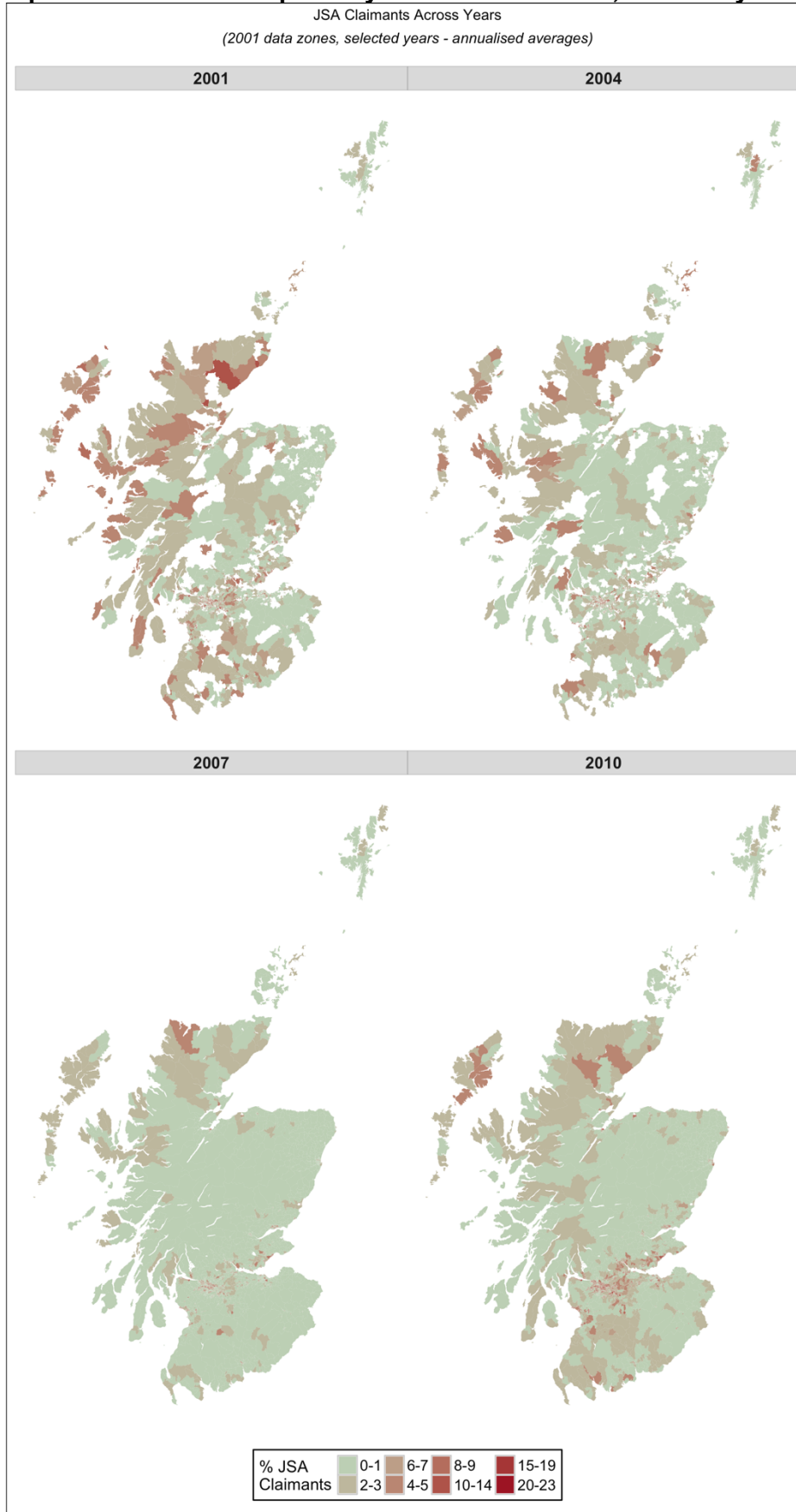
Figure 3-8 — Average % of JSA Claimants per SIMD'04 deciles (selected domains)



The above chart indicates that the average rates of JSA claimants selected per the lowest and highest decile of the 2004 iteration of the Scottish Index of Multiple Deprivation were characterised by a relatively consistent JSA dependency rate. From the summaries above, it can be inferred that the average deprivation levels across most deprived geographies that were pronounced by relatively high values with respect to the education/health and income domains were also characterised by significantly higher rates of JSA claimants when compared to geographies classified as being within the least deprived deciles. These findings reinforce the validity of using Jobseeker’s Allowance as a proxy for the overall measure of deprivation.

In addition to analysing the historical trends in the rates of JSA claimants, it is informative to explore the spatial distribution of JSA claimants. As shown in the subsequent sections of this analysis, the spatial distribution of deprivation measures as a percentage of Jobseeker’s Allowance claimants is relatively high. As visualised in Map 3-1, the elevated rates of JSA claimants can be observed across similar sets of geographies. In particular, it is noticeable that the neighbourhoods were consistently marked by elevated levels of benefits uptake.

Map 3-1 — Annualised quarterly JSA claimant rates, selected years



The consistency in the spatial distribution of the elevated level claimants can be further emphasised during a simple cross-tabulation by the local authority administrative areas. Such a cross-tabulation indicates that local authorities consisting of predominantly urban geographies were marked by elevated levels of JSA claimants. The vigintiles correspond to the percentage of quarterly rates by local authority subset, as the quarterly figures reflect data zone-level rates with data zone populations being of similar sizes as per the initial design assumptions. The most deprived vigintile is 20, with the maximum percentage of JSA claimants being 35%.

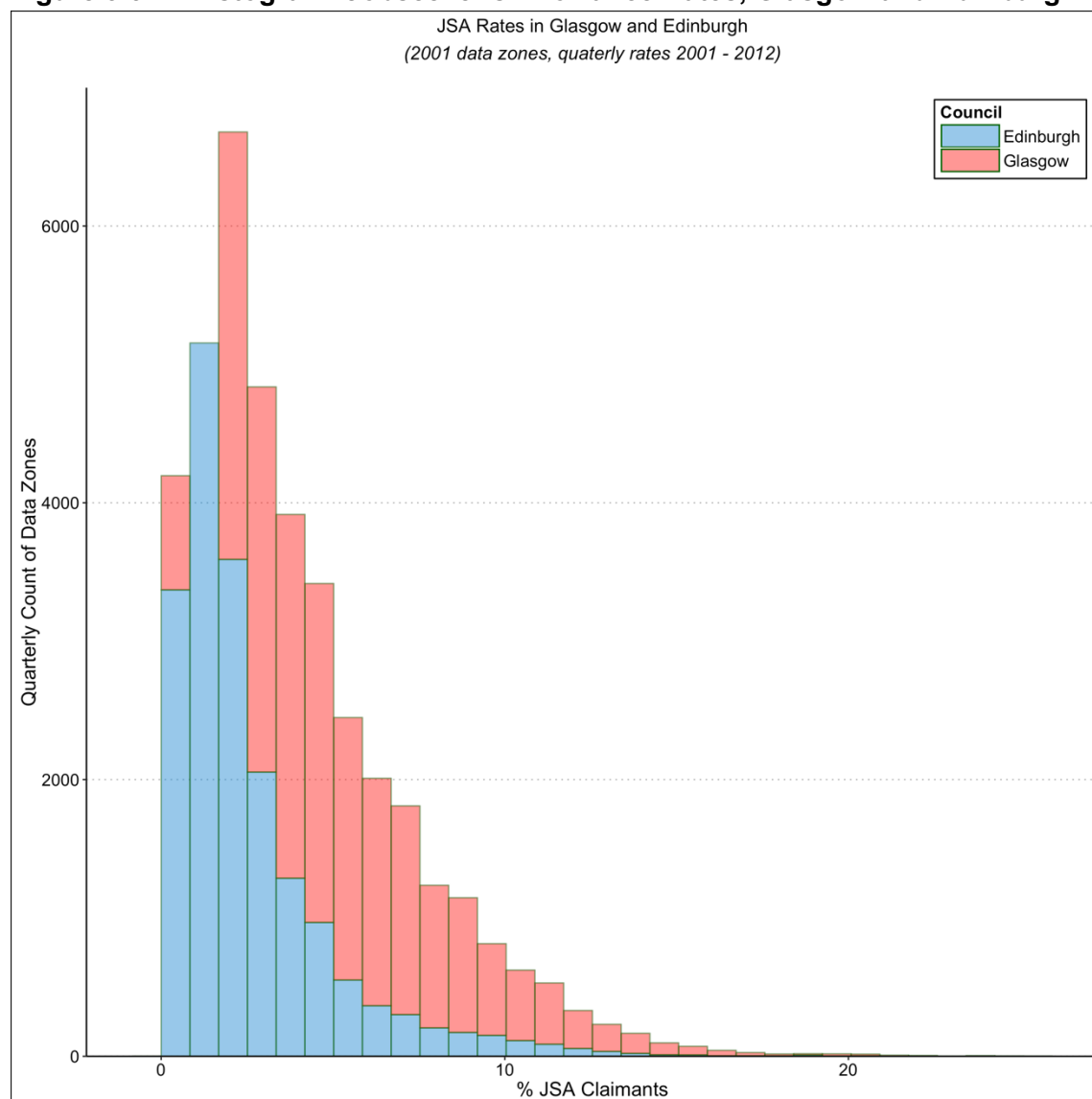
Likewise, councils that are traditionally considered deprived were also marked by elevated rates of JSA claimants, as shown in Table 3-3. An arithmetic calculation of aggregating the quarterly JSA rates for the data zones into vigintiles and cross-tabulating the relative distribution on a local authority level indicates that, on average, the distribution of geographies marked by elevated levels of benefits deprivation is common across selected geographies.

Table 3-3 – Relative average distribution of data zones per JSA vigintiles

Council	% of neighbourhoods with JSA rate claimants by vigintile, quarterly																			
	<i>Least deprived</i>										<i>Most deprived</i>									
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
Aberdeen City	24	7	8	7	7	6	5	5	4	4	4	3	3	3	2	2	2	2	1	1
Aberdeenshire	33	9	9	10	8	6	5	4	4	3	2	2	2	1	1	1	1	0	0	0
Angus	7	3	5	8	6	5	6	7	6	5	5	5	5	4	4	4	4	4	2	2
Argyll and Bute	7	2	5	5	6	6	6	6	6	7	5	6	6	5	5	4	4	3	3	4
Clackmannanshire	4	0	1	4	3	4	4	4	5	6	6	7	6	7	6	7	8	6	7	6
Dumfries and Galloway	6	2	3	6	6	6	6	7	7	7	7	7	7	5	5	4	3	2	3	4
Dundee City	4	2	3	3	3	3	3	3	4	3	4	3	4	4	5	5	7	10	13	13
East Ayrshire	2	1	2	3	3	3	3	3	3	4	4	5	5	6	6	7	8	9	10	11
East Dunbartonshire	10	7	8	8	9	7	7	6	6	5	4	4	4	3	3	3	2	1	1	1
East Lothian	9	6	4	6	8	7	8	7	7	7	7	5	4	4	4	3	2	1	0	0
East Renfrewshire	11	10	7	9	8	8	7	7	6	5	3	3	3	2	3	2	2	2	1	0
Edinburgh	5	10	7	7	7	7	6	6	5	5	5	5	4	3	3	2	2	3	3	3
Eilean Siar	0	1	1	2	3	5	5	6	8	8	10	8	9	8	8	8	5	4	2	1
Falkirk	2	6	3	4	4	4	4	5	5	5	6	6	6	6	7	6	6	6	5	4
Fife	2	5	3	4	4	4	4	5	5	5	5	5	5	5	6	6	7	7	7	6
Glasgow City	0	2	2	2	2	3	3	3	4	4	5	5	6	6	6	7	8	9	10	12
Highland	2	8	6	7	6	6	6	7	6	6	6	6	5	5	4	4	4	3	2	1
Inverclyde	1	2	2	3	3	3	3	3	4	4	4	4	5	6	5	7	9	10	11	10
Midlothian	1	7	4	5	5	6	5	8	6	6	6	7	7	6	6	5	4	3	1	0
Moray	3	6	7	6	6	8	6	7	8	8	7	7	5	5	4	3	2	2	1	0
North Ayrshire	1	2	2	3	3	3	4	4	4	3	4	4	4	4	5	7	8	10	12	15
North Lanarkshire	0	3	3	3	3	4	4	4	4	5	5	6	6	7	7	8	8	7	7	6
Orkney Islands	9	12	12	10	9	7	8	7	6	6	3	4	2	1	1	1	1	0	NA	NA
Perth and Kinross	4	11	11	7	8	8	7	7	7	6	4	4	3	3	2	2	2	2	1	1
Renfrewshire	1	4	6	4	5	6	5	4	5	6	5	5	4	5	5	5	6	7	7	7
Scottish Borders	1	8	8	7	9	8	7	6	6	7	6	5	5	5	3	3	2	2	1	0
Shetland Islands	9	12	14	7	8	9	8	7	5	5	5	3	2	1	2	1	0	1	0	NA
South Ayrshire	1	3	5	4	4	5	6	5	5	6	6	6	6	6	6	5	4	5	4	6
South Lanarkshire	1	3	5	5	4	5	5	5	5	6	6	6	6	6	6	6	6	5	4	3
Stirling	2	5	9	6	7	7	7	6	5	6	5	5	5	5	5	4	4	3	2	2
West Dunbartonshire	0	0	2	2	2	2	3	3	4	4	4	6	7	7	8	7	9	9	10	12
West Lothian	1	3	6	5	4	4	5	6	5	5	6	6	6	7	7	7	6	5	3	1

This phenomenon can be further illustrated by using data subsets reflecting local authority boundaries. For example, Figure 3-9 shows the historical distribution of rates of Jobseeker's Allowance claimants for Glasgow and Edinburgh. The visualised data pertain to the quarterly rates of Jobseeker's Allowance claimants. In effect, the data pertain to 42,009¹ distinct observations reflecting neighbourhood-level data collected during the period from quarter one of 2001 to the last quarter of 2012.

¹ Each observation reflects a count for a data zone for each quarter.

Figure 3-9 — Histogram: Jobseeker’s Allowance Rates, Glasgow and Edinburgh

The preliminary descriptive analysis conducted suggests that the neighbourhood-level rates of Jobseeker’s Allowance claimants indicate the existence of patterns with respect to the levels of benefits uptake across Scottish neighbourhoods. It is observable that the Scottish neighbourhoods are marked by a strong degree of consistency with respect to the spatio-temporal prevalence of elevated JSA claimant rates. The following analysis further validates these conclusions in a more formalised manner.

3.1.3 Missing Data Analysis

As can be observed across a wide range of publicly available datasets concerned with measuring real-life phenomena, the occurrence and existence of missing data is a well-researched subject and can usually be ascribed to one of several reasons, the majority of which are purely technical, concerning the operational aspects of the systems collecting the

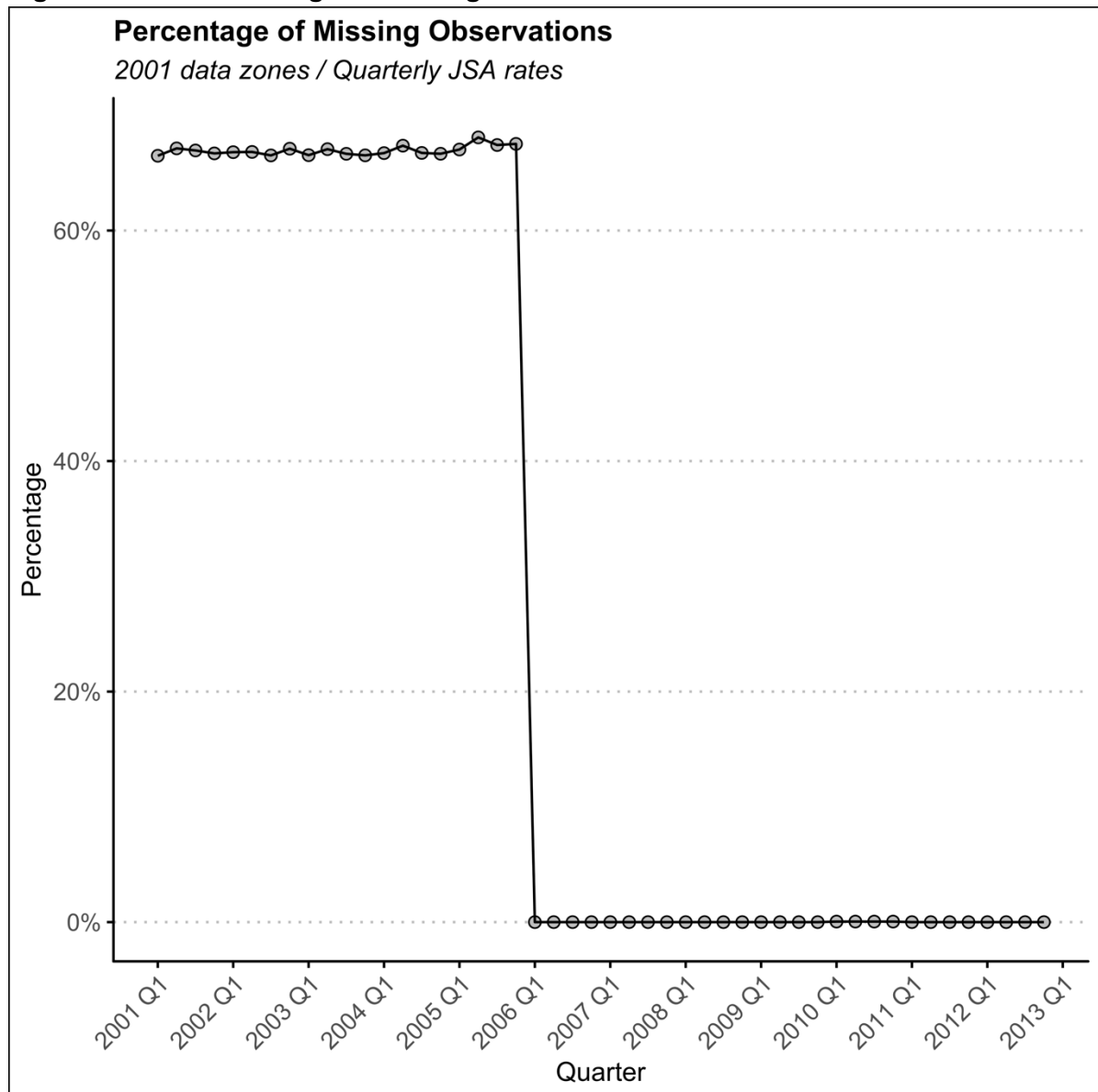
data. Outages, numerical mistakes and procedural disarrangements often result in missing data.

For the same reason, it can be further observed that indicators derived from multiple data sources are more prone to data losses and data outages. For instance, the Jobseeker's Allowance dependency rates are derived from multiple sources pertaining to the demographic data used as a rate denominator as well as DWP data for claimant and counts and other data sources pertaining to the development of the spatial frameworks for which the actual rates are later produced. Initially, the data collection systems supporting the registration of claimants feed information about claimant rates. Second, demographic indicators provide data allowing for the construction of denominators and generation of rates. A visualisation of the missing values is given in Figure 3-10 below.

In Figure 3-10, each bar represents a single geography accounting for the availability of the data across quarters used in the analysis. For the sake of readability, the labels on the chart were shown selectively. The y-axis corresponds to 6,505 geographies, whereas the x-axis reflects quarterly data from 2001 Q1 to 2012 Q4. It is clearly observable that there was a notable change in the pattern of missing data occurring in 2006 Q1, with the quality of the information collected improving in line with the enhanced data collection and retention methods.

The missing data patterns can be additionally visualised with a simple figure. The figure below shows a percentage of geographies for which the data were missing, accounting for the quarterly data. It is observable that from the initial relatively high rate of 60% in 2001 Q1, the number of missing observations decreased to 0 by 2006. The reasons behind the observed change in the quality of the administrative data reflect changes to the data collection procedures and technical arrangements facilitating the retention and management of the relevant statistical information.

Considering the volume of the data analysed, the patches of missing data do not adversely impact the results ultimately obtained. Also, the improvement in the data quality observed after 2006 led to a significant decrease in the rate of missing data values. This phenomenon is visualised in Figure 3-11. As shown, the average quarterly rate of data zones for which the JSA rate was missing dropped from over 60% to around 1% after 2006.

Figure 3-11 — Percentage of missing data

3.1.4 Neighbourhood Selection

The analysis focuses on the selection of Scottish neighbourhoods that are marked by persistently high rates of Jobseeker's Allowance claimants. With respect to identifying geographies marked by persistent levels of benefit uptake, the analysis utilises methodological assumptions underpinning work initially undertaken by Partridge and Rickman (2007). Utilising a panel dataset derived from the consecutive iteration of the census data, Partridge and Rickman (2007) identified persistently poor counties in the United States. The methodology utilised assumed that counties were defined as persistently poor if the poverty rate exceeded 20%. As expected, the ensuing quantitative analysis undertaken indicated that the 20%

threshold was indicative of more widespread deprivation across the communities identified, such as the prevalence of high male and female unemployment rates.

Further analytical work utilises observed variability in the JSA rates to operationalise the notion of vulnerability and illustrate the impact of macroeconomic changes on local labour markets and observed levels of benefits uptake. As informed by the dimensionality of the spatio-temporal data sets, prevalence is defined in the contexts of two characteristics: space and time. The assumptions behind the criteria may be summarised as follows:

1. The *deprivation* criterion is operationalised in terms of the prevalence of elevated levels of dependency on JSA
2. The *space* criterion is operationalised in the context of the phenomena being observed across a defined geographical area
3. The *consistency* criterion pertains to a certain phenomenon being observed across time

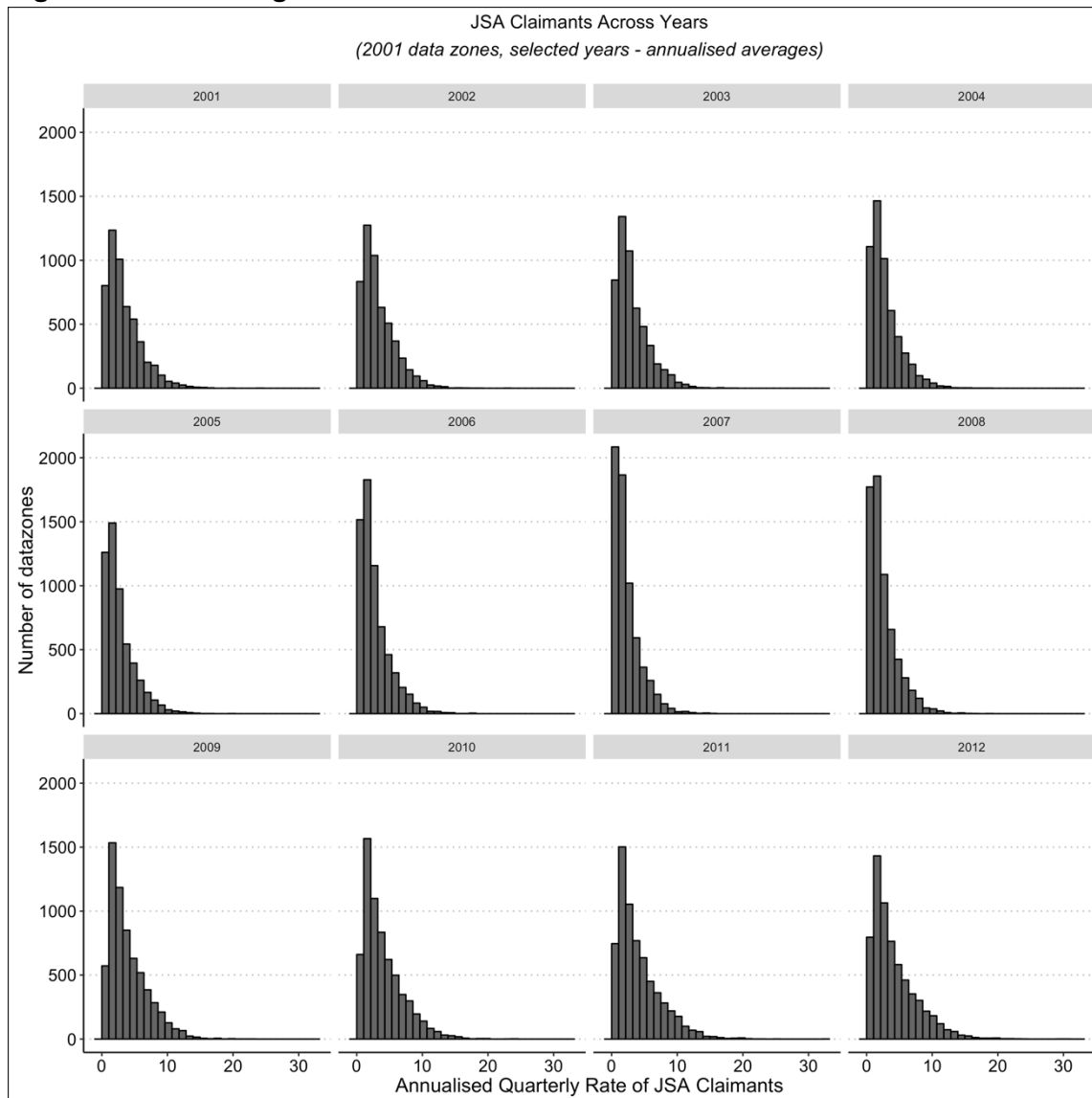
The following sections describe how the criteria are operationalised in terms of the indicators provided. The selection mechanism utilised that would identify the neighbourhoods as persistently poor utilises spatio-temporal analysis on a subset of small-area geographies. The criteria are designed to incorporate additional layers of filters on the provided data. If visualised with the use of a simple scheme, the process can be compared to filtering down the dataset to obtaining a small subset of geographies meeting the criteria. The nature of the process is illustrated by the use of the scheme below. The steps in the selection process are expressed in Table 3-4.

Table 3-4 — Selection mechanism for persistently deprived geographies

Step	Criterion	Analysis	Example
1	Elevated levels of deprivation	Identification of persistently higher values with respect to the selected indicators on benefits uptake	Analysing the distribution of the values across the periods available in the data
2	Consistency in elevated levels of benefits uptake	Time series analysis	Validating whether elevated levels of JSA dependency occur consistently across the defined geographical area
3	Positive spatial correlation	Moran's I	Analysis answers whether neighbourhoods located in vicinity are also pronounced by elevated levels of deprivation

3.1.4.1 Criterion 1 – Elevated Levels of Deprivation

As discussed in the previous chapter, the available academic literature on multiple deprivation and poverty provides an ample amount of evidence indicating the existence of spatial concentration of deprivation, both in economic as well as in social terms. It was shown that across the period analysed, the Scottish neighbourhoods were marked by significant variation with respect to the observed claimant rates. The operationalisation of this criterion implies deciding on what could be considered a significant variation in JSA claimants. As visualised in Figure 3-12, the annualised average quarterly rates of benefits uptake in Scotland are marked by significant variation, with a majority of the neighbourhoods having quarterly rates below 10% claimants per geography.

Figure 3-12 — Histograms of JSA Rates in Scotland

An analysis of the available grey literature on the use of the Scottish Index of Multiple Deprivation in the resource-allocation and expenditure mechanisms indicates that the SIMD values are traditionally used in the context of 5%/10% groupings of most deprived neighbourhoods. Justifying those arbitrary cut-offs scientifically is challenging; however, analysis of the relevant grey literature indicates this is a fairly widespread practice.

For example, references to the 5 per cent most deprived SIMD neighbourhoods can be found in government publications concerned with evaluating the effectiveness of nurseries or community ownership of assets (Doi et al., 2017; Leeman and Black, 2012). It is commonly known that this approach has an appeal to the decision-makers by virtue of its simplicity. The

concept can be further applied to JSA rates, in which spatio-temporal distribution is the main consideration, as in the current analysis.

Cross-tabulating the neighbourhood-level JSA values against the SIMD scores indicates that aggregate levels of benefits uptake are indicative of other life outcome characteristics. In particular, it is noticeable that neighbourhoods for which the rate of JSA claimants exceeds 5% are often simultaneously found in the most deprived decile across the domains of the Scottish Index of Multiple Deprivation. This is summarised in Table 3-5 below.

Table 3-5 – Data-zone level % of JSA Claimant values by SIMD Domains

<i>SIMD Domain</i>	<i>Year</i>	<i>Decile</i>	<i>Mean</i>	<i>Standard Deviation</i>	
<i>Crime</i>	2006	1	5.89	3.31	
		10	1.07	0.99	
	2009	1	7.58	3.77	
		10	1.58	1.09	
	2012	1	8.93	4.63	
		10	1.45	1.07	
	<i>Education</i>	2004	1	6.25	2.68
			10	1.04	0.86
2006		1	6.55	2.81	
		10	0.8	0.7	
2009		1	8.84	3.17	
		10	1.34	0.85	
2012		1	9.85	3.88	
		10	1.14	0.79	
<i>Employment</i>		2004	1	6.84	2.69
		2004	10	0.84	0.74
	2006	1	7.28	2.71	
		10	0.65	0.61	
	2009	1	9.43	3	
		10	1.14	0.79	
	2012	1	10.96	3.58	
		10	0.92	0.68	
	<i>Health</i>	2004	1	6.47	2.68
			10	0.9	0.77
2006		1	6.76	2.86	
		10	0.81	0.72	
2009		1	8.9	3.17	
		10	1.29	0.89	
2012		1	9.76	3.91	
		10	1.21	0.9	

<i>SIMD Domain</i>	<i>Year</i>	<i>Decile</i>	<i>Mean</i>	<i>Standard Deviation</i>
<i>Housing</i>	2004	1	4.79	2.67
		10	0.91	0.86
	2006	1	4.87	2.84
		10	0.86	0.75
	2009	1	6.24	3.39
		10	1.46	0.91
	2012	1	6.83	3.94
		10	1.22	0.89
<i>Income</i>	2004	1	6.86	2.59
		10	0.87	0.75
	2006	1	7.25	2.69
		10	0.73	0.66
	2009	1	9.39	2.99
		10	1.2	0.82
	2012	1	10.88	3.6
		10	0.94	0.68
<i>Scottish Index of Multiple Deprivation (all domains)</i>	2004	1	6.76	2.65
	2004	10	0.88	0.74
	2006	1	7.3	2.68
	2006	10	0.76	0.66
	2009	1	9.54	2.89
	2009	10	1.27	0.83
	2012	1	10.95	3.57
	2012	10	1.04	0.74

The findings summarised in Table 3-5 above correspond to the results of the correlational analysis summarised in the Section 3.1.1 and emphasise strong positive relationships between the levels of benefits uptake and the spatial prevalence of other aspects of deprivation. In the context of the ensuing analysis, it becomes apparent that JSA is a usable proxy for measuring neighbourhood-level deprivation. Following this line of reasoning, it is assumed that the selection of neighbourhoods with JSA rates higher than or equal to 5% can be considered a good proxy for exploring the spatio-temporal nature of deprivation.

The simple application of the outlined selection criteria to the data-zone level JSA data sets results in approximately 21% per cent of geographies meeting the criterion every quarter. A summary of these findings is provided in Table 3-6 below.

**Table 3-6 — Quarterly rates of JSA Claimants with JSA rates higher than 5%
Neighbourhoods with Rates Higher than 5%**

Quarter	All Observations	Neighbourhoods with Rates Higher than 5%	
		Count	Percentage
2001 Q1	2207	594	26.91
2001 Q2	2207	477	21.61
2001 Q3	2166	495	22.85
2001 Q4	2281	475	20.82
2002 Q1	2224	596	26.8
2002 Q2	2237	494	22.08
2002 Q3	2269	496	21.86
2002 Q4	2209	408	18.47
2003 Q1	2233	536	24
2003 Q2	2270	470	20.7
2003 Q3	2214	394	17.8
2003 Q4	2222	388	17.46
2004 Q1	2155	461	21.39
2004 Q2	2319	385	16.6
2004 Q3	2282	316	13.85
2004 Q4	2296	299	13.02
2005 Q1	2261	406	17.96
2005 Q2	2245	326	14.52
2005 Q3	2226	316	14.2
2005 Q4	2385	335	14.05
2006 Q1	6505	1,205	18.52
2006 Q2	6505	1,078	16.57
2006 Q3	6505	994	15.28
2006 Q4	6505	881	13.54
2007 Q1	6505	935	14.37
2007 Q2	6505	742	11.41
2007 Q3	6505	667	10.25
2007 Q4	6505	538	8.27
2008 Q1	6505	788	12.11
2008 Q2	6505	724	11.13
2008 Q3	6505	867	13.33
2008 Q4	6505	1,139	17.51
2009 Q1	6505	1,906	29.3
2009 Q2	6505	1,890	29.05
2009 Q3	6505	2,011	30.91
2009 Q4	6505	2,035	31.28
2010 Q1	6502	2,152	33.1
2010 Q2	6502	1,856	28.55
2010 Q3	6502	1,876	28.85
2010 Q4	6502	1,921	29.54

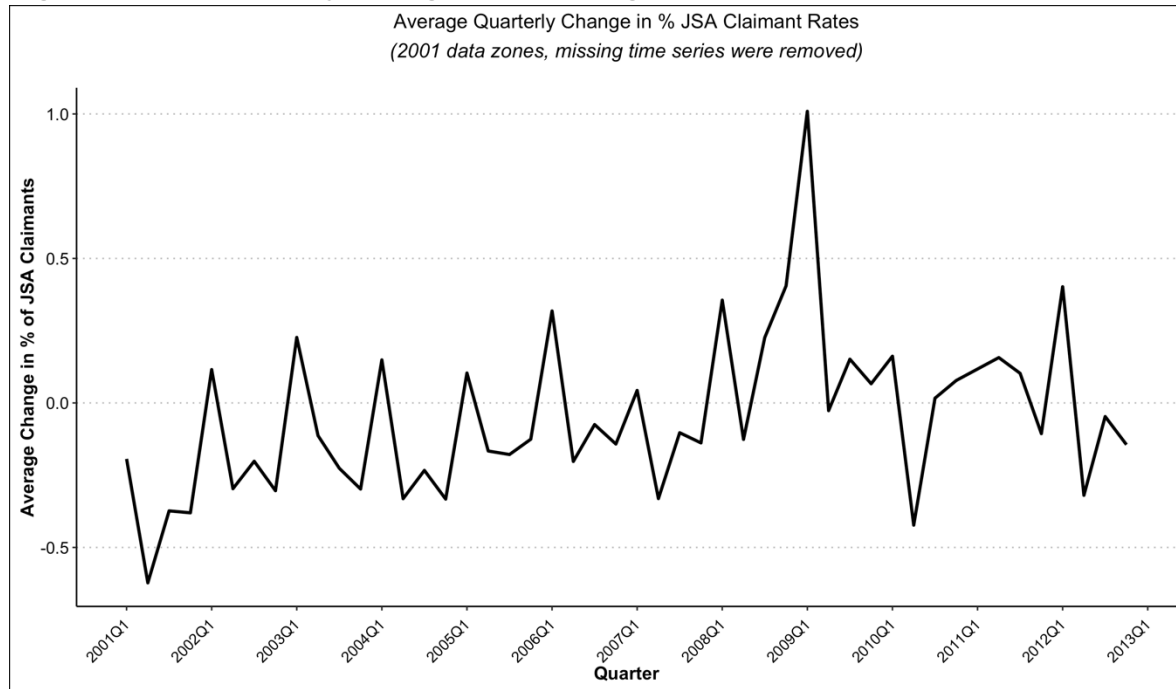
Quarter	All Observations	Neighbourhoods with Rates Higher than 5%	
		Count	Percentage
2011 Q2	6505	2,008	30.87
2011 Q3	6505	2,113	32.48
2011 Q4	6505	2,011	30.91
2012 Q1	6505	2,290	35.2
2012 Q2	6505	2,045	31.44
2012 Q3	6505	2,055	31.59
2012 Q4	6505	1,945	29.9

3.1.4.2 Criterion 2 – Consistency in Elevated Levels of Deprivation

This element of the analysis focuses on answering whether observed levels of deprivation are characterised by consistency in elevated levels of JSA claimants or whether the phenomenon is of a more ephemeral nature and occurs randomly across various geographies. In effect, a second filtering criterion is implemented as a follow-up to the previous analysis focusing on the temporal consistency of the existing elevated levels of deprivation across the set of previously identified geographies. In a technical sense, the following criterion utilises the previously generated subset of data zones and evaluates it in the context of temporal consistency in elevated levels of dependency on out-of-work benefits across local populations.

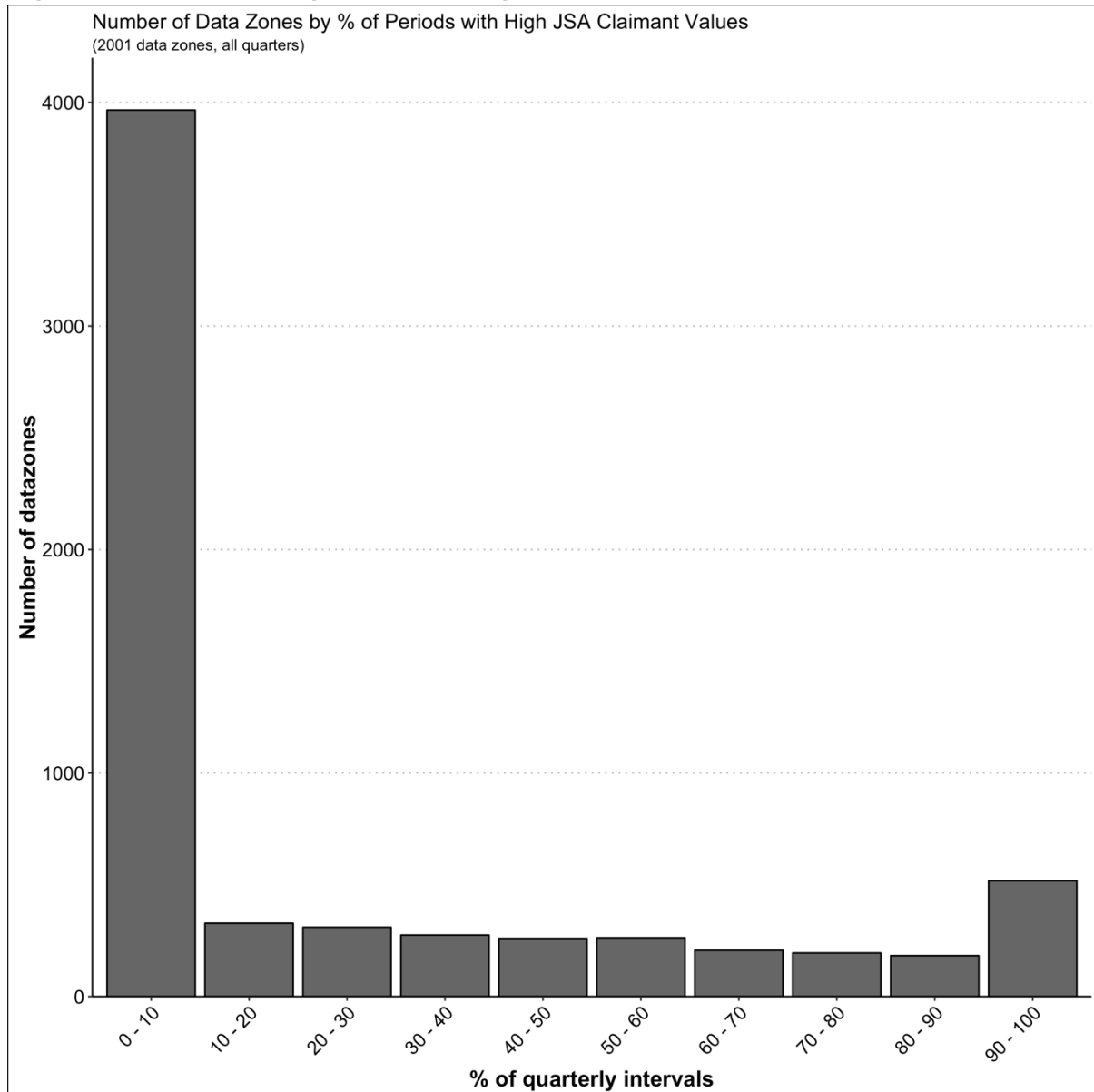
An initial analysis of variability in levels of benefits uptake indicates that the average quarterly change in the percentage of JSA claimants is within the range of -.5–1 percentage points, as demonstrated in Figure 3-13 below. It is noticeable that, across the data time series available in the data set, a momentous change in the average rate of JSA dependency took place around 2009. Further analysis discusses whether the observed change can be ascribed to macroeconomic events taking place during the same period.

Figure 3-13 — Quarterly Change in Percentage Points of JSA Claimants



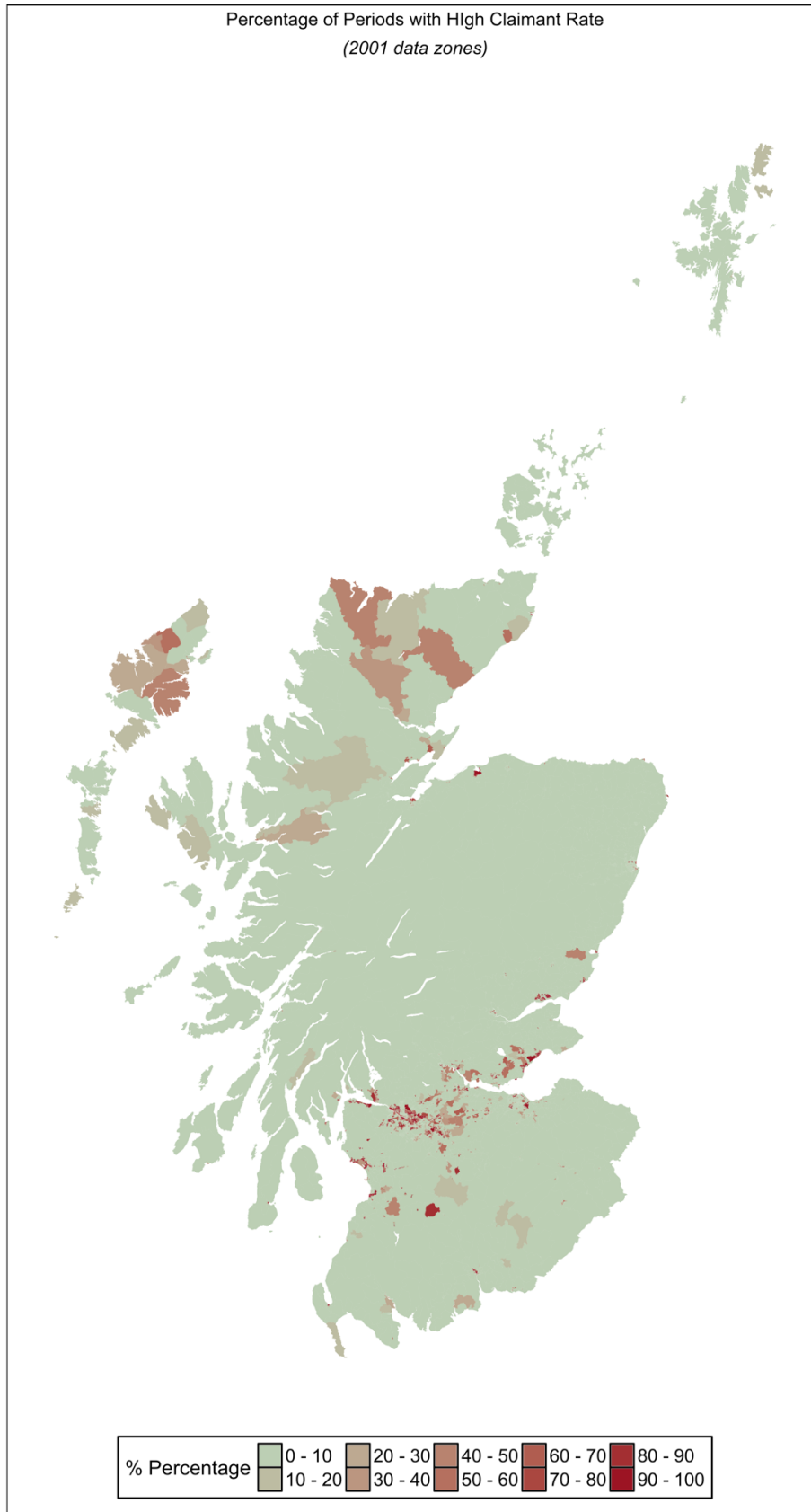
An initial analysis of the geographies that had claimant rates higher than 5% indicates that of the 6,505 available in the data, 252 (approximately 3.87%) had Jobseeker’s Allowance rates higher than 5%. The analysis was conducted for all intervals available for a specific data zone while excluding the missing observations. For instance, for a data zone for which JSA rates were noted across 40 quarters, the frequency of elevated claimant rates was calculated within that frame. Observing elevated levels of JSA dependency in that data zone for less than four occasions would place it in 0–10 bracket, as visualised in Figure 3-14.

If the threshold is increased to 90% of quarterly rates having elevated unemployment rates, 518 (7.98%) geographies meet the criteria of having JSA rates higher than 5% across all quarterly intervals available in the data. The relationship between the percentage of geographies meeting the criteria and the threshold can be visualised in Figure 3-14.

Figure 3-14 — % of Geographies Having More than 5% JSA Claimants

The results visualised in the figure above can also be mapped with the use of maps showing data zone geographies. Further analysis of spatial distributions indicates that the frequency of elevated values is observable across a similar set of geographies. As illustrated in Figure 3-15, neighbourhoods located within the Central Belt of Scotland are pronounced by a higher prevalence of geographies with a frequent occurrence of elevated Jobseeker's Allowance claimant rates when compared to geographies located outside the Central Belt of Scotland.

Figure 3-15 — Geographies with persistently high unemployment accounting for % of quarters



The phenomenon observed can be subsequently summarised with the use of a simple cross-tabulation, as provided in Table 3-7. The table below shows the count of geographies by the percentage of quarterly observations during which the same geography was identified as having a high (above 5%) rate of JSA claimants.

Table 3-7 — Count of Data Zones according to time series frequency of JSA

Council	Percentage of Quarterly Periods with High JSA Claimant Rate											Total
	0 – 10	10 – 20	20 – 30	30 – 40	40 – 50	50 – 60	60 – 70	70 – 80	80 – 90	90 – 100		
<i>Aberdeen City</i>	229	8	6	2	3	5	3	4	4	3		267
<i>Aberdeenshire</i>	291	3		2	2	2				1		301
<i>Angus</i>	103	6	4	4	5		3	6	5	6		142
<i>Argyll and Bute</i>	88	4	7	8	1	1	2	2	3	6		122
<i>Clackmannanshire</i>	29	2	7	5	2	5	4	2	2	6		64
<i>Dumfries and Galloway</i>	137	13	11	8	6		3	1	4	10		193
<i>Dundee City</i>	71	6	5	6	6	1	13	14	6	51		179
<i>East Ayrshire</i>	57	9	8	11	4	12	6	7	10	30		154
<i>East Dunbartonshire</i>	102	4	6	5	3	2	1		1	3		127
<i>East Lothian</i>	93	5	8	8	4	1	1					120
<i>East Renfrewshire</i>	103	2	4		3	4	2	1		1		120
<i>Edinburgh</i>	427	15	24	16	12	11	8	7	4	25		549
<i>Eilean Siar</i>	19	7	6	1	1	2						36
<i>Falkirk</i>	103	13	9	12	19	10	6	7	7	11		197
<i>Fife</i>	229	26	24	21	15	23	17	22	25	51		453
<i>Glasgow City</i>	251	42	32	39	38	42	31	44	38	137		694
<i>Highland</i>	219	21	13	7	8	9	7	2	3	3		292
<i>Inverclyde</i>	43	7	3	3	3	5	5	8	13	20		110
<i>Midlothian</i>	72	9	6	12	8	3	1	1				112
<i>Moray</i>	100	3	4	4	2		1		1	1		116
<i>North Ayrshire</i>	67	8	5	4	4	7	14	12	11	47		179
<i>North Lanarkshire</i>	164	24	33	25	45	46	24	14	17	26		418
<i>Orkney Islands</i>	26		1									27
<i>Perth and Kinross</i>	153	4	4	1	2	4	2	2	2	1		175
<i>Renfrewshire</i>	124	5	9	9	7	12	11	9	7	21		214
<i>Scottish Borders</i>	107	4	3	7	2	2	3	1	1			130
<i>Shetland Islands</i>	28	2										30
<i>South Ayrshire</i>	89	13	7	3	6	3	8	3		15		147
<i>South Lanarkshire</i>	206	31	31	30	26	30	11	15	6	12		398
<i>Stirling</i>	80	2	7	2	4	6	4	1		4		110
<i>West Dunbartonshire</i>	40	12	8	6	6	4	4	6	9	23		118
<i>West Lothian</i>	116	18	15	14	13	11	12	4	4	4		211
Total	3966	328	310	275	260	263	207	195	183	518		6505

3.1.4.3 Criterion 3 – Spatial Autocorrelation Across Elevated JSA Claimant Rates

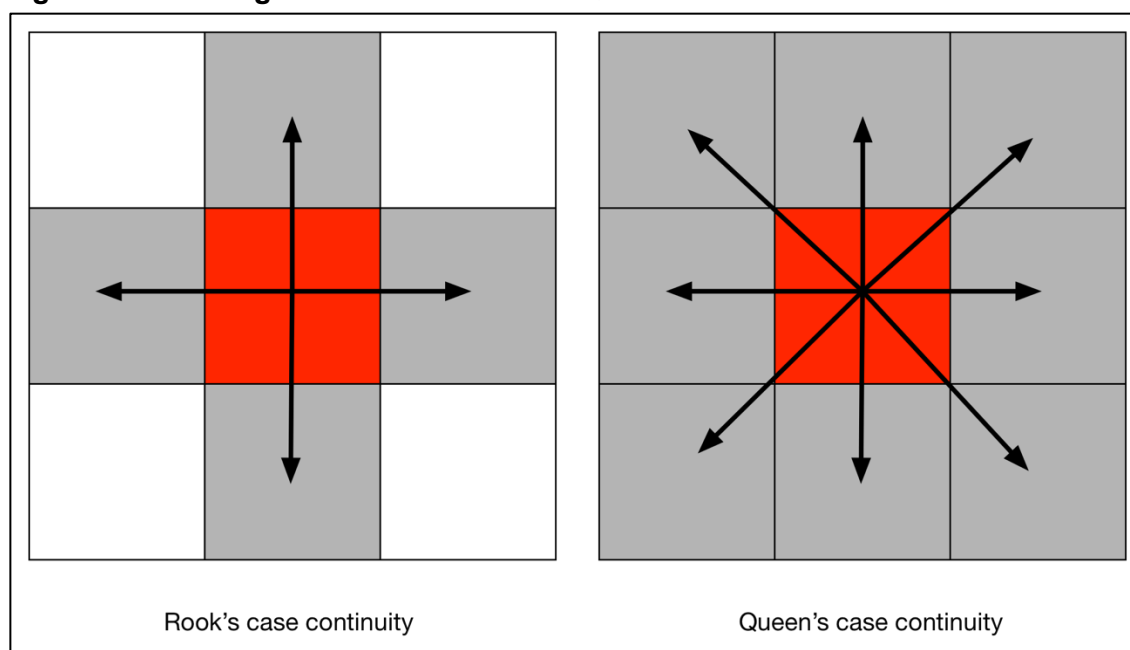
The following analysis extends the scope of the filtered neighbourhoods by incorporating data on spatial proximity. The analysis undertaken in the previous step indicated

that it is possible to differentiate between the rates of how often specific neighbourhoods are marked by comparatively high rates of Jobseeker's Allowance claimants. The role of space in the following model can be explored in a number of ways; the most straightforward approach, which is utilised in this chapter, involves undertaking traditional spatial autocorrelation analysis on the frequency variable.

The operational question that could be answered here would reflect the question of whether the observed neighbourhood-level high frequency of prevalence of benefits uptake can be asserted formally during a quantitative analysis. The straightforward approach would involve computing Moran's *I* (1950) or Geary's *C* (1954) statistic, the commonly used measures to assess the degree of spatial dependency among observations where proximity and relative positions are known (Li et al., 2007). The Moran's *I* procedure is operationalised with the use of a simple set of hypotheses. The null hypothesis assumes that the observations analysed are spatially independent and 'identically distributed normal random variates' (Li et al., 2007, p. 357).

In practice, the absence of spatial correlation indicates the lack of possibility of estimating the values of neighbouring observations by analysing local sub-samples of the data. The existing literature on the two procedures points to the existence of an inverse linear relationship between the two statistics (Sawada, 2009), with either statistic considered sufficient to capture the same relationship accurately. Moran's *I* is calculated as the ratio of the product of the variable of interest and its spatial lag (R. S. Bivand et al., 2013). The non-directional hypothesis would assume the existence of a relationship between neighbouring data points. Analogously with the assumptions of traditional correlational analysis, the Moran's *I* coefficient can have values from -1 to 1. A positive Moran's *I* result indicates the existence of a degree of similarity across observations located in proximity (Anselin and Rey, 2010).

The Moran's *I* analysis progresses from exploring the spatial dependencies among the available data. Technically, the approach involves constructing weights that reflect spatial proximity of the data points. Modern programmatic implementations yield a great deal of flexibility with respect to how the desired information on the proximity of observations is derived. The process of identifying neighbours commences with deciding on a continuity criterion that is used to classify two geographies as neighbours. The two commonly used spatial criteria are visualised in Figure 3-16. In the case of irregularly shaped polygons, the Queen criterion is sufficient to assert whether the selected set of geographies are adjoining.

Figure 3-16 — Neighbours in Rook's and Queen's case

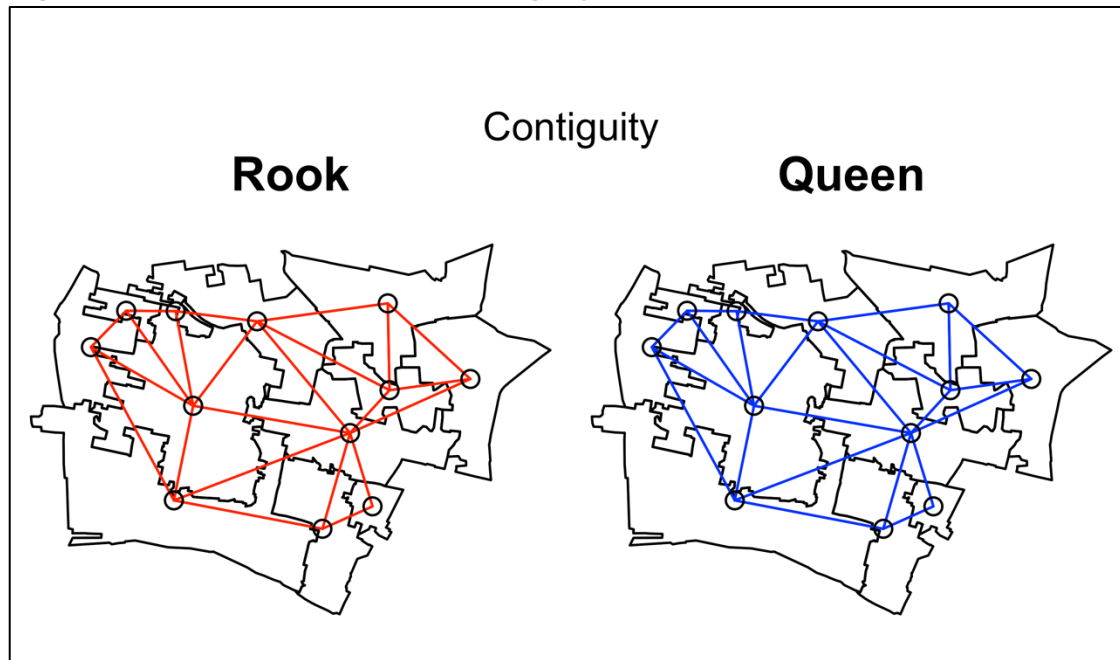
It can be further observed that in the context of the utilised shapefiles, there are no significant differences in the neighbourhood matrices generated in the course of applying rook and queen contiguity. A summary of the results of both procedures is provided in Table 3-8.

Table 3-8 — Comparison: Rook and Queen Comparison

<i>Measure</i>	<i>Rook</i>	<i>Queen</i>
<i>Number of regions</i>	6,505	6,505
<i>Average number of links</i>	5.44	5.58
<i>Number of regions with no links</i>	8	8

As shown in Figure 3-17, in the example of selected data zones from across Central Glasgow, applications of rook and queen contiguities deliver similar results.

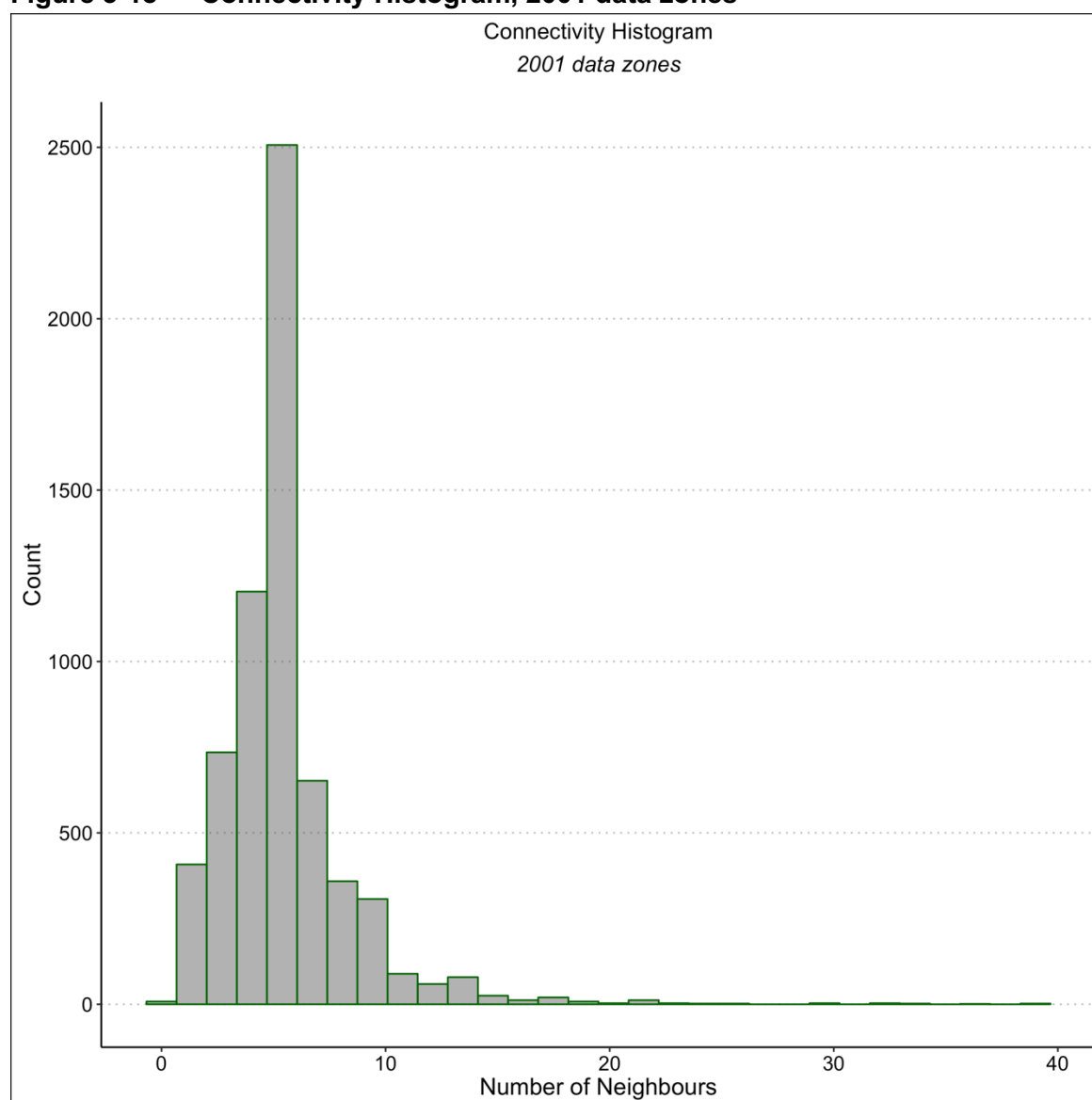
Figure 3-17 — Rook and Queen Contiguity Comparison



An initial analysis of the spatial characteristics of the neighbourhood characteristics across data zones indicates that, on average, each data zone neighbours on six other data zones. There are eight data zones that do not neighbour on any other geography and 93 data zones that neighbour on only one¹. Within the utilised data set, the maximum number of neighbours a data zone has is 39, and there are two data zones that meet that criterion.² The distribution of neighbours is further summarised in the connectivity histogram available in Figure 3-18.

¹ The quoted summary figures were achieved in the course of applying the queen's contiguity criterion to the spatial data set. Formally speaking, it would be possible to derive an analogous matrix, using the rook's contiguity criterion but, in the case of irregularly shaped polygons, the difference in summary results would not be that significant. For example, in case of queen's contiguity, the average number of neighbours is 5.59 and, in case of rook's continuity, 5.44.

² This rather uncommon occurrence takes place due to the nature of the population distribution. The geographic area of those data zones is substantial when compared to neighbouring smaller, more densely populated data zones.

Figure 3-18 — Connectivity Histogram, 2001 data zones

The results of the global Moran's I statistic are summarised in Table 3-9 below.

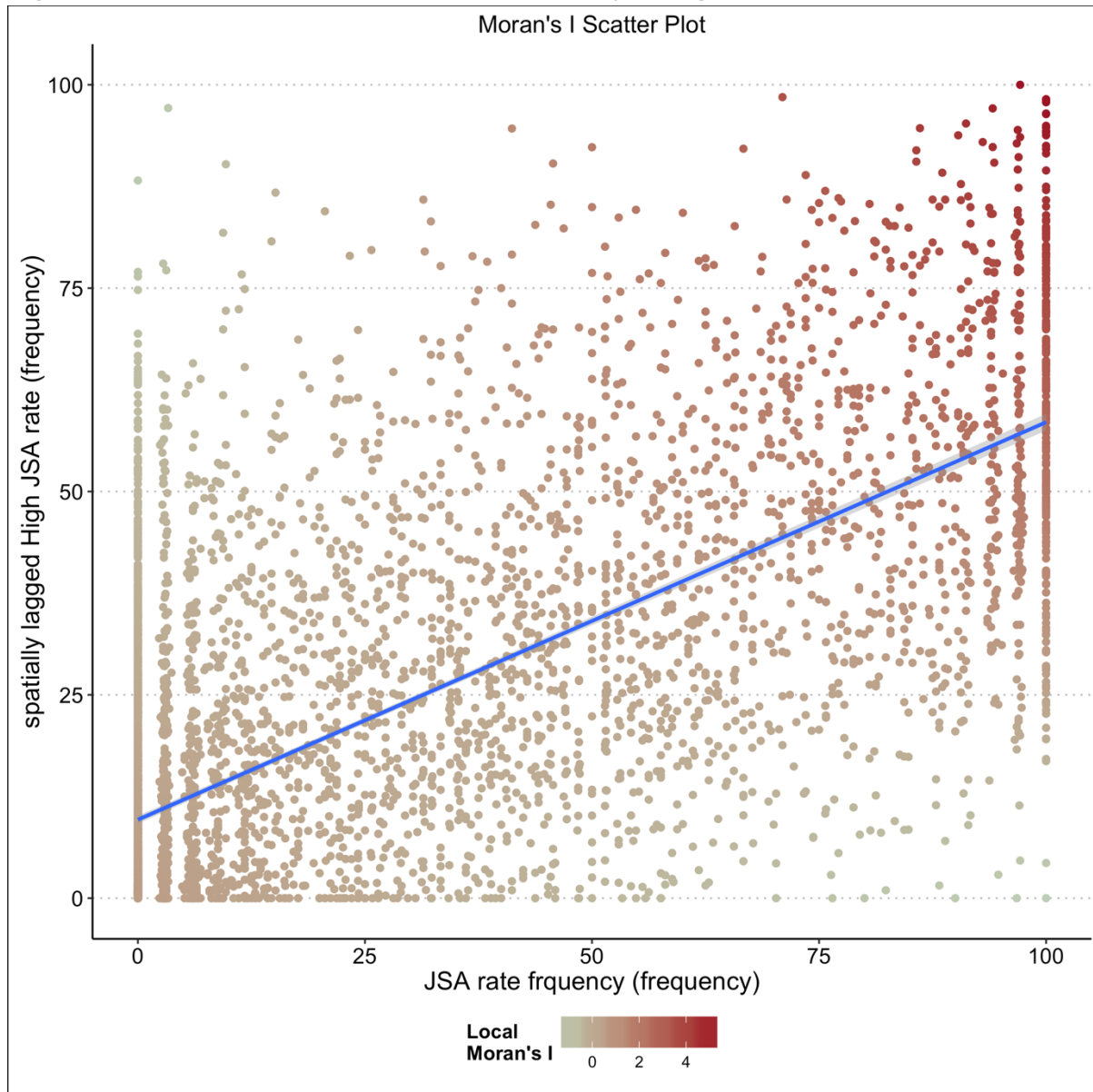
Table 3-9 — Global Moran's I Results

<i>Moran's I</i>	<i>Moran's I (expected)</i>	<i>p</i>
4.881	-1.539	$p < .01$

The results of the analysis undertaken are provided in a Moran's I scatter plot (Figure 3-19). The Moran's I scatter plot shows standardised values for the variable against spatially lagged standardised values for the variable. The spatially lagged variable reflects a value that accounts for the values of neighbouring geographies. The spatially lagged variable was

computed with the use of the `lag.listw` function offered within the `spdep` R language package (R. Bivand et al., 2013; Bivand and Piras, 2015). The `lag.listw` function utilises the previously constructed neighbourhood matrix and computes values for each geography as an average of neighbouring geographies. The derived value does not include the value derived from the actual neighbourhood for which the average is constructed.

Figure 3-19 — Moran's I Scatter Plot – Frequency of High Rates of JSA Claimants



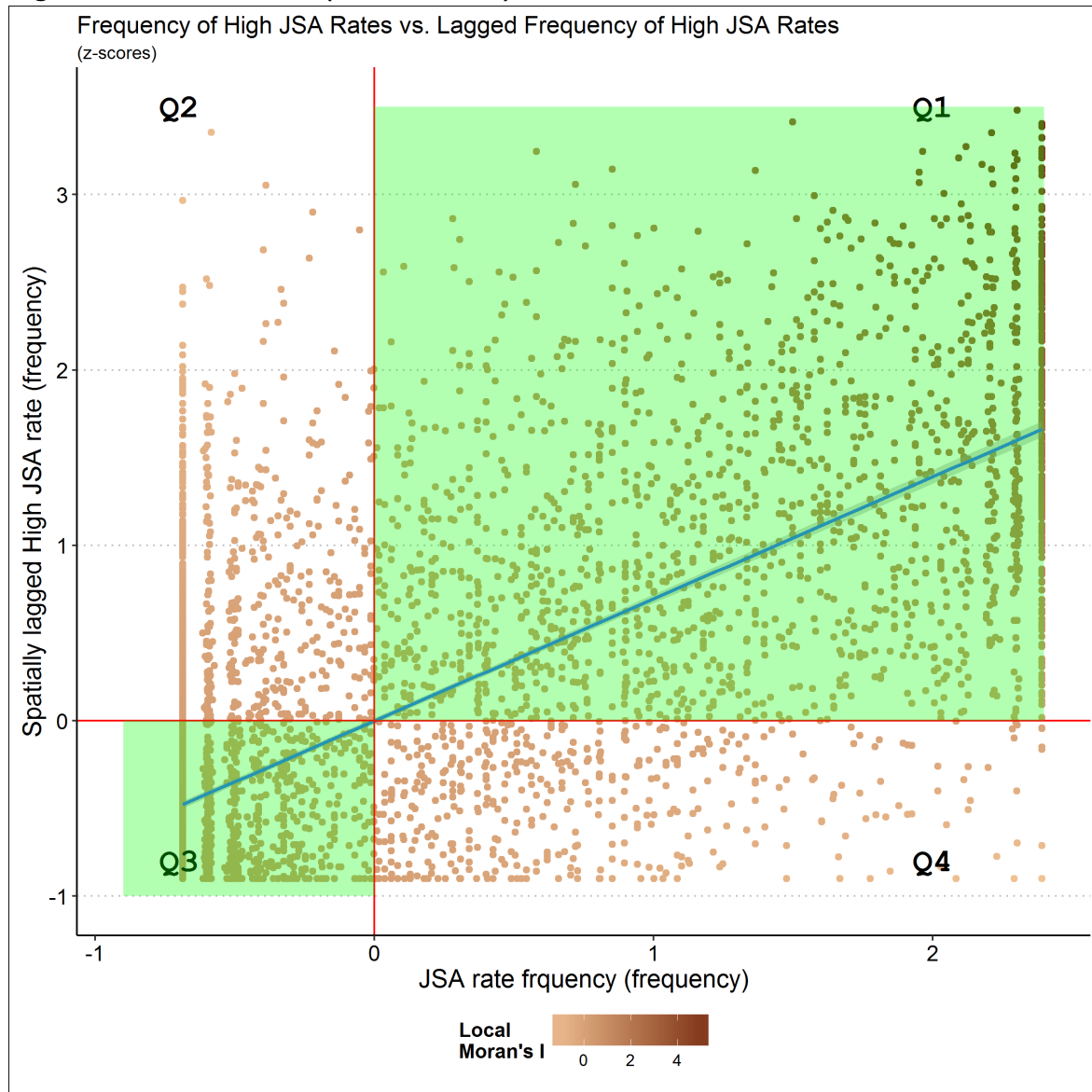
It is commonly expected that the values produced within a Moran's I scatter plot should be represented in a standardised format, enabling for easy differentiation of common quadrants. This visualisation is further provided in Figure 3-20. Placement of the values in quadrants should be interpreted as follows:

- a) Q1 contains high values surrounded by high lagged values

- b) Q2 contains low values surrounded by high values
- c) Q3 contains low values surrounded by low values
- d) Q4 contains high values surrounded by low values

The colouring provided on the chart highlights areas where the presence of most of the generated values indicates the existence of positive spatial autocorrelation. On the contrary, the presence of the majority of values across Q2 and Q4 indicates negative spatial autocorrelation.

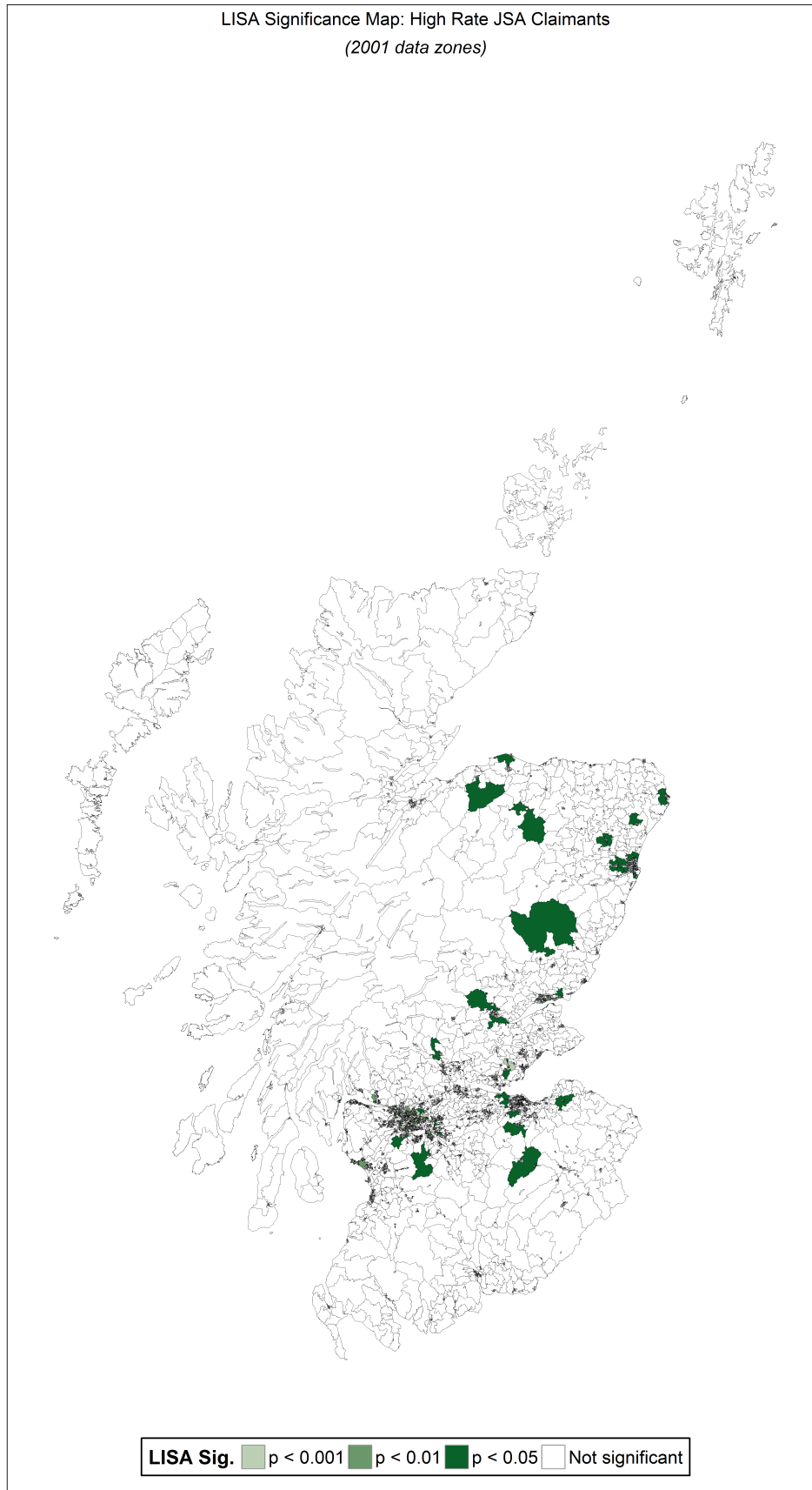
Figure 3-20 — Moran's I (standardised)



From the available results, it is possible to infer the level of spatial autocorrelation in the data. The results of local spatial significance are visualised in Figure 3-21. It is observable

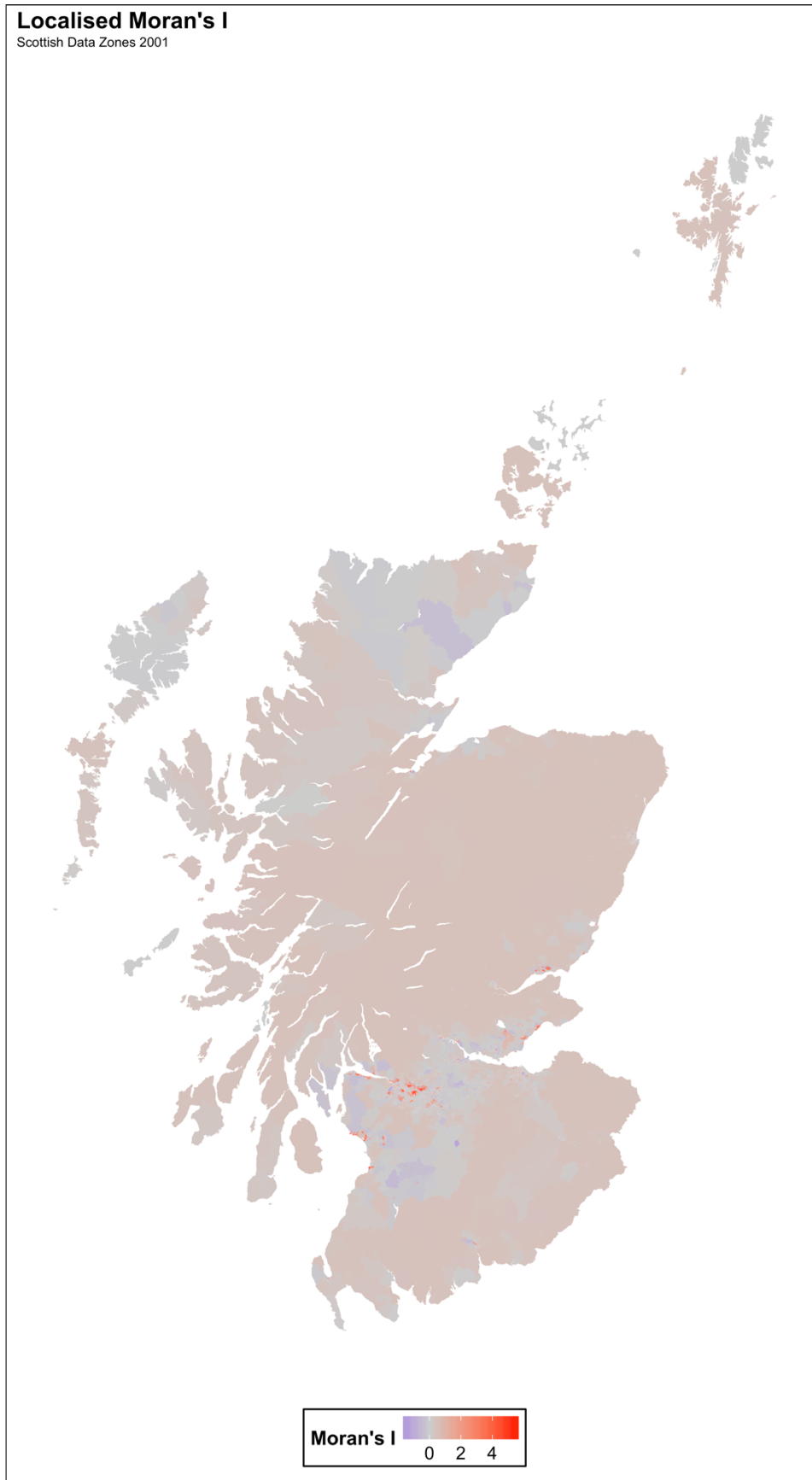
that significant results can be found across densely populated geographies, of which majority are located within the Central Belt of Scotland.

Figure 3-21 — Local Indicators of Spatial Association Map



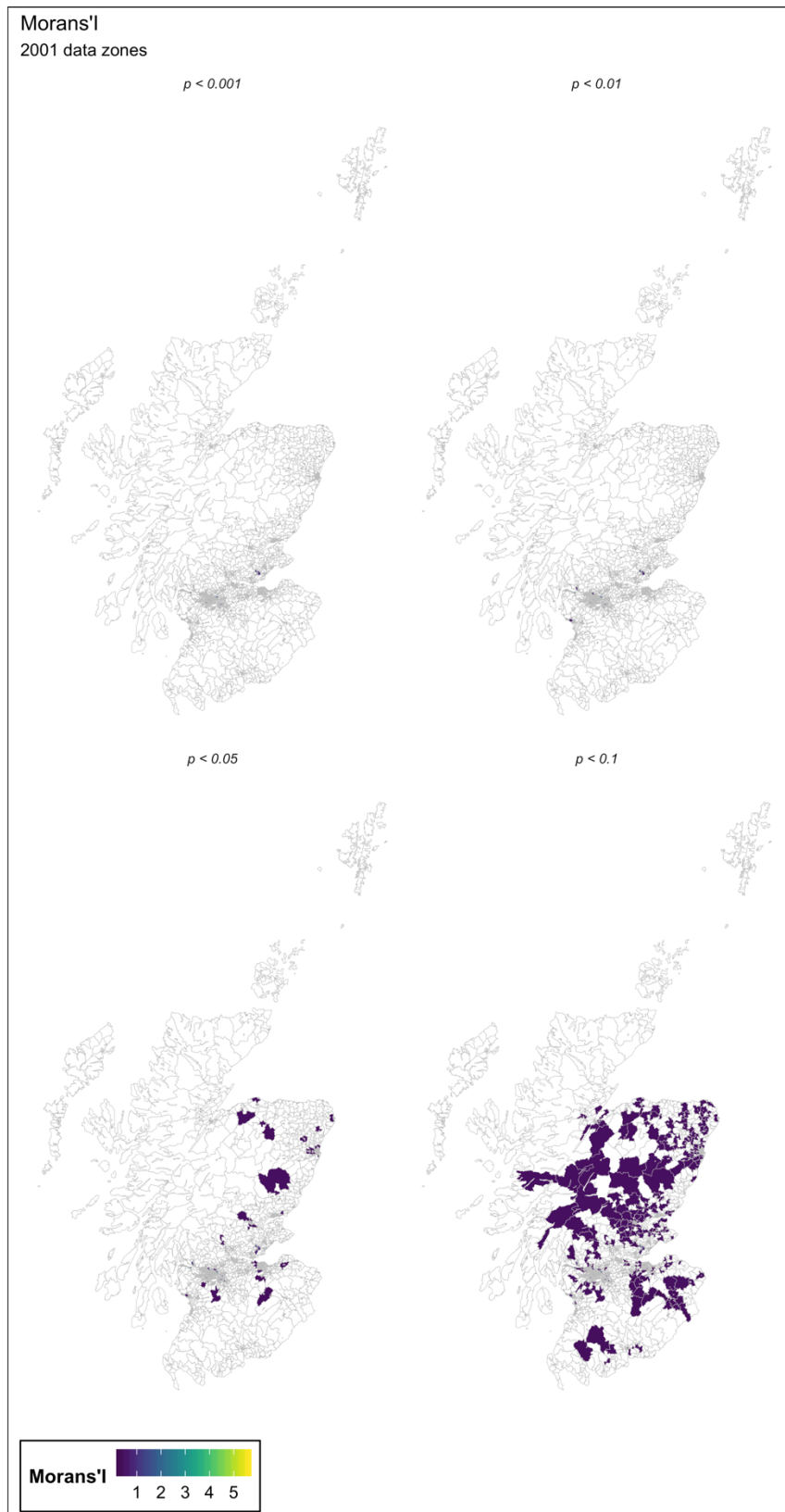
Additionally, the spatial distribution of the Moran's I values is visualised in Figure 3-22. It is observable that the high values are concentrated around urban geographies predominately located within the Central Belt of Scotland. The LISA map provided shows only the geographies for which the observed relationship is statistically significant without delivering information on the strength of the observed relationship. The localised Moran's I values reflect the strength of the relationship, indicating for which of the neighbourhoods analysed adjacent geographies are also pronounced by similarly high/low values.

Figure 3-22 — Localised Moran's I values



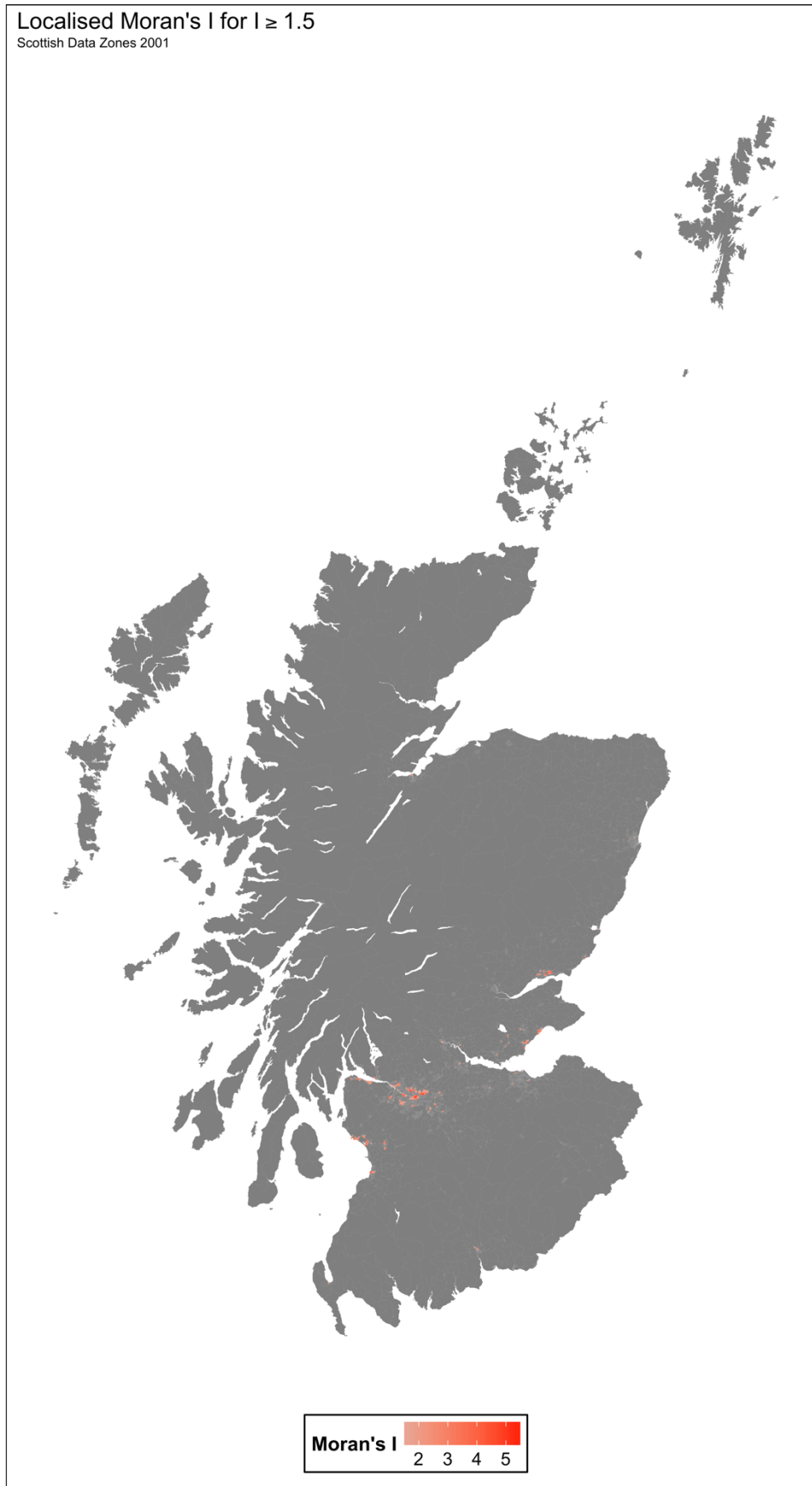
This occurrence can also be presented using the conventional significance levels of $p < .1$, $p < .01$ and $p < .05$. As shown in Figure 3-23, geographies located within the Central Belt of Scotland are marked by greater concentrations of statistically significant values, compared to the remaining regions of the country. As shown in Figure 3-23, statistically significant values of Moran's I, reflecting the existence of geographies that would be continuously marked by high Moran's I values, can be found for the relatively low significance level of $p < .1$, which customarily would be considered insufficient for the purpose of assuming that the observed relationship is not accidental.

Figure 3-23 — Moran's I values per significance levels



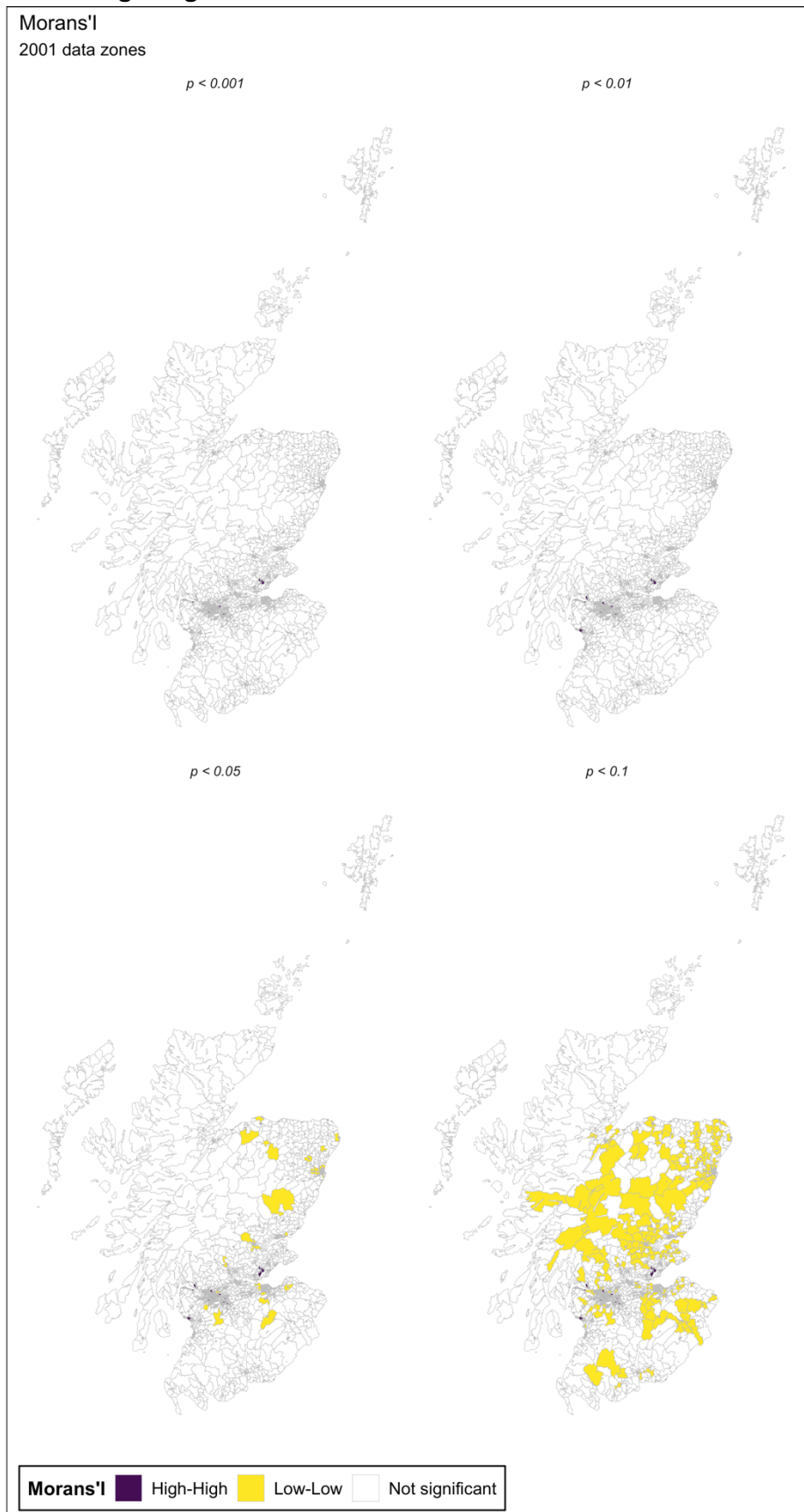
This relationship can be further illustrated with the use of a simple filter focusing on high local Moran's I values. Such an analysis is provided in Figure 3-24. The localised Moran's I statistics allow for the spatial variation in the spatial distribution of the data to be observed.

Figure 3-24 — Localised High Moran's I values



The provided localised Moran's I statistic reflects the presence of geographies for which the adjoining geographies are also characterised by high and/or low values. This information is more meaningful from the perspective of utilising the data in the context of decision-making concerned with pinpointing neighbourhoods surrounded by neighbourhoods of correspondingly high values. An attempt to visualise this relationship is given in Figure 3-25.

Figure 3-25 — High-High and Low-Low



The existence of geographies surrounded by other geographies marked by a high frequency of elevated levels of deprivation is presented in Figure 3-26. From the figure, it is observable that urban, densely populated geographies are most likely to have high levels of deprivation and be located in the vicinity of other geographies with similar characteristics.

Figure 3-26 indicates the existence of data zones that adjoin other data zones that are also characterised by a high frequency of elevated JSA rates. The figure accounts for two types of relationship: geographies that are adjoining to other geographies that also have high rates and geographies where a high frequency of JSA levels was not observed that adjoin to other geographies where a high frequency of JSA rates was not observed.

Figure 3-26 — Central Belt: High-High and Low-Low Clusters



3.1.5 Summary

The analysis evaluated whether the existing small-area data can inform the development of resource-allocation models across local authorities. This was answered in the course of an evaluation of whether it is possible to identify 'pockets of deprivation' across Scottish neighbourhoods using historical trend analysis.

Neighbourhood-level analysis across 2012Q4 deprivation measures indicated the existence of strong correlations. In particular, the correlation coefficient for Income Support and Employment Support Allowance is .9. An identical coefficient also exists for Incapacity Allowance and Income Support. A correlation of .8 exists for Employment Support Allowance, Incapacity Benefit, JSA and Income Support. Only the Attendance Allowance has a correlation with the remaining deprivation indicators of less than .5, with the exception of its .7 correlation with Pension Credit.

High neighbourhood-level JSA rates correlate with other measures of deprivation. In particular, significant correlations exist across indicators of economic deprivation. For instance, during the 2006–2012 period, JSA was correlated with Income Support at approximately .8. For the same period, Pension Credit was correlated with JSA at approximately .7.

Further analysis indicated higher correlation across the most deprived SIMD deciles. For instance, across the Education domain, the most deprived decile experienced an over 5% neighbourhood-level JSA claimant rate for the 2001–2012 period. On the contrary, the JSA rate did not exceed 2.5% across the least educationally deprived geographies. Comparable findings appear across the Health domain of SIMD. For the housing domain, the most deprived geographies experienced rates lower than 5% but always higher than 4%.

Descriptive spatial analysis indicates the existence of spatial variability across JSA dependency. In particular, urban, densely populated geographies are marked by high JSA rates. An analysis of the geographic make-up of local authorities demonstrates differences across councils. With the exception of Aberdeen City, predominantly urban councils have a higher frequency of geographies in the most deprived vigintile. More detailed analysis across the Edinburgh and Aberdeen Councils shows significant differences in JSA rates between both cities. The count of geographies with elevated JSA rates is higher across the Glasgow City Council.

An analysis of missing data indicated a significant improvement in the quality of the available data post-2006. This fact proved conducive to observing the post-2008 change across JSA dependency. The selection of permanently deprived neighbourhoods reflects the characteristics of elevated levels of deprivation. First, neighbourhoods are selected on the basis of high rates of JSA dependency. Depending on the quarter, approximately 15–30 per cent of data zones would have a more than 5% JSA rate. The second criterion evaluates consistency across the identified levels of deprivation. The criterion focuses on the percentage of quarterly snapshots during which a specific data zone would experience a rate higher than 5%. Across Scottish councils, most geographies would experience high levels of benefits uptake for not more than ten quarterly intervals. Within Glasgow, 137 data zones would experience over 5%. Across Dundee and Fife, 51 neighbourhoods would note a JSA claimant rate of over 5%.

The ensuing analysis focused on consistency across observed levels of deprivation. The criterion was operationalised on the grounds of frequency. Namely, each data zone was evaluated against the number of times it would experience a JSA claimant rate higher than

5%. Cross-tabulation showing data zones grouped by the number of quarters during which high dependency rates occurred indicates that almost 4,000 data zones did not experience high JSA rates for more than ten instances. The number of data zones that experienced high rates of JSA dependency on more than 90 intervals does not exceed 500.

The last element of the exploratory analysis focused on spatial autocorrelation across the frequency of elevated JSA rates. The analytical criterion used a Moran's I statistic on the frequency of high rates of JSA. The results obtained can be analysed in the context of negative and positive spatial autocorrelation. Positive spatial autocorrelation indicates the existence of clusters with high JSA rates.

The results were summarised for four probability levels reflecting the $p = .001$, $p = .01$ and $p = .05$ thresholds. Negative autocorrelation reflects the presence of neighbourhoods with a high frequency of vicinity to neighbourhoods that did not experience a high frequency of elevated JSA rates. The analysis indicated the existence of clusters of deprivation across the Central Belt and across regions with a prevalence of urban, densely populated geographies.

3.2 The impact of exogenous factors

The following section provides an outline of the results of the analysis focusing on the impact of external macroeconomic events on sub-local variability across JSA dependency. In particular, the section summarises the analysis focusing on assessing the impact of the 2008 financial crisis on neighbourhood levels of JSA claimants. The external factors are operationalised with a suite of macroeconomic variables and business data reflecting the performance of key Scottish enterprises.

A change-point analysis is used to identify potentially significant irregularities across the available data and to gain a more in-depth understanding of the immediate impact of macroeconomic events on sub-local levels of JSA dependency following the 2008 financial crisis. This goal is accomplished in the course of undertaking a set of regression models conducted independently for each of the neighbourhoods in Scotland, findings of which are later summarised in an explanatory spatial analysis.

3.2.1 Change-point analysis

The initial change-point analysis undertaken utilises the change-point methodology and contextualises the variances of the average Jobseeker's Allowance rates by using a time series analysis of the macroeconomic indicators frequently used to characterise the economic

situation across Scotland. The analysis tests whether a change in JSA levels of benefits uptake is observed on a statistically significant level.

Following findings of the descriptive analysis, the exploration focuses on evaluating the variation in average quarterly rates across the data zones grouped according to the 2004 iteration of the Scottish Index of Multiple Deprivation. As previously illustrated, the aggregated data zone-level variance across quarterly rates is characterised by a relatively greater variability across the deprived neighbourhoods compared to the less deprived geographies. The lines visualised on the figure below correspond to the average quarterly rates in Jobseeker’s Allowance across the data zones grouped per the deciles in the 2004 iteration of the Scottish Index of Multiple Deprivation; the occurrence is shown in Figure 3-27.

Figure 3-27 — Average JSA rates across SIMD deciles

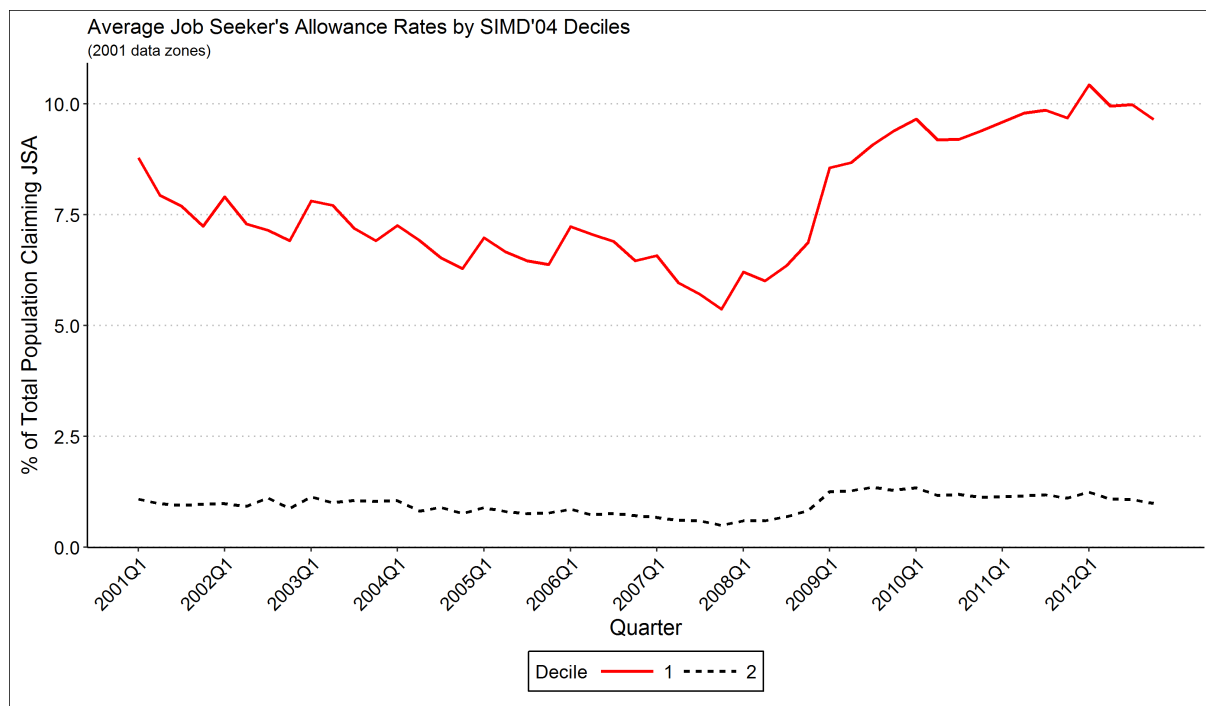


Figure 3-27 groups neighbourhoods according to the deciles of the 2004 iteration of SIMD. It is observable that the quarterly change across levels of benefits uptake is greater across the subset encompassing the most deprived neighbourhoods than across the least deprived. In addition, it is observable that the benefits uptake rates across neighbourhoods where local spatial autocorrelation was statistically significant follow the patterns observed across the most deprived SIMD decile.

The results obtained were anticipated in the context of the analysis conducted so far. The analysis demonstrated that the neighbourhoods marked by elevated rates of Jobseeker’s Allowance claimants are most often observed across urban neighbourhoods. The preliminary

summary of these findings, illustrating the quarterly variability in JSA rates, is provided in Figure 3-28.

Figure 3-28 — Mean quarterly JSA rates

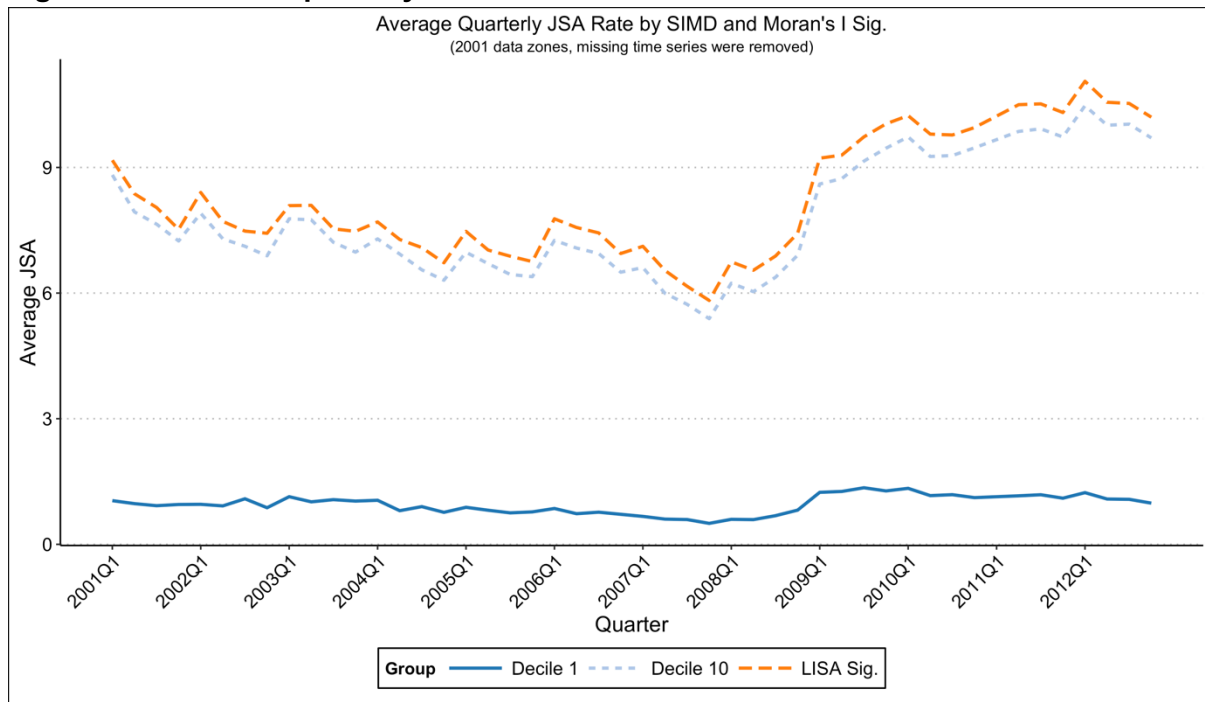


Figure 3-28 shows variability in JSA trends, additionally accounting for subgroups of geographies for which calculated LISA measures were significant. As subsequently shown, the variability in the average rates of Jobseeker's Allowance claimants is more strongly pronounced across neighbourhoods for which the local Moran's I value was statistically significant; these are represented on the chart above as the *LISA Sig* subgroup.

Conventionally, a change-point analysis commences with preliminary trend data analysis delivered through a control chart. Control charts are widely recognised as one of the basic tools in the quality control process (American Society for Quality, 2016). Control charts visualise a similar number of elements that are mostly concerned with identifying points where the key change can be observed; this is usually achieved in the course of plotting the observed values alongside visual representations of rolling descriptive statistics.

The most common version of the control chart is the cumulative control sum chart, commonly referred to as a *cusum* chart. The *cusum* charts were originally predominantly used in industry. The more recent academic literature provides examples of this charting technique being successfully used across various disciplines, with financial analysis being one of the most common (Xin et al., 2013). The relevant statistical literature recognises two principal types of *cusum* charts: 'the tabular (algorithmic, decision interval) cusum and the V-mask form' (Grigg et al., 2003, p. 152). The tabular cusum chart, which is the currently most widely used

version of the chart, was originally developed by Page (1954) at the University of Cambridge. The V-mask chart, originally developed by George Alfred Barnard (1959), utilises a set of two lines that reflect standardised deviations from the target value.

The approach utilised to generate a control chart relies on producing a line representing the average values for the sourced sample. Building on the previously discussed findings, the average values are explored for the geographies that were grouped according to the deciles of the Scottish Index of Multiple Deprivation as well as by the geographies that were previously identified as pronounced by the statistically significant localised Moran's I values. The next step in the change-plot analysis would involve generating a cusum chart between the current value and the average to the previous sum, as given in Equation 3-1 below.

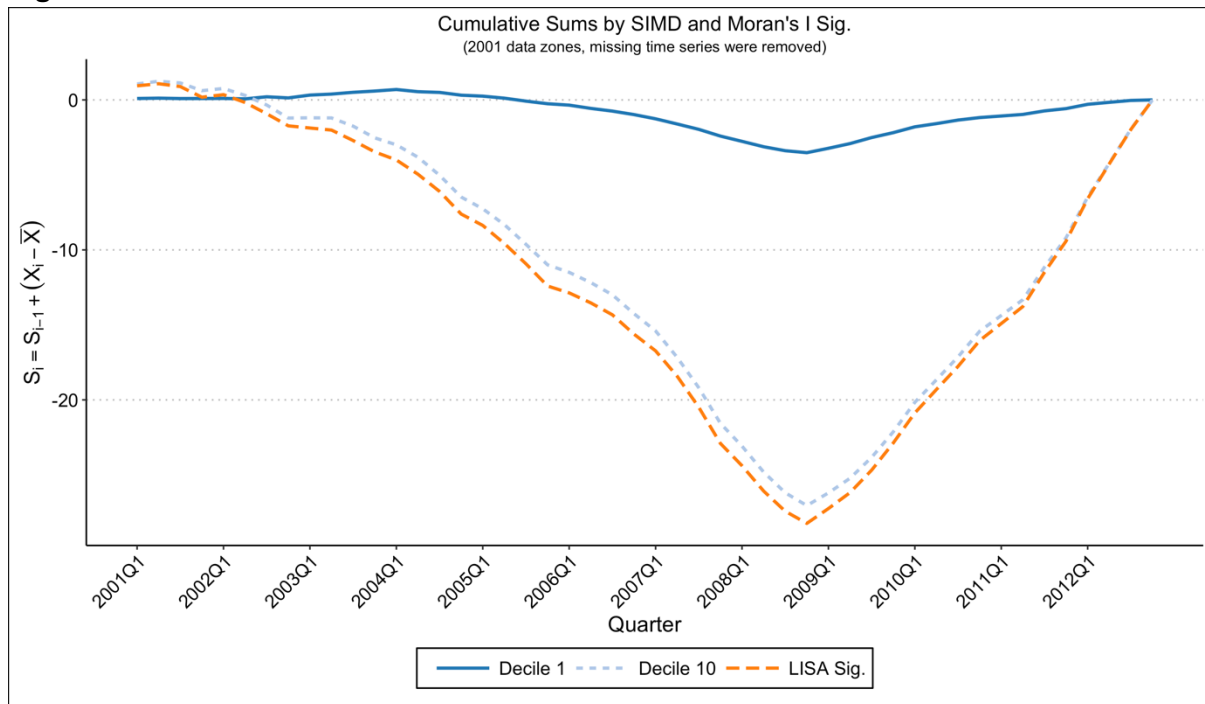
Equation 3-1 — Cumulative Sum

$$S_i = S_{i-1} + (X_i - \bar{X})$$

where:

- \bar{X} – average of the subgroup
- X_i – value of the current observation
- S_i – cumulative sum for the current observation of the previous observation for (S_{i-1})

The calculations of the cumulative sum commence with $S_0 = 0$. In the context of the data analysed, X_i pertains to the average value for data zones within each subgroup created by the selected SIMD deciles and separately by the subgroups of neighbourhoods with statistically significant values of local spatial association, as previously outlined. The outcomes of these calculations are summarised in Figure 3-29. In the context of the data visualised in Figure 3-29, the average pertains to the subgroups.

Figure 3-29 — Cusum chart

The direction of the slopes visualised on the cusum chart above indicates that for the upward slope the values tend to be above the average, whereas for the downward slope the values tend to be below the average. The accurate interpretation of the cusum chart is reflected in the overall principle underpinning this type of analysis. As the analytical principle concerned with the cusum chart reflects the desire to assert whether an actual change took place, the focus is on the slope of the values obtained, which indicates whether the chart data are above or below average. The method for estimating difference can be expressed by the equation:

Equation 3-2 — Magnitude Estimator

$$S_{diff} = S_{max} - S_{min}$$

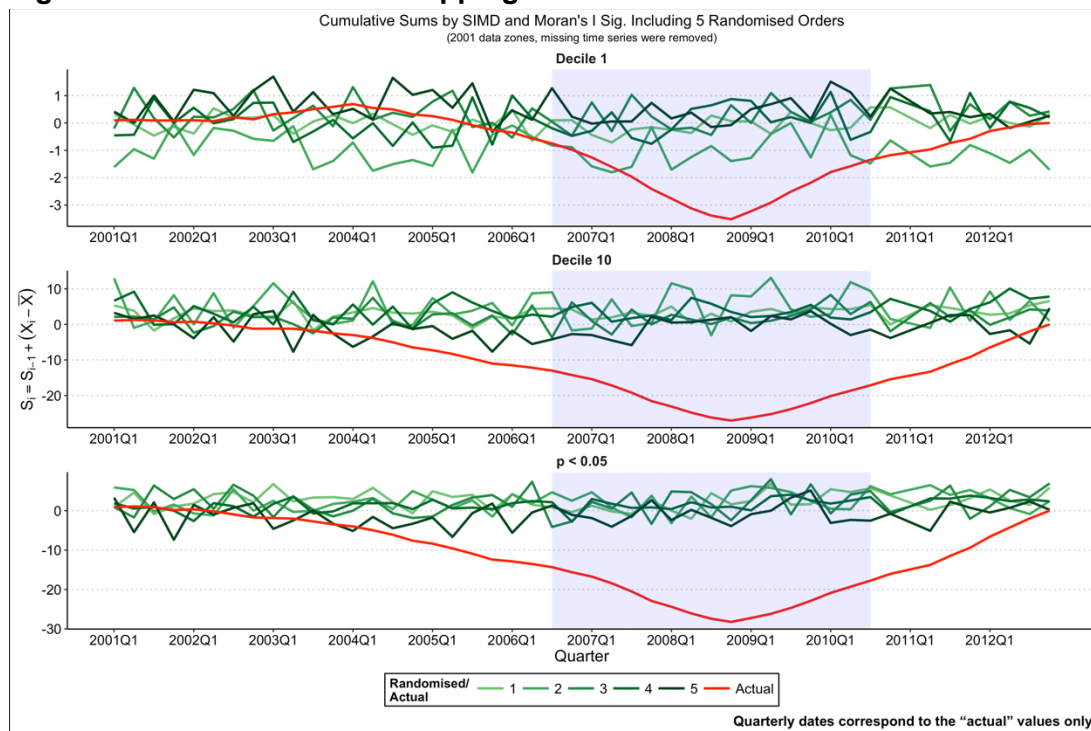
For the data utilised, the differences for each of the data zone subgroups are given in Table 3-10.

Table 3-10 — Magnitude Estimators for the cohorts analysed

Subgroup	S_{max}	S_{min}	S_{diff}
Decile 1	0.69	-3.52	4.21
Decile 10	1.24	-27.05	28.29
LISA significant	1.08	-28.23	29.31

The confidence levels of the observed change can be estimated in the course of the bootstrapping. The key principle underpinning the bootstrapping in change-point analysis requires producing cumulative sum values for *randomised* orders of the data utilised. The simplified results of this work are visualised in Figure 3-30. The idea of utilising bootstrapped samples reflects the idea that a significant change taking place across the observed time series would be visible against the randomised computations of the cumulative statistic. For the purposes of presentation, Figure 3-30 provides a summary of the results of randomised calculations of the cusum for each of the subgroups compared against the actual values for a selected random sample of bootstrapped distributions. Visualising the full range of the utilised bootstrapped distribution would not be readable.

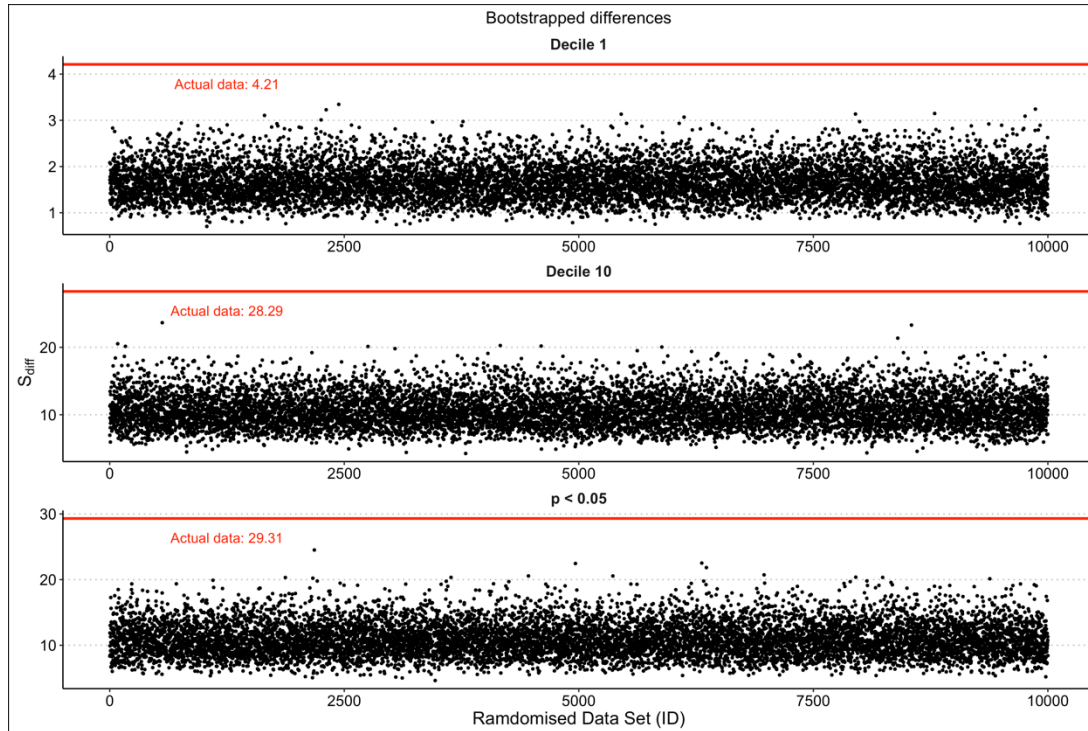
Figure 3-30 — Cusum Bootstrapping



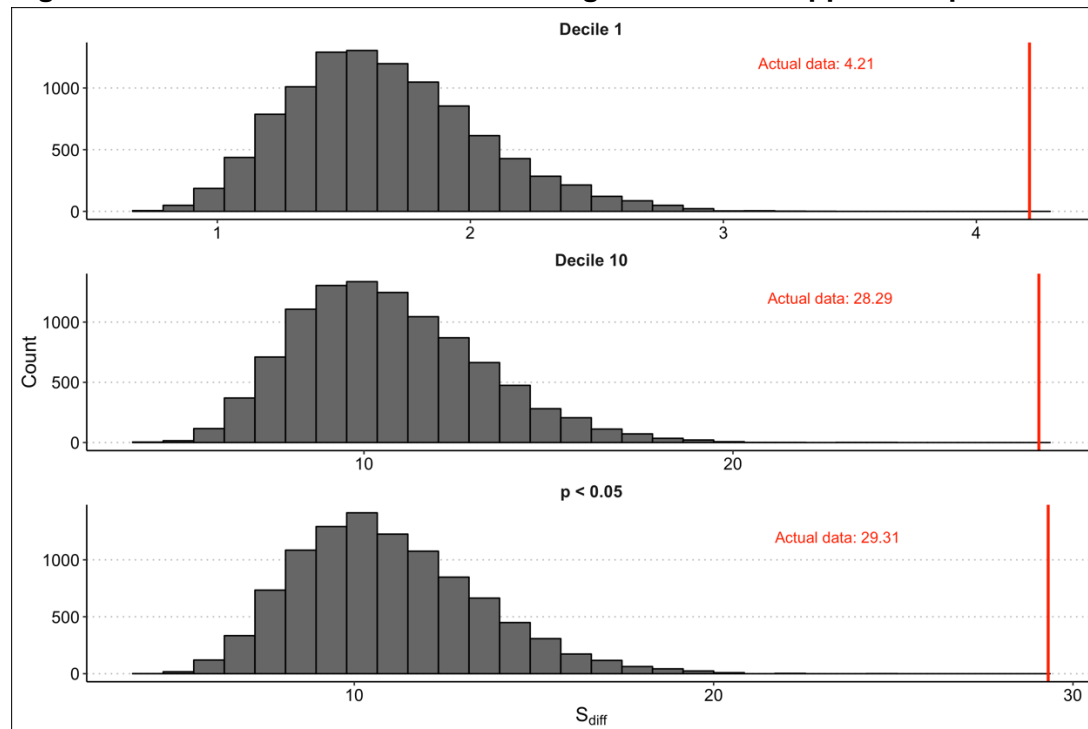
In the case of the described analysis, bootstrapped results for 10,000 randomisations were generated. The results of the following analysis are summarised in Figure 3-31 below. It

is noticeable that the values derived from the actual data are significantly higher when compared to the values derived from the bootstrapped samples. It is observable that during the period from 2007 to 2010, the difference in cumulative sum deviated significantly from what can be observed across the remaining values generated from the random data.

Figure 3-31 — S_{diff} values generated from actual and bootstrapped data



Alternatively, the relevant distributions can be visualised with the use of a histogram. Histograms make it clearly observable that the maximum differences generated across randomised samples of the group fell below differences observed in the actual data; the occurrence is visualised in Figure 3-32.

Figure 3-32 — Maximum Difference Histograms: Bootstrapped Samples

Bootstrapping techniques enable inferences to be derived from the data without making assumptions about the distribution, which is particularly advantageous in the case of working with variables that do not meet the normality assumptions (Haukoos and Lewis, 2005). The bootstrapping analysis allows for estimating the confidence levels. The confidence levels can be estimated with an equation:

$$\text{Confidence Level} = 100 \frac{X}{N} \%$$

where:

- N – reflects the total number of bootstrapped time series
- X – reflects time series where the S_{diff} was higher than the maximum magnitude estimator obtained on the real data

In the context of the summarised analysis, from the generated random distributions, there were no bootstrapped randomisations that would yield magnitude estimators greater than the values derived from the actual data. These results were obtained for the $N = 50,000$, which is traditionally considered a sufficient number of permutations. Theoretically, one would attempt to establish the distribution of the S_{diff} reflecting all possible permutations of the data. Bootstrapping methods rely on random sampling with replacement. Such an approach is frequently computationally demanding. With respect to the data analysed, there are $47!$ or approximately 2.6×10^{59} permutations for each of the data zone subgroups.

At this stage of the analysis, it can be further asserted that change in the existing data can be detected. Traditionally, the second step in the change-point analysis is concerned with estimating when the change took place. This can be achieved with the use of a mean square error estimator (mse). The formula used to estimate the mean square error is given in Equation 3-3.

Equation 3-3 — Mean Square Error

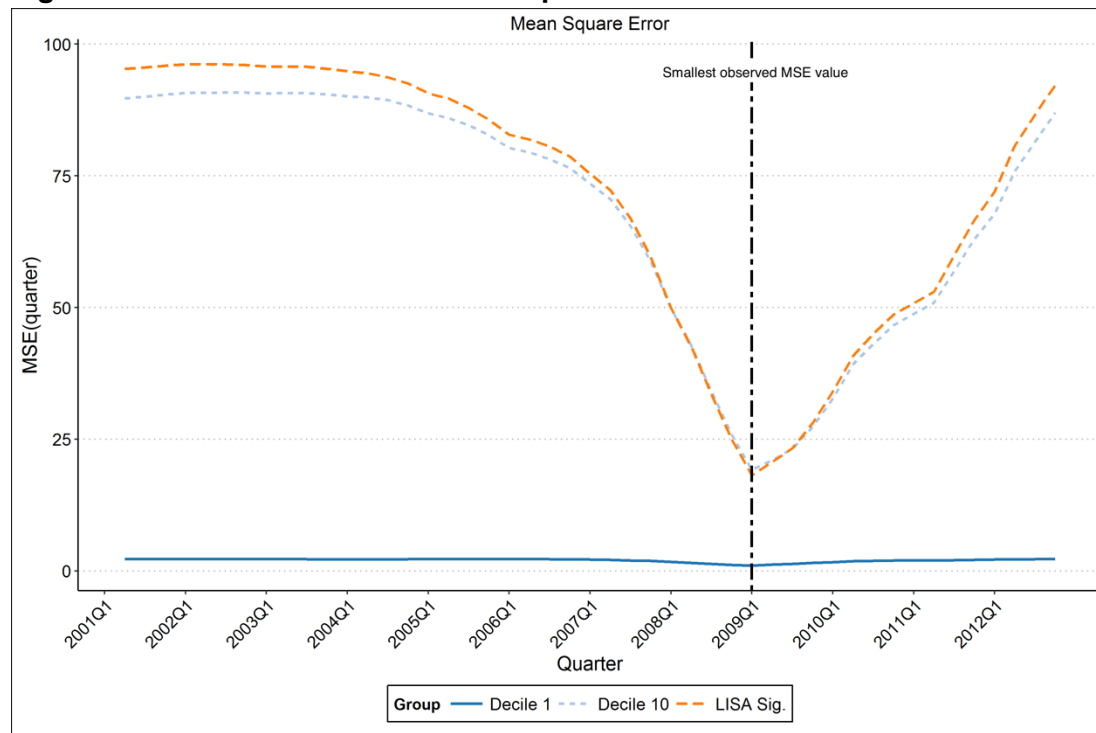
$$MSE(q) = \sum_{i=1}^q (X_i - \bar{X}_1)^2 + \sum_{i=q+1}^{47} (X_i - \bar{X}_2)^2$$

where:

- $\bar{X}_1 = \frac{\sum_{i=1}^q X_i}{q}$
- $\bar{X}_2 = \frac{\sum_{i=q+1}^{47} X_i}{47-q}$
- q – order according to quarter

The idea behind the MSE estimator is to split the data into two segments and deliver an estimate for each of the segments (Nigro et al., 2014). The value where the $MSE(m)$ is smallest is considered to be a best estimator before the change in the observed data took place.

Figure 3-33 — MSE estimates across quarters



It was established that the minimum $MSE(q)$ was identified in 2009, as shown in the figure above. So far, the change-point analysis showed that a significant change in the neighbourhood levels of JSA claimant rates was observed around the first quarter of 2009. As the following analysis is concerned with indicating whether an external factor can explain the observed change, it is necessary to introduce a set of indicators corresponding to the global macroeconomic factors characterising the 2008 financial crisis.

3.2.2 Role of Exogenous Indicators

A significant change across average levels of benefit claimants can be observed around 2009 when the wider macroeconomic effects of the 2008 financial crisis were expected to be observable. The analysis of the impact of the exogenous factors on the neighbourhood-level distribution of life outcomes commences with the selection of a suite of indicators that could be utilised in the analysis as a set of exogenous variables. In a meta-analysis, concerned with the review of crisis warning indicators, Frankel and Sarvelos (2012, p. 216) suggest a set of variables that can be used to assert the incidence of the 2008 financial crisis, and those are: drops in GDP; falls in industrial production, currency depreciation, stock market performance, reserve losses, and; participation in the IMF programme.

The ability to measure the relevant aspects of macroeconomic performance is, to a great extent, determined by the availability of the data and choice of methodological paradigm reflecting the definition of the macroeconomic performance. The proposed approach decides on a relatively uncontroversial suite of indicators. In particular, the choice of variables reflects GDP data derived from the National Accounts publications as well as the selection of the core stock data from a suite of key Scottish companies.

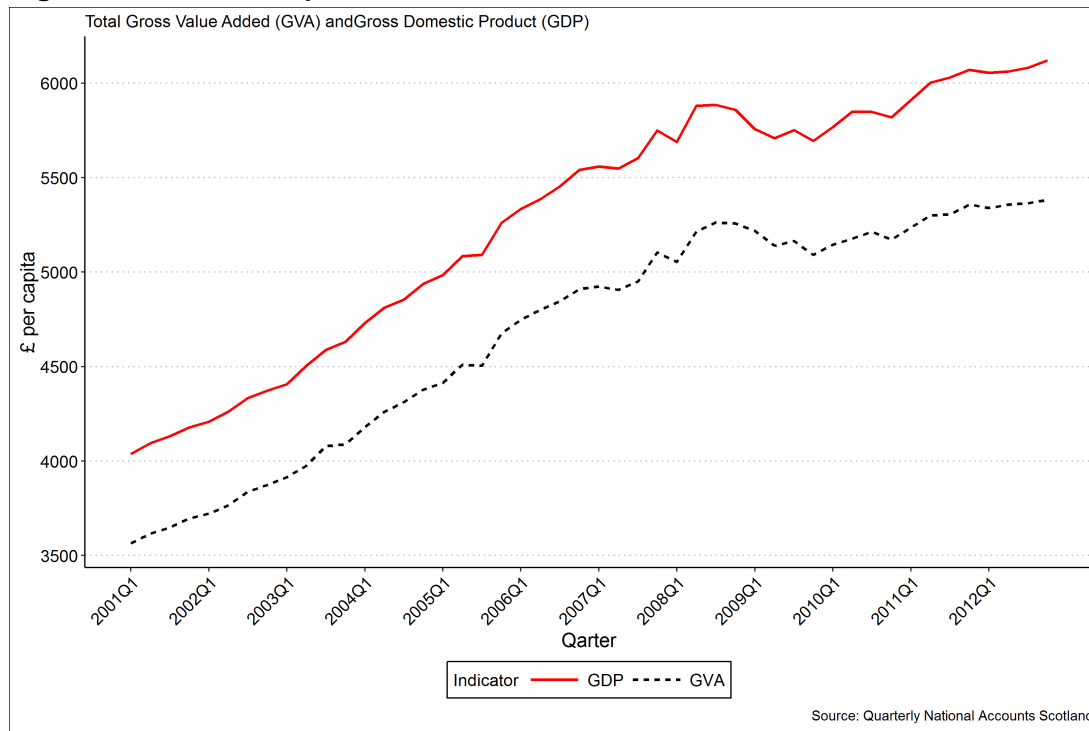
In Scottish finance, the performance of the Scottish economy is usually measured with the use of stock data gathered from key businesses headquartered Scotland. Those companies are Aberdeen Asset Management, FirstGroup, SSE, Weir Group, Standard Life, John Wood Group, A. G. Barr, Stagecoach Group, Cairn Energy, RBS, Aggreko, Exova Group. Those businesses are commonly referred to as the *Saltire 12* and are considered as indicative of the overall performance of the Scottish economy.

It should be noted that the choice of the indicators used to describe the Scottish economic performance attempts to account for the official macroeconomic statistics but also for a more volatile enterprise data. The assumption underpinning the utilised suite of indicators reflects the idea that neighbourhood-level changes in benefit uptake variability may not be captured in case of GDP being introduced as a single indicator due to the technical complexities surrounding the development of national indicators. The GDP estimates are created using aggregate outputs from the industries (Agriculture, Forestry & Fishing, Production, Construction or Services) (Scottish Government, 2016). Introduction of the additional business data into the analysis aims to provide additional insight into a relationship between neighbourhood-level life outcomes and core business data available on a national level.

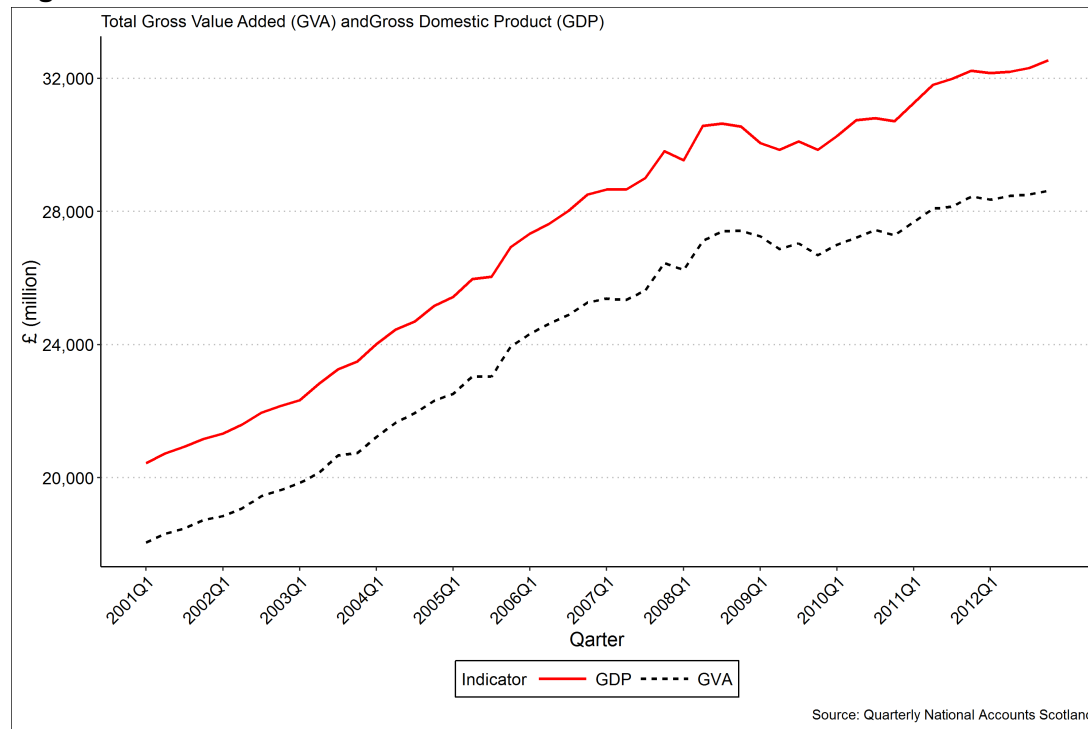
3.2.2.1 Descriptive Analysis

The following section summarises the undertaken preliminary descriptive analysis of the outlined set of exogenous indicators. Those indicators are utilised as the independent variables during the subsequent key analytical components concerned with evaluating the role of exogenous factors on a neighbourhood level. The variables initially considered in the descriptive analysis reflect GVA, GDP figures, as well as the stock data of the previously mentioned companies. Prior to considering additional data, the GVA and GDP are visualised in Figure 3-34.

Figure 3-34 — Per Capita GVA and GDP



For additional background information, the trend in total values is also reported in Figure 3-35 below.

Figure 3-35 — National Accounts

Following the literature on assessing the impact of 2008 financial crisis; the ensuing analysis focuses on utilising national macroeconomic indicators, such as GDP and GVA (Arcia et al., 2001; Erkens et al., 2012). The GDP and GVA statistics are produced routinely by the Scottish Government and are subsequently made publicly available through official statistical releases.

3.2.2.2 Temporal Autocorrelation

One of the assumptions of the regression analysis is that the observations of the error term are independent. In practice, there must be no correlation between preceding or superseding observation error-terms (Halcoussis, 2005). When the provided assumption is violated, we can speak of autocorrelation or, in other words, serial correlation being present in the model (Halcoussis, 2005; Mooi and Sarstedt, 2011). In a time series-analysis, a positive autocorrelation is a fairly common occurrence and usually signifies that an independent variable is missing from a model (Halcoussis, 2005). Autocorrelation on its own leaves the coefficient estimates unbiased; however, if untreated, the estimated standard errors produced by the model will be smaller than the true values (Halcoussis, 2005).

A Durbin–Watson test on the presence of temporal autocorrelation across residuals was obtained for each of the 6,505 regression models. The residuals obtained in the course of all of four modelling exercises were tested for the presence of temporal autocorrelation

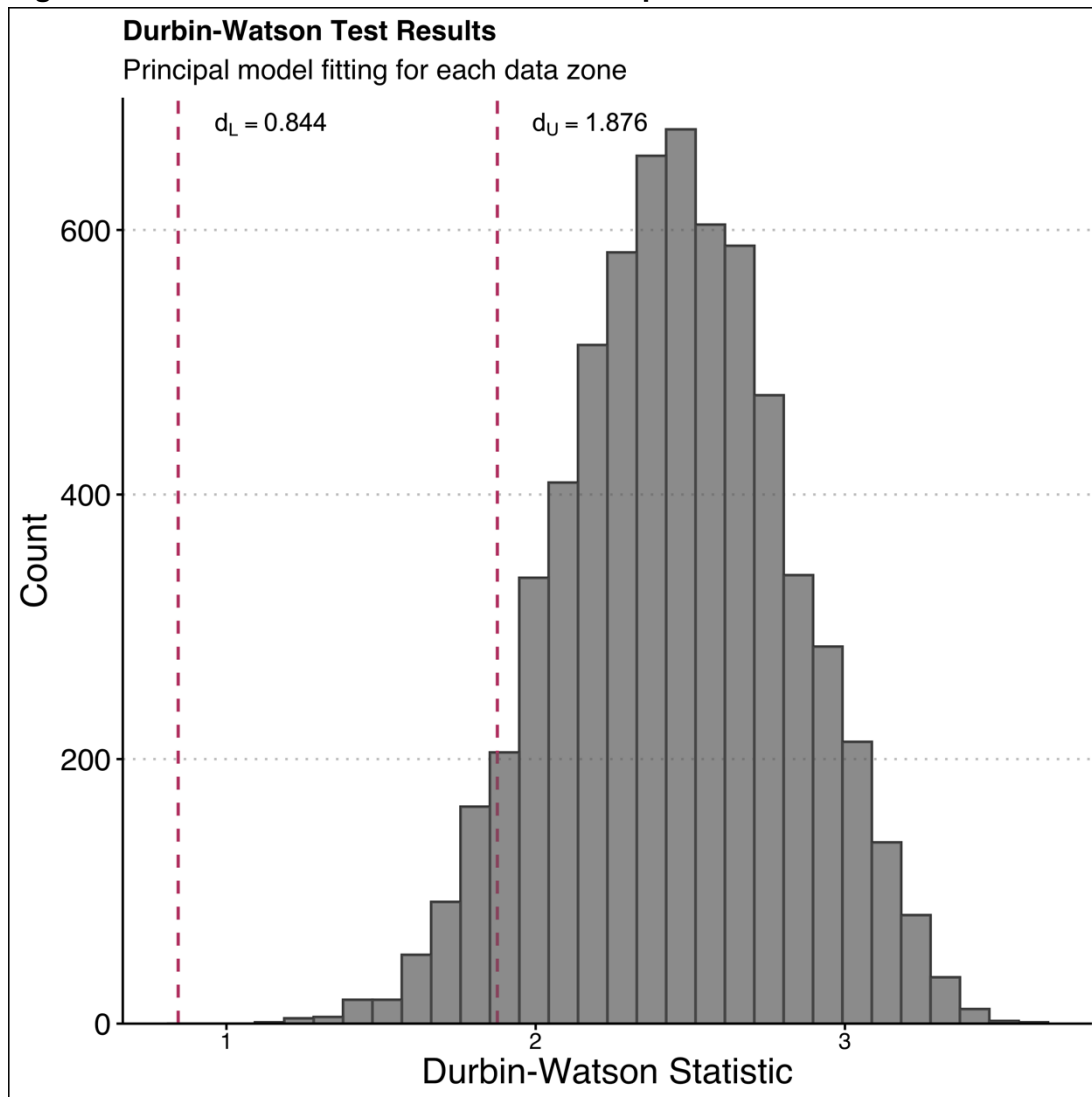
using a Durbin–Watson test. The Durbin–Watson tests for null hypothesis for of no autocorrelation and produces results between 0 and 4 and reflect one of the three situations:

- Values falling below lower critical values indicate negative autocorrelation
- Values falling above higher critical value indicate positive autocorrelation
- Values falling between lower and higher critical value indicate no autocorrelation

(Mooi and Sarstedt, 2011).

Consequently, the Durbin–Watson statistic has three regions, ‘reject the null hypothesis, do not reject the null hypothesis and inconclusive region’ (Halcoussis, 2005, p. 143). Values close 0 indicate positive autocorrelation, values near 2 signify no autocorrelation and values close to 4 indicate negative autocorrelation (Halcoussis, 2005). Upper critical value d_U and lower critical value d_L can be sourced from commonly available tables for a modelling solution reflecting a number of independent variables and sample size.

In the undertaken analysis, the sample size is 40 for each data zone for which model is fitted, the number of regressors is variable, and for models with noncollinearity reflects nine or fewer variables. For that configuration, and 1 per cent significance, the upper critical value d_U is 1.876 and the lower critical value d_L is 0.844. The results of the Durbin–Watson test for all of the 6,505 models accounting for critical values fitted for the principal model are provided in Table 3-11.

Figure 3-36 — Durbin–Watson Results for Stepwise Fitted Models

Following Halcoussis (2005), the decision rules for the Durbin–Watson test for positive autocorrelation are as follows: for Durbin–Watson statistics less than d_L , the null hypothesis of no autocorrelation should be rejected, and positive autocorrelation can be assumed. In the case of the Durbin–Watson statistic being greater than d_U , the null hypothesis of no autocorrelation should not be rejected, implying no autocorrelation. For the Durbin–Watson statistic lying between d_U and d_L (or equal to either of two), the test is deemed inconclusive.

Given the principal model configuration of 9 regressors, for 6,505 fitted principal models, the results for the majority of the obtained models indicate lack of autocorrelation.

Table 3-11 — Durbin–Watson Results for Principal Modelling Scenario

<i>Durbin–Watson Results</i>	<i>No. Results</i>	<i>Percentage</i>
<i>Inconclusive</i>	390	6%
<i>No autocorrelation</i>	6,115	94%

Interpreting Durbin-Watson test results for stepwise model fitting is more challenging due to the variable number of regressors obtained in the course of the stepwise fitting. For a smaller number of regressors values d_U and d_L will be decreasing. The challenge can be solved programmatically, and Durbin–Watson results can be obtained for each model accounting for the number of regressors k . The utilised process also accounts for the number of observations n .

Table 3-12 — Durbin–Watson Results for Stepwise Models

<i>Durbin–Watson Results</i>	<i>No. Results</i>	<i>Percentage</i>
<i>Inconclusive</i>	580	10%
<i>No autocorrelation</i>	5,739	90%

3.2.2.3 Regression Analysis

Initially, a simple linear regression model accounting for all variables of interest for 6505 data zones is fitted for each geography. The variables of interest reflect the share prices from the previously listed set Saltire 12 companies as well as national GDP and GVA indicators. The regression equation applied to each of the data zones available in the data set is Equation 3-4 is given below.

Equation 3-4 — Multiple Regression Equation

$$Y_i = b_0 + b_1X_1 + b_2X_2 + \dots + b_nX_n + e_i$$

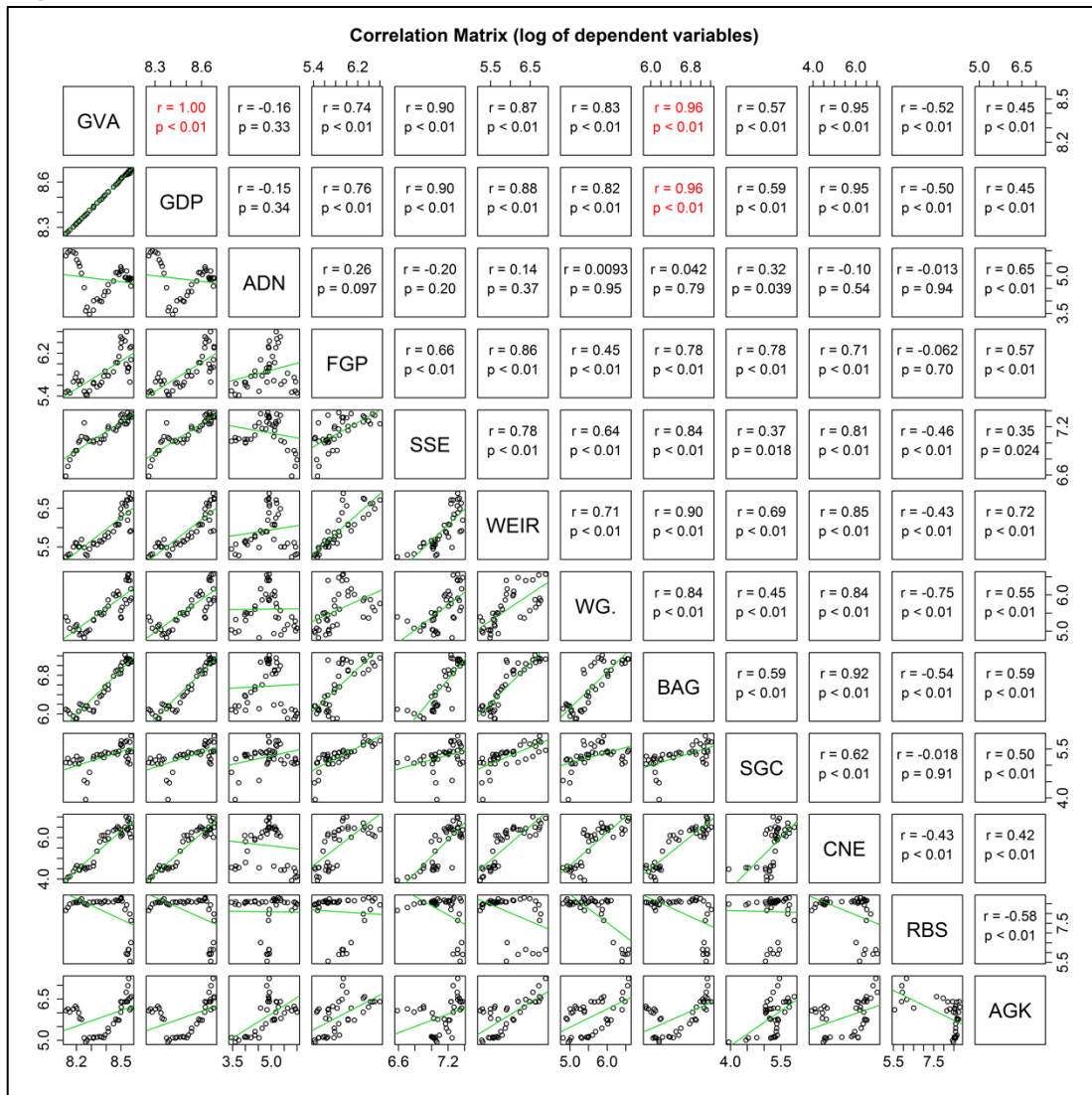
Where:

- Y_i – reflects the dependent variable: JSA rate for a specific data zone
- b_0 to b_n – are the regression coefficients determined in the analysis
- X_1 to X_n – are the independent variables for the exogenous indicators, the list of variables
- e_i – is the residual error of the difference between the observed and estimated dependent variable for data zone i .

Conventionally in regression modelling, the process of model fitting relies on applying the diagnostic criteria to the initial model and selecting a suite of variables reflecting the conceptually coherent approach but also delivering optimal statistical quality. In the context of the research undertaken, traditionally utilised diagnostic criteria were applied across 6,505 models constituting the analytical data set.

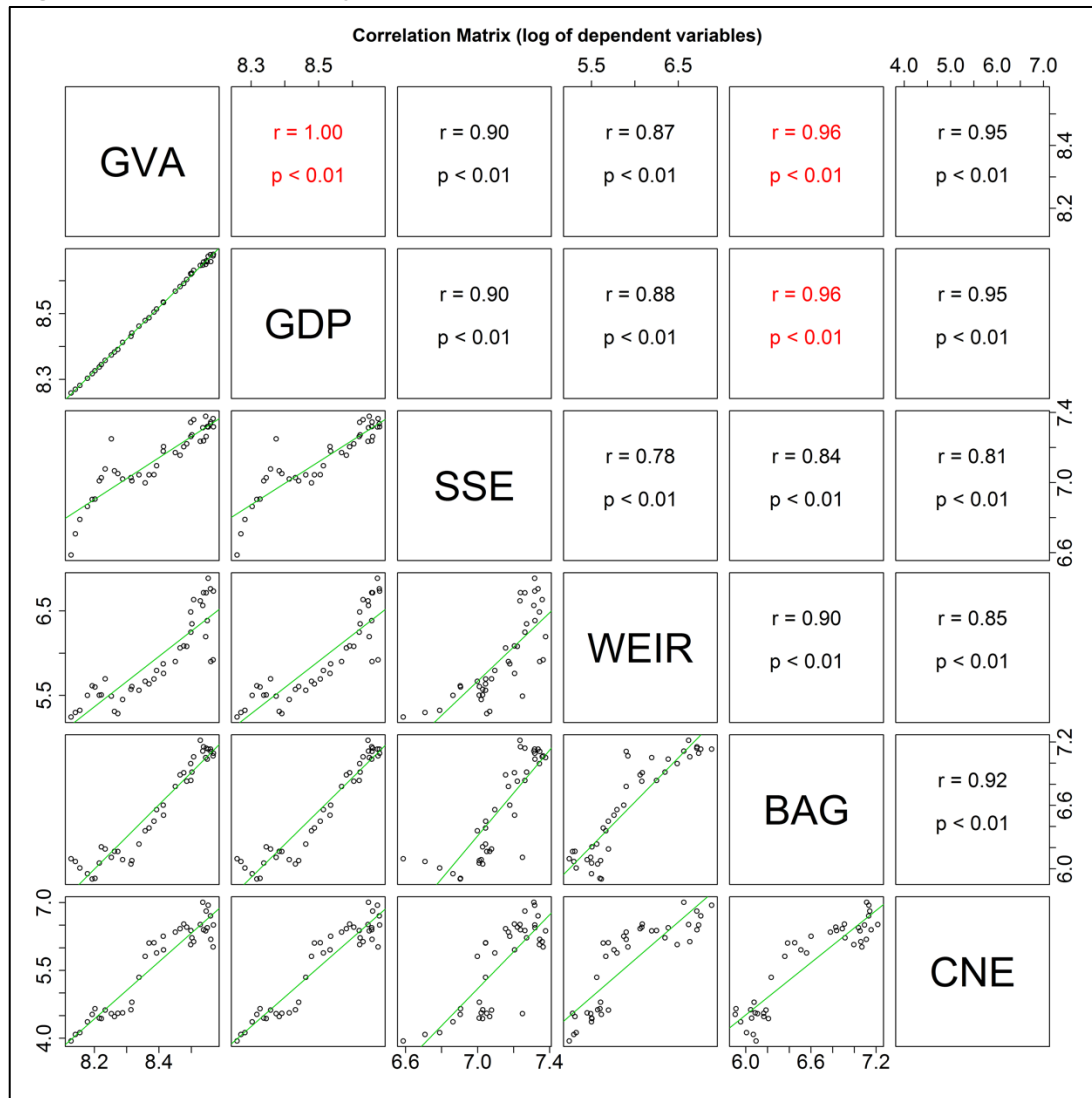
Prior to undertaking more advanced analysis, the initial set of indicators was verified for collinearity. Collinearity is defined as an occurrence where two or more regressors are linearly related (Dormann et al., 2013). Strong collinearity creates problems in model interpretation, for example, when two regressors are strongly related, it may be not possible to separate the effects they exert on a dependent variable (Dormann et al., 2013; Zainodin and Yap, 2013). Pearson correlation coefficients for the observed dependent variables are provided in Figure 3-37. The particularly problematic correlations of coefficients $r \geq 0.95$ are highlighted in red, which reflects the threshold at which it is recommended to remove strongly correlated variables from the module (Zainodin and Yap, 2013)

Figure 3-37 — Correlation Matrix for Dependent Variables



For the sake of further explanation, the matrix accounting for the strongly correlated variables is provided in Figure 3-38. The high correlation coefficient observed between GDP and GVA can be explained on the grounds of how the indicators are collected. Following this observation, the GDP per capita can be included, as it corresponds closely to the data. The noted correlations between the stock data of the enterprises constituting Saltire 12 are more informative, as the coefficients reflect the related change to the share prices.

Figure 3-38 — Potentially problematic correlations



Following those initial findings indicating strong multicollinearity, Gross Value Added and the stock for the A.G. Barr group were removed from the data.

Stepwise model fitting

Following the initial fittings on the multicollinearity, the estimates are further fitted with the use of a stepwise model selection employing the Akaike Information Criterion across the 6,505 initial models. The Akaike Information Criterion (AIC) focuses on estimating the quality of a model in relation to other models and cannot be used on its own, i.e. the AIC is only informative when compared to AIC figures obtained from the other models (Akaike, 1974). The AIC is defined as:

Equation 3-5 — AIC Equation

$$AIC = 2k - 2 \ln(L)$$

where:

- k – reflects the number of estimated parameters
- L – reflects the maximum value of the likelihood function

The described stepwise model selection mechanism was applied across 6,505 geographies available within the utilised panel data set. The utilised procedure estimates the AIC for the sets of values passed to the initial model. Following the stepwise selection applied to the 6,505 models available in the data set, it was possible to indicate how frequently selected variables were recognised as viable predictors and reflected in the final formula.

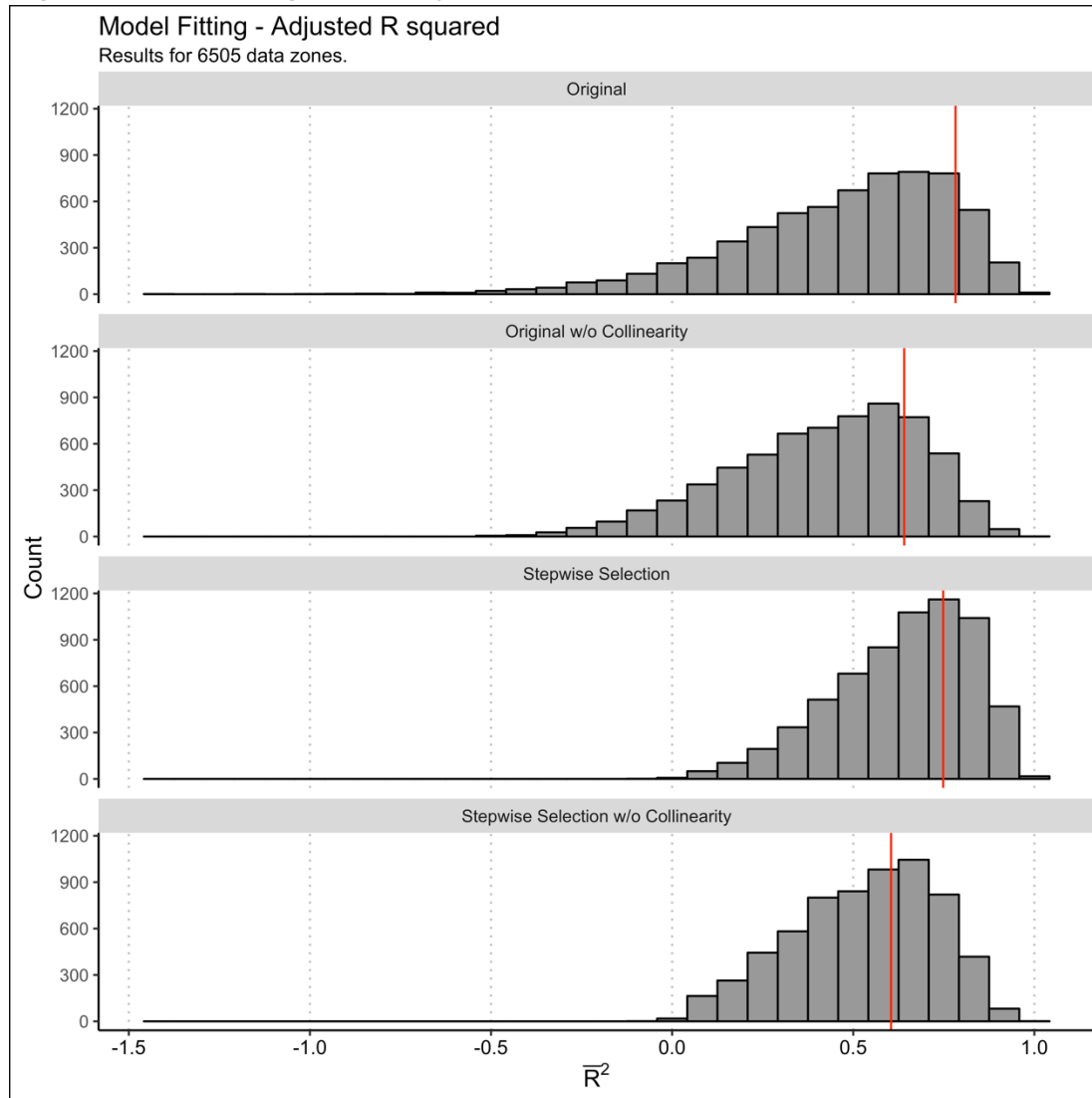
The results of the stepwise regression applied across the available indicators are summarised in Table 3-13. For example, it is observable that *GDP per capita* was indicated as a statistically significant predictor variable across 3,154 models; analogously RBS shares data is selected as a predictor variable across 50% of geographies/models. The findings indicated that, from across the data for the suite of companies, selected business were identified as predictors with variable frequency.

Table 3-13 — Frequency of variables used across models

<i>Regressor variable</i>	<i>Frequency across 6,505 iterations each</i>		
	<i>Count</i>	<i>Frequency (%)</i>	
GDP per capita	3,154	48.49	
Saltire 12 <i>stock</i>	Royal Bank of Scotland	3,253	50.01
	Aggreko	3,063	47.09
	Aberdeen Asset Management	3,006	46.21
	FirstGroup	2,754	42.34
	Weir Group	2,749	42.26
	Wood Group	2,698	41.48
	Stagecoach	2,632	40.46
	Cairn Energy	2,389	36.73
	<i>None</i>	43	0.66

After removing the initial subset of indicators marked by a high degree of collinearity and applying the stepwise model selection to the provided data, the test of the remaining modelling approaches can be summarised with the use of the adjusted R-squared values. The distribution of the adjusted R-squared values across the model approaches reflect the initial set of variables, the amended set of variables reflecting strongly correlated ones and the final selection of predictors accounting for the stepwise selection of the indicators, respectively, as visualised in Figure 3-39. Following the previously outlined model-fitting process, it is observable that from across 6,505 of geographies available in the data, the initial selection of the variables resulted in models explaining on average 50% of the variance.

Figure 3-39 — Histogram of Adjusted R-Squared Values with Mean



Due to the methodological decision to fit a single regression model for each geography, the process of model fitting is achieved in the course of the automatic variable selection. The utilised stepwise selection mechanism assumes that a set of predictor variables would have to be identified individually for each of the geographies. The distribution of adjusted R-squared values reflecting the results of the stepwise selection for each of 6,505 geographies is visualised in Figure 3-39. Additionally, the chart compares different approaches to variable selection. Each histogram provides a summary result for the 6,505 models, with the red line reflecting the mean-adjusted R-squared value obtained for each selection procedure. The models' characteristics across each of the subgroups are additionally summarised in Table 3-14.

On average, a full set of variables applied to all data zones available in the dataset performs better than a selection of predictors or a narrowed automatic variable selection. This applies to the stepwise selection processes deployed against the original set of variables and a set with multicollinearity removed. In effect, for each of the selected geographies, a model utilising a filtered set of predictors or focusing on a selected subset of predictors could perform better; however, in the context of the utilised selection process, the average performance rate of all the models is best in case of a stepwise selection applied to a full set of variables.

Table 3-14 — Comparison of model fitting approaches

<i>Iteration</i>	<i>Description</i>	<i>Average across all models</i>	
		R^2	\bar{R}^2
<i>Original</i>	Reflects the original set of variables	78.24	46.89
<i>Original without collinearity</i>	Reflects the set of variables without strongly correlated pairs	64.04	42.05
<i>Stepwise</i>	Reflects the results of the automatic stepwise selection model	74.83	63.61
<i>Stepwise without collinearity</i>	Reflects results of the stepwise selection on a subset of variables without collinearity	60.43	53.03

Across the results obtained, the most viable models were obtained during automatic stepwise selection, which resulted in models on average explaining 63.61% of the variance. It is further possible to visualise the spatial variability across the model fits obtained for all data zones. The distribution of the adjusted squared values reflecting the stepwise model selection is shown in Figure 3-40.

Figure 3-40 — Distribution of adjusted r -squared values across data zones

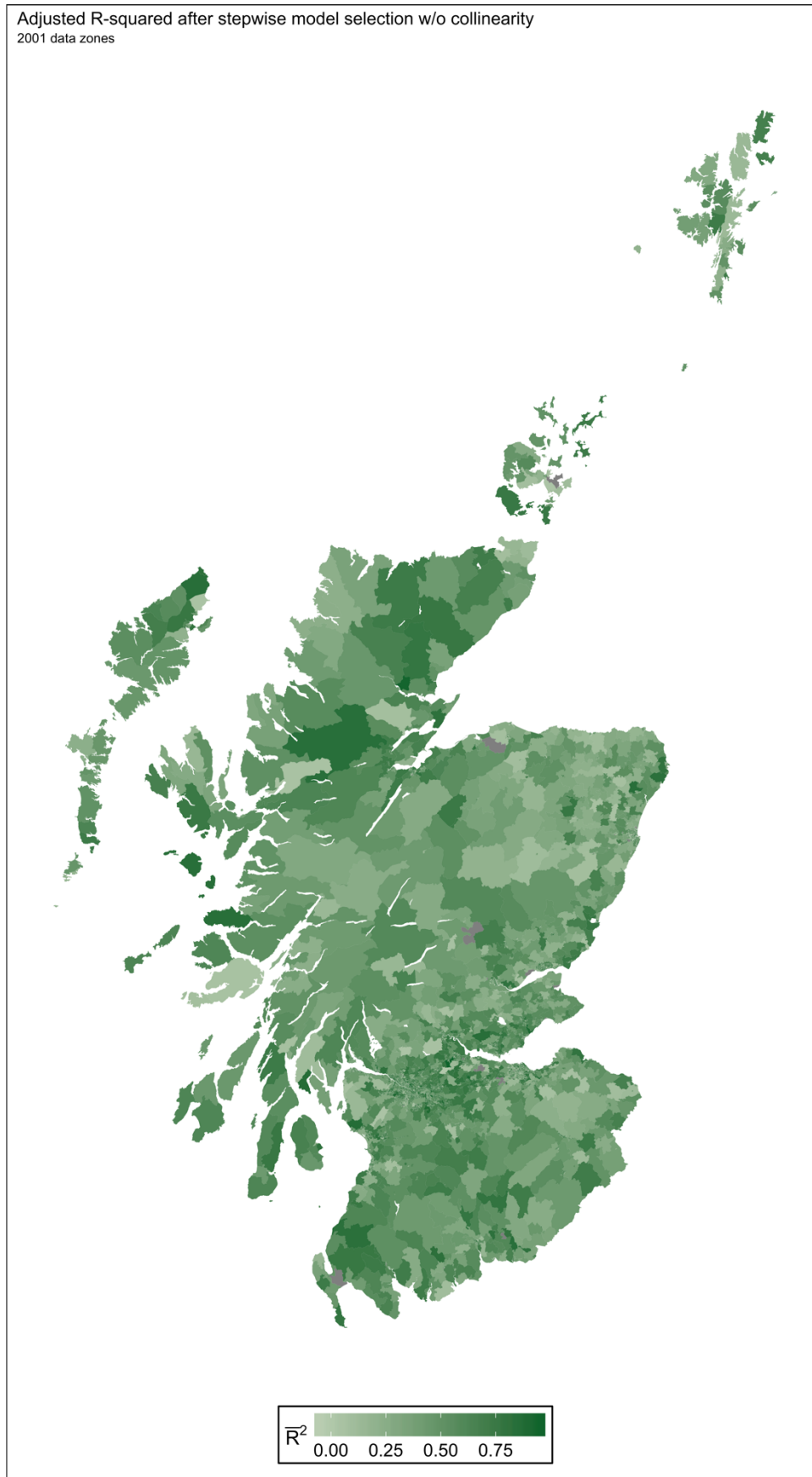


Figure 3-40 shows the spatial distribution of the obtained \bar{R}^2 values using 2001 data zones. The potential existence of spatial autocorrelation across the values obtained can be verified in the course of a Moran's I analysis. The observed global Moran's I value is 0.061, which is higher than the expected Moran's I value for $p = 0$. The expected *Moran's I* value is $-\frac{1}{N-1} = -0.00015$, where $N = 6505$. On these grounds, the null hypothesis on the absence of negative spatial autocorrelation can be rejected. The applicability of the following findings to the research question is mostly concerned with demonstrating neighbourhood-level variability in exposure to external macroeconomic events.

3.2.3 Conclusions

The analysis focused on the question of change in neighbourhood-level JSA dependency in relation to major macroeconomic events. Additional emphasis was placed on identifying macroeconomic events associated with the 2008 financial crisis. The analysis utilised a set of key national statistics, as well as stock market data from a set of key Scottish enterprises. The selection of indicators was motivated by the requirement to capture potential changes to the Scottish economy that could have taken place during the 2008 financial crisis comprehensively.

The impact of the 2008 financial crisis was investigated in the course of the change-point analysis. A statistically significant change across levels of benefits uptake was observed in the 2009 data, suggesting a relationship to the 2008 financial crisis. The change-point analysis additionally demonstrates that neighbourhood-level vulnerability to macroeconomic events varies for geographies grouped by deprivation. It is further observable that the impact of the macroeconomic change varies for geographies that were previously identified as having statistically significant Moran's I values. The key findings of the change-point analysis reflect the assertion that, across the Scottish data zones, the events of the 2008 financial crisis had a disproportionately higher impact across the most deprived geographies with respect to the average Jobseeker's Allowance claimant rates. On the contrary, across the least deprived geographies, the events of the 2008 financial crisis had an almost insignificant impact.

The removal of potentially problematic variables and the ensuing stepwise regression modelling exercise undertaken for each of the data zones highlighted the variable impact of utilised predictors on levels of JSA dependency. The principal model was independently fitted for each of the 6,505 data zones. The results of the stepwise model fitting show that from the initially introduced indicators, GDP per capita functions as a potential predictor variable for 3,154 (48.49%) of analysed data zones. In the course of the undertaken stepwise regression,

the performance of RBS was selected as a statistically significant predictor for approximately 50% of geographies.

An analysis of the spatial distribution of the R-squared values from across the available models indicates that the best fit across the results obtained is observable for urban geographies located across the Central Belt and within its vicinity. An additional analysis of spatial association on the model results obtained indicates the existence of spatial autocorrelation. The distribution of R-squared values is characterised by spatial autocorrelation, which corresponds with the previous results. It is observable that stepwise selected models perform better for the urban geographies located within the Central Belt or its vicinity.

Chapter 4 — Results and Scottish Context

Summary:

The results obtained demonstrate the existence of neighbourhoods across Scotland that are marked by the consistency of elevated rates of Jobseeker's Allowance claimants. An analysis of the impact exerted by exogenous indicators shows that increases in neighbourhood-level JSA claimant rates vary spatially following the 2008 macroeconomic recession. This chapter additionally summarises the analytical evidence concerned with the prevalence of high JSA rates and other aspects of multiple deprivation, stating that elevated JSA levels are frequently indicative of other types of neighbourhood deprivation.

The purpose of this chapter is to place the results obtained in the context of a wider set of theoretical frameworks and outline how the data can be understood across a wider spectrum of social and macroeconomic changes. Consistent with the structure of the thesis, this chapter focuses on each of the previously analysed sections and provides an explanation for the results obtained in the context of wider academic research. The final section of the chapter provides suggestions for further research that would be of value in terms of arriving at a wider understanding of the phenomena observed but also with respect to the applicability of the findings obtained to practicalities of local governance.

This thesis focuses on the probabilistic nature of deprivation and vulnerability to macroeconomic events observed across Scottish neighbourhoods. The purpose of the work was to explore hitherto under-researched aspects of deprivation and highlight spatial characteristics and changes in neighbourhood-level JSA claimant rates in relation to adverse macroeconomic events, giving additional focus to neighbourhoods marked by persistently high JSA rates. By providing a supplementary perspective on neighbourhood-level deprivation across Scotland, the findings of the work aim to generate insights that could be applicable to informing local resource-allocation models and highlighting under-researched aspects of neighbourhood deprivation across Scotland.

In particular, the research design used capitalises on the high-quality small-area data that is available for Scottish neighbourhoods. Considering the research potential offered by the high analytical quality of the small-area data for Scotland, the key methodological principles draw on a successful study concerned with the identification of persistently poverty-stricken US counties undertaken by Partridge and Rickman (2007). Following the key research question outlined in the thesis, it aims to achieve the following objectives:

- a) Contribute to the better understanding of neighbourhood-level deprivation across Scotland by analysing the neighbourhood-level spatial characteristics of JSA claimant rates
- b) Extend the understanding of local deprivation by looking at the impact of macroeconomic events across the variables observed concerned with the levels of benefits uptake

The research proposes a novel approach to studying neighbourhood-level vulnerability by looking at the impact of macroeconomic events on neighbourhood-level JSA claimant rates to understand differences in local vulnerability to adverse macroeconomic change. Spatial variability in the vulnerability of local communities was explored in relation to the observed

macroeconomic changes following the 2008 financial crisis. The results were obtained in the course of a multi-stage analysis that focused on:

- Highlighting the existence of neighbourhood-level interdependencies across out-of-work benefit claimant rates, focusing on correlations of JSA dependency to other Scottish neighbourhood-level deprivation measures
- Prevalence of persistent levels of elevated rates of JSA claimants across Scottish neighbourhoods
- Vulnerability of Scottish communities to external macroeconomic events, focusing on the 2008 macroeconomic recession

The analysis concerned with evaluating persistency in elevated levels of JSA claimants on a neighbourhood level draws from past work by Partridge and Rickman (2007) concerned with studying the persistent levels of poverty across US counties. The methodology employed by Partridge and Rickman (2007) focused on analysing American census data and identifying counties for which the unemployment levels were persistently high compared to the remaining geographies for which data were available across the selected iterations of the US Census. The purpose of the analysis was to evaluate trend characteristics in the context of spatial variability in poverty rates of deprived neighbourhoods compared to the remaining geographies across Scotland. The methodological approach used in this analysis focuses on the prevalence of elevated levels of JSA claimants across Scottish neighbourhoods and spatial variability in the vulnerability of the neighbourhoods identified to macroeconomic change.

In a broader sense, the research undertaken was concerned with expanding the existing understanding of multiple deprivation by providing additional dimensions of deprivation that would be concerned not only with the existing and historical levels of deprivation but also with a wider dimension of inequalities pertaining to the vulnerability of local communities to adverse macroeconomic events. The analysis extends the existing understanding of neighbourhood-level deprivation by demonstrating the existence of relationships among available neighbourhood-level multiple deprivation indicators and JSA claimant rates. The change-point analysis demonstrated a significant increase in levels of JSA dependency following the 2008 financial crisis. The motivation behind this element of the research was concerned with expanding the understanding of neighbourhood-level inequalities by illustrating the impact of macroeconomic changes on the neighbourhood-level variability in levels of JSA claimant rates.

The purpose of this research was to indicate whether the available JSA claimant data lends itself well to the identification of neighbourhood clusters that are marked by persistently

high levels of JSA claimants and whether rates were impacted by adverse macroeconomic events to a disproportionately large extent. With this goal in mind, the ensuing analysis focused on a set of key characteristics concerned with the neighbourhood-level variability of JSA claimant rates, as well as the impact of external macroeconomic factors on these.

The research design utilised recognises that the findings could be potentially useful in informing local service-delivery mechanisms currently utilised across local governments in Scotland. The work undertaken is guided by the assumption that the potential practical applications of the findings could be materialised in the course of providing actionable insights in identifying neighbourhoods that are particularly vulnerable to adverse macroeconomic change and persistently characterised by elevated levels of JSA claimants. The research recognises that the predictive capacity that can be derived from identifying variability in neighbourhood-level vulnerability to macroeconomic events. The findings are relevant to the existing service-delivery mechanisms that tend to focus on historical levels of deprivation without focusing on vulnerability to macroeconomic change.

The initial analysis of the existing practice in relation to the utilisation of small-area data across local policies, focusing on the Scottish local authorities, suggests that the predictive potential of the available data is frequently not utilised. The usual policy approach to developing resource-allocation mechanisms focuses on the descriptive statistics that can be derived from the existing data, with an emphasis on the most recent figures. The model factors utilised in the existing levels of JSA claimant rates and variability across these may be of use in identifying particularly vulnerable neighbourhoods that could potentially benefit from more attuned service delivery.

With respect to the current local governance practices, the use of predictive analysis on a sub-national level in Scotland is mostly concerned with incorporating population predictions. The population projections in Scotland are produced on a regular basis by the National Records of Scotland and are used to inform local service-delivery models. The demographic projections are then used to inform related projections of future service demand and associated expenditure. The projections are incorporated in the decision-making processes influencing decisions with respect to the allocation of resources between local authorities. The argument supporting the potential practical value of the findings reflects the notion that the predictions are strongly correlated with the trends in expenditure observed across local authorities and the variable approach to resource allocation due to diverse anticipated levels of expenditure.

Due to reliance on the assumed linear relationship between demography and expenditure, these models are often recognised as simplistic. For instance, the statistical evidence for a strong correlation between an elderly population and social work expenditure suggests that social work expenses faced by local authorities are likely to increase following the anticipated demographic change. Consequently, local authorities for which sub-national projections indicate a significant increase in the elderly population have a stronger position to negotiate for additional resources from the central budget.

The ensuing analysis is used to differentiate the scale of impact of demographic change across local authorities by exploiting Scottish sub-national demographic projections provided by the National Records of Scotland. The demographic projections are composed of several variants reflecting assumptions on high/low mortality as well as high/low migration and combinations of these. The principal projections, reflecting the most probable demographic outcomes, are usually utilised in the context of forecasting sub-national expenditure levels. The innovative value of this research is concerned with building the analytical conclusions on neighbourhood-level deprivation in Scotland utilising predictive models as well as acknowledging spatial variability of the observed changes across life outcomes in relation to macroeconomic events. The methodological choices made in this work reflect a suite of commonly utilised indicators in financial modelling. In particular, the scope of the analysis is extended by the mechanism allowing for the incorporation of business data from across key Scottish businesses, as well as national account reports.

The criteria underpinning the choice of the Jobseeker's Allowance as a dependent variable reflect the assumption that the required high cross-time comparability was mostly concerned with the prerequisite for the indicators to measure the same phenomenon consistently across time. The initial exploratory analysis determined that the Jobseeker's Allowance rate of utilisation presents itself as a suitable dependent variable. In general terms, the local JSA claimant rates measure a specific nature of citizens' engagement with the welfare system that is concerned with a person claiming out-of-work benefits. However, elevated neighbourhood-level claimant rates are strongly correlated with other available neighbourhood deprivation measures and can be reliably used as indicators of wider societal deprivation.

The analysis of the numerical quality of the sourced neighbourhood data was primarily concerned with gaining an understanding of how data production methodology could impact the derived findings. In particular, the evaluation was concerned with testing for high numerical quality of the neighbourhood-level JSA rates. The applicability of the outlined criterion to the utilised spatial data adds further complexities to this assumption, as it forces the use of an additional set of criteria concerned mostly with the utilisation of the spatial data. These criteria

are usually associated with methodological assumptions underpinning the development of geographies for which the data are made available.

The data used consist of 6,505 geographies with 47 quarterly time series being available for each geography. The unit of analysis, conceptually equivalent to a neighbourhood, utilised in the data set corresponds to a single data zone of approximately 650 residents. As demonstrated in section 3.1.3, the data utilised are sufficiently complete, with the patches of the missing data only occurring during the initial years of the data collection from 2000 to 2006. The periods of missing data were caused by early technical and procedural shortcomings of the data collection systems. These inadequacies in data availability were solved around 2006, resulting in almost perfect availability of data for years after 2006.

The analysis delivered makes extensive use of neighbourhood-level JSA claimant rates, which are constructed using the count for the total number of Jobseeker's Allowance claimants as the numerator and a demographic estimate for the total residential population of a selected neighbourhood as the denominator. The absence of either of these two indicators would inherently result in data zone-level statistics for this region not being available. As the analysis focuses on the impact of the macroeconomic events following 2008, the data covering that period are not affected, thus enabling differentiation of the change in dependency rates across Scottish geographies in detail.

4.1 Exploratory Analysis

The following section discusses the key findings of the initial exploratory analysis while emphasising the wider applicability of neighbourhood-level JSA rates to measuring overall neighbourhood-level deprivation. The main purpose of the following work was to explore the relationship between persistency in elevated JSA claimant rates on a neighbourhood level and the impact exerted by the market and macroeconomic indicators on the change in neighbourhood-level JSA claimant rates across Scotland. The analysis utilised a set of publicly available data sets reflecting the data zone-level Jobseeker's Allowance and macroeconomic indicators, as well as market data frequently used in Scotland for the purpose of measuring the overall performance of the Scottish economy.

The choice of the data utilised was motivated by the operational requirements of the research and by the relevance of the available data to the principal research question. As the ambition behind the analysis was to focus on the macroeconomic events and local aspects of the JSA claimant rates, the technical qualities concerned with the frequency and data availability had to be factored in. For instance, the Scottish Index of Multiple Deprivation, which

is more suited to analysing neighbourhood-level multiple deprivation and is produced every four years, would not provide a sufficient frequency of observations to enable an assessment of the impact of macroeconomic events on the conditions of local communities.

Considering the operationalisation of the research, the choice was made to utilise the JSA claimant rate data, as this was satisfactory to answer the proposed research question. One of the key obstacles concerned with this work was related to the availability of the data across the period analysed within the required intervals. In practice, only the Jobseeker's Allowance data has a sufficient granularity for this type of analysis to be undertaken.

The exploratory analysis concerned with cross-tabulating neighbourhood levels of JSA claimant rates by SIMD deciles and accounting for the respective SIMD domains demonstrated that, on a neighbourhood level, high rates of Jobseeker's Allowance claimants are more frequently found across the geographies pronounced by high levels of deprivation measured across the SIMD domains. For instance, the average rate of JSA claimants for data zones falling in decile one of the 2006 iteration of the SIMD rank for the Crime domain was 5.89%, 4.82 percentage points higher than the average derived from the neighbourhoods in decile 10 of the SIMD Crime domain in the same period. Similar disparities were found across the remaining SIMD domains. For instance, cross-tabulation of the JSA rates with the 2004 iteration of the Education domain resulted in a 6.25% JSA rate across most deprived data zones and 1.04 for the least educationally deprived data zones.

In a broader sense, the initial exploratory analysis on benefits uptake contributes to an understanding of relationships across the currently measurable inequality domains and out-of-work benefit claimant rates in Scotland on a neighbourhood level. The observed consistency in elevated levels of deprivation was further formally verified in the course of correlational analysis. The exploratory analysis demonstrated the existence of statistically significant correlations across a number of deprivation indicators on a neighbourhood level.

The preliminary results demonstrated that the levels of benefits uptake on a neighbourhood level are strongly correlated. The preliminary analysis on the strength of the observed relationship further extends these findings by highlighting that the observed correlations are not only concerned with the Jobseeker's Allowance but have a wider impact that can be observed across the remaining domains. The support for the existence of statistically significant relationships across deprivation indicators for a neighbourhood is reflected in a wide body of international research. In particular, claims concerned with the prevalence of poor health outcomes and socioeconomic deprivation are well supported by the existing evidence (Pickett and Pearl, 2001).

It is observable that, on a neighbourhood level, the correlations across the existing deprivation measures concerned with the financial and material aspects of deprivation are particularly strongly pronounced when compared to relationships observed across the remaining life outcome domains for which neighbourhood-level data was available. The neighbourhood-level JSA claimant rate correlates with Income Support and Employment Support Allowance on $r = .8$ and with Incapacity and Severe Disablement Allowance on $r = .7$ for $p < .05$. Consistently, correlations across the remaining available neighbourhood-level deprivation measures were also strong.

The analysis conducted on correlations across various benefits counts corresponds to the wider body of Scottish and international research concerned with evaluating the spatial relationships concerned with neighbourhood-level deprivation. The related research conducted in Scotland also provides further evidence for the existence of strong dependencies with respect to the rates of out-of-work benefits claimants. The leading purpose of the work undertaken was to provide insights into currently under-researched aspects of neighbourhood-level deprivation in Scotland in the context of variability in vulnerability to macroeconomic events. As a result, the key research themes focus on exploring aspects of neighbourhood-level deprivation that are relevant in the context of understanding the nature of neighbourhood-level inequalities across Scotland. In line with the ambition to provide analytical grounds that would facilitate reducing neighbourhood-level inequalities, which was emphasised in the Christie (2011) report, the correlational analysis provides an initial insight into how the elevated levels of Jobseeker's Allowance can be considered as indicative of the wider deprivation that is observable across the remaining life outcome indicators.

Further analysis of the available time-series data indicates that comparable relationships can be identified across the remaining available neighbourhood-level deprivation measures. In particular, it is noticeable that the selection of neighbourhoods according to elevated levels of JSA claimants would also result in selecting neighbourhoods that would be pronounced by comparatively high levels of emergency hospital admissions and, more than likely, comparatively low educational outcomes. Consequently, for the purpose of this analysis, the neighbourhood-level JSA claimant rates are considered to be robust predictors of multiple deprivation on a neighbourhood level. This assumption was verified in the course of an initial correlational analysis concerned with the data derived from the benefits uptake systems and corresponding to neighbourhood-level measures reflecting pension credits, Income Support, Incapacity Benefit and Employment Support Allowance.

It was observed that the correlations among the indicators reflecting the benefits related to the economy are particularly strongly pronounced for the acknowledged cross-

domain deprivation relationships, such as the neighbourhood-level relationship between poor health outcomes and elevated socioeconomic benefits claimant rates. The findings provided are consistent with a wide body of research concerned with neighbourhood-level relationships across various aspects of deprivation, ranging from levels of benefits uptake to levels of educational attainment.

For instance, for the data from Q4 2012, the Jobseeker's Allowance correlates on an average level of .6 or higher with a range of indicators representing neighbourhood-level indicators of socioeconomic deprivation. As such, neighbourhood-level Jobseeker's Allowance claimant rates would correlate with Employment Support Allowance at .8, with the Incapacity Benefit at .7 and with Income Support at .8 for the 2012Q4 iteration. The findings are broadly consistent with a wider body of research emphasising the existence of spatial autocorrelation across the various benefits levels.

In summary, the exploratory analysis undertaken on the relationship between neighbourhood-level JSA claimant rates and other available deprivation measures confirmed that:

- a) Elevated neighbourhood-level JSA claimant rates are present across neighbourhoods that are also frequently marked by elevated levels of deprivation available across other domains
- b) On a neighbourhood level, the presence of elevated JSA rates correlates most strongly with high deprivation measured on income-related indicators
- c) Exploration of the spatial distribution of JSA rates indicates a higher concentration of elevated JSA claimant rates across urban geographies

4.2 Temporal Consistency

The temporal consistency analysis focuses on identifying the data zones that were persistently marked by persistently high rates of JSA claimants. Following the summarised exploratory analysis dedicated to providing a more in-depth understanding of neighbourhood-level deprivation in Scotland, the temporal consistency focuses on identifying localities persistently affected by elevated JSA claimant rates. From the available neighbourhood-level deprivation and socioeconomic indicators, only JSA claimant rates were available for the required period across sufficient intervals. Following previous analysis on neighbourhood-level interdependencies across deprivation measures, the presence of elevated JSA rates can be considered a sufficient measure to reflect neighbourhood-level poverty.

The measurement of temporal consistency was operationalised as a frequency of instances during which a given neighbourhood would experience more than 5% of its total population receiving JSA in a given quarter. In the course of the period analysed, a JSA claimant rate of more than 5% was observed at some point across 21% data zones. Excluding missing data, for 3,972 data zones, the average JSA claimant rate observed across the analysed period did not exceed 5% for more than 10% of the available time-series data. Elevated levels of JSA dependency, exceeding 5% of the claimant rate per total data zone population, occurring for more than 90% of available time series, were noted across 513 data zones. The distribution of the remaining counts for thresholds for all data zones across Scotland is summarised in Table 4-1.

Table 4-1 — Frequency of High JSA Rates

<i>Quarterly* Frequency of High JSA Rates</i>	<i>Count</i>
<i>0 – 10%</i>	<i>3,972</i>
<i>11% – 20%</i>	<i>339</i>
<i>21% – 30%</i>	<i>294</i>
<i>31% – 40%</i>	<i>289</i>
<i>41% – 50%</i>	<i>273</i>
<i>51% – 60%</i>	<i>244</i>
<i>61% – 70%</i>	<i>201</i>
<i>71% – 80%</i>	<i>196</i>
<i>81% – 90%</i>	<i>184</i>
<i>91% – 100%</i>	<i>513</i>

** Excluding missing time series*

The purpose of this analytical section was to evaluate what proportion of the geographies was frequently pronounced by a Jobseeker's Allowance rate higher than 5% across the available quarterly time series. The choice of the 5% threshold as an indication of an elevated claimant rate is made on the grounds of the distribution analysis of Jobseeker's Allowance claimant rates observed across Scottish data zones and neighbourhood-level correlation with other deprivation measures, as discussed in the previous section.

The distribution analysis conducted across quarterly rates of JSA claimants indicates that for the data-zone level JSA claimant rate for all of the data periods represented in the dataset, it appears that across 14 quarters the neighbourhood-level rates of JSA claimants would be within the range of 2.5%–3% and on ten occasions the range would be between 3% and 3.5%. Considering this distribution, the choice to utilise the 5% cut-off point as a demarcation criterion for the high JSA claimant rate resulted in the selection of geographies in the upper quantile for the majority of the available time-series data. This selected criterion was subsequently used to operationalise the second research objective of the analysis.

Considering that the average population size of a data zone is 650 residents, a 5% JSA claimant rate would amount to approximately 32 residents receiving JSA in a given quarter.

The choice of the 5% claimants rate as a cut-off point is further supported by analysis of data zone deprivation characteristics measured across the remaining indicators available in the data. For instance, with respect to the 2012 iteration of the SIMD, all of the 3,934 data zones that did not experience JSA dependency rates higher than 5% across the four quarters in 2012 were not classified as being among the 5% most deprived geographies. Conversely, from 2,571 geographies that experienced JSA rates greater than 5% during 2012, 1,834 were in the most deprived 30% of SIMD data zones, with 325 also being in the most deprived 5%. Summary findings for the remaining SIMD iterations are provided in Table 4-2.

Table 4-2 — SIMD score across data zones experiencing over 5% JSA rate

Year	Over 5% JSA rate observed	Count	SIMD rank					
			1 - 325	1 - 651	1 - 976	1 - 1301	1 - 1626	1 - 1952
2004	No	4,346	42	113	208	346	517	720
	Yes	964	213	411	577	706	794	849
2006	No	5,064	9	44	145	282	450	678
	Yes	1,441	316	607	831	1,019	1,176	1,274
2009	No	4,027	1	2	18	43	90	180
	Yes	2,478	324	649	958	1,258	1,536	1,772
2012	No	3,934	0	1	5	21	51	118
	Yes	2,571	325	650	971	1,280	1,575	1,834

* Excluding missing time series

The assertion on the consistency of the elevated rates of JSA claimant rates was verified by measuring the quarterly frequency of elevated claimant rates. The choice of the cut-off reflects the propensity of data zones marked by over 5% JSA claimant rates to be also marked by significantly worse outcomes with respect to the number of domains reflected across the SIMD data. Data zones where high JSA rates were identified are also frequently characterised by other types of deprivation, as indicated by the SIMD scores. For instance, during 2006, a JSA claimant rate greater than 5% was observed across 1,441 data zones. From that amount, 21% (316) of data zones also had low-ranked SIMD scores, from 1 to 325. The results of the analysis answer the initial research question and demonstrate that from across the available panel data, 518 data zones experienced JSA claimant rates greater than 5% for at least 90% of the available quarterly data. In a non-missing data scenario, a neighbourhood in that subgroup would experience over a decade of elevated JSA claimant rates, indicating high consistency in elevated levels of JSA claimants.

4.3 Spatial Consistency

The analysis concerned with evaluating the spatial consistency across the Scottish neighbourhoods for which elevated levels of JSA claimant rates were already identified extends the previously obtained findings on temporal consistency in elevated JSA levels and correlations with other neighbourhood-level measures of deprivation. The key purpose of the preceding analysis was to identify the existence of neighbourhoods for which elevated levels of JSA claimant rates exist across the observed time periods. The purpose of this follow-up analysis is to evaluate whether the neighbourhoods where frequent elevated JSA claimant

rates were observed were in the vicinity of each other and whether it is possible to identify clusters where elevated JSA claimant rates could be observed.

This goal was achieved through evaluating the degree of spatial autocorrelation across neighbourhoods marked by persistent claimant rates greater than 5%. Measures evaluating the strength of spatial autocorrelation, such as Moran's I or Geary's C enable us to assert whether the observed phenomena are spatially consistent (Geary, 1954; Moran, 1950). The analysis of spatial association focused on global and local indicators of spatial association (LISA). The spatial autocorrelation was measured by calculating the Moran's I coefficient. The Moran's I statistic indicates whether a positive or negative spatial autocorrelation exists across the full data set. The localised methodology of assessing spatial association focuses on whether the spatial autocorrelations is observable across a single geography in relation to the surrounding geographies. Consequently, local indicators of spatial association are frequently used to identify clusters of continuous regions produced by a selected set of characteristics (Porter and Howell, 2012). In practice, LISA indicators facilitate decomposition of global indicators of spatial association and provide data on how much each indicator contributes to the global value (Anselin, 1995).

An application of this approach to the existing data indicated a strong spatial autocorrelation across Scottish neighbourhoods concerning the existence of elevated JSA rates. The completed analysis was concerned with evaluating the spatial autocorrelation cross-frequency of the high JSA claimant rates. In particular, neighbourhood clusters persistently characterised by the presence of geographies with elevated JSA claimant rates were identified across urban, densely populated, regions within the Central Belt of Scotland. This specific phenomenon can be explained by characteristics distinctive to inner-city geographies. The relatively high population density and the more uniform characteristics of the local communities associated with it make it more likely that a particular set of attributes will be shared across neighbouring geographies.

Analysis of global spatial association demonstrated the existence of a statistically significant spatial autocorrelation across elevated levels of JSA claimants. Analysis of a localised Moran's I coefficient indicated the existence of groupings with high rates of JSA claimants across the Central Belt of Scotland, as well as densely populated neighbourhoods. Further examination of the identified clusters focusing on high-high and low-low units indicates the presence of high-high clusters across the Central Belt in the vicinity of densely populated geographies. The findings are consistent with the wider body of research indicating that high rates of benefits claimants are more frequently observed across urban geographies.

In summary, the conclusions that can be derived from the analysis undertaken so far indicate that it is possible to identify neighbourhoods for which persistently elevated levels of JSA claimants would be observable. Furthermore, the occurrence does not appear to be limited to an insignificant number of isolated patterns of spatial autocorrelation. In particular, urban geographies located within the Central Belt of Scotland were characterised by a higher rate of neighbourhoods marked by elevated JSA rates than less densely populated geographies located outside the Central Belt.

4.4 Impact of Exogenous Macroeconomic Factors

The analysis of the impact exerted by exogenous macroeconomic factors on neighbourhood-level JSA claimant rates answers the last part of the leading research question. The analysis combines publicly available business performance and macroeconomic data with neighbourhood-level JSA claimant rates in an endeavour to assess the significance of the 2008 macroeconomic recession. Specifically, the goal of this analysis was to provide an insight into the magnitude of the impact of the 2008 financial crisis on JSA claimant rates across Scottish neighbourhoods. The analysis answered whether statistically significant increases in neighbourhood-level JSA claimant rates were observable following the 2008 macroeconomic downturn. The spatial variability in the observed neighbourhood-level increase in JSA claimant rates was also evaluated.

The impact of the 2008 macroeconomic events was assessed independently in the course of a change-point analysis and linear model fitting. The statistical significance of the observed changes was assessed in the course of the change-point analysis, which utilised a bootstrapped sample exploring whether it would be possible for a similar change to occur accidentally. Similar to other research utilising bootstrapped methodologies, the analysis undertaken here is pronounced by a significant computational overhead and, as such, the sampling approach had to be applied to verify the conclusion.

The change-point analysis demonstrated that an increase in the average rate of JSA claimants across neighbourhoods was unlikely to occur by chance and was higher across localities that were characterised by elevated levels of JSA claimants following the 2008 recession. Corresponding conclusions were derived from analysing the impact of the 2008 financial crisis on neighbourhoods that were identified as the most deprived according to the 2004 iteration of SIMD. The change in the average neighbourhood levels of JSA claimants for data zones classified as being within the most deprived decile of the 2004 SIMD iteration was

exceeded by three percentage points, which is significantly higher than the change observed during the same period for the remaining neighbourhoods.

The spatial variability in patterns of neighbourhood-level JSA claimant rates was explored separately in an approach utilising a suite of linear regression models. The method allowing for measuring the impact was concerned with fitting the regression model and assessing the impact of macroeconomic changes by the degree to which the model explained the observed local variation. Consistent with the previous findings, the model performed better for urban geographies, demonstrating a better model fit when compared to the remaining geographies across Scotland. The analysis demonstrated that the impact exerted by the incorporated exogenous factors varies spatially, with the urban neighbourhoods experiencing the greatest increase in rates of JSA claimants following the 2008 macroeconomic events.

The findings obtained in the course of the change-point analysis were additionally verified in the analysis concerned with the exploration of the impact of specific macroeconomic indicators on neighbourhood levels of benefits uptake. The analysis utilised a common suite of financial indicators that are widely used in business. The results demonstrated that the impact exerted by the analysed suite of macroeconomic indicators is variable across the available data. In particular, the completed analysis shows that the variability of impact is observable across the spatial distribution of changes in the JSA rates but also within the suite of indicators provided. The conclusions that can be derived from the observed neighbourhood-level variability indicate that the impact exerted by a significant change in business performance is not equally distributed across Scottish neighbourhoods. For instance, it became apparent that the intentional adverse macroeconomic change is more pronounced across neighbourhoods that were previously characterised as most deprived.

Chapter 5 – Conclusions

Summary:

This chapter contextualises the findings obtained in wider body of research related to neighbourhood-level deprivation. This chapter further explicates the core results in the light of their potential to improve decision-making and performance management across local authorities. Focus is also directed towards the potential shortcomings of the existing decision-making mechanisms across Scottish local authorities and analytical benefits that could be derived from incorporating macroeconomic and neighbourhood-level data. Finally, the chapter also provides a brief discussion of the encountered limitations and directions for future research.

5.1 Findings in the Context of Existing Research

The key objectives of this research were concerned with assessing suitability of the available small area data to identifying particularly vulnerable neighbourhoods informing resource allocation models. This objective was realised through providing deeper understanding of neighbourhood-level vulnerability to macroeconomic shocks and spatio-temporal consistency in Jobseeker's Allowance claimant rates. From perspective of potential practical applicability of the findings, the key deliverable of this research was concerned with identifying neighbourhoods that would benefit from more attuned service-delivery mechanisms due to higher vulnerability to adverse macroeconomic events and persistently high deprivation.

Stage I of the research was concerned with assessing whether the currently available small-area data is of sufficient quality to provide the information relevant to developing alternative service-delivery and resource-allocation models that would be applicable to local governance. Stage II focused on evaluating whether the impact of the exogenous factors renders the distribution of small area outcomes unusable from the perspective of providing information that would be conducive to local inequality reduction strategies.

In answer to the problem posed in Stage I of the research, the findings demonstrated that elevated Jobseeker's Allowance rates are indicative of wider neighbourhood-level deprivation and are consistent with the wider international research findings on spatial interdependencies across life outcome indicators. The existing literature demonstrates the existence of strong relationships among facets of deprivation, such as the prevalence of negative health outcomes and/or below par educational outcomes across neighbourhoods experiencing economic hardships.

Considering that one of the main functions of local authorities is to reduce inequalities, the focus on regional disparities is justifiable in the context of the development of more efficient resource-allocation mechanisms. The practical applicability of this work is concerned with wider policy goals of reducing inequality. Elhorst (2003, p. 710) notes 'reducing these disparities produces substantial social benefits. It lessens the adverse effects related to geographical concentrations of high unemployment and counteracts the downward spiral effect of economically depressed regions experiencing increasing difficulty keeping pace with economically thriving regions.'

The challenges pertaining to the utilisation of neighbourhood-level data in generating actionable insights that would be applicable to local decision-making in Scotland are

concerned with three main elements: availability of quality data, availability of suitable modelling techniques and willingness to ground decision-making in forecasts instead of descriptive analysis of historical trends. The technical challenges associated with data availability are mostly related to data granularity that lends itself to the identification of the actual communities that could benefit from more attuned service delivery and forecasting of future trends. The analysis demonstrated that those challenges are applicable to the utilised data.

Implementing probabilistic methodologies in local decision-making has implications pertaining to the operationalisation of vulnerability. Consequently, one of the challenges tackled in this analysis was concerned with defining vulnerability so it can be measured with the existing data. The concept of vulnerability remains vague and is frequently defined in a context-dependent manner (Schroeder and Gefenas, 2009). Most of the existing definitions of vulnerability account for two components: the presence of external risk and innate (individual or group) ability to mitigate those risks. Schroeder and Gefenas (2009, p. 117) propose: '[t]o be vulnerable means to face a significant probability of incurring an identifiable harm while substantially lacking ability and/or means to protect oneself'.

Stage II of the research operationalised the problem with use of a directional hypothesis assuming variability in vulnerability to macroeconomic events. In particular, the research assumed that persistently poor geographies are impacted by exogenous factors to a greater extent than geographies not marked by persistently high levels of JSA claimants. On a microeconomic level, vulnerability to adverse macroeconomic events manifests itself in different forms, like potential deterioration of health outcomes, inability to acquire necessary food products or a combination of these and other adverse outcomes (Dutta et al., 2011). On a national level, vulnerability is usually conceptualised as the inability of a country to absorb and recover after macroeconomic shocks. The micro-theoretic approach to measuring poverty is rooted in the assumption that individual poverty is reflected on a national level.

Contrary to the measures of deprivation and life outcomes, any measure of vulnerability is, in effect, a forecast. Depending on the definition utilised, individual or household vulnerability may be concerned with the ability to recover or the likelihood of worsening of a specific set of life outcomes in the light of an adverse event. The increase in vulnerability is a function of two vectors: an increase in the probability of adverse outcomes or an increase in exposure to risk (Calvo and Dercon, 2013; Rothschild and Stiglitz, 1970).

The importance of measuring vulnerability as a dimension of deprivation is widely recognised and references to it can be found in World Bank recommendations on poverty

reduction. As noted by the World Bank, ‘protecting vulnerable groups during episodes of macroeconomic contractions is vital to poverty reduction in developing countries’ (Culhane, 1997, p. 1). The concept of vulnerability is a complex one; however, most of economic literature argue that a household’s sense of ‘well-being depends not just on its average income or expenditures, but on the risk it faces’ (Ligon and Schechter, 2003, p. 95).

A utilitarian approach to measuring vulnerability on a household level proposed by Ligon and Schechter (2003) defines vulnerability as the likelihood of a decrease in household consumption below a given level. In this context, the vulnerability can be defined as an *ex-ante* poverty line that would be crossed in the course of adverse macroeconomic events. In practice, the individual or household-level vulnerability reflects an anticipated and conditional drop in consumption taking place in line with the occurrence of adverse macroeconomic events. The micro-theoretic approach to measuring vulnerability assumes calculating individual vulnerability and then aggregating it up to obtain a measure on a national level.

The employed analysis dealt with this challenge by operationalising neighbourhood-level vulnerability as a change in Jobseeker’s Allowance claimant rates. Exploratory analysis indicates that elevated Jobseeker’s Allowance claimant rates make the elevated rates indicative of other multiple deprivations observable on a neighbourhood level.

Another challenge pertaining to utilisation of small-area data is concerned with employing the small-area estimates in delivering predictive capacity in decision-making. This poses challenges on two accounts: one is concerned with the potential to derive predictive capacity that can be obtained from the neighbourhood-level data, and the other is to do with the technical qualities of the data required for deriving predictive analytical delivery demonstrating the capacity of the existing data in delivering viable neighbourhood-level predictive insight. These points merit further consideration from the perspective of the usability of the findings in decision-making processes across Scottish councils.

The applicability of predictive insight to local decision-making processes is challenged by three distinct factors that pertain to the quality and availability of the relevant data, the complexity of the nature of the analysis and the usability of the findings in the decision-making process. The thesis dealt with the first two aspects, demonstrating that it is possible to derive potentially actionable and relevant insights through identification of neighbourhoods that are characterised by a greater likelihood of being impacted by adverse macroeconomic events and are also likely to be impacted by other aspects of deprivation.

As indicated in earlier sections of this thesis, the existing decision-making processes are frequently infructuous due to several challenges. First, a focus on the most recent historical

data and a lack of focus on historical spatio-temporal data provide only a narrow definition of deprived communities. Communities that are characterised as most deprived according to the most recent iteration of the utilised deprivation data may not be the same as those that have experienced high levels of deprivation consistently across the remaining years. A more refined approach to identifying deprived localities could reduce the existing bias associated with over-reliance on the most recent historical data.

In response to the goal of deriving potentially actionable insights, this thesis argued for broadening the traditional approach to neighbourhood-level deprivation and incorporating vulnerability. As shown, vulnerability is not only concerned with immediate, measurable life outcomes but, predominantly, with the potential of a given community to respond effectively to an adverse event. The current reactive approach to identifying deprived communities does not place sufficient emphasis on the notion of vulnerability forcing a reactive approach to policy intervention. Introducing the concept of vulnerability to policy planning would allow for the identification of communities before the deterioration of life outcomes.

Incorporating macroeconomic vulnerability as an element of deprivation in addition to expanding the understanding of deprivation widens the scope of potential policy activity. Outlining that potential is key to the practical value of the leading research questions. As previously discussed, a separate challenge pertaining to the utilisation of the forecasting and modelling outputs in informing local governance resource-allocation mechanisms arises from a wider criticism related to incorporating algorithmic and forecast-based outcomes in decision-making. In a study concerned with the utilisation of algorithms in public sector decision-making within the UK, Oswald (2018) points to procedural fairness as one of the key challenges obstructing the implementation of automated decision-making systems.

Oswald (2018, p. 4) defines procedural fairness as ‘the control and knowledge of the procedure by which public bodies take action or make decisions’. In practice, this implies a certain degree of intelligibility of the implemented solution. Comprehensibility of the utilised solution poses requirements with respect to the complexity of the model and transparency. Arguably, solutions that are overly complex from a mathematical and statistical perspective are not procedurally fair because they are unintelligible to the public. The undertaken research tackled this potential hindrance by utilising publicly available small-area and macroeconomic data.

Transparency in the decision-making process is another element that is important in considering the role of forecasting methodologies in decision-making. Tools like COMPAS,¹ which is used to estimate recidivism scores of suspects across the US, have been criticised for the opaqueness of the forecasting methodology used and a lack of transparency concerning the proprietary nature of the algorithms utilised (Dressel and Farid, 2018; Oswald, 2018). Furthermore, in a critical analysis concerned with the effectiveness of the solution, Dressel and Farid (Dressel and Farid, 2018, p. 1) point out that ‘COMPAS is no more accurate or fair than predictions made by people with little or no criminal justice expertise’.

A similar solution implemented in the UK was met with a much more favourable reception due to the greater transparency of the implementation. Durham Constabulary, which looked into the implementation of the Harm Assessment Risk Tool (HART), has been open about the tool’s random forest modelling approach, data utilised and validation exercises (Oswald, 2018). Durham Constabulary opened the solution to public scrutiny and the move attracted substantial attention and was generally seen in a positive light (Oswald et al., 2018). The introduction of automation to predictive policing is of a specific nature; however, the wider principles of transparency and accountability involved are applicable outside this context. In considering the introduction of predictive and forecasting components to local decision-making, transparency and openness are key to assuring public support for the solution implemented.

A further challenge associated with incorporating neighbourhood-level measures of vulnerability in decision-making pertains to incorporating vulnerability assessment in profiling local communities as doing that requires incorporating a view of the future. As demonstrated, communities across Scotland are not uniformly affected by the macroeconomic change. In particular, urban neighbourhoods were more vulnerable than more sparsely populated localities. As shown through change-point analysis, the increase in the JSA claimant rates was significantly higher after the financial crisis. In reply to the problem formulated in Stage II of the research, this thesis argues that the identified neighbourhoods were particularly vulnerable to macroeconomic shocks but likely would not have been impacted if the adverse macroeconomic events had not occurred.

The relevant academic literature recognises that neighbourhood-level life outcome indicators are often correlated (Steptoe and Feldman, 2001). A meta-analysis conducted by Pickett and Pearl (2001) concerned with the role of socioeconomic outcomes on health

¹ Correctional Offender Management Profiling for Alternative Sanctions – a recidivism prediction tool used by some American police force units.

demonstrated the existence of a moderate neighbourhood effect on health across a variety of studies using different methodological approaches. The researchers reported that from across 25 studies analysed, 23 reported statistically significant associations between at least one measure of socioeconomic status and health (Pickett and Pearl, 2001). The findings obtained in this analysis are consistent with conclusions offered by research concerned with neighbourhood-level deprivation in Scotland, and, in a wider context, neighbourhood-level deprivation internationally.

This research established that the observed elevated levels of Jobseeker's Allowance claimants are frequently symptomatic of wider deprivation. In addition to subpar health outcomes, the literature concerned with identifying potential correlates of neighbourhood deprivation points to the existence of other adverse outcomes, such as the prevalence of alcohol consumption or increased rates of behavioural problems observed across children in the population (Kalff et al., 2001; Matheson et al., 2012). The frequently voiced explanation of the interdependencies observed revolves around analytical efforts emphasising the importance of socioeconomic variables in relation to other aspects of life outcomes such as health deprivation and levels of educational attainment. Those assertions find confirmation in the undertaken analysis that indicated greater prevalence of adverse life outcomes across neighbourhoods with high Jobseeker's Allowance claimant rate.

The variability across neighbourhood-level deprivation is frequently interpreted in the context of the role played by local property markets, the reasoning being that local property characteristics are frequently considered as viable indicators of local life outcome and deprivation patterns. This assertion finds further support in broader research concerned with the dynamics of local household income and house prices. The research on the quality of social housing indicates that the overall characteristics of social housing are considered inferior compared to housing in the public stock (Hastings, 2004). Hastings (2004) further notes that the challenging perception of social housing and other deprived estates is often a function of a multitude of factors, such as the portrayal of specific estates across local media or the approach of estate/insurance agents. Irrespective of the source, the outcome is reflected in lowering the desirability and marketability of specific estates (Dean and Hastings, 2000; Hastings, 2004).

Other environmental factors are also considered to play a role in multiple deprivation. For example, in an analysis of the spatial distribution of outlets selling tobacco, alcohol and fast food in Germany, Schneider and Gruber (2013) indicated that deprived neighbourhoods are often characterised by a greater density of alcohol- and tobacco-selling outlets. The

authors present a further plausible hypothesis on the relationship between the nature of the local commercial environment and the influence it exerts on the lifestyle choices of residents.

Commensurate conclusions about the impact of the local commercial environment on health were derived from research conducted across the UK by Cummins et al. (2005). Cummins et al. (2005) report the existence of a statistically significant relationship between the density of McDonald's restaurants in Scotland and England and neighbourhood deprivation. The study utilised neighbourhood-level data on Scottish and English Indices of Multiple Deprivation and indicated that the average number of McDonald's restaurants per 1,000 residents in Scotland was 0.025 for the most deprived quintile and 0.004 for the least deprived quintile. For England, most deprived quintile had 0.030 restaurants, whereas the least deprived had 0.007.

As out-of-work benefits eligibility is governed by legal and organisational arrangements that vary across national welfare regimes rendering comparative research on the implications of elevated levels of benefits uptake across problematic. Comparing international research findings concerned with levels of benefits claimants is challenged by the diversity of the methodologies utilised and of the exploratory and comparative indicators used to quantify the potential impact. With respect to the methodology used, this thesis was concerned with evaluating historical variability in a single indicator representing neighbourhood-level variability in Jobseeker's Allowance claimant rates.

Reliance on utilising Jobseeker's Allowance as an indicator of vulnerability is mostly concerned with the idiosyncratic nature of welfare regimes. Application of the methodology in another welfare framework would require identifying neighbourhood-level data of cognate characteristics. In a study concerned with methodological difficulties pertaining to comparisons of change across welfare regimes, Clasen and Clegg (2007) indicate that change in welfare regimes often takes place as a result of a multitude of factors including changes to the government, propagation of new policy ideas on delivering welfare provisions, the establishment of new institutions and changes to the benefits policies.

In a review of the existing research concerned with local deprivation and health outcomes, Macintyre et al. (1993) observe that the majority of the existing deprivation research proposes aetiological approaches to the problem of deprivation with the focus being directed at potentially relevant aspects of the physical environment as explanatory factors of variability in disease and sickness rates. The second group of research papers analysed by Macintyre et al. (1993) incorporates uses neighbourhood as a unit of analysis emphasising the incorporation of econometric models in identifying potential correlates among life outcome

indicators. Macintyre et al. (1993) suggest that the potential for econometric research to focus on the problem of deprivation in isolation is partially caused by the availability of the specific data. This thesis extends the existing literature by providing analysis on Scottish context and by indicating the role played by macroeconomic events in local Jobseeker's Allowance claimant rates.

Wilkinson and Pickett (2007) point out to variety of methodological challenges pertaining to establishing meaningful comparison on degrees of deprivation experienced by local communities (Wilkinson and Pickett, 2007). It is possible to draw a parallel between the obtained findings and a wider discussion on the nature of international welfare regimes. Wiggan (2012) notes that the increasing political salience of unemployment resulted in more research focusing on unemployment as reason for benefits uptake. Unemployment is being recognised as a source of a wider set of challenges associated with deprivation and subpar life outcomes across impacted neighbourhoods. Recognition of this view has implications for the shape of the welfare regime and nature of the mechanisms impacting local benefit claimant rates.

Summing up these findings can be explained on the grounds of two concurrent assumptions. The correlations observed between the levels of benefits uptake are broadly consistent with the wider body of research that focuses on the relationship between benefits and deprivation levels. Second, the existence of strong spatial dependency relationships across the neighbourhood-level benefits counts is explained on the grounds of the nature of the welfare dependency system. Eligibility for numerous benefits, including Jobseeker's Allowance, is determined through operationalisation of circumstances corresponding to the notion of economic hardship. Frequently, eligibility for one specific benefit will often correspond to eligibility for the remaining ones that utilise cognate eligibility criteria.

This emphasises the value of the findings on prevalence of elevated Jobseeker's Allowance claimant rates across localities characterised by other deprivation. Through an analysis of relationships indicating increased levels of engagement with the benefits system across specific geographies, the research demonstrated that deprivation facets are not only strongly correlated but occur as a function of a complex dynamic observed across those neighbourhoods. The results obtained support the view that high levels of multiple deprivation observed across neighbourhoods cannot be explained on the grounds of isolated characteristics, such as poor quality of the physical environment, but are a function of complex interactions between system elements.

Consistency of the observed outcomes is important from the perspective of information being usable in the context of informing local resource allocation models. Lack of spatio-temporal consistency across the observed outcomes would pose challenges from the perspective of long-term planning in resource allocation models. In a historical analysis concerned with consistency in deprivation on a postcode level across Scotland in the 1981 and 1991 census data, McLoone and Boddy (1994) observed that the small-area spatial variability in the levels of deprivation did not change when evaluated using the two available iterations of the census data. The researchers utilised a Carstairs score to define the variability in the extent of material deprivation (McLoone and Boddy, 1994). The Carstairs score, which was initially developed by Morris and Carstairs (1991), focuses on capturing material deprivation by utilising Census data on class, overcrowding, employment and car ownership (Brown et al., 2014). The Carstairs score reflects relative levels of material deprivation and is usually constructed on a postcode level.

In particular, the approach focuses on access to a car, overcrowded households, households with unemployed men and households where the head of the household was of IV or V social class¹ (McLoone and Boddy, 1994; Morris and Carstairs, 1991). Furthermore, the analysis noted that the postcodes that were identified as deprived in 1981 were substantially more deprived when analysed using the 1991 data (McLoone and Boddy, 1994). It is also worth indicating that, in addition to the increasing levels of deprivation, the research points to an increase in mortality rates that is mostly associated with the increase in suicide rates. The authors also indicate that the elevated levels of deprivation observed are positively correlated with elevated levels of deprivation observed across other life domains such as health.

In line with the factors considered as explaining the growth in benefits uptake in the US, McVicar (2008) hypothesises that the growth in the rates of disability benefits claimants in the UK is partially explained by the changes observed across the labour market, with reduced demand for low-skilled labour being the key reason for the increase in the claimant rate. Following earlier work by Blundell and Johnson (1998), McVicar (2008) postulated that the nature of the benefits uptake system in the UK creates incentives for elderly people to use disability benefits as a mechanism to acquire bridge funding prior to retirement.

This thesis provided extension of those findings by focusing on the Scottish data and consistency in elevated rates of Jobseeker's Allowance claimants. The analysis concerned

¹ The reference utilised reflects Registrar's General Social class, which corresponds to partly-skilled occupations for class IV and unskilled occupations for class V (CeLSIUS, 2012).

with the frequency of elevated levels of benefits uptake indicated that it is feasible to identify neighbourhoods for which levels of benefits uptake remained consistently high across the period analysed. In addition, it is also observable that, for a selected number of neighbourhoods, the benefits uptake levels remained consistently below the national average. The demonstrated consistency is reassuring, as the identified phenomena and dependencies are not ephemeral and therefore are suitable to inform more long-term planning exercises.

With respect to the role played by labour market institutions and policy actors, the broad focus of the existing analyses names taxation, unemployment benefits, trade union bargaining, the anti-competition labour market and active labour market policies as key institutional factors (Bassanini and Romain, 2006). The findings in this research contributed to the existing literature by demonstrating the existence of variability in dependence on macroeconomic events across Scottish neighbourhoods. The evidence on the effectiveness of schemes supporting the reduction of unemployment across deprived geographies is mixed, both in the UK and internationally.

The broad consensus, which emerges from the existing research concerned with sub-national variability in unemployment trends, is that local unemployment patterns are closely correlated with other local deprivation trends (Conley and Topa, 2002). This thesis has expanded on the existing literature by demonstrating that persistently high levels of deprivation can be frequently found across communities that are characterised by disproportionately high out of work benefit claimant rates. The existing economic research literature offers several established hypotheses explaining the role of institutional actors in changing regional and national unemployment levels. For instance, the a number of research papers indicates that high taxation and associated high labour costs are not conducive to reducing unemployment (Belot and Ours, 2004).

In addition to focusing on spatio-temporal consistency in benefit dependency, the thesis expanded on the existing understanding of neighbourhood-level variability in Jobseeker's Allowance claimant rates. The findings on regional variability in unemployment levels observed in this research are consistent with a wider body of research. In a meta-analysis concerned with evaluating 41 research projects, Elhorst (2003) concludes that regional variability in unemployment observed across industrialised countries is frequently as significant as international differences in unemployment. Elhorst (2003) states that the existing macroeconomic literature does not provide a comprehensive explanation for why these differences can be found.

The assertion that consistently high levels of deprivation can be observed across small areas is supported by the relevant international research. For instance, an analysis of benefits uptake on interstate levels conducted by Vedder and Gallaway (1996) in the US demonstrated that the interstate variations in unemployment rates tend to be less significant in a short timeframe when compared to a longer timeframe, likely reflecting cyclical unemployment. The sub-national unemployment rates measured on the local level are frequently characterised by different trends when compared to the national unemployment levels. In particular, the persistence of neighbourhood unemployment levels is often explained on the grounds of the neighbourhood effect and the role played by the social make-up of the communities as well as local labour market characteristics. In an analysis of the generic spatial characteristics across unemployment trends in the OECD countries, Gordon (2003) notes that across the UK it is possible to observe a high spatial concentration of elevated unemployment rates since the 1980s. Gordon (2003) further observes that, in addition to spatio-temporal consistency, significant variability in unemployment levels between regions can also be observed.

The local patterns observed across Jobseeker's Allowance claimant rates are explained by a wider body of international research devoted to the characteristics of unemployment trends. Research concerned with the analysis of neighbourhood effects on unemployment across Belgian youths residing in Brussels conducted by Dujardin et al. (2008) suggests that a specific set of neighbourhood characteristics, such as employment density or proximity to areas with high employment density is conducive to predicting youth unemployment rates across those neighbourhoods.

Similar conclusions are also applicable to the Scottish context. Pacione (1989) observed that the quality of life across urban regions of Scotland was lower than that in less densely populated geographies. In addition, the existing research often points to the variable characteristics of local labour markets as a reason underpinning related variability across life outcomes. Worklessness and unemployment are frequently considered determinants of regional socioeconomic well-being (Elhorst, 2003). Consequently, factors influencing local employment and worklessness will have an impact on the aspects of well-being affected by elevated unemployment levels. The importance of the findings is additionally emphasised by spatial consistency in the results.

Addressing these outcomes was the focus of various area-based initiatives. Potentially, one of the most ambitious attempts aimed at reducing the elevated levels of urban deprivation was the Glasgow Eastern Area Renewal (GEAR) project, which was managed by the Scottish Development Agency and involved eight local authorities (Pacione, 1989). The key purpose of the GEAR project was to focus on social-economic renewal with a focus on specific

geographic areas (McDonald, 1984; Robertson, 1978). The ambition of the programme was to achieve that by addressing the following set of priorities:

1. Increasing residents' competitiveness in securing employment.
2. To arrest the economic decline and raise the potential of GEAR as a major employment centre.
3. To overcome the social disadvantages of residents.
4. To improve and maintain the environment.
5. To stem population decline and engender a better-balanced age and social structure.
6. To foster residents' commitment and confidence.

(Orton and Fraser, 1982, p. 27).

Wannop (1990) notes that the GEAR programme's aspirations were exceptionally ambitious and aimed to coordinate the utilisation of multiple resources focusing on a single area and addressing a variety of life outcomes, from the social to the economic. The GEAR programme's deliverables were reflected in the change in employability levels across areas that were of interest to the programme. However, as indicated in the literature review, the prevalence of unemployment that was observed within the central region of Glasgow and urban geographies across Scotland prior to the initiation of GEAR and later during the subsequent years after the completion of the programme, was still observable in the data used for this research.

The bulk of the existing literature concerned with the sub-national spatial variability of the unemployment rates focuses on the reasons underpinning the observed variability across unemployment rates. For instance, in an analysis of interstate unemployment rates, Vedder and Gallaway (1996) explain the observed differential in the unemployment rates on the grounds of economic factors such as variability in labour costs. Consistent with the arguments discussed across previously quoted papers, this research emphasises the additional links between deprivation and Jobseeker's Allowance claimant rates and utilises variability in claimant rates as a way of gauging the overall deprivation characteristics of Scotland.

Sridharan et al. (2007) provided initial insight into the role of space in predicting deprivation patterns across Scotland. By focusing on the prevalence of adverse health outcomes in Scotland, Sridharan et al. (2007) suggest that the observed prevalence in health deprivation is partially explainable through the overall deprivation that is reflected across the remaining multiple deprivation indicators. In a stricter sense, the work undertaken in this thesis

enriches the existing research by analysing other deprivation indicators and complementing the picture of the spatial relationship between deprivation and place in Scotland. The argument underpinning the influence of the localised labour market and economic characteristics on health outcomes is rooted in the assumption that the area impacts health levels not only by the extent of deprivation observed in the locality but also by the extent of deprivation observed across neighbouring localities (Livingston and Lee, 2014).

The conclusions derived from this research are consistent with this approach and indicate that the observed elevated levels of benefits uptake as well as consistency across life outcomes measured on a neighbourhood level occurs not only across the narrow selection of geographies but is also observable across larger areas of shared characteristics. Considering the previously observed correlations across various deprivation domains, these findings are not surprising, as they correspond to what was initially demonstrated in the course of correlational analysis on benefits uptake.

The spatial consistency found across the data analysed is expected and can be explained on the grounds of multiple factors reflecting the nature of the utilised data as well as wider characteristics associated with the analysed life outcome indicators. A more informative way of looking at the neighbourhood-level inequalities noted would focus on unemployment in relation to the wider body of research concerned with multiple deprivation, not necessarily with the unemployment levels per se. As such, the findings are more consistent with similar work concerned with the Scottish Index of Multiple Deprivation and the overall spatial characteristics of economic development. It is widely recognised that uneven spatial development is endemic to market economies and, as such, it could be observed since the early days of capitalism (Cassiers and Kesteloot, 2012).

The research concludes that elevated patterns of benefit dependency are observed across Scottish neighbourhoods in a manner consistent with the cognate international research. It was demonstrated that elevated Jobseeker's Allowance claimant rates can be identified across clusters of neighbourhoods. This knowledge was further extended with research demonstrating likely increased vulnerability of those neighbourhoods to adverse macroeconomic events. Relatively high increases in neighbourhood-level Jobseeker's Allowance claimant rates occurring after the 2008 financial crisis across mostly deprived neighbourhoods enhanced the existing understanding of deprivation.

The research demonstrates that vulnerability to macroeconomic events is disproportionately distributed across Scottish localities. High regional increases in Jobseeker's Allowance claimant rates point to likely more precarious position of certain communities. From

the perspective of informing resource allocation mechanisms, the research provides methodological foundations for incorporating vulnerability and macroeconomic data in identifying at-risk communities. The overview of the existing decision-making practices demonstrates that, in the majority of cases, local resource allocation mechanisms determine vulnerable neighbourhoods through identification of historical patterns in aggregate deprivation indices. Likely, a more attuned service delivery models could be developed with use of methodologies incorporating neighbourhood-level insight on macroeconomic vulnerability.

5.2 Suggestions for Further Research

In an analysis of renewal and decline of British neighbourhoods, Lupton (2003, p. 8) postulates that '[t]he only way to transform the fortunes of poor areas is to transform the fortunes of the poor, by redistributing economic gains and not just by creating them'. The purpose of this work is to broaden the existing understanding of the deprivation and vulnerability experienced by Scottish communities in order to demonstrate usability of small area data in informing local decision-making. This goal was achieved by providing additional insight into under-researched aspects of the impact of macroeconomic change on life outcomes of local communities, with a focus on Jobseeker's Allowance claimant rates. The work also focused on defining vulnerability to macroeconomic events as an additional dimension of deprivation. This was accomplished by analysing the variance in the neighbourhood-level variability in relation to the macroeconomic changes taking place around 2008.

Future research should recognise that the practical applicability of the findings provided is likely to be impacted by within-neighbourhood population flows. The data utilised do not convey information on within-neighbourhood population flows. Consequently, the outstanding question is concerned with examining whether the observed neighbourhood-level phenomena mostly have an impact on the same cohorts of residents or whether the changes in local population flows imply that different cohorts are impacted.

An analysis of internal migration trends within the UK indicates a decline in internal migratory flows from urban to rural areas (Lomax et al., 2014). A time-series analysis of Crude Migration Intensity¹ (CMI) showed a 7.5% decline in CMI for the UK from 2001 to 2011 (Lomax

¹ Crude Migration Intensity is an aggregate migration measure calculating migration intensity through factoring the number of people migrating between districts in relation to regional population that is at risk of migrating within fixed, usually annual, periods (Bell et al., 2015)

et al., 2014). The existing research concerned with comparative analysis of vertical population mobility shows that in the UK, population flows are less volatile than those observed, for example, in the US (Bell et al., 2015). Considering that internal migration rates for the UK population are usually estimated within 2–7%, this does not justify the hypothesis that the make-up of the population of a neighbourhood changes significantly within a short period of time.

However, it is not justifiable to assume that the population of a neighbourhood remains entirely unaltered by demographic flows. It would be correct to assume that some inflow and outflow of residents occurs, but that flow is only concerned with fraction of residential population. The impact of the within-neighbourhood population flow merits further research, as it would demonstrate to what extent the research reflects the nature of the actual communities. Evidence from the 1991 and 2001 census indicates that the internal propensity for migration is higher across regions with greater non-white shares of the population (Stillwell et al., 2008). The internal migration rates for residents of Chinese ethnicity was estimated to be 14%, whereas, for white residents, it was only 10% (Stillwell et al., 2008).

Further research concerned with understanding the impact exerted by population flows on the validity of the findings should be undertaken in order to answer the question of how focusing on the vulnerability of local communities could be impacted by the changing internal structure of those communities. The internal migration flows should be researched from the perspective of understanding their relationship with the demonstrated characteristics of the neighbourhoods analysed.

The challenge of internal migration should be researched not only from the perspective of the potential impact on the effectiveness of the targeting exercises but also from the perspective of outcomes. Evidence obtained in Canada by Day and Winter (2006) shows that internal migration may be caused by significant policy changes. Day and Winter (2006) observe that extraordinary political events impacting local labour markets have a particularly strong potential to induce internal migratory flow. As such, further research on internal migration flows should consider internal migration as a factor potentially impacting the effectiveness of localised programmes, but also as an outcome of introducing variability in local policies.

Second element that merits further in-depth research is concerned with persistently high Jobseeker's Allowance claimant levels. The existence of a historical consistency across unemployment rates is supported by a wider body of research. A substantial number of the existing macroeconomic studies ascribe changes to unemployment rates as a function of the

relationship between demand and supply. For instance, in an analysis of cyclical unemployment trends, Juhn et al. (1991), argue that the long-term increase in non-work rates across young males since 1967 is a function of the changing nature of the labour market and the decreasing demand for low-skilled jobs.

The findings of additional analysis concerned with identifying clusters of deprived geographies are further supported by a growing body of research on increasing social polarisation across developed countries and major cities (Hamnett, 1996). This argument assumes that society bifurcates into two strata in an expanding higher, highly skilled cohort and an expanding less skilled cohort (Hamnett, 1996). The thesis, which is widely supported in labour market research, assumes that the expansion happens at the expense of the declining middle class. Recent economic research argues that it is possible to observe polarisation across the job market, with an increasing amount of jobs available to skilled professionals and a fairly steady pool of jobs available to unskilled work sets; however, the pool of jobs available to semi-skilled workers is decreasing.

Other research strands that merit further investigation are concerned with deepening the understanding of spatial variability in employment characteristics. This thesis demonstrated the existence of spatial variability in response to adverse macroeconomic events. Further research offering evidence on why certain localities respond badly to macroeconomic shocks would be informative in the context of devising pre-emptive strategies aimed to alleviate the problem. It is plausible that the observed relationships would be explainable on the grounds of spatial variability in the prevalence of precarious employment and other labour market characteristics. A deeper understanding of this dependency could be exploited by local authorities willing to address this challenge.

Wider economic research argues that technological change in society, as well as wider economic trends taking place across international labour markets, are responsible for the increasing polarisation. The key argument is that a certain number of jobs are inadvertently lost due to the increasing automation of production processes. This subject is widely described in the economic literature, and an in-depth discussion of it is beyond the scope of this study. The other important factor relates to the impact of globalisation and the transfer of jobs to countries with cheaper labour costs.

The key assumption reflects the notion that a great deal of the employment present across urban geographies is concerned with low-skilled jobs. The usual contractual nature of those positions makes them more vulnerable to the adverse impact of macroeconomic change. The following line of reasoning would be consistent with the reverse argument,

suggesting that high-skilled jobs are protected from the adverse impact of market change to a greater extent and are consequently less susceptible to the consequences of adverse macroeconomic change. It can be hypothesised with a reasonable degree of certainty that the observed patterns in JSA claimant rates are, to a degree, related to the changing employment characteristics. The further questions that could be explored are concerned with understanding the role of these grand economic narratives in shaping the resilience of local labour markets across Scotland and internationally.

The greater than average vulnerability of distinct socioeconomic groups to adverse macroeconomic change is a well-recognised fact, supported by a wide body of academic and policy research. Due to the availability of the relevant data, the majority of the existing research on spatial variability in vulnerability to macroeconomic shocks focuses on national data (Dewachter et al., 2012). The spatial variation in macroeconomic vulnerability is mostly researched in the context of gaining a better understanding of the local labour market. Due to the associated higher transaction costs of producing neighbourhood-level data, research focusing on the neighbourhood-level impact of macroeconomic change is produced less often.

The research undertaken by Dewachter et al. (2012) incorporated a spatial model in order to assess the dynamics of the output gap and short-term interest rates across 11 European countries over the period 1998–2008 indicated the existence of a strong spatial dependence across inflation, interest rate and the output gap. The authors compare three concurrent approaches to defining proximity between the countries and utilise distance matrices reflecting common borders, the physical and economic distance between the countries (Dewachter et al., 2012).

The economic distance was defined by using trade linkages between the 11 countries for which data was available. The distance matrices constructed were subsequently utilised to explore the spatial impact of the macroeconomic shocks occurring in Germany during the period analysed. The research concludes that the neighbouring countries are affected to the highest degree and that it is possible to observe the spatial propagation of the shocks across the remaining countries over time (Dewachter et al., 2012).

Although the complexities of national economies are more intricate than those of neighbourhoods, the wider message about the spatial propagation of macroeconomic shocks is applicable to the broad principles governing this research, despite the fact that the actual research is not concerned with the econometric modelling of spatial propagation of macroeconomic effects observed on a single locality.

Relevant research on variability in macroeconomic vulnerability concerned with developing a framework for enabling assessing vulnerability internationally was undertaken by Briguglio et al. (2009). Briguglio et al. (1995) focused on analysing macroeconomic vulnerabilities experienced by nation-states in relation to their macroeconomic characteristics. Briguglio et al. (1995) identified aspects of national policies, such as the fiscal deficit or capacity to enact discretionary policies by the central bank when faced with macroeconomic shocks as factors explaining vulnerability to macroeconomic shocks.

Further challenges such as workforce skill level are widely recognised as factors contributing to the unemployment levels observed across selected countries. In an analysis attempting to estimate the natural unemployment levels across Visegrád Group¹ countries, Tuleja and Tvrdoň (2012) argue that the skill levels will be one of the key characteristics correlating with the local unemployment levels. The authors also hypothesise that the aggregate ability of the national labour market to develop new skills is conducive to reducing overall vulnerability to macroeconomic shocks (Tuleja and Tvrdoň, 2012). The broad conclusion, which could benefit from further research accounting for Scottish context, is that the skilled labour force is better placed to maintain employment at times of adverse economic circumstances and can more easily adapt to the changing conditions by requalifying and gaining new skills more rapidly when needed.

Another factor that is likely to contribute to the spatial variability in the temporal consistency of neighbourhood unemployment levels is concerned with the aspects of the horizontal mobility of the resident population. The majority of the existing research evidence supporting the variability in patterns of vertical mobility in Europe and the United States suggests that the patterns of vertical mobility across Europe are lower compared to the figures derived from research conducted across the American workforce (Siebert, 1997). The consistency in sub-national unemployment trends across Scotland has not been researched widely enough to assert whether consistency in elevated unemployment levels is explainable by patterns of vertical mobility. The existing international research evidence indicates that labour force migration is a broadly positive phenomenon conducive to increasing GDP, reducing labour market imbalances as well as delivering tax contributions (OECD, 2014).

In the manner of national macroeconomic resilience, the vulnerability of local communities to macroeconomic shocks is often analysed in the wider context of community resilience. The definition of resilience is rooted in physics and broadly corresponds to the ability

¹ The Czech Republic, Hungary, Poland, and Slovakia

to return to equilibrium after experiencing displacement (Norris et al., 2008). In a wider context, resilience is defined as an ‘ability of the system to absorb disturbance and re-organise while undergoing change so as to still retain essentially the same function, structure, identity and feedbacks’ (Folke, 2006, p. 259). When applied in relation to a community, resilience can be described as ‘the existence, development, and engagement of community resources by community members to thrive in an environment characterised by change, uncertainty, unpredictability and surprise’ (Magis, 2010, p. 402).

Relevant explanatory research concerned with the conceptualisation of community resilience was undertaken by Norris et al. (2008), who defined community resilience as a function of local resource availability, ability to transfer resources within the community as well as a wide range of other community characteristics, like the ability to engage in effective decision-making. Norris et al. (2008) point out that the notion of community resilience is applied broadly across disciplines with reference to individual resilience, or more widely in a geopolitical context, with a focus on the wider resilience of nation-states.

Norris et al. (2008) differentiate among definitions of resilience that focus on individual or community perspectives. The common themes that re-emerge across these definitions reflect references to characteristics concerned with the ability of an individual or community to regain balance after a potentially adverse event and successfully adapt to the changed circumstances.

Additional likely contributing factors affecting the Jobseeker’s Allowance claimant rates can be explained through variability in neighbourhood-level asset bases. By applying the Cobb-Douglas production function¹ to regional data available through Eurostat, Dettori et al. (2012) conclude that the observed variability in regional production is explainable on the grounds of spatial variability in intangible assets. Dettori et al. (2012, p. 1406) define those as ‘social capital, human capital and technological capital’.

Barring difficulties pertaining to measuring complex and vaguely defined phenomena, such as social capital, the evidence supporting a positive correlation between the degree of social capital and positive economic outcomes is very strong (Glaeser et al., 2002). Commencing with the seminal work of Robert Putnam (1993) on the role of social capital in relation to the economic outcomes of a community, a coherent body of evidence emphasising

¹ The Cobb-Douglas production function gives a technological relationship between physical inputs and outputs (goods). The Cobb-Douglas function is commonly used to express the relationship between quantities of capital, labour and derived outputs. With these two factors, the function is usually written as $Y = AL^\beta K^\alpha$ where Y stands for total production, A for total-factor productivity (ratio of outputs to inputs), L for labour input, K for capital input, while β as well as α are constants for output elasticities.

the positive role of social capital in achieving community outcomes has been built. A more direct explanation of the variability in the unemployment rates is concerned with the local diversity in employment opportunities. The spatial variability in the prevalence of precarious opportunities is of relevance to variability in local vulnerability.

Precarious employment is frequently defined as employment that is 'uncertain, unpredictable and risky' from the worker's point of view (Kalleberg, 2009, p. 2). This signifies employment in which the likelihood of redundancy is great compared to the remaining opportunities available on the job market. On broadly similar lines, the International Labour Organization (2015) defines precarious employment as all forms of employment that are not permanent and full-time and in a subordinate relationship to the employer. In practical terms, precarious employment will often take the form of an agency or part-time work that does not provide an equivalent degree of security to that available in traditional permanent employment.

The diversity of legal arrangements defining employment makes it challenging to come up with a uniformly acceptable definition of precarious employment; however, it is commonly understood that precarious employment is characterised by the temporary nature of the relevant contractual arrangement (Vosko et al., 2003). The changing nature of employment is recognised to be a key element in the creation of the risk society (Beck, 2000). The approach proposed by Beck (2000) to enable the measurement of the change in precarious employment focuses on analysing historical trends in perceived job security. In a study concerned with an analysis of perceived job security across the American public, Fullerton and Wallace (2007) observe that the proportion of workers who perceived their job as secure declined from 1977 to 2002.

The assumed relationship between the prevalence of precarious work in relation to its neighbourhood-level characteristics remains under-researched; however, an informative study concerned with the analysis of the distribution of supply and demand on employment was undertaken on a number of occasions, with a periodic focus directed at small-area level characteristics. Groisman et al. (2009) maintain that a range of social factors, mostly concerned with the expansion of gated communities and expensive housing, results in further exacerbation of the differences across neighbourhood-level economic outcomes, including unemployment rates (Groisman and Suárez, 2009). Consistently, Quinlan et al. (2001) observe that the increasing emphasis on new managerialism across the public sector and the business-related drive to increase the efficiency of service-delivery mechanisms results in a constant drive to reduce employment costs, which is often achieved in the course of reducing employment and enacting policies that generate a supply of cheap labour. The extent to which

new managerial practices impact the local labour markets is a subject worthy of further exploration and research.

Statistical analysis devoted to tracking international trends in the quality of employment suggests an increase in the precarious nature of employment across the OECD countries (OECD, 2016). The increasing number of part-time vacancies is usually considered an indication of that trend, due to part-time and temporary employment usually being considered more precarious than permanent and full-time forms of employment. The growth in precarious employment is explained by a multitude of factors, some of them associated with increasing budgetary constraints in which governments and business have to function and the associated desire to increase service delivery efficiency by reducing transactional overheads and costs (Quinlan et al., 2001).

It may be reasonably hypothesised that precarious employment will become a more important challenge in the future. As estimated by the OECD (2016), part-time employment has continued to increase across developed countries. The percentage of workers having a part-time job increased from 14.6% to 15.7% across the OECD countries. It is also worth noting that an analysis of labour market trends across the OECD countries indicates that full-time employment fell significantly during the 2008 financial crisis, with part-time employment opportunities increasing steadily despite the economic downturn (OECD, 2016). Analysis conducted for the European Parliament indicates the existence of comparable trends across the EU Member States (Broughton et al., 2016). It is observable that the availability of open-ended full-time vacancies across Europe decreased and the prevalence of fixed-term contracts increased. In France, for example, the percentage of non-permanent contracts increased from 5% to 12% between the 1980s and the 1990s.

Forrest and Hirayama (2009) maintain that the recent increase in the proliferation of neoliberal policies in Britain is correlated with the increasing prevalence of non-standard employment contracts. They argue that key characteristics associated with non-standard employment contracts make those arrangements particularly unsuitable for long-term borrowing and property acquisition.

The topic of the prevalence of precarious employment is related to the spatial variability in community resilience, which, in the context of the observed peaks in the levels of unemployment, would be associated with communities' capacity to absorb risk. The research on the economic community resilience of Scottish rural communities undertaken by Streiner and Atterton (2014) indicated that the presence of small and medium enterprises was conducive to increasing the resilience of local communities (Steiner and Atterton, 2014).

Streiner and Atterton (2014) hypothesise that the capacity of small and medium-sized enterprises to absorb local fallout from macroeconomic events is greater than that of large enterprises and is thus conducive to improving employment across local communities.

Research undertaken by Tunstall (2009) concerned with the impact of the 2008 financial crisis on disadvantaged communities in the UK argues that the impact on the most disadvantaged communities due to its dual nature (Tunstall, 2009). Disadvantaged communities were faced with cuts to the local services on which they rely and with job losses (Tunstall, 2009). In a related study concerned with the analysis of neighbourhood-level unemployment in Helsinki, Kauppinen et al. (2011) argue that neighbourhood unemployment rates can be used as a viable predictor of future individual unemployment rates. In particular, the researchers observed that '[h]aving been unemployed during the recession predicted much lower later earnings and a much higher probability of having no earnings at all as compared with those having been employed for the whole period' (Kauppinen et al., 2011, p. 1279). The researchers observed that the neighbourhood exerts an effect on the employability opportunities of single residents, with the most deprived being the most impacted.

Using data gathered from the Helsinki metropolitan area during the 1990s shortly after a deep recession,¹ the researchers discovered that the increase in unemployment rates varied across neighbourhoods, with some geographies experiencing a rise to 30% (Kauppinen et al., 2011). The researchers point out that the impact of the recession significantly widened the differences in unemployment rates.

The research concerned with the spatial variability of life outcomes often recognises that the high degree of asymmetry observed across unemployment levels is more strongly pronounced for small geographies than in the case of bigger spatial units (Vedder and Gallaway, 1996). Kauppinen et al. (2011) also observed that the experience of unemployment during the recession was strongly correlated with subsequent later lower earnings. The researchers also observe that the effect was significantly stronger for residents living in poor neighbourhoods.

By highlighting neighbourhood-level macroeconomic vulnerabilities, the findings obtained challenge the validity of the traditional resource-allocation models currently utilised by the Scottish local authorities. Welfare systems focus on individual eligibility conditions defining benefits eligibility. Similarly, a substantial number of economic initiatives focus on

¹ The collapse of the Soviet Union at that time took a fifth of Finnish exports, with the Finnish economy contracting by 15% in early 1990s (Milbank, 1994; The Economist, 1997).

industries or socio-demographic cohorts, without an emphasis on space or neighbourhood-level disparities.

As shown in the analysis concerned with the existing usage of data zone-level statistics across local authorities, the present analytical focus across Scottish local authorities is mostly concerned with analysing historical trends and identifying deprived geographies using the most recent data.

The spatio-temporal consistency across the observed life outcome indicators further emphasises the usefulness of neighbourhood-level data development of resource-allocation models. More importantly, from the perspective of the applicability of the findings obtained to local government service-delivery planning, the spatial variability in neighbourhood-level vulnerability of Scottish neighbourhoods to macroeconomic change is relevant in attuning service-delivery mechanisms.

During the analysis, it became apparent that the observed qualities of the data lend themselves well to the development of predictive models that could be applicable in identifying particularly vulnerable communities. In particular, the variable impact of macroeconomic events on the levels of benefits uptake across Scottish neighbourhoods suggests that the already collected data may have an undiscovered potential that could facilitate better decision-making across local government institutions in Scotland.

As demonstrated, the neighbourhoods affected by the elevated change in the levels of JSA claimant rates were also identified as those most prone to market and macroeconomic changes. The concentration of more macroeconomically vulnerable neighbourhoods within the Central Belt of Scotland and other urban geographies across Scotland indicates that the needs of local communities vary spatially to a significant extent. The conclusions obtained allow for drawing a further parallel with aspects of multilevel governance. The observed variability in the changes across neighbourhood-level JSA claimant rates makes evident the potential better capacity of local policies to respond effectively to the local impact of macroeconomic change than national policies.

As the extent of change varies significantly on a small-area level, one can reasonably hypothesise that an efficient manner of addressing these changes would imply giving greater control and flexibility to local administrative units instead of leaving control to the national level, where local developments are expected to be less visible. In an analysis concerned with the

impact of the New Deal¹ policy in the United Kingdom, Nativel et al. (2002, p. 913) note that '[o]ne of the paradoxical outcomes of the lack of decentralisation has been a local variability in outcomes involving relatively poorer performance in many inner urban and depressed labour markets'.

The implications of the findings resonate further than neighbourhood-level benefits dependency. Research undertaken by Abrams and Vasiljevic (2014) emphasises the existence of an association between macroeconomic change and individual social identity. Focusing on the repercussions of the 2007–08 financial crash that took place across the United States, the authors argue that '[c]hanges in the macroeconomy affect the salience of, and people's affiliations with, different groups, and thus affect the level of social cohesion and connectedness between different groups in society' (Abrams and Vasiljevic, 2014, p. 332). Consistent with the writings of economic historians such as Inglehart and Welzel (2005), Abrams and Vasiljevic (2014) reveal that periods of economic growth are often associated with increased liberalisation, tolerance and social mobility, whereas economic downturns are usually associated with the proliferation of authoritarian and right-wing ideologies.

The findings highlight a range of opportunities for further research concerned with enhancing the understanding of how the revealed variability in vulnerability should be used in informing service-delivery mechanisms. The review conducted of service-delivery models suggests that the knowledge generated in the course of this research is not fully reflected in the existing service-delivery mechanisms implemented across Scottish local authorities. Furthermore, the research indicated the existence of relevant and frequently overlooked analytical qualities that can be used to derive information relevant to the development of resource-allocation mechanisms, and, in particular, the degree to which the existing service-delivery and resource-allocation models are attuned to the variable needs of local communities. Area-Based Initiatives have been present in the UK for over 40 years; hence, it is reasonable to assume that the ample amount of evidence generated would permit an in-depth evaluation of the results achieved (Muscat, 2010).

¹ The New Deal programme was introduced by the Labour government in the late nineties and its conceptual assumptions reflected the need to increase the skills of the labour force as well as the introduction of mechanisms facilitating sanctioning claimants refusing *reasonable employment* (the term itself was a subject of debate). The New Deal consisted of several tracks focusing on distinct social groups such as young people or lone parents. For example, the New Deal for Young People provided subsidised placement options and training but also introduced sanction mechanisms for young people refusing to take the New Deal option offered without a 'good cause' (Finn, 2000, p. 390).

Research concerned with developing a more in-depth understanding of the vulnerability and risks faced by local communities would be justifiable in the context of the consistencies emphasised across historical life outcome patterns. The extent to which the livelihoods of actual communities are considered to be affected partially depends on the consistency across the observed data. As such, any work concerned with gaining a deeper and more robust understanding of the spatial dependencies across selected life outcome indicators would positively impact any future research that aspires to utilise data zone-level data. Factors such as spatial variability in the prevalence of precarious employment merit further research in understanding the role played by local labour markets in local community resilience and vulnerability.

Quinlan et al. (2001) propose that the global expansion of precarious employment is positively correlated with the deterioration in occupational health standards and the increasing prevalence of negative health outcomes across affected industries. The research on the adverse effects of precarious employment also suggests that the increasing lack of employment security correlates with lower self-assessed health across the observed population (Benach and Muntaner, 2007). Benach and Muntaner (2007) hypothesise that worsening of the health outcomes occurs due to the common characteristics of precarious employment such as lack of stability or diminished level of control over the nature of the work undertaken, which are correlated with increased levels of stress.

Drawing on a related study by Autor, Leavy and Murnane (2003) on the impact of computerisation on the skilled and semi-skilled job market, Goos and Manning (2007) hypothesise that the increasing proliferation of computers across semi-skilled jobs reduces the demand for semi-skilled positions. In particular, Goos and Manning (2007) hypothesise that the UK labour market is polarising, with the number of clerical jobs and skilled manual jobs in manufacturing decreasing.

The argument assumes variable susceptibility of selected occupational groups to changes in skill demand across the labour market. Baumol and Bowen (1968) hold that mid-level jobs are often more exposed to the adverse impact of technical change than managerial positions or positions requiring human input such as nursing or the caring professions. The observed phenomena correspond closely to the notion of Baumol's cost effect (Baumol and Bowen, 1968). Baumol's cost effect assumes the existence of occupations that experience growth in earnings without experiencing growth in labour productivity (Baumol and Bowen, 1968).

Arguably, globalisation and automatisisation have been indicated as potential factors contributing to rising unemployment and increasing wage inequality (Moore and Ranjan, 2005). The existing economic literature does not offer a clear answer as to which occupations are immune to Baumol's disease and which would be impacted. However, it is possible to differentiate a broad set of patterns roughly indicating types of employment that can be considered as secure and types of employment that are most prone to change.

The argument that variability in local employment exists and that it should be considered by local authorities when planning for service delivery is a viable suggestion. An alternative research strand that is worth exploring would focus on spatial variability in the prevalence of precarious employment. This raises another question worth exploring that would focus on the neighbourhood-level variability in vulnerability to broader macroeconomic change. In particular, it could be explored to what extent changes in life outcomes and JSA claimant rates across Scottish neighbourhoods respond to wider macroeconomic changes in a systematic manner, as the initial analysis indicates that the changes in the performance data of Scottish business impact the levels of benefits uptake in a variable manner. Irrespectively of whether the observed performance variability takes place because of the direct relationship between employee or employer or whether the observed changes in the performance data are signs of wider changes in the Scottish economy, the variability becomes observable.

Another matter that lends itself well to further investigation is concerned with studying the strength of the neighbourhood effect across Scottish geographies. Most of the existing research literature refers to the neighbourhood effect in the context of evaluating its role in relation to public health, class or social cohesion. The potential role of a neighbourhood effect in shaping local labour markets across Scotland remains an under-researched subject. Qualitative work undertaken by Dean and Hastings (2000) concerned with the life outcomes of residents across a selection of deprived residential estates in the UK demonstrated widespread perception of insecurity pertaining to macroeconomic change.

A relevant study concerned with the effects of neighbourhood deprivation on local labour market performance undertaken across Glasgow and Edinburgh areas was conducted by Atkinson and Kintera (2001). The researchers refer to the rise of the Labour Party to power and the associated increasing popularity of area-based initiatives during the ensuing years. The authors further hypothesise that those policies were motivated by a conviction that the experience of neighbourhood-level deprivation adversely affected residents' ability to participate in society and exacerbated social exclusion. Work concerned with neighbourhood-level inequalities, like the research undertaken by Shaw et al. (2000) emphasised the expanding gap in life outcomes between affluent and deprived UK neighbourhoods.

The conclusions that emerge from the analysis suggest that increasing concentrations of inequality and poor life outcomes are not only an immediate problem but are likely to create implications for the effectiveness of national economic strategy and development. The purpose of this research was concerned with expanding our understanding of neighbourhood-level deprivation and evaluating the usability of neighbourhood-level data in identifying communities vulnerable to macroeconomic change. In a broader context, this research corresponds to the body of research concerned with neighbourhood-level inequalities and the spatial characteristics of multiple deprivation.

The potential future usability of the findings discussed should be understood not only in the context of the observed variability and changes to the values but also in relation to the possible implementation of the indicators utilised as tools informing non-uniform service-delivery mechanisms. Understanding the outlined relationship requires focusing on specific aspects of area-based policies for which the identified relationship would be most meaningful.

Appendix — Regression Results

The following annexe provides a detailed regression results summary calculated for Equation 3-4:

$$Y_i = b_0 + b_1X_1 + b_2X_2 + \dots + b_nX_n + e_i$$

Where:

- Y_i – reflects the dependent variable: JSA rate for a specific data zone
- b_0 to b_n – are the regression coefficients determined in the analysis
- X_1 to X_n – are the independent variables for the exogenous indicators, the list of variables
- e_i – is the residual error of the difference between the observed and estimated dependent variable for data zone i .

The results are provided on the example of the S01000001 data zone in Table A-5-1. The summary accounts for the initial model (1) and an adjusted version used after stepwise selection (2) mirroring the process that was applied across all 6,505 data zones.

Linear regression results for data zone S01000001		
	<i>Dependent variable:</i>	
	<i>JSA claimant rate</i>	
	(1)	(2)
<i>GDP per capita</i>	0.0003 (0.0005)	
<i>Aberdeen Asset Management</i>	0.001 (0.002)	
<i>FirstGroup</i>	-0.0004 (0.002)	
<i>Weir Group</i>	0.0002 (0.001)	
<i>John Wood Group</i>	0.003 (0.002)	0.004*** (0.001)
<i>Stagecoach Group</i>	-0.003 (0.004)	
<i>Cairn Energy</i>	-0.001 (0.001)	-0.001* (0.0004)
<i>RBS</i>	0.0002** (0.0001)	0.0002** (0.0001)
<i>Aggreko</i>	-0.001 (0.001)	-0.0005** (0.0002)
<i>Constant</i>	-1.764 (1.943)	-0.862 (0.595)
<i>Observations</i>	33	33
<i>R2</i>	0.314	0.294
<i>Adjusted R2</i>	0.045	0.193
<i>Residual Std. Error</i>	0.527 (df = 23)	0.484 (df = 28)
<i>F Statistic</i>	1.169 (df = 9; 23)	2.915** (df = 4; 28)
<i>Note:</i>	$p < 0.1$; $p < 0.05$; $p < 0.01$	

Table A-5-1 — Regression Results

Diagnostic plots for the models referenced in Table A-5-1 are provided in Figure A-5-1 for the first iteration and Figure A-5-2 for the second iteration. Residual vs Fitted plot provides a scatter plot of residuals on the y-axis and fitted values on the x-axis. In the context of this particular model, the plot does not seem to indicate that residuals and the fitted values are uncorrelated. Normal Q-Q, or quantile-quantile plot helps to assess whether the utilised data came from a normal distribution. The Q-Q plot is generated by plotting two sets of quantiles against one another. The plot will return a straight line if the errors are distributed normally. The Scale-Location plot shows if residuals are spread equally along the ranges of predictors and can be used to validate the assumption of homoscedasticity (equal variance). In case of a met assumption the plot will usually show a horizontal line with equally (randomly) spread

points. The Residual vs Leverage can be used in order to help identify influential cases. Existence of influential outliers will be usually pronounced by the presence of points in the upper right corner or at the lower right corner.

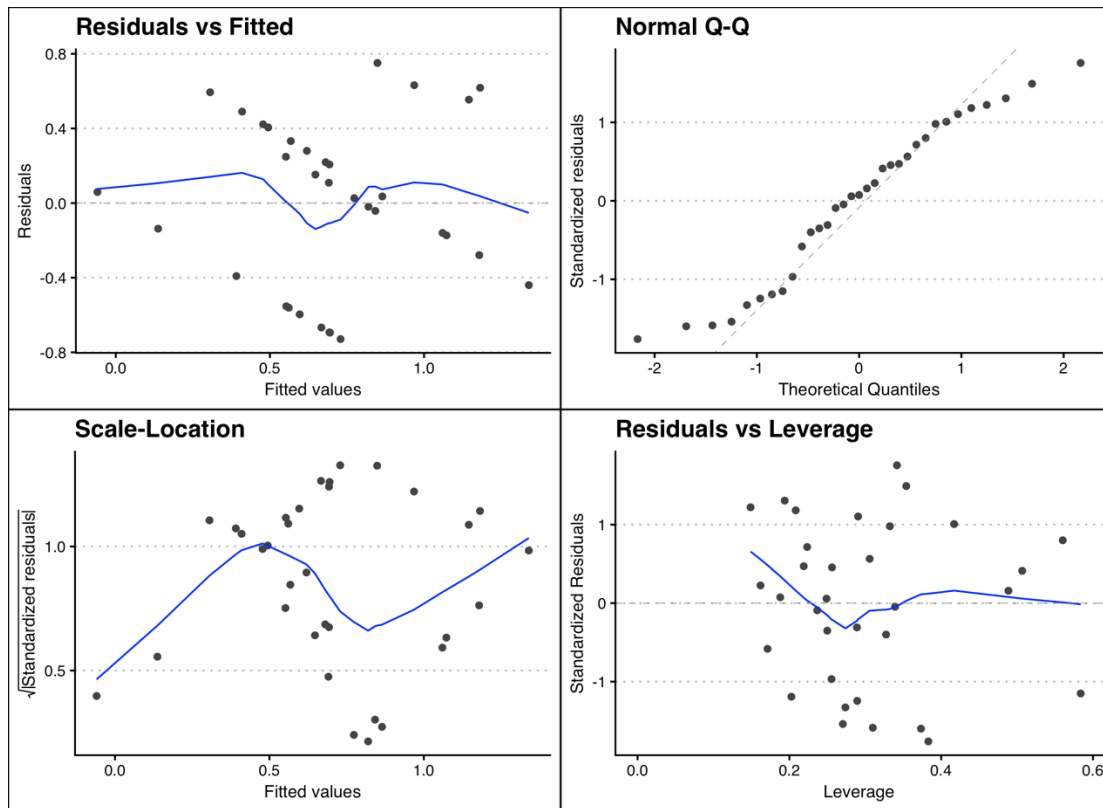


Figure A-5-1 — Diagnostic Plots for Model S0100001 – initial version

Performance of the model visibly improved after stepwise selection is summarised in Figure A-5-2.

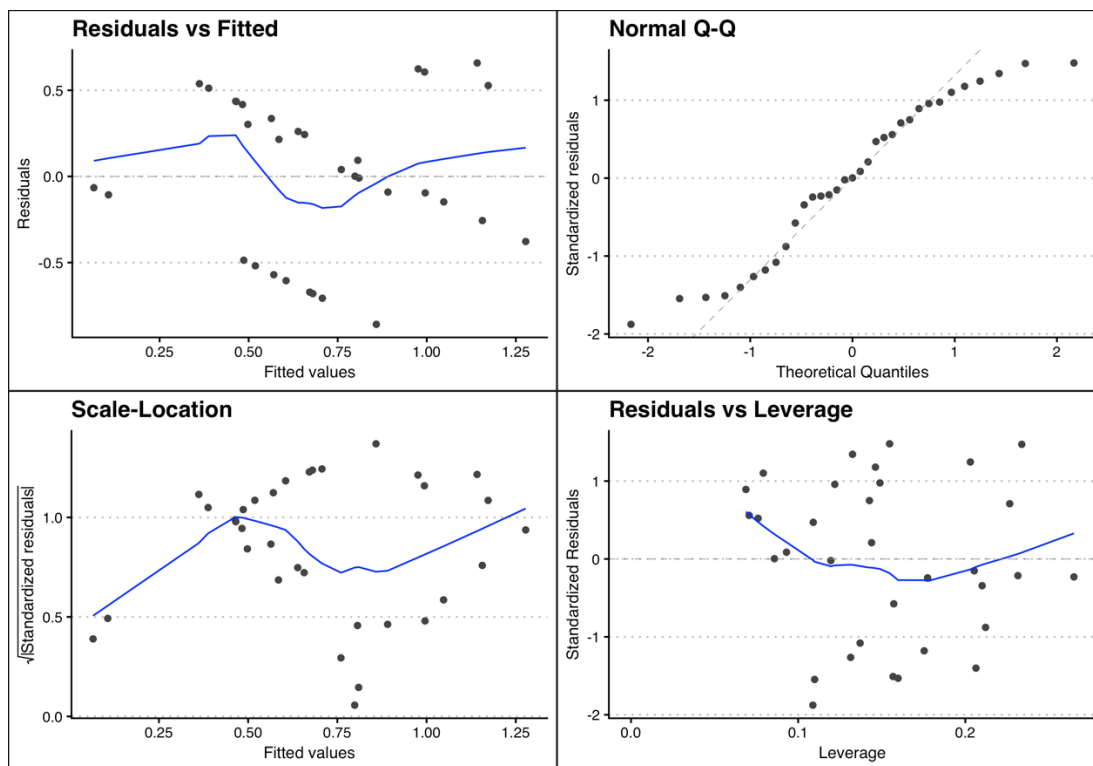


Figure A-5-2 — Diagnostic Plots for Model S0100001 – after stepwise fitting

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