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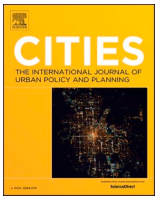

The spatial reordering of poverty and crime: A study of Glasgow and Birmingham (United Kingdom), 2001/2 to 2015/16

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ABSTRACT

Across developed polities, there is growing evidence of the spatial reordering of poverty and of its detrimental impact on the life chances of poorer people. This paper extends this body of research, via a comparative case study of two cities in the United Kingdom, by unravelling the interplay of policies shaping the changing morphology of poverty. It progresses to examine the significance of the changing centralisation and segregation of poverty on neighbourhood inequalities in the exposure to crime, probing the relevance of urban criminological tool sets to account for the spatial patterning of crime. It achieves this through interweaving fifteen years of data on poverty and police recorded crime with accounts of the policies and interventions that have sought to reshape and address their manifestation. Though the cities exhibit distinct trajectories, we find evidence of both the decentralisation of poverty and of decreasing segregation in contrast to previous studies. Poverty and crime patterns are converging in the neighbourhoods closest to, but less so in the neighbourhoods furthest away from, city centres. We discuss the relevance of these findings for research seeking to understand the spatial reordering of poverty and neighbourhood inequality in the exposure to crime.

1. Introduction

Across developed polities, the poorest have lived in neighbourhoods close to, whilst the wealthiest have lived in neighbourhoods further away from, city centres (Burgess, 1925/1974; Robson, 1988). However, in recent years there is evidence of a suburbanisation or spatial reordering of poverty, pointing towards the (partial) reversal of this pattern, in the United Kingdom (UK), Europe and the United States (Bailey & Minton, 2018; Kavanagh et al., 2016; Kneebone & Berube, 2014; Musterd et al., 2017).

Various drivers have been posited as underpinning the spatial reordering of poverty, inclusive of the economic restructuring prompted by globalization, national changes to both welfare and housing policies, and strategies designed to revitalize inner urban areas (Bailey & Minton, 2018). The revitalization of the urban core has increased its attractivity to more affluent city dwellers (Lees & Ley, 2008), whilst poorer city dwellers priced out or relocated from these settings have moved towards outer urban areas (Zhang & Pryce, 2020, Hochstenbach & Musterd, 2017). Existing research on the spatial reordering of poverty, founded on the comparison of multiple cities or on the in-depth investigation of a single site, has struggled to disentangle the interplay and significance of its varied drivers. Addressing this challenge serves as a motivation for this paper and has underpinned the choice of research strategy to support its address.

Understanding the factors shaping the character of the spatial reordering of poverty is important as a new strand of research has begun to question its consequence upon the life chances of the poor. Zhang and Pryce (2020), for example, have explored its consequence upon poorer people's access to employment opportunities and to amenities. We extend this analysis to consider its consequence upon inequalities in the exposure to crime. Addressing this shortfall serves as a further motivation for this paper. In this regard, understanding the character of the spatial reordering of poverty, whether it becomes increasingly or decreasingly segregated, matters. The significance of segregation stems from the fact that neighbourhoods differ because of their internal characteristics and in terms of their connection to other neighbourhoods. The spatial concentration of crime in particular areas of cities is suggestive of a 'tight coupling of crime with the places where crime occurs' (Weisburd, 2011: 156). Criminological literatures, interpreted through an explicit urban lens, collectively imply that crime is a complex spatial interplay and consequence of the social and physical characteristics of the urban environment (Bannister & O'Sullivan, 2020).

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Amongst these characteristics, neighbourhood poverty has been identified as holding a 'robust' association with crime (Hipp & Yates, 2011), having been extensively studied at city and local levels (Bannister et al., 2017; Hipp & Yates, 2011). Neighbourhoods with higher and persistent levels of poverty tend to have worse crime outcomes (Higgins et al., 2010; Hipp, 2007). These insights provoke the interest in exploring whether the spatial reordering of poverty has been accompanied by a spatial reordering of crime, or whether the character of the spatial reordering of poverty has served to reshape its association with crime.

2. Background

2.1. Poverty and crime

Given the diversity of cities should we expect different urban crime profiles to present in different places? Are criminological theories capable of accommodating urban change? Set against these broader questions, it is important to note that whilst an association between neighbourhood poverty and crime has been established, the functional form of this relationship remains uncertain (Hipp & Yates, 2011 and Sharkey et al., 2016). Poverty sits as a core explanatory variable in two dominant strands of urban criminological thinking. Economic theories of crime suggest that the motivation for offending holds a relation to the economic returns to criminal activity relative to earnings from employment (Becker, 1968; Ehrlich, 1973). Yet, poverty also influences where people live and their access to criminal opportunities. Thus, whilst poverty might serve as a significant motivation for offending, it is not regarded as a sufficient condition (Webster & Kingston, 2014). Social disorganization theory (Shaw & McKay, 1942) recognizes that neighbourhoods with higher levels of poverty tend to be characterized by residential instability and family disruption (Livingston, Kearns, & Bannister, 2014; Sampson et al., 1997; Sampson & Groves, 1989), factors that weaken the capacity of neighbourhood residents to exercise informal social control, or collective efficacy, and increase the likelihood of offending (by residents and outsiders) and victimization from crime.

The strength of the association between neighbourhood poverty and crime has been evidenced to vary by crime type, the measure of poverty considered, and according to the locality and spatial scale of the analysis (Metz & Burdina, 2018; Weisburd et al., 2020). Violent crime, inclusive of murder, assault and domestic violence, tends to hold a positive and strong correlation with neighbourhood poverty (Webster & Kingston, 2014; Bannister et al., 2013), i.e., neighbourhoods with higher levels of poverty tend to have a higher concentration of both victims and offenders of violent crime. In contrast, there is equivocal evidence of the strength of the correlation between property crimes and poverty (Metz & Burdina, 2018). Whilst levels of property crime, such as burglary, are higher within neighbourhoods with higher levels of poverty, offenders also victimize surrounding neighbourhoods (Livingston, Galster, et al., 2014).

The existing literature is suggestive of income-related poverty serving to heighten the motivation and opportunity to commit property crime (Edmark, 2005; Hooghe et al., 2011). Violence has been proposed as a means of dealing with poverty and its associated crises of everyday life, such as poor housing and family disruption (Parker, 2008; Webster & Kingston, 2014). Further, the relative nature of poverty has been suggested to provoke a sense of injustice and anger amongst the poor, leading to aggression, hostility and violent crime (Neckerman & Torche, 2007). Yet, does the character of the spatial reordering of poverty serve to reshape these issues? Having outlined the case that poverty serves to influence the nature and extent of crime taking place within neighbourhoods, it is important to note that the spatial patterning of crime events is also informed by land use functions (Brantingham & Brantingham, 1993), as they serve as crime generators (drawing in population groups) or crime attractors (drawing in offenders) or both (Brantingham & Brantingham, 1995). The recurrent mobility of urban populations performing routine activities (Cohen & Felson, 1979), therefore, can be understood to account in part for crime committed in residential and to a significant extent in non-residential areas. In these terms, we might consider the proximity of neighbourhoods to a city centre as a fundamental factor underpinning their crime profile. Examining the spatial reordering of poverty opens prospect of shedding light on this issue.

In reviewing this literature, it is vital to note that urban criminological theories deploying poverty as core explanatory variables were developed in settings and in a period in which the spatial patterning of poverty was stable and concentrated in neighbourhoods encircling city centres. Thus, studies that have sought to deploy comparable measures of poverty, and its associated characteristics, across polities have discerned markedly differing findings. For example, Pauwels et al. (2018), found limited support for the relevance of social disorganization models (and their component poverty measures) in European contexts in contrast to the United States where more robust findings have been discerned. A likely explanation for this observation being the contrasting welfare models deployed in these polities, with European states consequently exhibiting lower absolute levels of, and narrower, relative distinction in poverty measures. We take up this issue through examining the spatial reordering of poverty and crime in two case study settings, Glasgow and Birmingham. The spatial scale of analysis can also influence the strength of the observed association between poverty and crime. Typically, the smaller the spatial unit of analysis deployed the more concentrated the objects of analysis (i.e., crime and poverty) are (Bannister et al., 2019; Weisburd et al., 2020). In these terms, research should utilise spatial units in which it is possible to identify the greatest variance in crime when seeking to advance explanatory models (Rosser et al., 2017). Yet, given the theoretical framing of this investigation it is also important that the spatial unit of analysis comprises meaningful ontological settings (i.e., neighbourhoods).

2.2. The spatial reordering of poverty and crime

Studies have found the 'flight from blight' (Foote, 2015), the suburbanisation of non-poor city dwellers, to be driven by the concentration of poverty and crime in inner urban areas (Ellen & O'Regan, 2010). What then might the counter urbanisation of non-poor, and the suburbanisation of poor, city dwellers imply for the spatial patterning of crime? A key issue here is the way in which the spatial reordering of poverty manifests. If poverty remains spatially concentrated then we should expect, ceteris paribus, its association with crime to remain consistent. If, however, the spatial reordering of poverty delivers a greater mixing of poor and non-poor households, enhanced positive socialization, improved institutions and collective resources, as well as lower levels of stigmatization may serve to weaken the association between poverty and crime (Galster, 2007; Musterd & Andersson, 2005). In these terms, it is necessary to examine whether the spatial reordering of poverty delivers an urban morphology less clearly delineated by poverty. In other words, we require to examine the evenness of poverty as well as its (de)centralization and to recognize that contextually specific factors, such as housing systems, can not only serve to shape the spatial reordering of poverty but also the spatial distribution of offenders and offending (Bottoms, 2007; Foster & Hope, 1993). This points to the necessity of examining the dynamism of neighbourhood poverty and of crime profiles, of exploring their transitional or enduring nature through a longitudinal study.

Addressing important gaps in the international literature, the

motivations underpinning this paper provoke the following research questions:

- How has the suburbanisation of poverty manifested within different city contexts?
- Has the spatial reordering of poverty been mirrored by a spatial reordering of crime? And, does this vary by crime type?

3. Data and analytical strategy

3.1. Case study settings

Our case study areas are two cities in the United Kingdom, Glasgow in Scotland, and Birmingham in England. These cities possess comparable deprivation, crime and population levels. Glasgow is ranked as the most deprived city in Scotland, with 30 % of its neighbourhoods being amongst the 10 % most deprived in Scotland. Birmingham is the 6th most deprived local authority in England, with 40 % of its neighbourhoods ranked amongst the 10 % most deprived in England.[1] The crime rates in Glasgow and Birmingham are higher than their respective national averages. In Glasgow, there were 715 crimes per 10,000 population in 2015 compared with 456 for Scotland as a whole (Scottish Government, 2016). In Birmingham, there were 695 crimes per 10,000 population in 2015, compared with 673 for England as a whole (ONS, 2015). In 2016, Glasgow had a population of 1.56 million whilst Birmingham had a population of 1.74 million (ONS, 2015). The value of undertaking a comparison between Glasgow and Birmingham rests in its opportunity to unravel the significance of diverse national and local policies and interventions, the historical, socio-political and institutional structures and resources of each setting, in shaping the suburbanisation of poverty and of their respective crime profiles. Thus, whilst the two cities exhibit similar characteristics, they have been subject to distinct welfare and housing regimes. Relatedly, it enables assessment of whether the unique trajectories of the suburbanisation of poverty in each setting have reshaped the relevance of poverty to the spatial patterning of crime.

England and Scotland have adopted distinct welfare and housing policies since the creation of the Scottish Parliament in 1999. Following the financial crisis of 2007/8, the UK government has pursued public spending austerity involving diminishing provision of social welfare services (Lobao et al., 2018). In contrast, the Scottish government has tended to favour a social democratic approach to welfare provision with an emphasis on social justice (MacKinnon, 2015). Scotland adopted a divergent welfare and social security system, as well as distinct housing and poverty reduction strategies (McKee & Phillips, 2012). Scotland maintains a national level Scottish Welfare Fund, discretionary housing payments to compensate for benefit cuts, and possesses the capability to vary income tax rates and thresholds (Bradshaw & Bennett, 2018). Whilst Scotland has the highest proportion of social housing in the UK (McKee & Phillips, 2012) it continues to pursue new council house building (Gibb, 2021). In contrast, England has substantially reduced social housing supply, placing more emphasis on 'affordable' home ownership and renting schemes (ibid).

In both countries, the 2000's marked a surge in urban renewal programmes and Area-Based Initiatives (ABIs) aimed at tackling pockets of deprivation through delivering social and function mixing, particularly in inner-city areas subject to decades of counterurbanization (Colomb, 2007). Birmingham received a substantive amount of government funding through the Housing Market Renewal (HMR) (2002−2011) programme, the New Deal for Communities (NDC) (1998–2010) programme and the Neighbourhood Renewal Fund (2000–2008), to deliver urban and housing renewal programmes. During the same time, neighbourhoods with a concentration of social housing were identified for renewal by Glasgow City Council in six 'Transformational or Local Regeneration Areas' and in nine 'Housing Improvement Areas, Wider Surrounding Areas and Peripheral Estates', alongside a variety of neighbourhood, social and personal-support interventions (Kearns & Mason, 2018). By the late 2000's, however, regeneration funding in England dried up and the 'holistic' approach to the regeneration of deprived areas and ABIs was abandoned in favour of job creation through economic development (McGuinness et al., 2015). In contrast, Scotland retained a more comprehensive policy approach to regeneration, maintaining dedicated funding for community regeneration initiatives albeit with a weakened focus on deprived neighbourhoods (McGuinness et al., 2015).

It is, of course, important to note the longstanding nature of the housing renewal programmes that have served to shape (in part) the suburbanisation of poverty in each polity and city. The expansion of public sector housebuilding was a main vehicle for the post-war economic reconstruction of cities and of the welfare state in the UK (Murie, 2018). It delivered the largest slum clearance programme in the western world, seeing the creation of peripheral council estates across major cities and leading to the relocation of millions of inner-city residents (Power & Mumford, 1999). Following rapid de-industrialisation and neighbourhood decline which accelerated in the 1980s and 1990s, large-scale investment in housing and the physical environment took place across UK cities. The social housing stock in Glasgow was transformed following the 2003 transfer of the social housing stock to the Glasgow Housing Association, which was accompanied with a £4 billion investment in physical repairs, social services and other regeneration activities (Zhang et al., 2021). The social housing stock transfer was rejected by tenants in Birmingham but between 2004 and 2010 the Birmingham Sandwell HMR Pathfinder allocated £117 million towards demolitions, new building and refurbishment projects in inner Birmingham, Smethwick and West Bromwich (Leather & Nevin, 2013). Birmingham's most deprived neighbourhoods received an additional £5 million a year for 10 years under the NDC Programme.

In both Scotland (Glasgow) and England (Birmingham), the level of recorded crime began to fall in the 1990s, as it did across many polities (Farrell et al., 2011; Tseloni et al., 2010), and it has continued to do so over the study period of this research. In no small part, this has been attributed to crime prevention, specifically securitisation initiatives (Farrell et al., 2011), embedded in urban regeneration and housing renewal programmes. Whilst policing is a devolved matter in Scotland, the policing approach to crime prevention is similar in both countries (Brown, 2021). This being said, the austerity driven budget cuts imposed on Police forces in England led to a dramatic reduction in the police workforce in England, particularly from 2010 onwards (Allen & Harding, 2021). In contrast, police strength in Scotland has seen an almost continuous increase year on year (ibid).

3.2. Study areas

The study areas are defined in terms of their Travel-To-Work-Areas (TTWAs), which are self-contained areas in which most people live and work. Glasgow is the largest urban conurbation in Scotland, extending to 10 local authorities including the City of Glasgow, East and West Dunbartonshire, North and South Lanarkshire, East Renfrewshire, Renfrewshire and Inverclyde. Birmingham is located in the West Midlands region in England, and comprises the local authorities of the City of Birmingham, Solihull, Sandwell, Walsall, as well as parts of Bromsgrove, Lichfield, North Warwickshire, Redditch, Stratford-on-Avon, Tamworth and Wychavon.[2]

[1] Deprivation figures are taken from the 2015 English indices of deprivation and 2016 Scottish indices of deprivation.

[2] The Birmingham study area, which matches the West Midlands Police force area, comprises just over 80 % of the neighbourhoods (LSOAs) in the ONS Travel-To-Work area.

3.3. Spatial scale of analysis

The spatial scale of analysis is that of Data Zones in Glasgow, and Lower Super Output Areas (LSOAs) in Birmingham. Data Zones and LSOAS are Census geographies, identified as being representative of neighbourhoods in that they are defined on the basis of possessing homogenous socio-economic groups and where possible shaped to respect the physical boundaries of communities in line with residents' perceptions (Brunton-Smith et al., 2014). Data Zones comprise approximately 750 people, whereas LSOAs are larger, comprising on average 1500 people. There are approximately 1600 Data Zones in the Glasgow TTWA and 1039 LSOAs in the Birmingham TTWA. To take into account of changes to boundaries over time, we re-apportion data for 2001 to the 2015 boundaries. As our interest lies in examining the consequence of the suburbanisation of poverty on the spatial patterning of poverty and crime, the analysis excludes neighbourhoods (Data Zones and LSOAs) that fall within the city centre boundaries of Glasgow and Birmingham.

3.4. Measures of crime

The research utilizes police recorded property and violent crime data, provided by Police Scotland for Glasgow and West Midlands Police for Birmingham, for the financial years 2001/2 to 2015/16. The data possess latitude and longitude co-ordinates enabling their allocation to Data Zones and LSOAs. Crime rates are calculated with reference to the residential populations identified by Census data (2001 and 2011). Property and violent crime hold marginal distinction in terms of their definition, in Scotland and England, but are broadly comparable. In Scotland, property crimes are grouped under crimes of dishonesty, and include theft and housebreaking. Violent crimes include any action involving physical assault. In England and Wales, property crime is defined as incidents involving property being damaged or acquired by illegal means (ONS, 2015). It includes fraud; criminal damage; burglary; vehicle offences; shoplifting; bicycle theft; theft from the person; and robbery. Violent crime is defined as those incidents wherein the victim is intentionally stabbed, punched, kicked, pushed, jostled, etc., or threatened with violence whether or not there is any injury (Home Office, 2010).

As noted previously, and in line with national trends, the rates of both property and violent crime fell markedly over the study period in both cities. In Glasgow, violent crime fell by one third, whilst property crime more than halved between 2001 and 2015. In Birmingham, violent crime fell by a fifth, and property crime halved. A significant consequence of the city-wide crime drops has been their impact on the variance between neighbourhood crime rates, which have substantially narrowed over the study period. For example, and in Birmingham, the standard deviation of neighbourhood property crime rates fell from 38.2 to 15.2, and violent crime rates fell from 14.8 to 9. In these terms, any spatial shift in the preponderance of crime requires recognizing an overarching trend towards a narrowing distinction between crime rates at the neighbourhood level.

3.5. Measures of poverty

Poverty is a highly contested concept though it is commonly associated with individual measures such as income (Sen, 1973), as well as composite measures of deprivation (Townsend, 1979). The most widely used composite measure of deprivation in the UK is the Index of Multiple Deprivation (IMD), which is a relative measure of deprivation calculated at the neighbourhood level (approximated by Data Zones in Scotland and LSOAs in England), and comprises of a range of indicators covering seven dimensions of deprivation: income, employment, health, education, barriers to housing and services, crime, and the living environment. Here, and in line with existing research examining the association between poverty and crime, we utilise a measure of income-related poverty derived from the IMD. In Scotland, we use the 2004 and 2016 IMD and in England the 2004 and 2019 IMD. The IMD income domain used in this study includes recipients of national government welfare benefit and tax credits and the source data for the two countries relate to similar years.[3]

3.6. Analytical strategy

The analytical strategy comprises numerous steps. First, we assess the spatial reordering of poverty. To this end, we follow the approach of Bailey and Minton (2018) by using the Relative Centralisation Index (RCI). The RCI measures the concentration of one type of population (poor) relative to the concentration of another type of population (non-poor), according to the distance from the city centre. The RCI creates values ranging from −1 to 1, with values greater than zero indicating that the poor (relative to the non-poor) are more likely to be concentrated in neighbourhoods closer to the city centre.[4]

The RCI is calculated using the following formula:

$$RCI = \sum_{k=2}^{N} (X_{k-1}Y_k - X_kY_{k-1})$$

Here, neighbourhoods (N) are ordered by distance from the city centre, with Xk (Yk) being the cumulative proportion of group X (Y) in neighbourhoods 1 to k, X being the reference category (poor) and Y being the remainder (non-poor). We present the global pattern and then the local picture, by examining how the share of poverty has changed in neighbourhoods ordered by centrality (according to distance from the city centre).

Second, we examine the extent to which the spatial reordering of poverty has led to a change in the spatial concentration of poverty. We utilise the Index of Dissimilarity (ID) which provides a measure of the *segregation or unevenness* in the share of the poor and non-poor across space. This provides an indication about how spatial patterns of poverty are changing across urban space over time and helps account for patterns of decentralisation (Bailey & Minton, 2018). The Index of Dissimilarity is calculated as follows:

$$D = 0.5^* \sum_{k=1}^{N} |(x_k/X - y_k/Y)|$$

Here, xk and yk are the number of poor and non-poor in neighbourhood k respectively, and X and Y the number of poor and non-poor in each city. The Index of Dissimilarity generates values from 0 to 1, with values closer to 1 indicating a higher level of segregation.

Third, we commence comparison of the spatial patterning of poverty and crime by calculating the correlation between income-related poverty and crime at the beginning and end of the study period. We then calculate the change in the share and average rate of property and violent crime in neighbourhoods (Data Zones and LSOAs) ordered by centrality, enabling a comparison of the changing share of income-related poverty, and of property and violent crime, ordered by distance to the city centres of Glasgow and Birmingham.

Finally, we move to test the degree of similarity between the spatial patterns of income-related poverty and crime (by type) at the beginning (2001/2) and end (2015/16) of the study period by applying the Spatial

[3] There are some differences between the English IMD (EIMD) and the Scottish IMD (SIMD) in terms of their constituent data and reporting geography (see Bailey & Minton, 2018). The underlying data comprising the deprivation indices relate to the years 2001/2 (2004 EIMD & SIMD) and 2015 (2019 EIMD and 2016 SIMD).

[4] We treat Glasgow and Birmingham as monocentric regions, with each LSOA ordered by distance to the city centre (from the closest to the furthest). We define city centres with reference to 2015 Ordnance Survey Points of Interest (POI) data by calculating the density of premises in each Data Zone and LSOA, and by ensuring that the centres included features such as major transport hubs, city halls and shopping streets (significant POIs).

Point Pattern Test (SPPT) (Andresen, 2009, 2016). The SPPT produces a *global Similarity (S) Index*, a measure of the degree of similarity in patterns of income-related poverty and crime (by type) for the entirety of each study area. It also produces a *local S-index,* a measure of the degree of similarity in the patterns of poverty and crime (by type) between 2001/2 and 2015/16 at the neighbourhood level (Data Zones in Glasgow and LSOAs in Birmingham).

This Similarity Index is calculated as follows:

$$S = \sum_{i=1}^{n} S_i / n$$

where n is the number of areas, s_i is equal to 1 if the spatial pattern of two data sets is considered similar for areal unit i, and 0 otherwise. This Global Index of Similarity represents the proportion of areal units that exhibit similar spatial patterns (Andresen, 2009 and 2016).

4. Results

4.1. The spatial reordering and evenness of poverty

Over the study period, the relative centralisation of poverty declined in both settings. In 2002, Glasgow had a RCI score of 0.18, but by 2015 this had fallen to 0.12, indicative of a decentralisation of poorer households. In 2001, Birmingham had a RCI score of 0.28, but by 2015 this had fallen to 0.19, also indicative of a decentralisation of poorer households. Households experiencing income-related poverty remained more centralized in Birmingham at the end of the study period than in Glasgow at the commencement of the study period. This speaks not only to the differing starting positions of each city, but also of the influence of both welfare and housing policies on the pace and direction change in the spatial patterning of poverty (Musterd & Ostendorf, 1998), with the speed of change being fastest in Birmingham.

Fig. 1 depicts the "evenness" with which the poor and non-poor are distributed across neighbourhoods, by distance to the city centre, within Glasgow and Birmingham. Markedly distinct patterns emerge. In Glasgow, the lowest levels of segregation are found in the areas closest to and furthest away from the city centre, whilst the highest levels of segregation are found in the areas in between. In Birmingham, there is a clear gradient of segregation, with segregation rising as the distance from the city centre increases. Over the study period and in Glasgow, we observe an increasing segregation of income-related poverty between the neighbourhoods closest to and furthest away from the city centre, whilst it declines in all other deciles. In Birmingham, a similar pattern occurs, with an increasing segregation of income-related poverty between neighbourhoods in the innermost decile, and declining segregation in all other deciles. These findings stand in contrast to those observed in other European cities (Musterd et al., 2016) and may be indicative of poverty dispersing to neighbourhoods with lower concentrations of income poor (Bailey & Minton, 2018).

There were also substantial changes in tenure mix as ordered by distance to the city centres. In both cities, the proportion of households in social housing decreased in all deciles ordered by distance to the city centre (Table 1). In Birmingham, the largest decrease of households in social housing and the largest rise of households in private renting occurred in the decile closest to the city centre. In contrast, the largest decreases of households in social housing and largest rises of households in private renting were found in areas further away from the city centre in Glasgow (deciles 6, 7 and 9).

Fig. 2 shows the index of dissimilarity for social housing households for each decile ordered by distance to the city centre. In both cities we observe higher levels of segregation between households in social housing and those in private renting/owner occupation, than between the income poor and non-income poor, in 2011 compared to 2001. This finding chimes with evidence of the expansion of the private rented sector across the UK (Kemp, 2010) albeit it has grown at a greater pace in Birmingham which has been subject to a greater contraction of the welfare state and consequently of social housing compared to Glasgow (MacKinnon, 2015).

4.2. The spatial reordering of crime

Fig. 3, presents the average property and violent crime rates in neighbourhoods, ordered according to their distance from the city centre, at the beginning and end of the study period. Given the significant crime drop during this time, it is unsurprising that property and violent crime rates fell markedly in most areas. However, the greatest falls can be discerned in the areas closest to the city centre. In Glasgow,

Table 1
Tenure change 2001–11 by distance to the city centre.

	Glasgow			Birmingham		
	Owner-occupiers	Social rented	Private rented/ rent free	Owner-occupiers	Social rented	Private rented/ rent free
1	−7.7	−1.9	9.6	−3.7	−11	14.6
2	−5.3	−1.8	7.1	−5	−3.7	8.7
3	−1.4	−2	3.4	−6.5	−2.9	9.4
4	−0.6	−1.9	2.5	−8.1	−1.3	9.4
5	−0.2	−1	1.2	−3.2	−3.4	6.6
6	1.8	−3.4	1.6	−2.8	−2.8	5.5
7	−0.5	−2.7	3.2	−2.5	−2.2	4.7
8	−0.8	−2.2	3.1	−2.5	−1.6	4.1
9	0.5	−2.9	2.4	−2.3	−2.8	5
10	−1.4	−1.6	3	−2.9	−2.3	5.2

Source: 2001 and 2011 Census

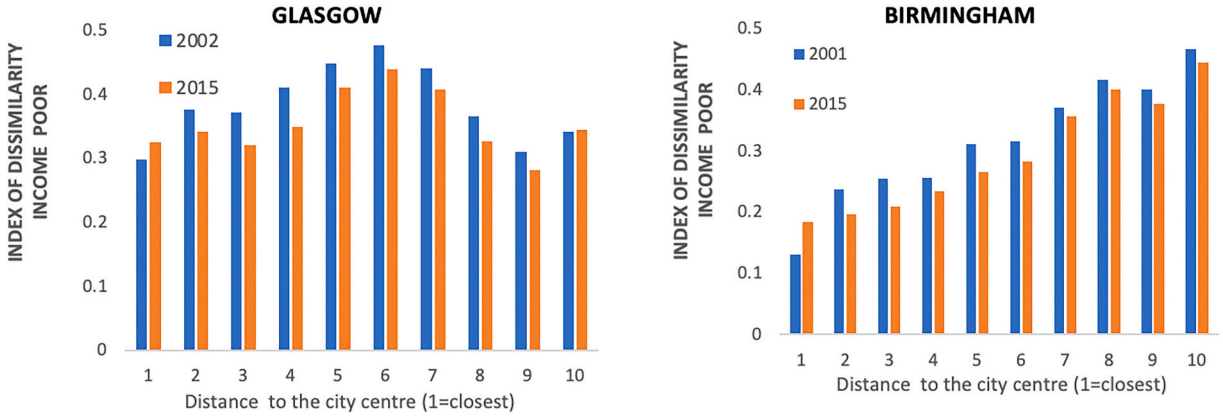

Fig. 1. Index of dissimilarity for income poor in 2001/2 and 2015 by distance to the city centre.

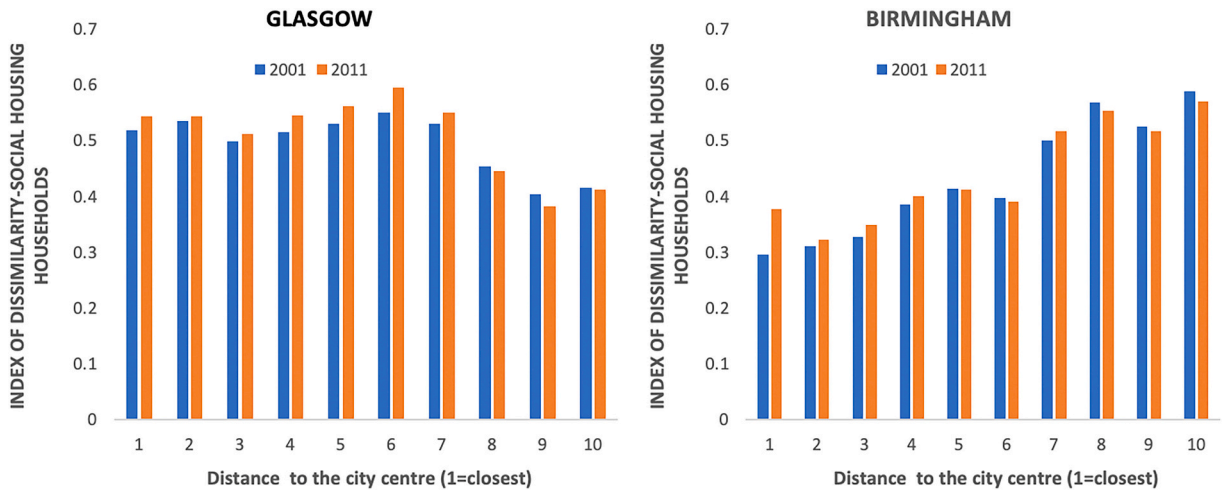

Fig. 2. Index of dissimilarity in 2001 and 2011 for social renters by distance to the city centre.

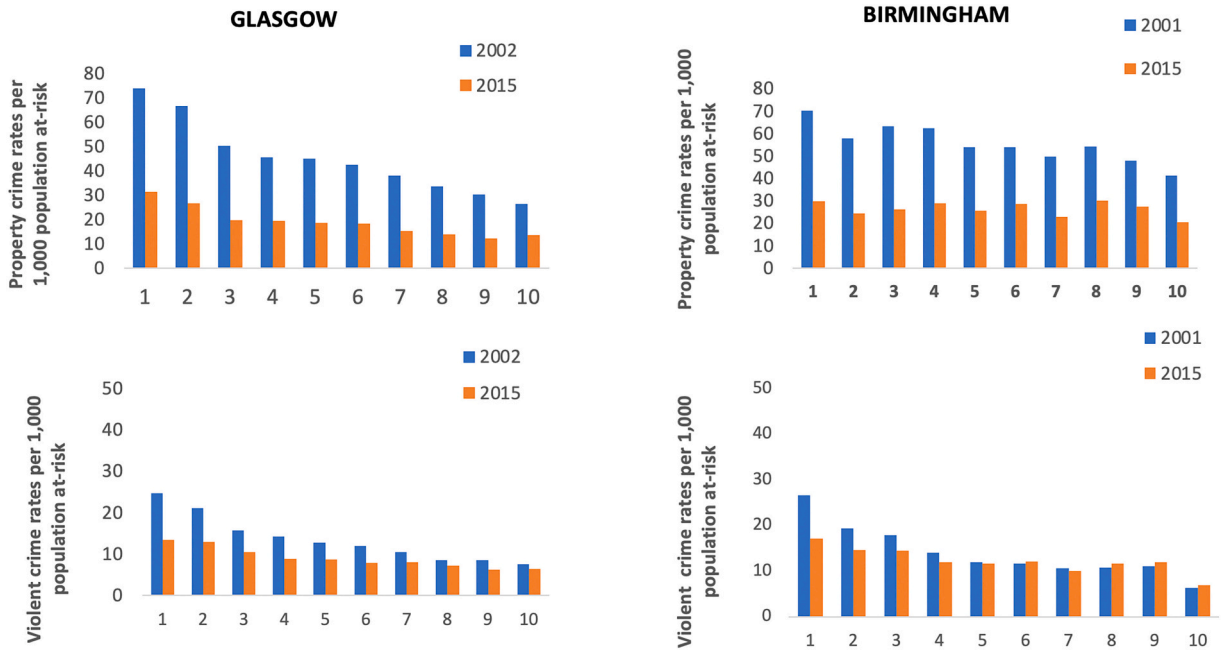

Fig. 3. Average crime rates in neighbourhoods in Glasgow and Birmingham by distance to the city centre, 2001/2 and 2015/6.

violent crime rates fell by 46 % in decile 1, compared to 15 % in decile 10. In Birmingham, violent crime rates fell by 36 % in decile 1 but increased by 10 % in decile 10. Glasgow retains a clear gradient in both average property and violent crime rates ordered by distance from the city centre. In contrast, Birmingham has more even average property crime rates, whilst retaining a gradient in average violent crime rates, ordered by distance from the city centre. It also exhibits evidence of average violent crime rates rising in the neighbourhoods furthest away from the city centre. Finally, it is important to note that despite these changes, the correlation between neighbourhood income-related poverty and both violent (r = 0.6) and property (r = 0.3) crime remained unchanged across the study period in both study areas. The stable association between income-related poverty and violent crime across both cities is noteworthy in a period in which the pace and character of their suburbansation of poverty differed.

4.3. The association between the spatial reordering of poverty and crime

Fig. 4, serves to illustrate the similarities between the changing share of poverty and crime (by type), ordered by distance to the city centre. Whilst there is a reduction in the share of poverty in the central deciles (1 and 2) of both cities, thereafter, they exhibit distinct trajectories. In Glasgow, the share of poverty remains stable in deciles 3–6, but rises in the outer deciles. In Birmingham, there is an increase in the share of poverty in deciles 3 and 4, but the share of poverty remains stable in the outer deciles. Examining the changing share of crime, ordered by distance to the city centre, there is clearly some resemblance to the patterns found for poverty. This is particularly evident in the case of violent crime where it declines in the deciles closest to the city centre, whilst rising in the middle deciles and increasing to the greatest extent in the outer deciles.

Fig. 5 presents the local similarity of the spatial patterns of poverty

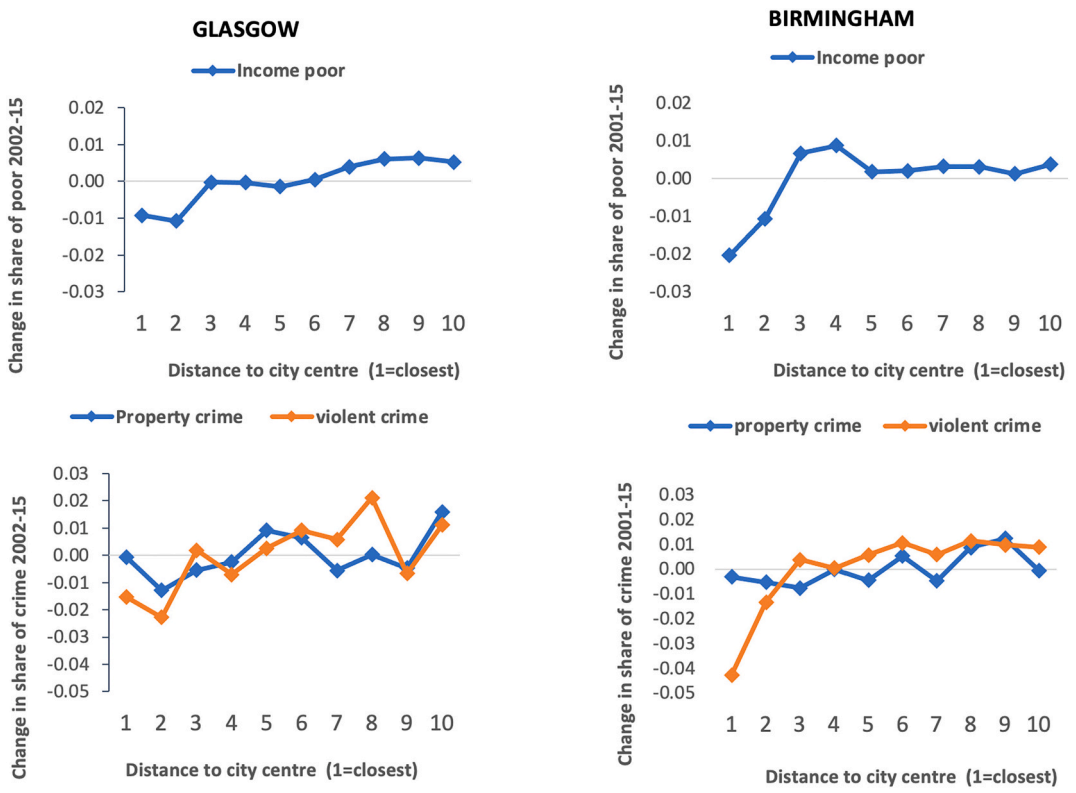

Fig. 4. Change in the share of poverty and crime by distance to the city centre, 2001/2 to 2015/16.

and of crime (by type) between the commencement and end of the study in Glasgow and Birmingham. Fig. 5 (i) presents neighbourhoods with a statistically significant decrease (blue), increase (red) or non-significant difference (yellow) in the percentage of income poor. Similarly, Fig. 5(ii) and (iii) presents neighbourhoods with a statistically significant decrease (blue), increase (red) or non-significant difference (yellow) in violent and property crime rates.

In Glasgow, there are notable instances in which the rate of income-related neighbourhood poverty increased. Overall, around a quarter of neighbourhoods experienced an increase in poverty rates and a further quarter a decrease. Only a few neighbourhoods experienced rising rates of crime (by type), with the majority of neighbourhoods experiencing a decline or remaining unchanged. In Birmingham, the rate of income-related poverty remained unchanged across most neighbourhoods (see Fig. 5).

In both cities, neighbourhoods with the highest concentration of poverty in 2001/2 defined as those in the top 30 % of the income poverty distribution, were more likely to experience a decline in poverty compared to other neighbourhoods. The distribution of income poor neighbourhoods in Birmingham shows that they were more likely to be in the deciles closest to the city centre compared to Glasgow. However, there is a marked cluster of neighbourhoods around the city centre in which the rate of poverty decreased, as well as smaller clusters of neighbourhoods outside this core in which the rate of poverty increased. The spatial patterning of neighbourhoods in which a decrease or an increase in the rate of violent crime took place bears resemblance to the changing spatial patterning of poverty. Once more, neighbourhoods with the highest concentration of poverty were far more likely to experience a decline in violent crime rates compared to the rest of the city. In contrast, the rate of property crime decreased or remained unchanged across most neighbourhoods in Birmingham.

Given these findings, it is to be expected that the global similarity indices for poverty and for crime (by type) are low. Both poverty and crime patterns have diverged significantly between 2001/2 and 2015 in both cities, indicated by rather low Global S- indices (0.34–0.61). Income poverty in Birmingham was more stable over time than in Glasgow, indicated by a higher S-index, showing that 61 % of neighbourhoods exhibit similar spatial patterns in Birmingham compared to 52 % in Glasgow. Whilst there was larger divergence in income poverty patterns in Birmingham, the level of spatial change in property crime was similar in both cities. In contrast, violent crime patterns diverged more in Birmingham than in Glasgow. In Birmingham just 34 % of areas experienced the same percentage of violent crime in 2001/2 and 2015, compared to 47 % of areas in Glasgow.

To assess the extent to which the changing spatial patterning of crime (by type) has mirrored the changing spatial patterning of income-related poverty, in both Glasgow and Birmingham, we compared the values of the Local Similarity Index for poverty and crime (by type) corresponding to the patterns shown in Fig. 5. This allows us to identify neighbourhoods where crime patterns converged to poverty patterns indicating that poverty and crime moved in the same direction. The neighbourhoods with a statistically significant decrease (blue), increase (red) or non-significant difference (yellow) in both poverty and crime are shown in Fig. 6. Table 2 presents the percentage of neighbourhoods in each decile ordered by distance to the city centre where both poverty and crime (by type) exhibited a statistically significant increase or decrease over time. The column indicating an increase corresponds to the number of neighbourhoods where both poverty and crime increased (shown in red in Fig. 6) expressed as a percentage of the total neighbourhoods in each decile ordered by distance to the city centre. Similarly, the column indicating a decrease shows the percentage of neighbourhoods where both poverty and crime decreased (shown in blue in Fig. 6) in each decile ordered by distance to the city centre. The neighbourhoods with the highest concentration of income poor that had crime patterns converging to poverty patterns are also shown (in parenthesis).

In Glasgow, a higher percentage of neighbourhoods mirror poverty and crime performance in the deciles closest to the city centre in comparison to those furthest away. Neighbourhoods closest to the city

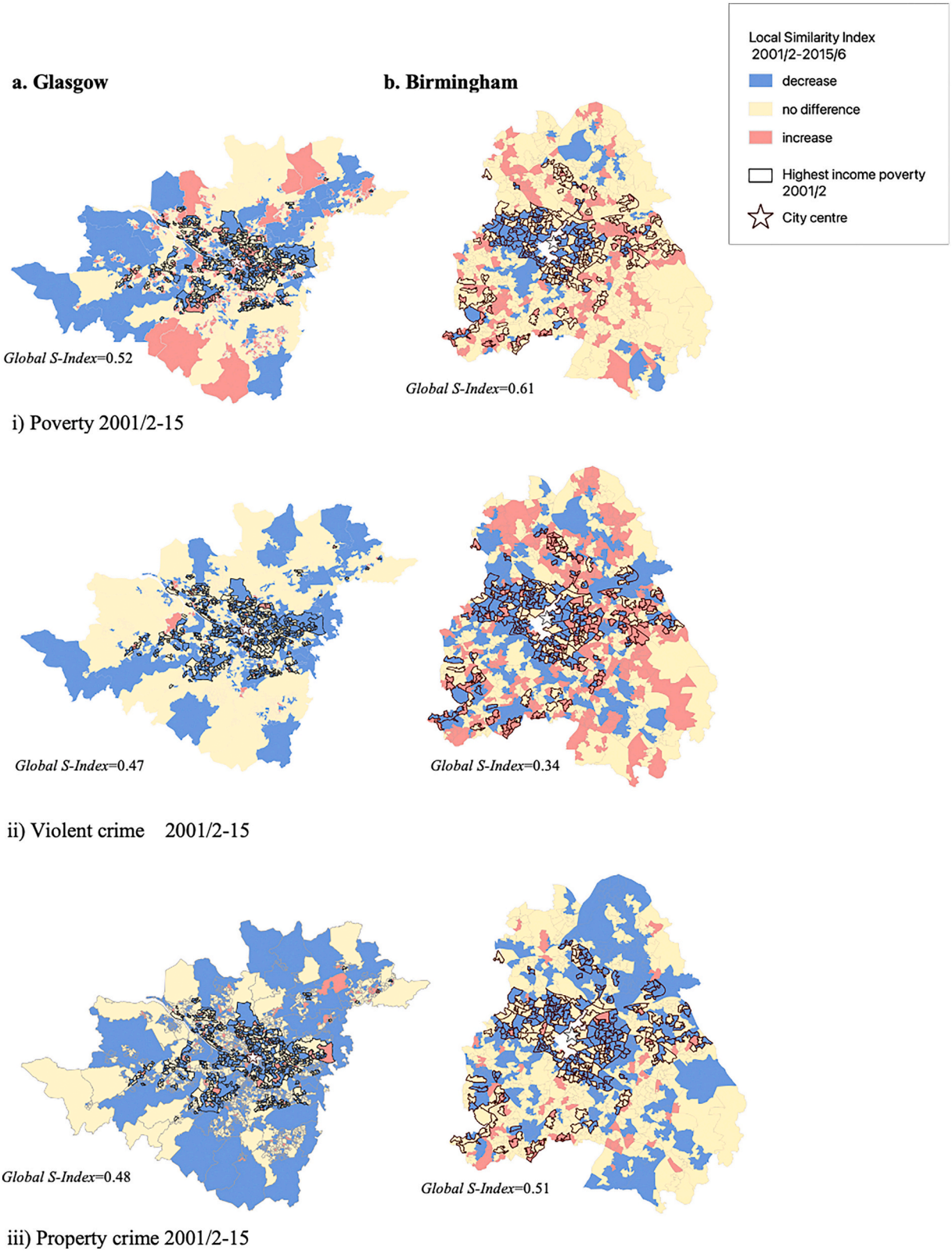

Fig. 5. The local similarity between the spatial patterns of poverty and crime (by type), in Glasgow and Birmingham, in 2001/2 and 2015/6.

centre, including places such as the Gorbals and Sighthill which underwent both large-scale housing demolition and rebuilding programmes, are more likely to have experienced a decline in both poverty and crime rates. Additionally, between 20 % and 30 % of areas with the highest concentration of income poor located in the middle deciles ordered by distance to the city centre (deciles 4, 5, and 6) experienced a decline in poverty and violent crimes. In contrast, 30 % of neighbourhoods with the highest income poverty in the decile furthest away from the city centre experienced an increase in both poverty and violent crime.

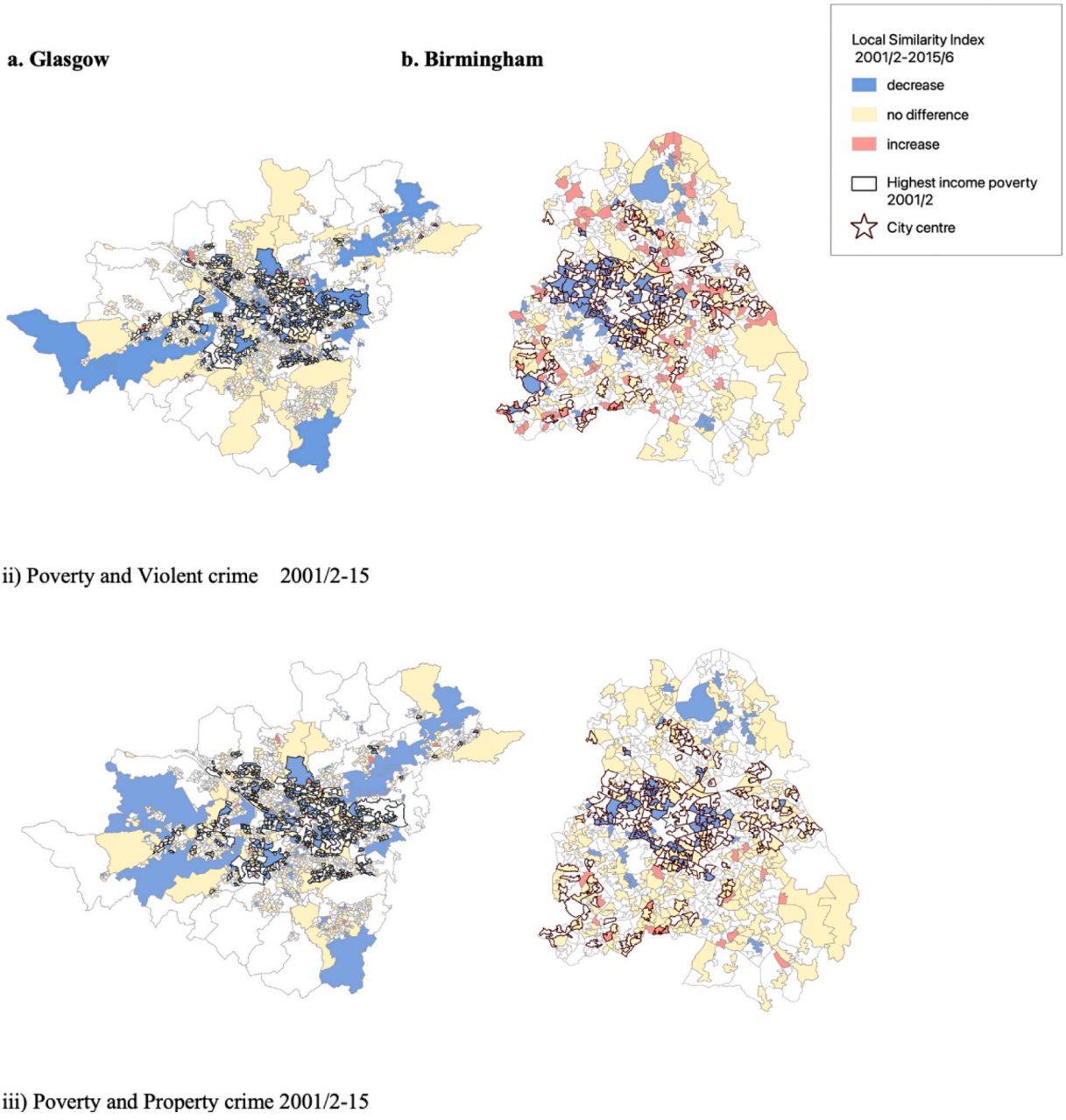

Fig. 6. Neighbourhoods in Glasgow and Birmingham where both poverty and crime increased, decreased or did not exhibit significant difference (by type) between 2001/2 and 2015/6.

In Birmingham, a contrasting picture emerges where a higher percentage of neighbourhoods exhibited similar patterns of change in poverty and crime. Neighbourhoods closest to the city centre, including Aston, Lozells, Handsworth and Winson Green which were subject to large-scale housing renewal (as part of the HMR programme) and regeneration programmes, are most likely to have experienced a decline in both poverty and crime rates. However, a notable percentage of neighbourhoods in the deciles further away from the city centre experienced a rise in the rate of poverty and violent crime.

This can also be seen in Fig. 6, which shows that the neighbourhoods where both poverty and crime increased during the study period were in parts of outer Birmingham in and around smaller clusters of neighbourhoods with a high concentration of income poverty. In Glasgow, neighbourhoods with a reduction in both poverty and crime were concentrated in peripheral areas in the outskirts of the city including parts of Drumchapel in the North-West, Castlemilk and Pollok in the south of the city centre, and Easterhouse located in the East end, where large-scale housing investments took place. In overview, the patterns of change in poverty and crime, specifically the more marked increases in poverty and violent crime in peripheral areas of Birmingham compared to Glasgow, are aligned with their historical and contemporary welfare and housing policies.

5. Discussion and conclusion

This research contributes to international discourse on the suburbanisation of poverty by providing original empirical analyses that demonstrate the local spatial dynamics of, and disentangle the influence of multiple local policies upon, the centralisation and residential segregation of poverty. The comparative case study enabled assessment of the extent to which similarities and differences in the trajectories of the suburbanisation of poverty aligned with the historical, socio-

Table 2
The percentage of all (and the highest income poverty)[a] neighbourhoods in Glasgow and Birmingham with a comparable trajectory of poverty and crime rates, ordered by decile of distance to the city centre.

	Glasgow				Birmingham			
	Poverty and property crime		Poverty and violent crime		Poverty and property crime		Poverty and violent crime	
	Increase	Decrease	Increase	Decrease	Increase	Decrease	Increase	Decrease
1	3.8 (4.1)	22.3 (27)	1.3 (0)	22.9 (23)	0 (0)	35.7 (38.9)	1.2 (1.4)	35.7 (36.1)
2	1.3 (1.4)	21.5 (21.6)	1.3 (1.4)	19 (21.6)	1.2 (0)	21.4 (28.6)	1.2 (0)	21.4 (25)
3	2.5 (3)	9.6 (17.9)	1.9 (4.5)	10.8 (19.4)	0 (0)	7.1 (20.8)	6 (0)	11.9 (29.2)
4	2.5 (1.7)	9.5 (19)	0.6 (1.7)	13.3 (27.6)	1.2 (0)	8.4 (10)	13.3 (10)	4.8 (0)
5	1.9 (1.5)	10.2 (18.2)	2.5 (3)	11.5 (19.7)	2.4 (5.3)	1.2 (5.3)	15.5 (5.3)	3.6 (15.8)
6	2.5 (2.2)	13.3 (13.3)	1.3 (0)	8.2 (20)	1.2 (0)	1.2 (0)	13.1 (0)	2.4 (0)
7	1.3 (0)	8.9 (16.7)	1.3 (5.6)	5.7 (11.1)	2.4 (0)	3.6 (0)	9.6 (0)	3.6 (0)
8	1.9 (3.8)	7.6 (11.5)	0.6 (3.8)	3.8 (11.5)	6 (13.3)	4.8 (6.7)	11.9 (20)	4.8 (0)
9	1.3 (0)	5.7 (16.7)	1.9 (8.3)	4.4 (16.7)	4.8 (6.7)	4.8 (0)	10.7 (13.3)	3.6 (6.7)
10	3.2 (14.3)	11.5 (7.1)	4.5 (28.6)	5.8 (7.1)	1.2 (0)	2.4 (0)	13.4 (33.3)	4.9 (16.7)

[a] % The percentage in the parenthesis is calculated by dividing the number of neighbourhoods with the highest income poverty (in the top 30 % of the income poverty distribution in 2001/2 in each city) with a comparable trajectory of poverty and crime, by the total number of neighbourhoods with the highest income poverty, in each decile ordered by distance to the city centre.

political and institutional resources and regimes of the settings. Moreover, it has illuminated the consequence of the suburbanisation of poverty on neighbourhood inequality in exposure to crime. In so doing, it also probes the continued relevance of urban criminological theories utilising poverty as a core explanatory variable.

In line with existing evidence, this research found evidence of spatial reordering of poverty in two major conurbations in the UK (Bailey & Minton, 2018; Zhang & Pryce, 2020), though both its degree and character varied between settings. Glasgow exhibits lower levels of income-related poverty segregation between neighbourhoods in the areas closest to and furthest away from the city centre. Birmingham, though holding a lower average level of segregation, exhibits a clear gradient of segregation with the lowest level of segregation between neighbourhoods found in the inner city and the highest levels in the outer urban areas. In both settings, poverty segregation fell across the study period, with exception of the decile closest to the city centre.

The findings demonstrate that whilst a spatial reordering of poverty and crime occurred in both cities, it was shaped by their distinct housing, regeneration and crime prevention policies. Marked reductions in both poverty and crime took place in the inner-city areas. In Glasgow, the council housing stock was transformed following several high-profile demolitions of large inner-city housing estates, as well as new build developments on the outskirts of the city, leading to a substantial reduction in income-related poverty in the inner-city areas and changes in the tenure mix (Glasgow City Council, 2017). The local character of these changes, entailing the interplay between housing and criminal justice strategies is exemplified in the East End of Glasgow where a large reduction of violent crime has been attributed to a range of interventions deployed by the Violence Reduction Unit (set up in 2005) (Williams et al., 2014) and a significant reduction in neighbourhood poverty to the housing investment that took place surrounding the 2014 Commonwealth games (Scottish Government, 2015).

In Birmingham, both urban renewal programmes (Birmingham City Council, 2019; Leather & Nevin, 2013) and gentrification have been associated with the revitalisation, and changing deprivation profile, of many deprived inner-city neighbourhoods (Lupton et al., 2013) as well as a reduction in crime in these areas (Alonso et al., 2019; Batty et al., 2010). Relatedly, NDC partnerships, supplementing police budgets, in these (and other) areas implemented a range of interventions to address issues of crime and community safety (Batty et al., 2010). These were complemented by the HMR programme which placed emphasis on improving the design quality, standards and security of housing as well as on neighbourhood management activity (Leather & Nevin, 2013).

In both cities, large scale investments also took place in new build developments on the outskirts of the city including in Pollok, Drumchapel, Castlemilk and Easterhouse in Glasgow and the Northern Periphery and South-West in Birmingham. However, and in these areas both poverty and crime declined or did not exhibit significant change in their trajectories over time. Given that poorer people tend to reside in social housing and have a greater choice of affordable private housing in the urban periphery (Bailey & Minton, 2018), this findings appears to reflect a greater mixing of tenure in the peripheries of these cities which might mask local concentrations of both poverty and crime.

Despite evidence of the spatial reordering of poverty and of crime, this has not served to substantively alter the association between poverty and crime, which has remained stable. Indeed, that the association between violent crime (in particular) and poverty remained robust despite the overall crime drop (Tseloni et al., 2010) and in the face of a substantial reordering of poverty points to the continued relevance of criminological explanations of crime that deploy poverty as a key explanatory variable. The research found evidence that neighbourhood crime trajectories mirrored those of poverty, particularly in the areas closest to the city centre. Further away from the city centre, and reflective of both the urban structure and housing policies of the settings, violent crime rates increased in the middle to outer areas of Birmingham, whilst in Glasgow they remained relatively unchanged. The higher degree of similarity between the patterns of change in poverty and violent crime in suburban Birmingham, compared to suburban Glasgow, appears to be reflective of the greater suburbanisation of poverty in Birmingham during this period. In these terms also, it is plausible to conclude that the spatial reordering of poverty does not appear to have delivered a greater mixing of poverty within these neighbourhoods, absenting the benefit that this might afford social organisation (Galster, 2007; Musterd & Andersson, 2005). These insights open avenues through which future urban criminological research might be advanced. Given that we provide compelling evidence of an enduring association between poverty and crime despite the substantial spatial restructuring of poverty, future studies utilising longitudinal approaches might seek to illuminate the mechanisms underlying the relationship between poverty and crime. It might do so by examining the causal effect of suburbanisation on crime, taking into account changes in both the social and physical environment and the location of offenders.

That the suburbanisation of poverty has not resulted in increasing levels of residential segregation of the income poor outside inner-city areas is suggestive of the relationship between the suburbanisation and segregation of poverty being complex. It is likely that this has been conditioned by changes in the housing tenure mix in general and an increase in the private renting sector in particular. If the suburbanisation of the income poor to the outer areas of the cities has involved movement into the private rented sector, which is more dispersed, this would account for the lower levels of segregation observed. It is possible that this might be a short-term effect of the suburbanisation of poverty and

not a factor that serves to erode long-term spatial inequalities in UK cities (Bailey & Minton, 2018). In line with research that has pointed to the suburbanisation of poverty worsening the socio-economic conditions and opportunities of the urban poor (Bailey & Minton, 2018; Zhang & Pryce, 2020), the association between poverty and crime in these localities may heighten through time. Just as concentrated poverty and crime has been identified as intensifying the exodus of the middle classes from the 'problematic' central city (Jargowsky & Park, 2009), in time it may serve to stimulate a similar flight from certain outer urban areas.

Our research has also evidenced that the contraction of social housing, taking place in both cities, has been accompanied by increases in levels of segregation of social rented households. Given that both poverty and crime tend to concentrate in social housing areas our analyses draw attention to the relevance of housing tenure to ecological explanations of crime. Whilst a rich vein of criminological research has previously considered this issue (Bottoms, 2007; Foster & Hope, 1993) our findings provoke the necessity of renewing this avenue of research and of integrating it with economic, social and environmental theories of crime (Bannister et al., 2019).

Finally, and in interpreting our findings it is also important to recognize that Police recorded crime may conceal the true levels of crime due to under-reporting or under-recoding of crime by the Police in income-poor areas (Lymperopoulou et al., 2022). Moreover, it is also possible that the spatial scale of analysis deployed in this study might have served to mask micro area concentrations of both poverty and crime. Accessing finer grained poverty and crime data would serve to help unpick this issue.

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CRediT authorship contribution statement

Kitty Lymperopoulou: Conceptualization, Methodology, Formal analysis, Visualization, Investigation, Writing – original draft, Writing – review & editing. **Jon Bannister:** Conceptualization, Methodology, Supervision, Writing – original draft, Writing – review & editing, Funding acquisition.

Declaration of competing interest

The authors have no conflicts of interest to disclose.

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