Trajectories of deprivation in the UK

Main Public Output

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Summary of key findings

This research report shows how deprivation has changed over neighbourhoods across the UK over the period 1971 to 2021 (2022 in Scotland). The analysis of deprivation trajectories – the ways on which deprivation has changed over the study period – demonstrates that single timepoints obscure local-level dynamics in deprivation and that a focus on single time points is not sufficient. It is shown that there are many – mostly urban – areas of the UK which have remained amongst the most deprived communities for over fifty years. Persistently deprived communities are found in cities including Birmingham, Liverpool, Manchester, Glasgow, Belfast, and in other locales across the UK. In other areas, there have been relative decreases in deprivation which appear to correspond to regeneration programmes and, in some cases, specific interventions.

The results show widening spatial inequalities in some areas with relative increases in deprivation in areas which already have the largest concentrations of deprivation. In England, as an example, the differences between the north and west and the south and east are growing - with increasingly large shares of the most deprived areas in the former areas over time. Without an understanding of how deprivation changes in local areas it is impossible to properly design interventions which can effectively address the challenges faced by communities in areas of persistent or growing deprivation levels. These findings should be used to help to design new approaches to tackling deprivation in those areas where levels are persistently high.

The research also shows how deprivation can be spatially concentrated into small areas and is often obscured by using the standard geographical areas which provide the basis of most analyses. The project supports calls to both more fully understand the implications of changes in deprivation in neighbourhoods and also to better measure and target deprivation which is often found in very small pockets within areas with generally low deprivation levels.

The resources this project offers will enable analysts to better understand why some areas have seen relative improvements while others have remained persistently deprived. The lessons learned from those areas which have seen improvements could become a crucial means of tackling long-term deprivation in other areas and provide an important tool in support of efforts aimed at breaking the cycle of deprivation which plagues many communities

Executive summary

Introduction

Deprivation indices are area-based measures of deprivation which combine different characteristics potentially including employment status, education level, health, and many others. Deprivation indices are a key means of understanding the geographies of inequality in the UK and elsewhere. Such measures are also used to target resources to communities in need. In the UK, the indices of multiple deprivation (IMDs) have been used in numerous contexts to show where, and in what ways, communities are deprived. They have also been used to allocate billions of pounds of public money and they have been a core tool in major UK government programmes including the Neighbourhood Renewal Fund and the Single Regeneration Budget, as well locating Sure Start Centres, and in many other contexts[1].

[1] https://ocsi.uk/2016/03/24/why-the-imd-is-still-important-in-the-open-data-age/

One limitation of most applications of deprivation indices is that they focus only on the most recent time period (for example, 2019 in the case of the most recent English Index of Deprivation), meaning that neighbourhoods with similar levels of deprivation during that period are treated as the same. As an example, funding might be targeted at all areas which are among the most deprived 10% nationally. In practice, however, the deprivation histories of these areas will be very different. Some areas will have remained amongst the 10% most deprived for several decades while others may have had fluctuating levels of deprivation, or perhaps have seen markedly increased deprivation in recent years. Given this, the challenges associated with reducing deprivation in areas may differ considerably, not least in part because the historical context of areas differs. The 'Trajectories of Deprivation in the UK' project seeks to characterise the ways in which deprivation has changed in local areas over time.

The project team has developed an innovative toolkit for documenting and understanding local area changes in deprivation, and for assessing the effectiveness of – and guiding future – interventions for reducing social and spatial inequalities. The project has integrated and analysed data on deprivation for all four UK nations using several measures (Census data, multiple deprivation measures, monthly benefits claimants data), to explore how deprivation has changed across local areas. This novel approach – of exploring neighbourhoods *across* the UK and integrating multiple data sources – is further strengthened with an innovative component that interweaves an historic perspective, documenting deprivation over the last fifty years. The project has generated a classification of deprivation trajectories and identified those places falling into each trajectory type.

The project addressed five core research questions:
1: What are the characteristics of deprivation in each neighbourhood (e.g., high unemployment, poor health, high crime)?
2: What are the most significant components of change in each neighbourhood (e.g., employment, housing)?
3: What are the characteristics of areas where there have been relative increases/decreases/stability in deprivation? A related sub-question is: which areas saw the largest increase in unemployment following the first Covid-19 lockdown?
4: What interventions are associated with changes in deprivation?
5: How can lessons learned from areas with decreasing deprivation levels be used to shape interventions elsewhere?

Project structure and outputs

Work package 1. Producing temporally consistent data for the UK
Assessing medium- and long-term trends in neighbourhood deprivation requires access to data which have the same spatial units across time – they are temporally consistent. Building on previous work by members of the project team (e.g., Norman, 2016), the team has generated temporally consistent data for small geographical areas - namely lower layer super output areas (LSOAs) (England and Wales), data zones (DZs) (Scotland) and super data zones (SDZs) (NI).

The separate indices of multiple deprivation (IMDs) for the four UK nations are constructed using similar methodologies (see Noble et al., 2019 on the English index). However, the IMDs are not directly comparable between nations and inconsistencies in data and definitions make between-nation analyses difficult. Our IMD analyses were therefore undertaken for each UK nation in isolation.

Work package 2. Tracking change in deprivation

The team has analysed trajectories of deprivation using data from the Censuses of 1971 to 2021/22, the IMDs for each of the four UK nations, and claimant count rates (a proxy for unemployment, in the absence of routinely updated unemployment data for small areas). The main focus was on the most recent period (ten to 15 years) given the concern with assessing interventions (e.g., employment training schemes, healthcare initiatives), but analysis of earlier periods has allowed assessment of how deprivation has persisted in the long term. The aim was to group together neighbourhoods with similar trajectories — patterns of, for example, consistent, increasing, or declining deprivation.

For each nation, common data from each of the Censuses 1971 to 2021 (2022 in Scotland) were extracted and combined into a single deprivation index – the Townsend index. This combines data on unemployment, rented households, car or van access, and overcrowding. Several releases of the IMD were also compared for each nation.

In the case of Census data and claimant counts, analysis of changing rates over time was undertaken (e.g., unemployment levels in 2001 compared to 2011). For the IMDs, the focus was on comparing changing ranks over time, since domain scores for different releases are not comparable. The first stage of the analysis included summaries of change, including identification of which components of deprivation (e.g., income, employment, health, etc.) changed most over what period. The main changes differed by indicator and by nation. As one example, in England for the Townsend index the largest changes were in employment over the periods 1971 to 1981 and 1981 to 1991, while tenure and overcrowding saw the largest changes in the most recent periods.

The key focus of the analysis was on grouping together neighbourhoods with similar deprivation trends across time. Two sets of deprivation trajectory clusters were developed. The first involved combining the Townsend index indicators for each neighbourhood into a classification comprising five groups, while the second involved classifying each neighbourhood into one of ten groups according to its rankings in the seven or eight domains of the relevant nation's IMD. Some example locations are listed below.

The classes differentiate, for example, neighbourhoods with persistently high deprivation levels from those with persistently low levels, and also areas which have seen decreasing deprivation levels in recent years from those where deprivation levels have increased. The research shows, for neighbourhoods across the UK, how deprivation has changed over a 50 year period – but with a focus on the last 20 years. The analyses indicate that, in some areas, deprivation has remained very high – there are many such cases in, for example, the North West and North East of England. In some localities, deprivation levels not only remain high but are worsening when compared to other areas across the UK – for example, judging by the IMD, the North West of England is becoming relatively more deprived than the rest of England. Conversely, some neighbourhoods which had very high deprivation levels 20 years ago have seen marked decreases in deprivation compared to other areas - there are many areas in London with relative decreases in deprivation as measured by the IMD. The research has highlighted those areas where deprivation has remained high, so as to highlight areas where the need for support may be particularly marked. It has also taken a focus on areas which have seen a notable decrease in deprivation from a relatively high level. In these cases, the aim is to assess evidence for interventions which may be contributed to this decrease and which could potentially be implemented elsewhere to help 'turn the curve' in areas where high deprivation levels have not decreased.

Work package 3. Local authority deprivation profiling
The team has developed deprivation trajectory profiles for every local authority district (LA) in the UK. These profiles detail temporal and spatial trends in deprivation, using spatially consistent data from the UK Censuses of 1971 to 2021/22 to provide historical background on long-term changes in deprivation across each LA. The profiles were created using an automated procedure using R markdown[2]. This means that they can be adapted and updated easily and recreated for all or a subset of LAs. Each profile highlights geographical patterns of deprivation and outlines which Townsend index indicators or IMD domains have changed most in each LA. The deprivation trajectory classes (groups) to which each neighbourhood belongs are summarised.

Work package 4. Understanding changes
Provisional outputs from WP3 were shared with LA analysts from the project advisory group and from a further 32 selected case study LAs. The analysts were invited to discuss the changes detailed in the profiles with the team, bringing the benefit of their local knowledge of changes and policy/strategic interventions over the last ten years. This consultation process, along with documentary analysis (of, e.g., intervention evaluations and policy reports), combined to produce an evidence base on how local areas have changed and what might have influenced these changes, including the role played by interventions aimed at reducing spatial inequalities. This evidence is being used to help develop approaches to tackling ongoing inequalities by allowing a focus on those areas where deprivation is persistently high or is increasing.

Work package 5. Deprivation toolkit: guiding interventions
The team has produced a set of 'how-to' guides[3] which explain how the results from this study can be used within local areas to understand deprivation change and help shape interventions, following best practice in other LAs with similar deprivation trajectories. Seminars and workshops have been used to disseminate the key findings to LAs, central/devolved government department analysts, voluntary and community sector (VCS) representatives, and academics. These events detailed the resources produced (web-based mapping tools, profiles, report, etc.) and presented the main changes observed across the UK. They have also considered how the results can be used to help shape future interventions, by detailing the types of schemes which have had most impact on changing deprivation levels in particular situations. These include schemes aimed at ensuring that people who entitled to benefits take them up, educational allowances, universal free school meals, free school meals, youth clubs, and also major home building programmes.

Deprivation trends across the UK
The most intense concentrations of deprivation are generally found in the same types of areas across the UK nations, with high levels found in parts of all major urban areas including London, Birmingham, Liverpool, Manchester, Newcastle, and Glasgow, amongst others. Other areas with high levels include some coastal locales such as parts of Lincolnshire and the North East of England and, notably, the former coalfields of South Wales. Many areas with high deprivation have long histories of industrial decline, with ongoing implications for the wellbeing of occupants in these areas. The broad geographical trends are consistent across measures of deprivation (e.g., employment, health, etc), although it is important to note that, for some measures, other areas appear as highly deprived.

Spatial trends in deprivation depend on the size and shape of the areas used to report the data. The study includes an element which assesses how deprivation trends vary over a range of spatial scales in England and Wales, and in Northern Ireland. This element of the study demonstrates

[2] https://rmarkdown.rstudio.com/
[3] See the project website: https://www.qub.ac.uk/research-centres/GIS/Research/Deprivation/

that there are significant pockets of deprivation in some areas that are obscured if standard output areas – such as Lower layer Super Output Areas in England and Wales – are used to report and analyse deprivation. This is particularly the case in rural locales where large areas may be covered by standard output zones with the consequence that pockets of higher deprivation may be 'averaged out' by neighbouring more affluent areas. It is recommended that the smallest possible spatial areas are used for the analysis of deprivation trends.

The analysis of differences between the 2015 and the 2019 English IMDs highlights some of the challenges in assessing changes whereby differences in input data and definitions may partly explain some of these changes. It is argued, however, that there have been large scale differences in the two IMD releases which are likely to reflect real changes rather than simply data artefacts. The largest share of localities which became relatively *less* deprived were in London, while large *increases* in relative deprivation were seen in the North East and the North West of England.

There are many commonalities across the UK nations with respect to the indicators or domains which changed most between each tine point. As an example, employment increased more than any other indicator over the period 1971 to 1981 in all four UK nations. For later periods, the picture is more mixed although housing tenure (rent) deprivation increased most in England, Wales and Northern Ireland between 2001 and 2011 and in all four nations between 2011 and 2021/2022 (in Scotland). For the IMDs, comparisons are more difficult because of differences in deprivation domains and index time points. There are, however, common changes in access to service / barriers to housing and services in each of England, Wales, and Northern Ireland. Collectively, the results suggest that the similarities between the four nations are greater than the differences between them and that the most notable temporal trends in deprivation are shared by all four areas.

There are similar trajectories of deprivation in each of the four UK nations with local areas which remain stubbornly highly deprived (and which are generally found in the larger urban areas) and other areas which remain (in relative terms) only moderately deprived, or with consistently low deprivation levels. There are, however, differences in how the trajectory types change relative to one another. In England and Wales, and to a lesser degree Scotland, there are areas which switch positions – one starting more highly deprived than the other on average but ending the study period with lower levels of deprivation. There are no such trajectory classes in Northern Ireland. For the Townsend Index trajectories, there are common trends which include an absolute decrease in deprivation over the period of the study (that is, 1971 to 2021), but with similar differences between most classes at the end of the period as at the start. In other words, broad inequalities remain similar but deprivation has, in an absolute sense, declined in most localities.

For the IMDs, as for the Townsend Index, there are areas which remain consistently highly deprived and areas which have low levels of deprivation at all time points, as well as areas with moderate levels of relative deprivation. The differences between trajectory types (in terms of average ranks) in each nation are, however, contrasting. For Scotland and Northern Ireland there are large differences between the trajectories for the most deprived areas and the areas at the next level down the chart (that is, areas with the second highest deprivation levels) while the equivalent differences for England and for Wales are much smaller. In other words, in Scotland and Northern Ireland there is only one type of highly persistently deprived area. In contrast, there are distinct different types of persistently highly deprived areas in England and Wales. There are some distinct trends in deprivation by area type. As an example, some 52% of neighbourhoods which saw a relative increase in deprivation between 2015 and 2019, as measured by the English IMD, were in rural areas.

Persistently deprived areas in England are most commonly found in urban areas of the North West (e.g., Liverpool, Manchester) and the North East (e.g., Newcastle) and in the Midlands (most notably Birmingham). In Wales, persistently high deprivation is most obviously concentrated in the former coalfields in the south of the nation. Glasgow has the highest concentration of such areas in Scotland while, in Northern Ireland, Belfast and Derry/Londonderry have the largest shares of persistently highly deprived areas.

While the differences between the IMD trajectory profiles are partly a function of the characteristics of each of the four sets of IMDs, there are common trends in the trajectories corresponding to the most deprived areas being most commonly found in urban areas. A notable exception to this is London which has no local areas which have persistently highest deprivation. In England, large concentrations of areas with high but decreasing deprivation are found in London and parts of Birmingham, with a few scattered areas elsewhere.

Some of the IMD trajectory classes indicate high deprivation at the start of the study period (2004 for England) which decreases over time. Understanding these areas is important as a key concern of the project is to identify the key drivers of decreasing deprivation. If successful interventions can be identified, then it is possible that this knowledge could help to shape strategies elsewhere. To unpick these changes, the share of people in professional and managerial occupations was assessed by trajectory class. This analysis showed that, in a small minority of places with high but decreasing deprivation, there was a disproportionally large increase in the share of people in professional and managerial occupations. This was interpreted as showing that decreases in deprivation in some areas is related to processes of gentrification whereby some members of existing communities are displaced and new housing attracts more affluent people. In other cases, in contrast, there is a suggestion that decreasing deprivation may be explained by interventions aimed at reducing spatial inequalities. Fuller assessment of areas of decreasing deprivation using a Census data based area change classification shows that the population profiles of areas with similar deprivation trajectories can be quite different and that, therefore, 'one size fits all' approach to tackling persistent deprivation may not be appropriate.

The project also explored how spatial scale impacts on the measurement and understanding of deprivation trends. If the size of areas used to measure deprivation are larger than underlying pockets of deprivation then those pockets may be missed and support (e.g., funding) assigned to areas may miss out communities in need. The analyses for England and Wales show that differences in Census-based deprivation measures within Lower Layer Super Output Areas, which are commonly used for deprivation measurement, can be considerable. The potential benefits of using smaller areas – Output Areas (which fit within which fit within LSOAs) – was assessed. For LAs such as Merthyr Tydfil, where deprivation is focused in highly localised areas, there is clear 'added value' in using an OA-based targeting approach. Similarly, areas such as Eastbourne would benefit from an OA-based targeting mechanism since using measures at LSOA level would miss this local authority's most deprived OAs completely. These findings suggest that the smallest possible geographical areas should be used in analyses of deprivation so as to direct support to those most in need. Using data unique to Northern Ireland, a deprivation measure was produced for an array of different geographical zones, including 1km and 100m grid squares. The analyses showed, for rural areas in particular, marked variation in deprivation within even the smallest standard geographical areas. As in the case of England and Wales, the use of the smallest available areas is strongly recommended so as to best characterise and support deprived communities.

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Project introduction

Neighbourhood deprivation measures play a major role in identifying vulnerable communities in the UK, and in targeting resources to support these communities. Indices of multiple deprivation (IMDs) are the official measures of deprivation in each of the four nations of the UK and they have been used to allocate billions of pounds of government money. The success of schemes to reduce deprivation should be assessed by measuring changes in deprivation over time, yet this is rarely attempted. This is important, because their impacts are likely to be a partly a function of the deprivation history of an area (e.g., deindustrialisation, population decline). More generally, the trajectory of deprivation, and not just its current state, is significant in outcomes such as health status (e.g., Dearden et al., 2020).

The 'Trajectories of Deprivation in the UK' project has developed a novel resource which characterises deprivation across neighbourhoods of the UK and, crucially, assesses the ways in which it has changed over time. The project has explored changes over a long time period (from 1971) but has focused on the last 20 years. Utilising Census data (1971 to 2021/22), the IMDs for the four UK nations, and monthly benefit claimants data from 2020 onwards, classifications of area trajectories in deprivation have been created for neighbourhoods across the UK. The classes represent, for example, persistent deprivation, recent increasing deprivation, or declining deprivation (accounting for changes in different domains of deprivation).

The project team has collaborated with policy and practice experts within case study local authorities (LAs) to interpret the main trends in deprivation in their areas. We anticipate that LA analysts will find learning about other areas with deprivation trajectories similar to their own very useful. Understanding interventions associated with decreases in deprivation may help to shape similar schemes elsewhere. These might include, for example, new employment training to equip young people with key skills, targeted capital investments, or enhancements to housing quality.

In addition to its novel academic contributions, the project has produced a toolkit for LA analysts and the voluntary and community sector (VCS), detailing both the vulnerabilities faced by people living in deprived areas and some approaches to reducing spatial inequalities. The research has been co-produced, linking published accounts with 'on-the-ground' knowledge of interventions from LA policy and strategy officers. The outputs will be used in addressing long- and medium-term inequalities, very recent changes associated with Covid-19, and connections between them. We hope and anticipate that this resource will become a core tool in identifying local challenges and solutions, and in improving community welfare across the UK.

To summarise, there are four key issues which have driven the research:

1. Deprivation measures are crucial in the development and implementation of policies to help disadvantaged communities
2. Funding tends to be allocated based upon indices for a single time point
3. The likely success of interventions is determined by the deprivation history and trajectory of an area
4. Success of schemes should be assessed by measuring changes in deprivation over time.

Project context

The measurement of area deprivation has attracted considerable attention over the last 20 years and more and composite measures have played a major role in identifying areas in need and in allocating financial and other resources; in the UK, each nation's Index of Multiple Deprivation (IMD) (see Noble et al. 2006) is used to allocate billions of pounds of public money annually (note that different terminology has been used at different time points and in different nations, but 'IMD' is used here throughout as a general term for these indices). Numerous measures of deprivation have been proposed and in Britain these have traditionally tended to make use of data from the Census (see Senior 2002 for a review). More recently, the IMD, with variants in England, Wales, Scotland, and Northern Ireland, has become the key means for profiling deprivation in small areas of the UK. It has been estimated that as much as 1% of all government spending in England has been allocated using the IMD[4]. The IMDs for each of the constituent nations of the UK cannot be directly compared, although Abel et al. (2016) present a methodology which allows for adjustment of the income and employment domains of the IMD so that cross-UK comparisons can be made. Changing definitions mean that direct comparisons across time within countries are also problematic.

Many studies have explored area deprivation, its measurement, and the (major) consequences it has for people living in areas with high deprivation levels. However, only a small number of these studies concern themselves with deprivation histories of areas, instead focusing upon recent time periods and contemporary states of deprivation. However, there is significant value in understanding how area-based deprivation changes over time. This is partly for the purpose of assessing the impact of, and monitoring the effectiveness of, various interventions, policies, and strategies which aim to address deprivation. As Norman (2016) noted, "if a measure can be derived which is comparable over time, then practitioners can use that information to assess whether places are becoming more or less deprived in parallel with economic cycles and other changes such as housing development schemes". Lloyd et al. (2023) comment that a substantial amount of money is invested in schemes across the UK in a bid to tackle or address deprivation. They argue that the success of these schemes can only be assessed by measuring changes in deprivation over time, and the effect of schemes is likely to be a function (at least in part) of the deprivation history of an area. The trajectory of deprivation, including its current state, is important in understanding the likely impacts of deprivation on those who live in deprived areas. It is argued that a greater knowledge of deprivation trajectories is crucial in achieving any meaningful reduction of spatial inequalities.

Across the UK, LAs are tasked with responsibilities such as delivering social care for children and adults, providing 'neighbourhood services' such as libraries and waste collection, and attending to some aspects of transport, housing, and education. To undertake such activities, they typically rely on funding obtained from central government grants, council tax, and business rates. However, compared to some other countries, local government in the UK has limited revenue-raising power[5], and over the last decade, there have also been large reductions in central government grants. As a result, despite projected increases in LA grant funding in the most deprived areas to support 'levelling up', generally their spending power has fallen. LAs have had to learn to 'do more with less', including tackling the persistent issue of deprivation. It is therefore crucial that interventions designed to address deprivation are targeted to ensure they reach those who are most vulnerable.

[4] http://ocsi.uk/2011/03/24/why-the-imd-is-still-important-in-the-open-data-age/; the analysis refers to the period between approximately 2000 and 2010

[5] https://www.instituteforgovernment.org.uk/explainer/local-government-funding-england

Previous work on change in deprivation in Britain over small areas has utilised standard Census geographies with counts reallocated from source zones (the original geographical areas for which data are provided) to a common target geography (the new geographical areas for which data are required). Norman *et al.* (2003) and Norman (2010) explore change in deprivation using data for wards for 1991 and 2001. This work is extended by Norman (2016) and Norman and Darlington-Pollock (2017) who chart changes in deprivation for neighbourhoods in Britain between 1971 and 2011. Lloyd *et al.* (2017b) characterised change in deprivation in Britain between 1971 and 2011 over 1km grid cells developed as part of the PopChange project (Lloyd et al. 2017a). Hincks (2015) utilises the 2004 IMD as a benchmark along with data (for 2001 to 2007) on the total population, benefits claimants and median house prices, to profile change in deprived areas of Greater Manchester. The 1971 to 2001 deprivation scores developed by Norman and colleagues have been utilised in analyses of changing cancer registrations and survival from cancer (for example, McNally et al. 2012). Other studies which explore deprivation change include those of Noble et al. (2001), who assessed geographic patterns of income deprivation, Evans et al. (2002), with a focus on temporal trends in benefit claimant rates, Barnes et al. (2011), who were concerned with worklessness and deprivation, and McLennan et al. (2012), focusing on economic deprivation in England between 1999 and 2009. In these studies, individual-level linked administrative data were used to explore the individual-level dynamics that underpinned the observed change (or lack of change) at small area level.

It is worth noting that an area which appears to have 'no change' in deprivation might in fact have a high degree of change at the individual person level, with people moving into and out of poverty and people moving into and out of the area. Understanding the individual level dynamics in an area is extremely important in tailoring polices to tackle persistent deprivation (see Robson et al., 2008). Barnes et al. (2011) built on the Robson typology using individual level benefits administrative data to track people into and out of work and between geographical areas. Mobility into and out of areas is not considered in this study (see Rae et al., 2016, who consider community and migration trends in relation to deprivation).

Context – how local authorities understand deprivation

Over the years, both the definition and measurement of deprivation have been the subject of extensive debate. Many deprivation measures now incorporate multiple dimensions or domains of deprivation. The indices of multiple deprivation (IMD), of which each devolved UK nation across the UK has their own version, is a key resource for measuring deprivation, and is commonly used by LAs nationwide. The IMDs capture diverse forms of deprivation including individual characteristics such as income and education, but also contextual variables including crime rates and air quality.

For this project, an assessment was undertaken on the extent to which LAs engage with the topic of deprivation (and its trajectories) using composite indices. The team found that LAs acknowledge the importance of understanding and addressing deprivation, and the majority use deprivation measures to characterise their area. To do this, they rely heavily on composite indices such as the Townsend index (which uses census data) and the IMD (which uses administrative data). Both of these deprivation indices account for the multidimensional nature of the concept. Specifically, the IMD combines multiple indicators which cover a range of economic, social, environmental, and housing issues.

Spatial analysts often engage with widely published datasets to understand area level deprivation within their LAs. The findings from such analyses are sometimes then published. Interestingly, a review carried out by the project team found that, despite widespread acknowledgement of the importance of local level deprivation, some LAs only produced fairly superficial 'snapshot overviews' rather than detailed insights, while others did not publicise any such analysis within the public domain. The review revealed that those LAs which are evidently dedicating resources to enhancing their understanding of deprivation and its various dimensions, and presenting their findings in detail, are more commonly located in places where multiple deprivation has been found to be a major and persistent challenge.

This review also revealed the extent to which LAs are aware of, and acknowledge, the unevenness of deprivation both *between* and *within* LAs. Within reports, the prevalence of deprivation at various local geographies was considered. There is also a clear interest in understanding how their respective LA performs nationally (i.e., deprivation at the LA level), but also on a more localised level (i.e., deprivation at the neighbourhood level). By exploring the distribution of deprivation across space, LAs have the potential to highlight spatial trends and identify pockets of deprivation which may otherwise remain hidden. Having this understanding of the spatial patterning of deprivation also enables a more in-depth understanding of spatial inequalities within and beyond a LA. It also enables LAs to develop a more targeted approach to tackling deprivation through local interventions and service provision, and allocating funds and resources. At a higher level, understanding how deprivation is being experienced across the nation's LAs and regions enables central government (and their executive agencies) to identify where deprivation is concentrated and subsequently where to prioritise resources, effectively target funding, and guide policy and strategy.

Across the LA reports reviewed, deprivation intensity, distribution, volume/scale, and concentration were all reported on. However, most reports focused primarily on deprivation rankings and decile membership (e.g., areas within the 10% most/least deprived) as these are considered effective means of assessing the polarisation of deprivation in an area. Nonetheless, many also recognised that there is a key limitation in doing this, namely that composite indices such as the IMD are limited in their ability to support conclusions on the absolute levels of deprivation in an area, either across space or over time. This is because the IMDs are based on a relative index system, meaning that as one area becomes more or less deprived, it will inevitably affect the rankings or scores of other areas around it. For example, an area may itself improve its deprivation characteristics but, if other places improve more, that place may be reported as having worsening conditions.

Although the reports reviewed typically focused on the area's single overall deprivation score, ranking, or decile membership, many LAs do provide some level of detail on the various deprivation domains which combine to make up the combined IMD scores. A few reports also provided additional detailed information on the various indicators used to determine the level of deprivation within each domain. Importantly, this can enable LAs to identify *which* areas are deprived, *how* deprived they are, but also in what ways they are deprived (i.e., by which deprivation domains). Such analyses can prove particularly useful for helping LAs recognise that not all areas experience deprivation identically, and targeted, tailored *domain specific* responses or interventions may be required.

Generally, the team concluded that many of the deprivation reports published by LAs are somewhat descriptive, with limited interpretation of what the findings mean for the LA, and rarely an explicit acknowledgement or recommendation of where and how deprivation needs to be addressed. Given that it is LAs who are likely to be in the best position to do this, as they would

have an in-depth understanding of the context within which deprivation is being considered, this is (in many cases) a missed opportunity. However, although the specific reports do not necessarily provide indications of how the findings will be applied in the LAs, there is evidence that they are integrated into wider projects, plans, and reviews. The data and accompanying analyses have been found to be used as part of evidence bases to support the development of the likes of joint strategic needs assessments (JSNAs), economic policies, public health, and regeneration strategies.

Whilst LAs are evidently interested in the distribution and types of deprivation, deprivation trajectories have received less attention. Despite recognising that deprivation is not static and is subject to change, few of the reports presented detailed insights into how deprivation has changed in the LA over time, or indeed acknowledged the impacts of a historical persistence of deprivation. Generally, they provide a brief synopsis of general trends in movements between IMD ranks and deciles, demonstrating whether the LA has become more or less deprived, or remained the same, over time. In doing this, most of the reports reviewed tended to rely upon comparing the latest IMD results with those previously published. Through simple comparisons, and exploring movements between deciles and ranks, LAs have used these analyses to determine *where* there has been most change over a short period, in more or less deprived areas. Whilst these types of comparisons, which are often over a 3–5-year period, are undoubtedly useful, being unable to account for the period prior to this makes it difficult to identify and understand the *persistence* of deprivation in an area. Few studies explore long term trends, patterns, and changes in deprivation. Unfortunately, many deprivation indices are not well designed to provide 'backwards' comparability or detailed insights into the complex issue of long-term change. Whereas the IMDs are undoubtedly useful for measuring (as accurately as possible) the relative distribution of deprivation at various spatial scales, changes to the indicators incorporated within the index, and in geographical boundaries, mean that *strict comparability* is not possible. Many LA analysts are aware of the difficulties of making comparisons between indices, which use only broadly consistent methodologies and geographies, and over time. Indeed, most LAs which do report on change over time accompany these findings with appropriate data health warnings.

Recent deprivation trends – setting the scene for the project

The UK government has as a key objective the aim of reducing spatial inequalities. In this context, and at a time when Covid-19 has markedly exacerbated existing spatial inequalities, there is an urgent need to better understand why some communities are 'left behind'. Neighbourhood deprivation measures play a major role in identifying vulnerable communities in the UK and targeting resources to them. The success of schemes to reduce inequalities should be assessed by measuring changes in deprivation over time, yet this is rarely attempted. The impact of interventions is also likely to be partly a function of an area's deprivation history (e.g., deindustrialisation, population decline).

The geographies of inequality in the UK are, broadly, consistent over time – with higher levels of deprivation in urban areas than in more rural locales and generally higher levels of deprivation in the north and west than in the south and east (although there are exceptions). Figure 1 maps unemployment levels in the UK using data from the 2011 Census. In the map, a value of 1 indicates neighbourhoods in the most deprived 10% (they have unemployment levels in the top 10% across the whole UK), while a value of 10 indicates neighbourhoods in the least deprived 10%. The

pattern of high rates in urban areas such as Glasgow, Belfast, Birmingham and parts of London, is reflected in multiple forms of deprivation at multiple time points. A key focus in this project is on how both recent deprivation and change in deprivation over time are shaped by deprivation histories. The analyses seek to discover which areas are home to the most vulnerable communities - for example, how far those communities which saw the greatest job losses following the first UK national Covid-19 lockdown had long histories of deprivation in general and unemployment in particular.

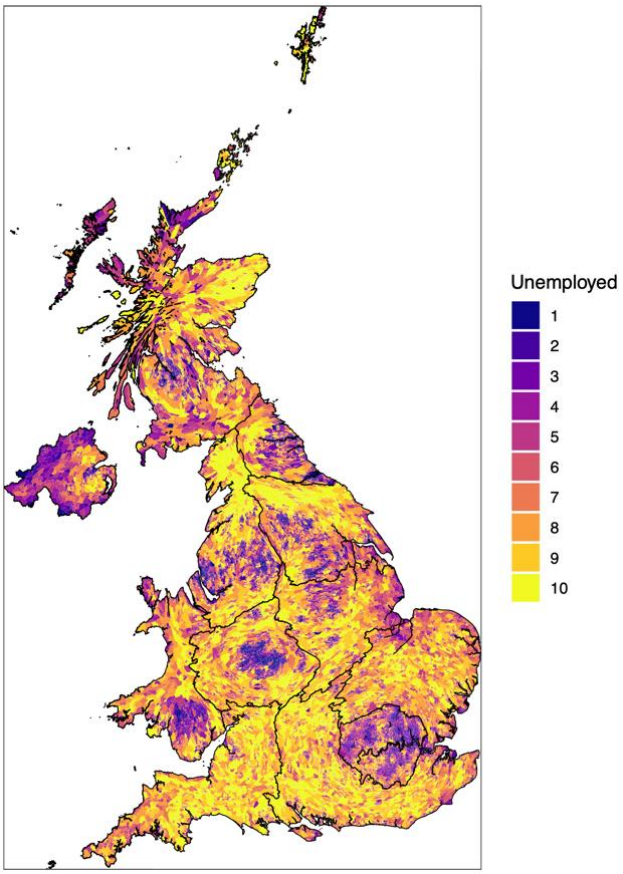


Figure 1. Unemployment deciles in the UK. Here, 1 is the most deprived 10% and 10 is the least deprived 10%.

The unemployment rates are shown as deciles - the rates are ordered from largest to smallest and the top 10% (the highest unemployment levels) are placed in decile group 1, and each set of rates is divided into one of ten groups representing the highest to the lowest rates.

The data are from the 2011 Census of England and Wales, Scotland, and Northern Ireland.

The data are represented as a cartogram. Small (more densely populated) areas are made proportionally larger while larger (more sparsely populated) areas are made proportionally smaller. This makes it easier to discern patterns in urban areas which are often obscured if normal map space is used. This map, as with all cartogram maps in the report, are scaled using the square root of their original area. This approach is described by Harris (2016) and Harris et al. (2017).

To assess very short terms changes in deprivation, experimental benefits claimant count data (Universal Credit and some Job Seeker's Allowance claimants; see ONS, 2015) by month were analysed. Figure 2 shows the claimant count rate deciles for March 2020, while Figure 3 shows the claimant count rate deciles for April 2020 - the first full month after the first UK national Covid-19 lockdown. Comparison of the two reveals very similar patterns. Figure 4 shows changes in claimant count rates between March and April 2020. In this map, larger positive values show large increases in the claimant count rate over the period. Most locations show small increases. There are notable increases in, for example, the east of London, urban areas in the North West of England, the South West and South Wales, amongst others.

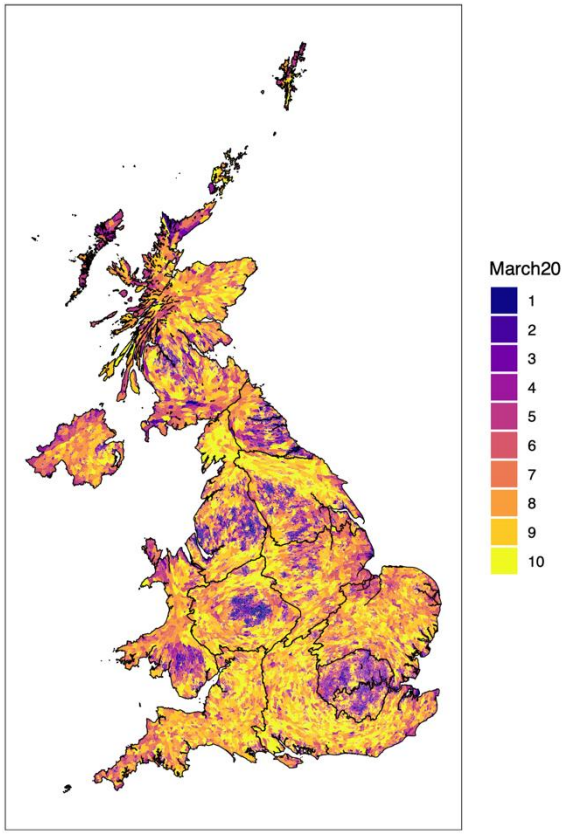


Figure 2. Claimant count rate, March 2020

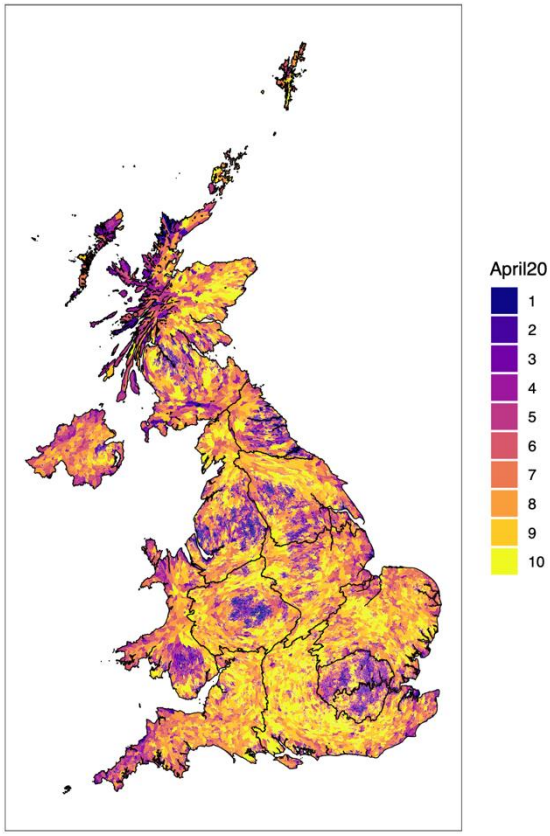


Figure 3. Claimant count rate, April 2020

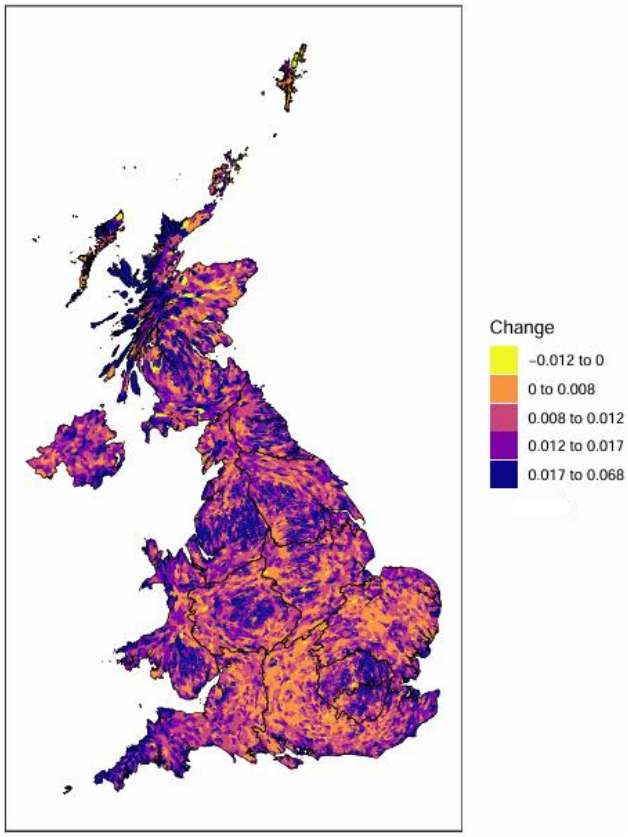


Figure 4. Claimant count rate, March-April 2020

Experimental benefits claimant count data (Universal Credit and some Job Seeker's Allowance claimants) provide a regularly-updateable estimate of unemployment for neighbourhoods.

These data, along with population mid-year estimates (providing annual populations for neighbourhoods), can be used to estimate unemployment for zones across the UK.

Here, the rates are computed as claimant counts (for a given month) divided by total persons represented using population mid-year estimates.

The analyses show that job losses following the UK Covid-19 lockdowns are strongly associated with deprivation (and employment) histories. However, the results do also suggest some significant departures from this. Some zones that had high deprivation/unemployment levels prior to lockdown experienced relatively low levels of job losses (but many such areas had very high unemployment levels prior to lockdown – much of Birmingham, for example, fits in this category), while conversely, some zones which had low deprivation/unemployment levels prior to lockdown had comparatively high levels of job losses (for example, some areas within the South West of England). Deconstructing these associations by assessing a wide array of population and housing characteristics at multiple timepoints could offer extremely important insights into why some areas improve and other do not.

Deprivation trajectories in the UK

The preceding analyses have introduced the geographies of deprivation in the UK and considered changes over a very short time period. The report now moves on to the main focus of the project – the classification of deprivation trajectories. Data and analyses for each of the four nations are outlined in turn, starting with England, followed by Wales, Scotland, and finally Northern Ireland.

Data sources
The geographical units used in each analysis are outlined at the start of the relevant section. In England and Wales, the units of analysis are lower Layer Super Output Areas (LSOAs). In Scotland, Data Zones (DZs) are used. In Northern Ireland, Super Data Zones (SDZs) are the units chosen. All of the data used in the trajectory analyses are for 2021 LSOAs (England and Wales), 2011 DZs (Scotland), and 2021 SDZs (Northern Ireland). The Census data from 1971, 1981, 1991, 2001 and 2011, upon which the Townsend Indices have been based, and most of the IMD releases, were based on different sets of geographical units to those listed above. Therefore, a GIS overlay procedure was used to convert these earlier datasets to the 2021 LSOAs. This approach is detailed by Norman at al. (2024).

Deprivation measures
The analyses are based on two measures. One, the Townsend index, is based on Census data for the period 1971 to 2021 (2022 in Scotland) and the second is the IMD for each individual nation. The broad context to each measure is provided below.

The Townsend index
The Townsend deprivation index (hereon referred to as the TI; Townsend et al., 1988) has been computed using Census data for multiple time points and it is used here to assess very long term (here, 1971 to 2021) deprivation trends. The TI is constructed using four sets of percentages which are each standardised (by calculating z-scores; see Appendix B: Townsend index technical summary) and then combined with equal weights to form the overall composite index:

1. Unemployed persons (% of employed plus unemployed) (Emp)
2. Non owner-occupied households (% total households) (Rnt)
3. Households without access to a car or van (% total households) (Car)
4. Households with more than one person per room (% total households) (Ovr)

Positive values of the TI indicate deprivation levels which are greater than the average deprivation levels in the relevant nation while negative values indicate deprivation which is less than the

average. See Appendix B: Townsend index technical summary for further details on how the TI was calculated for this research project.

The indices of multiple deprivation

The Indices of Multiple Deprivation (IMDs) are based mainly on administrative data and so are not restricted to Census years. They are typically updated every three to five years (although there are longer gaps in some cases). The indices can also draw upon a wider range of deprivation measures than are available in the Census. Noble et al. (2006) detail the conceptual background behind the IMDs. Each national report details the IMD releases utilised in the analysis. As an example, the 2019 English Index of Deprivation (IoD – the formal name for the IMD in England) release (see McLennan et al., 2019; Noble et al., 2019), comprises the following domain names with the weights applied in combining the domain scores into an overall IMD:

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

The names and numbers of domains and their weights vary across time and between nations. The domains and weights applied in each case are detailed in the relevant sections.

Several releases of the IMD were also compared for each nation, as follows. For England: IMD 2004, 2007, 2010, 2015, 2019. For Wales: 2008, 2011, 2014, 2019. For Scotland: 2006, 2009, 2012, 2016, 2020. For Northern Ireland: 2005, 2010, 2017. The team reviewed previous work which sought to link selected domains the four UK IMDs and consulted with the project advisory group. Following this process, the decision was taken to analyse the IMDs for each UK nation in isolation, rather than to attempt to undertake a combined UK-wide analysis.

Recent deprivation trends in England: unpicking the IoD

Before commencing analysis of deprivation trajectories over multiple time periods, an assessment was undertaken of just two IoD data releases, using the example of England – from 2015 and 2019. This analysis was undertaken for two main reasons. Firstly, it illustrated the value of exploring and understanding deprivation trajectories using administrative data at LSOA and LA level. Secondly, it provided a means to start to assess how far changes in IoD domains might reflect 'real' changes, or to be (at least partly) a function of changing data sources and definitions.

Initial analyses included all LSOAs across England. However, the team also undertook a more detailed consideration of deprivation change in LSOAs which fell within the top two most deprived deciles in 2015 and/or 2019 (i.e., the top 20% most deprived LSOAs in England). The decision to focus on these deciles was based on the fact that the IoD is "designed to reliably distinguish between areas at the most deprived end of the distribution, but not at the least deprived end" (Noble et al., 2019), but also given that deprived areas, as opposed to non-deprived areas, are the focus. By exploring domain-specific deprivation changes in these more highly deprived LSOAs it was thought that it would be possible to assess more accurately how far changes in overall

deprivation rankings have common characteristics within and between areas, or alternatively if they are a function of changes in different domains.

When assessing *only* the most recent iteration of the IoD (2019), it was possible to identify the existence of deprivation in large pockets across certain regions, namely the North West, South West, North East, the Midlands and in the East of England. However, when exploring the change in IoD rank and decile position of LSOAs between 2015 and 2019, it became evident that LSOAs experiencing the greatest decline (i.e., an increase in deprivation) were largely concentrated in the south of England, whereas those experiencing the greatest improvements were situated in London and the East Midlands.

As part of the analyses, changes in deprivation were also explored according to urban/rural status and the characterisation of communities (as defined by output area classification supergroups). This revealed that, although deprivation continues to remain a predominantly urban issue, rural areas are not exempt, with many, including communities subject to long term industrial decline (the population of this group live primarily in areas with high rates of social renting and older age groups; the group is part of the wider 'Hard-Pressed Living' group), becoming increasingly deprived between 2015 and 2019. On the contrary, many improvements have been reported in inner city cosmopolitan areas, potentially because this is where funding and resources have been targeted to date. The analyses also highlighted that, whilst identifying changes in overall IoD rank position or decile membership was undeniably useful for aiding our understanding on the level of overall deprivation change experienced in an area, there were also advantages to building upon these findings using domain specific data. From this, it was found that when experiencing either an increase or decrease in overall IoD rank position, the seven domains generally, *but not always,* followed a similar pattern. For example, some LSOAs became less deprived overall but more deprived by domains such as employment or barriers to housing and services.

Table 1 summarises changes in LSOAs which were in the top two most deprived deciles in 2015 and/or 2019 (this totals 7,142 LSOAs). The table includes three sets of areas – those that have 'improved' position, those that have 'worsened' their position, and those that have stayed the same. The LSOAs in each of these three groups are broken down by region, settlement type, OA classification, and the domain which changed most in each LSOA. As examples, of those LSOAs which improved their position (969 LSOAs fall within this class – some 13.6% of all LSOAs which were in the top 20% most deprived in 2015 and/or 2019), 45% were in London. In 38% of LSOAs which improved position, the domain which changed most was employment.

Table 1 highlights that a higher than average proportion of those more deprived LSOAs which had improved decile position (i.e. become less deprived) between 2015 and 2019 were situated in inner city cosmopolitan neighbourhoods, including in London, East England and the East Midlands. Employment, health and education were highlighted as the domains showing the greatest change within these neighbourhoods. In contrast, the more deprived LSOAs which had worsened between 2015 and 2019 (i.e., increased decile position), were more commonly found in the North East, South East, North West, and Yorkshire and the Humber. Interestingly, analyses considering the rural-urban classification of these LSOAs and their Output Area Classification (OAC; see ONS 2014) revealed that many are in rural areas, and the greatest changes in rank position have taken place in the income and crime domains.

	Region (as % of all LSOAs)	Settlement (as % of all LSOAs)	OA Classification (as % of all LSOAs)	Domain with largest change (as % of all LSOAs)
Improved position (n=969) 13.6%	45% **London** 16% East of England 15% East Midlands	17% Urban major conurbation	54% inner city cosmopolitan 25% cosmopolitan student neighbourhoods 15% multicultural living	38% employment 32% health 22% education 14% income
Worsened position (n=974) 13.6%	21% **North East** 20% **South East** 16% North West 16% Yorkshire 14% South West	50% rural village and dispersed in sparse setting 40% rural town and fringe in sparse setting 39% rural village and dispersed 22% rural town and fringe 15% urban city and town (in a sparse setting)	52% countryside living 35% ethnically diverse professionals 35% industrious communities 25% suburban living 14% hard pressed communities	26% income 19% crime
Stayed the Same (n=5199) 72.8%	80% **North West** 80% West Midlands 79% Yorkshire 75% South West 75% North East 74% East Midlands	85% urban city and town in sparse setting 80% urban minor conurbation 74% urban city and town	80% hard pressed communities 77% multicultural living 75% suburban living	79% barriers to housing and services 78% living environment

Table 1. Deprivation change by the regions of England, settlement type, Output Area Classification and domain with largest change. Figures refer only to LSOAs in the top two most deprived deciles in 2015 and/or 2019.

The majority of the *most* deprived LSOAs, typically concentrated in larger urban centres, did not change decile membership from 2015 to 2019, indicating that they had neither improved nor worsened (although they may have moved position with the decile). This is an important finding as it points towards at least a short-term persistence of deprivation. Of those most deprived LSOAs which did change decile position, there were distinct differences between those which improved and those which worsened. There was evidence of increased deprivation in rural, industrial and coastal areas, particularly in the East of England, with some of this change potentially stemming from an increase in income and crime deprivation. In contrast, improvements were identified in central London, with reductions in employment, health and education deprivation being highlighted as domains which have potentially contributed to this change. Again, this may

indicate *where and how* funding and resources to address this challenge have been prioritised over the past number of years.

Computing deprivation trajectory clusters

The Townsend index trajectories were derived using the *k*-means clustering method with the four sets of indicators for each census year as inputs. Five classes were derived for each nation. The classes differentiate, for example, areas with persistently high deprivation from those with persistently lower deprivation and those with deprivation levels that have fluctuated over time.

Clusters of trajectories were computed for the IMD ranks for each of the domains and for each IMD release (noting that the number of releases varies between nations), for each of the UK nations. The IMD trajectory clusters were generated using a variant of *k*-medians classification adapted for longitudinal (time series) data. The method was implemented using the kml3d[6] package (Genolini et al., 2015) in the R statistical environment (R Core Team, 2021). After experimentation, ten classes were derived.

The clusters derived for each measure and nation are described below in relation to each of the four UK nations.

Deprivation trajectories in England

The maps and data included in this report for England and Wales provide information on population and housing for areas called Lower Layer Super Output Areas (LSOAs). There are 33,755 LSOAs in England with an average population of 1674 (figures for 2021).

This section uses data which come from two sources: Census data for the period 1971 to 2021 and the English Indices of Deprivation (IoD) for 2004 to 2019. It is divided into three main sections. The first uses Census data for the period 1971 to 2021 to compute the Townsend deprivation index (TI), the second makes use of the IoD, and the third considers area deprivation trajectories using both measures. This part of the report is intended to provide an overview of deprivation in England, and to allow readers to assess how deprivation has changed in different areas since 1971.

Townsend index

Table 2 shows mean changes in indicator scores for the four constituent TI indicators (as noted in Appendix B, the indicators are based on *z*-scores (these standardise the data so that different variables can be combined), whereby a value above zero is above the average and a value below zero is below the average. So, Table 2 shows changes in the *z*-score values between successive iterations of the TI measure). The average values in Table 2 are for all LSOAs in England. In this case, an increase (a positive value) indicates an average absolute increase in deprivation on a given domain, while a decrease (a negative value) indicates an average absolute decrease in deprivation.

[6] https://cran.r-project.org/web/packages/kml3d/index.html

Period	Emp	Rnt	Car	Ovr
1971-1981	5.53	-7.34	-8.94	-2.51
1981-1991	0.24	-9.67	-5.37	-1.10
1991-2001	-4.03	-0.08	-5.13	-0.18
2001-2011	-0.99	4.41	-1.12	1.46
2011-2021	-1.53	2.07	-2.03	1.03

Table 2. Mean changes in TI indicator z-scores for all LSOAs. For Employment (Emp, Rented households (Rnt), Car or van access (Car) and Overcrowding (Ovr).

As can be seen from Table 2, the indicator score which **increased** the most over the period 1971 to 1981 was **Employment**, with an average change of 5.53.

The indicator score which **decreased** the most over the period 1971 to 1981 was **Car access**, with an average change of -8.94.

The indicator score which **increased** the most over the period 1981 to 1991 was **Employment**, with an average change of 0.24.

The indicator score which **decreased** the most over the period 1981 to 1991 was **Rent**, with an average change of -9.67.

The indicator score which **decreased** the least over the period 1991 to 2001 was **Rent**, with an average change of -0.08.

The indicator score which **decreased** the most over the period 1991 to 2001 was **Car access**, with an average change of -5.13.

The indicator score which **increased** the most over the period 2001 to 2011 was **Rent**, with an average change of 4.41.

The indicator score which **decreased** the most over the period 2001 to 2011 was **Car access**, with an average change of -1.12.

The indicator score which **increased** the most over the period 2011 to 2021 was **Rent**, with an average change of 2.07.

The indicator score which **decreased** the most over the period 2011 to 2021 was **Car access**, with an average change of -2.03.

Table 3 shows which indicators have changed the most over time. This table shows the percentage of LSOAs for adjacent TI releases where the change is largest for a given indicator. In other words, the table shows which indicator values increased (Table 3a) or decreased (Table 3b) the most over each time period. This shows which indicators contribute most to changes in deprivation over each of these time periods. Note that None indicates that no LSOAs saw an increase (Table 3a) or a decrease (Table 3b).

As can be seen from Table 3, in the majority of LSOAs the largest *increase* over the period 1971 to 1981 - in 86.89% of LSOAs - was for **Employment**. For the period 1981 to 1991 the largest

change was again for **Employment** (43.06% of LSOAs), while for 1991 to 2001 it was for **Rent** (46.57% of LSOAs). For 2001 to 2011 and 2011 to 2021 it was also for **Rent** (70.08% and 56.06% of LSOAs respectively). The largest decreases for 1971 to 1981 were for **Car access**, while for 1981 to 1991 it was for **Rent**. For each of 1991 to 2001, 2001 to 2011, and 2011 to 2021, the largest decreases were for **Car access**.

	% LSOAs with largest *increase* by indicator				
	71-81	81-91	91-01	01-11	11-21
Emp	86.89	43.06	1.04	2.70	1.47
Rnt	10.08	8.92	46.57	70.09	56.06
Car	0.63	6.27	2.74	5.36	9.42
Ovr	0.34	7.44	18.25	19.77	26.33
None	2.06	34.31	31.41	2.07	6.72
	% LSOAs with largest *decrease* by indicator				
	71-81	81-91	91-01	01-11	11-21
Emp	0.19	2.32	33.89	29.04	33.73
Rnt	39.22	61.20	13.21	4.75	8.72
Car	49.29	31.08	51.23	52.25	50.51
Ovr	10.09	4.26	1.08	2.15	3.73
None	1.21	1.14	0.59	11.81	3.31

Table 3. Percentages of LSOAs by the largest change for each TI indicator: (a) indicators with largest increases and (b) indicators with largest decreases

Figure 5 shows the TI scores in 2021 in England. As in previous maps, a cartogram is used here to highlight patterns in more densely populated areas. Note that the range of values included refer to England specifically. As noted already, positive values indicate higher levels of deprivation, while negative values indicate lower than average levels of deprivation according to this measure. Figure 6 shows changes in the TI scores between 1971 and in 2021. Positive values indicate increased levels of deprivation while negative values indicate decreased levels of deprivation over this time period.

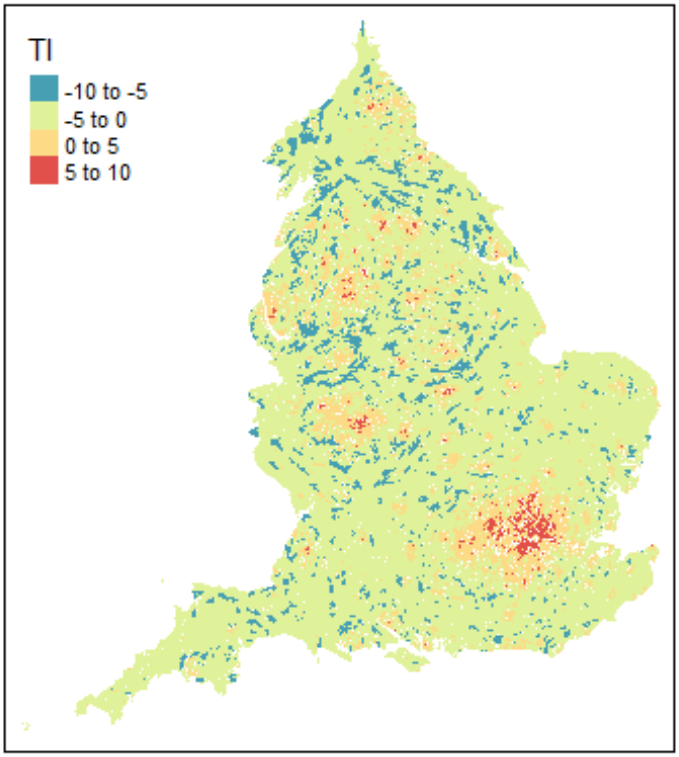


Figure 5. Townsend index score, 2021.

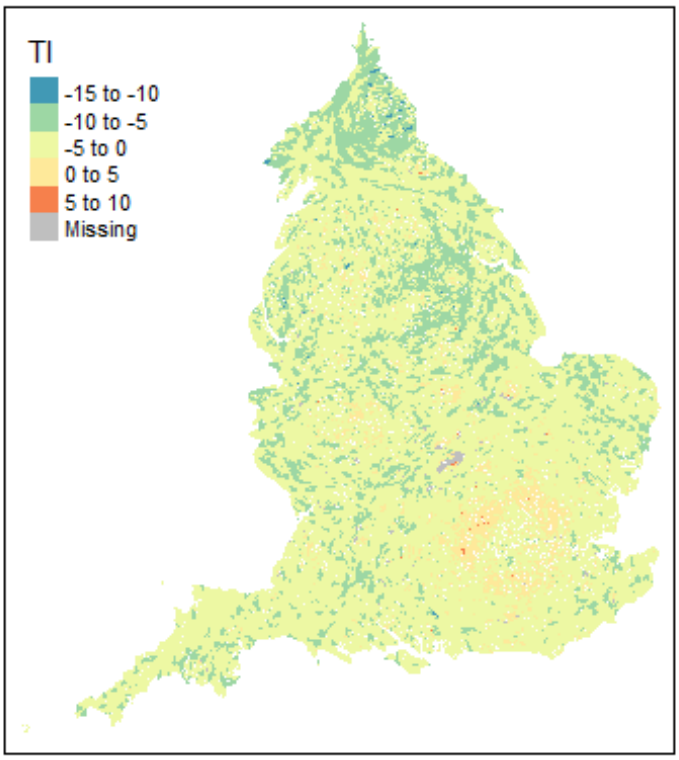


Figure 6. Townsend index score, 1971-2021.

The ways in which the TI has changed in local areas - its trajectories - is the key focus of this report. As introduced earlier in the report, the k-means clustering method was used to group the four constituent indicator scores for each TI calculated separately for each of the six Census years to generate area trajectory 'classes'. In other words, the clustering includes the individual indicators

as inputs. The clusters describe 'average' trends in areas – individual LSOAs in a given cluster may exhibit slightly different trends to one another but tend to follow the same general pattern of change as other areas in that same cluster.

The five classes A-E have been labelled as follows:

- A: Persistently deprived - deprivation levels were very high at the start of the period (1971) and remained high until the end (2021).
- B: Moderately deprived - deprivation levels were relatively high at the start of the period and moderate by the end.
- C: Worsening deprivation - deprivation levels were relatively high at the start of the period and became even higher by the end.
- D: Less deprived - deprivation levels are moderately high at the start of the period and much lower by the end.
- E: Persistently not deprived - deprivation levels are low at the start of the period and very low by the end.

Figure 7 shows the median average TI ranks by the five trajectory classes identified across all LSOAs in England and Wales (although the remainder of this section refers only to England). In this chart, trends in absolute deprivation are shown. In all but one case, median deprivation in 2021 is lower than it was in 1971. The exception is cluster C where the median TI index is at its highest in 2021.

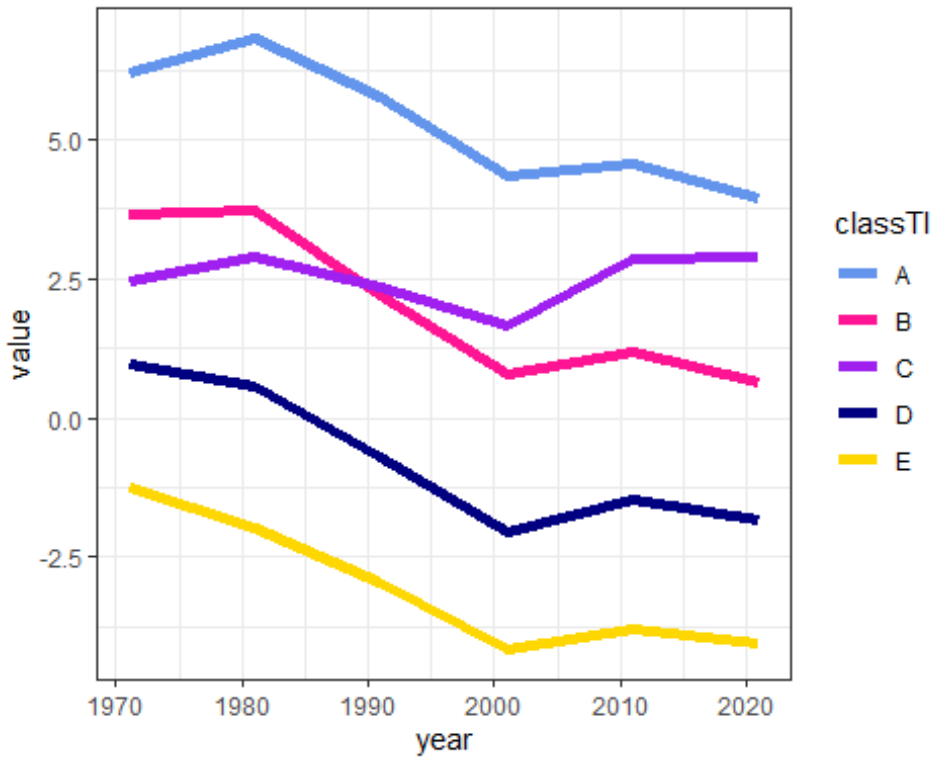


Figure 7. Median Townsend index scores by trajectory class. A: Persistently deprived; B: Moderately deprived; C: Worsening deprivation; D: Less deprived; E: Persistently not deprived.

Figure 8 shows the distribution of the trajectory classes across England using the same colours per class as in Figure 7. Classes A and B – reflecting the highest levels of deprivation at the start of the study period – are most commonly found in urban areas including London, Birmingham and the

North West and North East. Class C is most common in the fringes of these areas. Class D – Less deprived – is found in many coastal areas in the South West, the east and the North East and a few scattered areas elsewhere. Class E – showing areas which are persistently not deprived – are numerous in more rural areas across England.

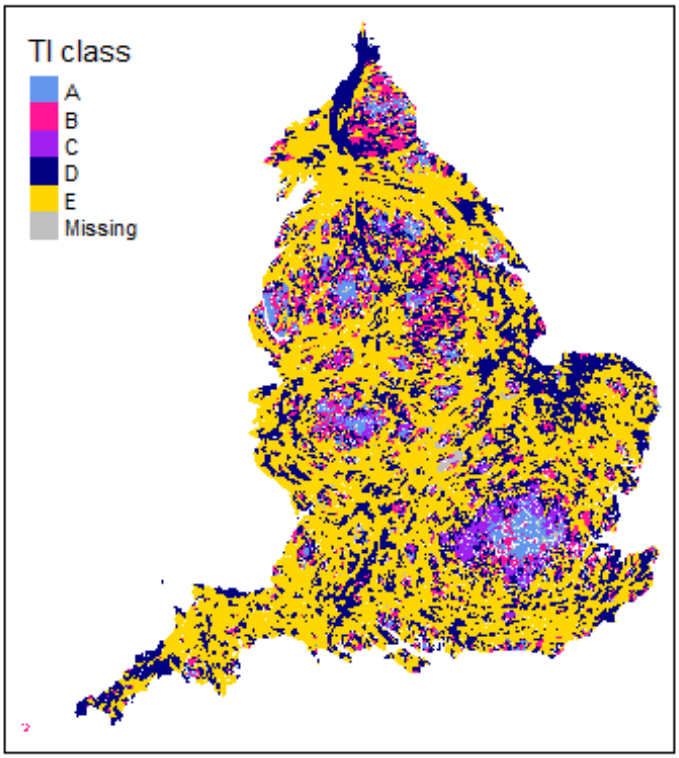


Figure 8. TI trajectory clusters. A: Persistently deprived; B: Moderately deprived; C: Worsening deprivation; D: Less deprived; E: Persistently not deprived.

Table 4 indicates the number of LSOAs within each 2021 TI decile (decile 1 is the least deprived 10%; decile 10 is the most deprived 10%) and TI trajectory class. We can see that LSOAs in (for example) the most deprived 2021 TI deciles (deciles 9 and 10) are spread across different trajectory classes. This demonstrates how the current TI decile may mask very different deprivation histories, and thus contrasting challenges.

	Most deprived				Least deprived
Dec	A	B	C	D	E
1 (least)	0	2	0	73	3228
2	0	2	0	284	2999
3	0	14	0	811	2437
4	0	43	0	1655	1527
5	1	195	1	2288	720
6	4	775	6	2216	218
7	45	1729	72	1408	33
8	365	2034	477	468	2
9	1244	1101	975	74	0
10 (most)	2535	100	775	0	0

Table 4. Number of LSOAs in each TI trajectory cluster and TI 2021 decile. Decile 1 is the least deprived 10%; decile 10 is the most deprived 10%.

Indices of Deprivation

In this analysis, five IoD releases are used: those for 2004, 2007, 2010, 2015, and 2019. The IoD comprises seven domains - each of these is based on a set of similar indicators and some comprise sub-domains. For the 2019 release (see McLennan et al., 2019; Noble et al., 2019), the domain names and the weights applied in combining the domain scores into an overall IoD are as follows:

1. Income Deprivation Domain (Inc) 22.5%
2. Employment Deprivation Domain (Emp) 22.5%
3. Health Deprivation and Disability Domain (Hea) 13.5%
4. Education, Skills and Training Deprivation Domain (Edu) 13.5%
5. Barriers to Housing and Services Domain (Bar) 9.3%
6. Crime Domain (Cri) 9.3%
7. Living Environment Deprivation Domain (Liv) 9.3%

Each domain is composed of multiple indicators, with approximately 40 indicators in total in each iteration of the IoD.

In the IoD framework, the terminology 'domain' is used instead of indicator (as used for the TI). This reflects the fact that the IoD comprises several distinct facets of deprivation, each of which may be analysed in their own right.

As noted previously, the IoD and TI are very different in nature, although they both attempt to measure the multidimensional nature of socio-economic deprivation at neighbourhood level. One notable difference is in the relative contribution of overcrowding (households with more than one person per room) to the two measures. Overcrowding is a major component of the TI (accounting for one quarter of the overall score), but just one element within one domain of the IoD (the Barriers to Housing and Services Domain - which is itself assigned a domain weight of 9.3%). Therefore, LSOAs with high levels of overcrowding are likely to have relatively high levels of overall deprivation according to the Townsend score, but not necessarily according to the IoD.

It is possible to assess change in the overall IoD (as shown above) and also each of the seven constituent domains that make up the IoD. A key interest in this profile is in LSOAs which have seen large changes in deprivation rank on particular domains - either a relative increase in deprivation, or a relative decrease. Like the overall IoD score, the IoD domain scores are relative, and thus a reduction in IoD domain ranks in a specific area would indicate that deprivation has declined in that area *relative to other areas* across the country.

Table 5 shows the percentages of LSOAs where the largest increase (5a) was by a given domain, as well as the percentages of LSOAs where the largest decrease (5b) was by each domain. As can be seen from Table 5, in the majority of LSOAs the largest increase over the period 2004 to 2007 - in 18.8% of LSOAs - was for **Employment**. For the period 2007 to 2010 the equivalent largest changes were for **Crime** (19.87%). For 2010 to 2015 it was **Barriers** (18.51% of LSOAs), while for 2015 to 2019 it was Crime (19.89%). The largest decreases for 2004 to 2007 were for **Employment**, while for 2007 to 2010 they were for **Crime**. For 2010 to 2015 the largest decreases were for **Barriers**, while for 2015 to 2019 the largest decreases were for **Crime**.

	% LSOAs with largest *increase* by indicator			
	04-07	07-10	10-15	15-19
Inc	17.18	15.21	11.68	12.3
Emp	18.8	15.56	15.19	13.11
Edu	9.92	9.31	10.42	9.52
Hea	7.04	14.37	12.26	14.68
Cri	15.27	19.87	16.18	19.89
Bar	18.3	15.98	18.51	16.01
Liv	11.52	8.16	14.31	12.61
None	1.97	1.53	1.46	1.88
	% LSOAs with largest *decrease* by indicator			
	04-07	07-10	10-15	15-19
Inc	17.05	15.22	10.99	12.09
Emp	18.25	15.35	15.06	13.49
Edu	10.7	9.23	10.17	9.77
Hea	6.59	14.24	12.26	13.87
Cri	15.52	20.12	16.5	19.02
Bar	17.86	16.28	17.26	16.8
Liv	12.3	7.88	16.06	13.36
None	1.72	1.68	1.7	1.6

Table 5. Percentages of LSOAs by the largest change for each IoD domain: (a) domains with largest increases and (b) domains with largest decreases

Figure 9 shows the IMD scores for 2004, while Figure 10 shows the equivalent for 2019. The IMD values are shown as national deciles, where decile 1 is the least deprived 10% and decile 10 is the most deprived 10%. The two maps show broadly similar trends, with high deprivation values in large cities including London, Birmingham, and urban areas across the North West and the North East. The most obvious difference in the two maps is the relative decrease of deprivation in many areas within greater London. It is worth noting that some areas with high deprivation in Figures 9 and 10 do not show equivalently high deprivation as measured by the TI (see Figure 5) – examples include coastal areas of the East and North East. This is no surprise given the differences in the input variables for the two measures.

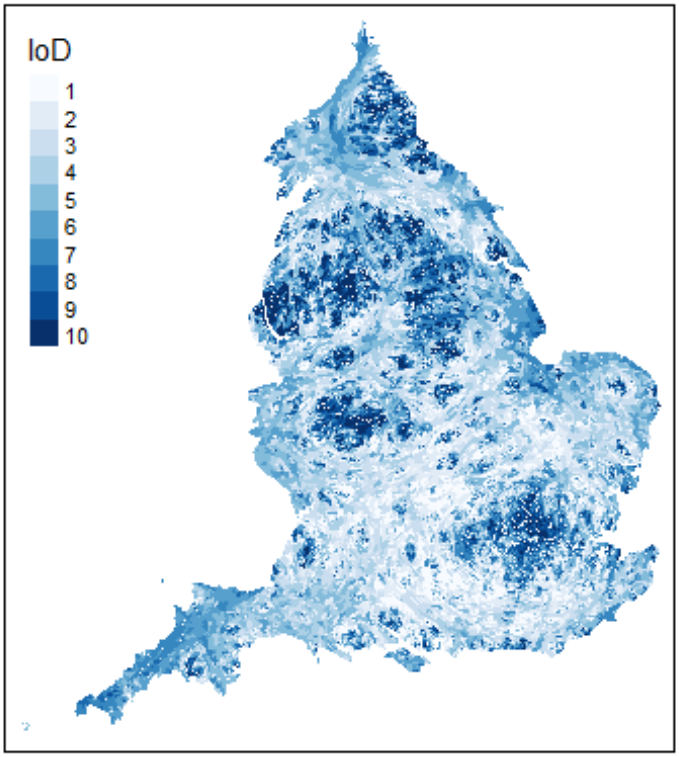


Figure 9. Index of deprivation national decile, 2004.

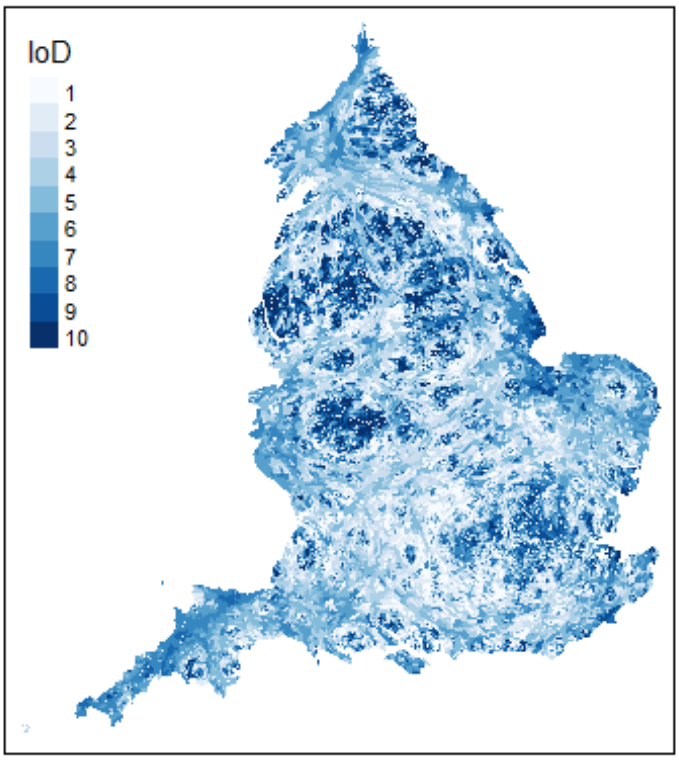


Figure 10. Index of deprivation national decile, 2019.

Clusters of trajectories were computed for the IoD ranks for each of the seven domains and for each IoD release (2004, 2007, 2010, 2015, 2019). The clusters for the IoD were generated, as discussed above, using a variant of k-medians classification adapted for longitudinal (time series)

data. Ten IoD clusters were identified through this process, each showing identifiable patterns across the data:

- A: Persistently highest and worsening deprivation - deprivation is, and persistently has been highest in these LSOAs between 2004 and 2019. Even with being the most deprived LSOAs across the nation since 2004, these areas have become increasingly deprived over time.
- B: Higher deprivation, markedly declining - These LSOAs were some of the most deprived in 2004, with levels increasing until 2007. Although levels have remained high, these LSOAs have become gradually less deprived since 2007.
- C: Higher deprivation, worsening - These LSOAs are currently, and typically have been, more deprived. Although deprivation levels were high in 2004, they fell slightly between 2004 and 2007. Since 2007, deprivation levels have persistently increased.
- D: Moderately high deprivation, markedly declining - these LSOAs have typically experienced moderately higher levels of deprivation. Deprivation levels increased between 2004 and 2007. However, since 2007, these deprivation levels have markedly and persistently declined. These decreases in deprivation have been even more pronounced since 2015.
- E: Moderately high deprivation, worsening - These LSOAs have been persistently moderately deprived. Deprivation levels fell slightly between 2004 and 2007, but have since gradually increased again, with these increases being more marked post 2016.
- F: Moderate deprivation, persistently worsening - These LSOAs are moderately deprived, and despite levels remaining moderate, deprivation levels have persistently increased since 2004.
- G: Lower deprivation, gradually worsening - deprivation levels are generally lower in these LSOAs. However, between 2004 and 2007, deprivation levels increased, before stabilising until 2010. Post 2010, deprivation increased again before stabilising in 2015. Deprivation levels have remained relatively low but stable since 2015.
- H: Moderately low deprivation, persistently declining - these LSOAs have been some of the less deprived areas across the nation since 2004. There has been evidence of improvement over time, with deprivation levels persistently falling since 2004. These improvements have been more pronounced since 2010.
- I: Persistently lower deprivation - deprivation has been persistently low in these LSOAs between 2004 and 2019. These LSOAs became slightly less deprived between 2007 and 2015 before deprivation levels, although remaining low, increased again post 2015 to 2019.
- J: Persistently lowest deprivation - deprivation was persistently very low in these LSOAs between 2004 and 2019.

Figure 11 shows the median IMD ranks by the ten trajectory classes identified. The IoD trajectory classes in England are mapped in Figure 12. The map uses the same colours per class as in Figure 11. Figure 11 shows how trajectories may correspond to changes in direction – with increases followed by decreases, or vice versa (for example, see classes D and E. While all classes suggest a degree of consistency – with highly deprived areas remaining highly deprived and less deprived areas seeing lower levels of deprivation across the study time period – there are clear systematic increases in deprivation (class A being the most notable) and decreases in deprivation (for example, class H) for some classes – as the above descriptions indicate. There are pronounced geographies of deprivation trajectories with many instances of classes H and I in rural areas and concentrations of classes B, C and D in urban areas. Instances of class A 'Persistently highest and worsening deprivation' – representing the highest levels of deprivation – are most commonly found in the North West and Birmingham.

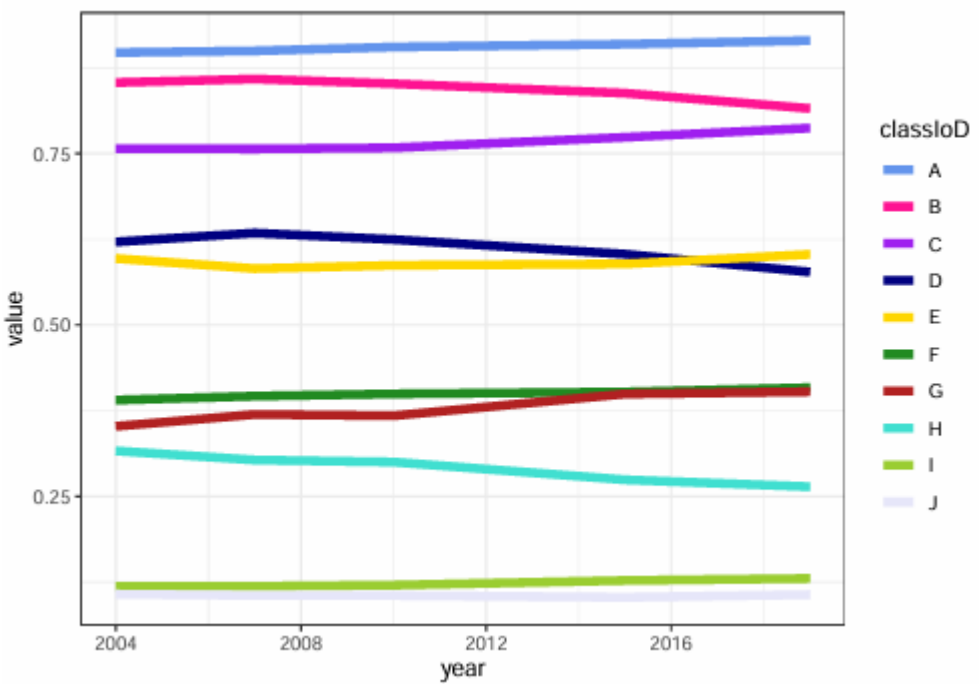


Figure 11. Median IoD ranks by trajectory class. The y axis is the IMD scaled rank.

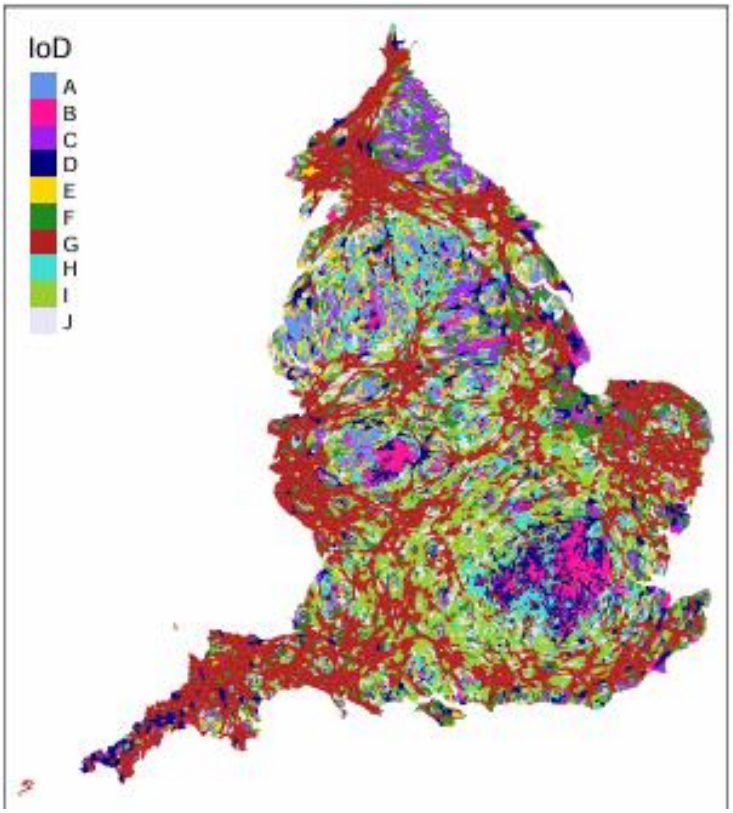


Figure 12. IoD trajectory clusters.

Combined analysis

Table 6 shows LSOA membership of both sets of trajectory clusters. This provides a summary of the ways in which LSOAs have changed according to both TI and IoD trajectory clusters. Linking both sets of clusters helps to identify, for example, LSOAs which have had high deprivation levels by both measures as distinct from, as an example, LSOAs which may have seen increasing deprivation levels in recent years (as judged using the IoD) but which do not have long histories of deprivation (as judged using the TI).

		IoD: Most deprived									Least deprived
		A	B	C	D	E	F	G	H	I	J
TI: Most deprived	A	1460	1643	535	474	17	1	47	17	0	0
	B	1663	532	1976	512	642	274	65	309	16	6
	C	436	694	92	803	127	25	58	71	0	0
	D	160	157	634	884	2350	2443	699	1230	316	404
Least deprived	E	0	4	13	118	276	1761	1647	1077	2942	3326

Table 6. TI trajectory clusters and IoD trajectory clusters.

As an example, most of the LSOAs in TI cluster A (most deprived) are in IoD clusters A or B – also the most deprived. There are, however, many LSOAs in the most deprived classes for one trajectory measure, but in much less deprived trajectory clusters by the other. For instance, there six LSOAs in TI cluster B which are in IoD cluster J. This shows that deprivation histories are complex and long-term persistently high deprivation does not necessarily predict persistent high deprivation by another measure. Understanding these differences is important in considering the distinct challenges communities may face.

It is important to note that the clusters refer to *relative* changes. For example, a (relative) increase in deprivation in one LSOA might mean that deprivation has increased in that LSOA in absolute terms *or* that deprivation has decreased everywhere but less so in that LSOA compared to elsewhere. Nonetheless, the clusters are useful in determining which LSOAs have been falling behind in regard to addressing the challenge of deprivation.

Table 7 shows the percentages of LSOAs in each English region that fall into each IoD decile, while Table 8 shows the percentages falling into each of the 10 trajectory clusters. Comparing the two tables reveals some interesting insights. For example, we can see that the North West has the largest share of decile 10 (most deprived) LSOAs, but an even larger share of LSOAs in trajectory cluster A 'Persistently highest and worsening deprivation'. So, not only is deprivation consistently high in many neighbourhoods in the North West but it is also growing (in relative terms) in many neighbourhoods in that region. According to this analysis, the North West is being left further and further behind.

IoD decile	East Midlands	East of England	London	North East	North West	South East	South West	West Midlands	Yorkshire and The Humber
1 (least deprived)	11.0%	**12.8%**				**19.8%**			
2	**11.8%**	12.5%				13.5%	10.8%		
3	11.5%	11.4%				12.1%	11.4%		
4		11.3%				11.3%	12.7%		10.0%
5		12.3%	10.7%			10.6%	**13.1%**		
6		12.2%	11.7%				11.9%	10.2%	

7			13.7%	10.1%			12.1%		
8	10.1%		**17.3%**	12.5%	10.2%				
9			14.5%	14.5%	12.4%			12.8%	10.9%
10 (most deprived)				**19.9%**	**21.7%**			**16.3%**	**19.4%**
Sum	100%	100%	100%	100%	100%	100%	100%	100%	100%

Table 7. Percentages of LSOAs in each region in each IoD decile. Values <10% have been excluded. The largest value(s) in each region are in bold.

Cluster	East Midlands	East of England	London	North East	North West	South East	South West	West Midlands	Yorkshire and The Humber
A	12.8%				28.4%			14.4%	24.6%
B			33.5%					14.9%	
C	14.0%	12.9%		43.8%					10.3%
D			32.7%						
E	13.6%				20.9%		10.7%	11.5%	17.4%
F	18.2%	23.0%		18.8%		17.5%	18.8%	12.3%	
G		10.2%					15.5%		
H			15.8%						10.9%
I	10.0%	16.3%				21.3%	12.4%		
J	14.9%	15.0%			13.0%	17.4%	11.9%		
Sum	100%	100%	100%	100%	100%	100%	100%	100%	100%

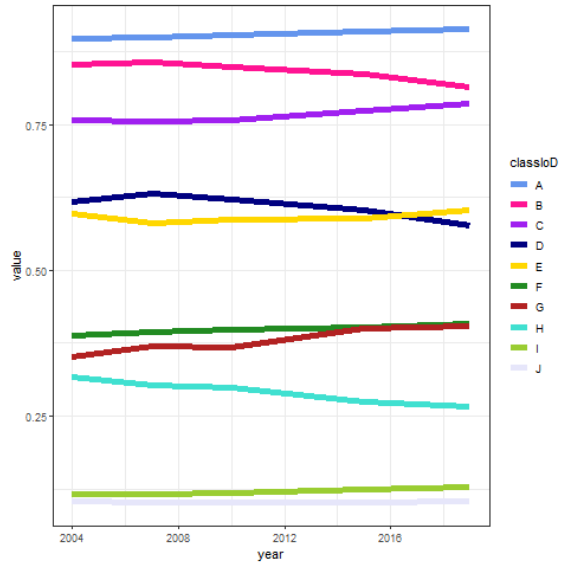
Table 8. Percentages of LSOAs in each region in each IoD trajectory class. Values <10% have been excluded. The largest value(s) in each region are in bold.

Understanding changes in the individual deprivation domains is important. For this reason, the median average ranks by class are assessed. In other words, we explore how the ranks for each deprivation domain change over time for each of the trajectory classes introduced earlier. This analysis shows that there are marked differences between the domains.

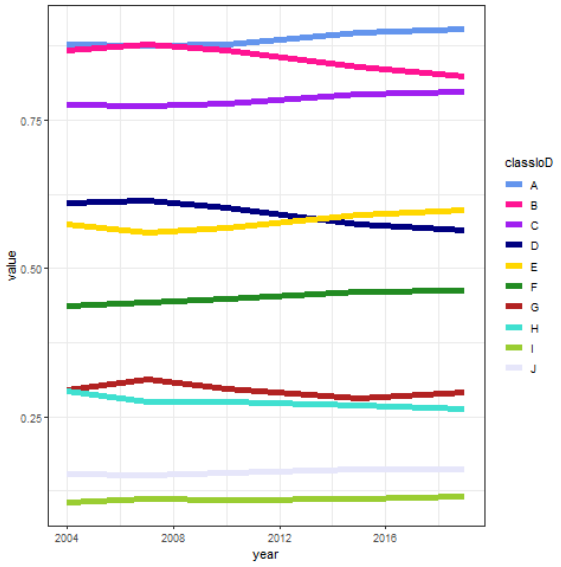
For the IMD as a whole, class A shows consistently higher relative deprivation than all other classes at all time points, and relative deprivation for this class increases year on year. In the case of most domains, there are consistent trends in terms of classes A, B, and C tending to appear at the top of the charts (the most deprived on most domains for most time points). Conversely, classes H, I, and J tend to appear at the bottom of the charts (the least deprived on most domains for most time points).

Taking Income alone, classes A and B have very similar median deprivation ranks up to 2010 when they depart – with class A showing increased relative Income deprivation and class B showing a marked decrease. Class A shows consistently higher deprivation for all time periods for Employment, Health, and Education. For each of these, there is a consistent increase in relative deprivation across time. For Crime and Living Environment there are no consistent patterns for class A as compared to other classes – median deprivation for class A is not consistently higher or lower than for other classes. For Barriers, trends are complex with sometimes marked changes in median relative ranks across time for many classes; in this case, class A appears at the lower of the graph. This likely reflects contrasting geographies of Barriers compared to other domains (for

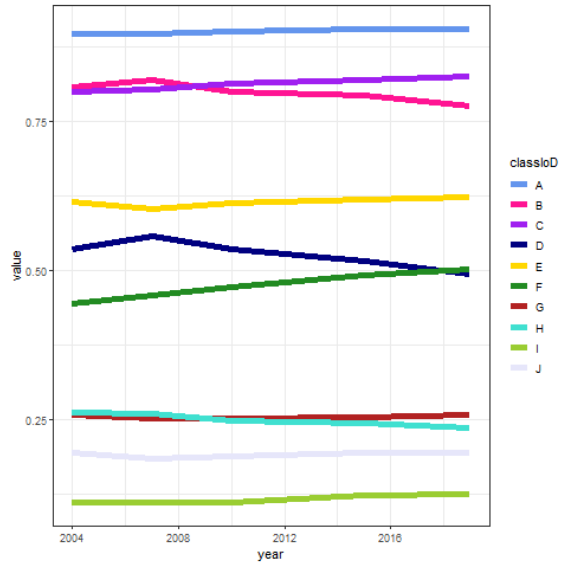
example, Income deprivation is high in many locales where Barriers deprivation is low), and also changes in measurement or data source changes across time.



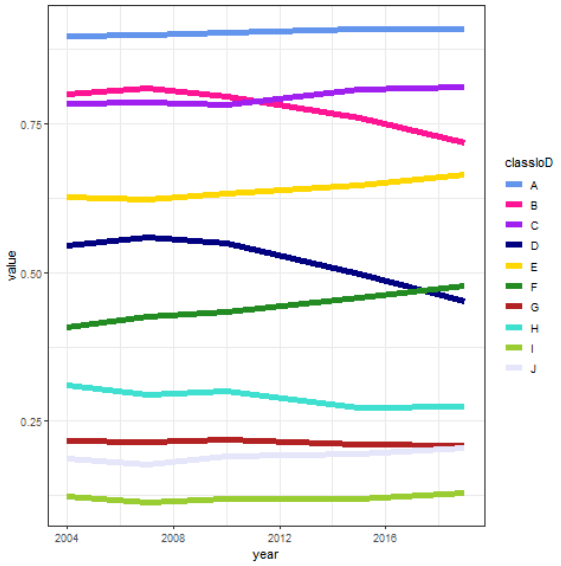
A. IoD



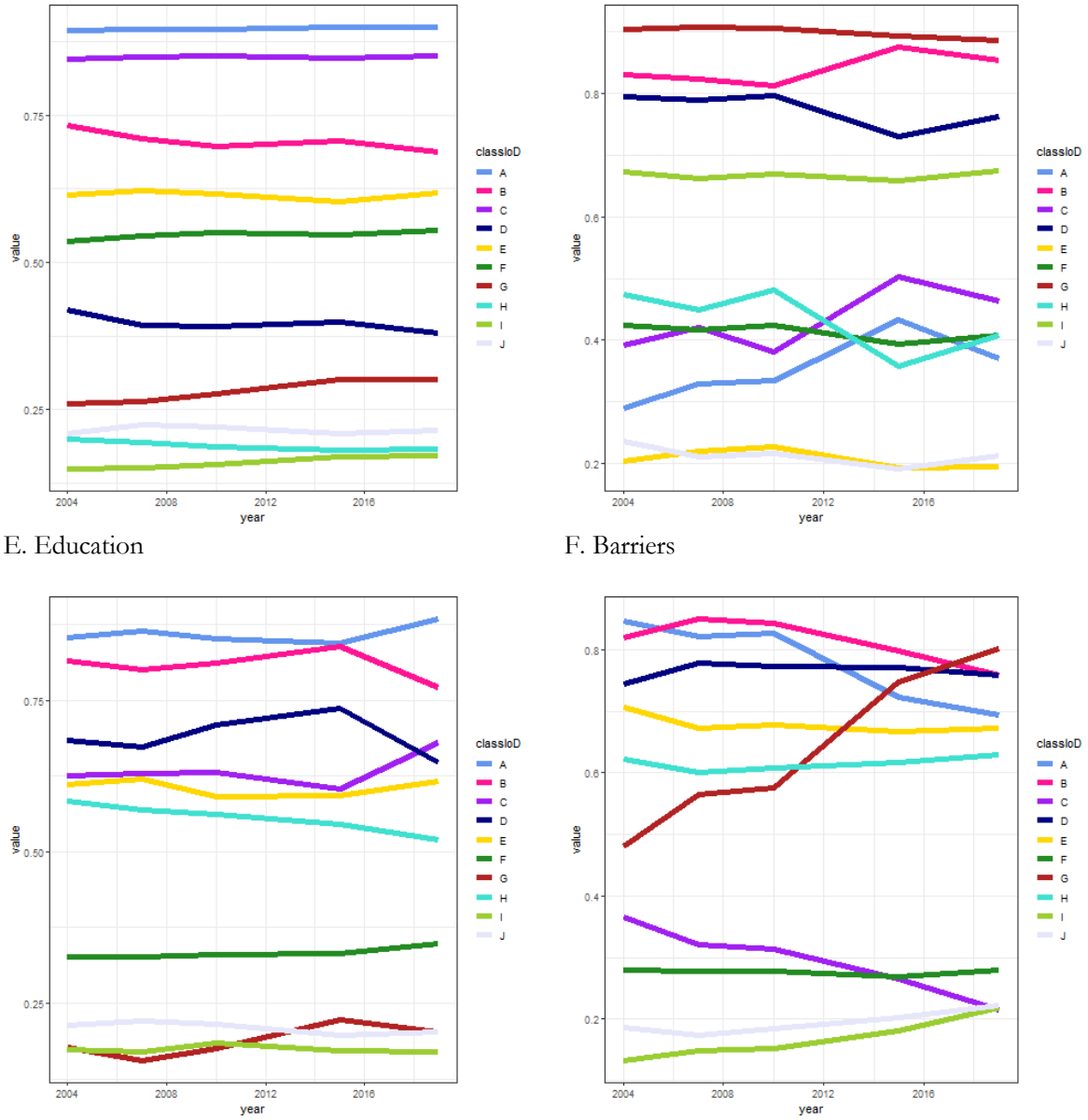
B. Income



C. Employment



D. Health



E. Education F. Barriers

G. Crime H. Living

Figure 13. Median ranks by IoD trajectory class by domain.

It is worth focusing also on IoD class B (Higher deprivation, markedly declining), given the interest in understanding decreases in deprivation from a high level. Some LSOAs in IoD class B have changed as a result of gentrification processes, and thus do not indicate a decrease in deprivation for deprived people. Two different approaches were applied to identify LSOAs where deprivation levels may have changed as a result of gentrification, to allow a focus instead on those areas where there may have been a decrease in deprivation for deprived communities. These were: (1) to assess changes in the share of people in National Statistics Socio-economic classification (NS-SeC) classes 1 and 2 (Higher managerial, administrative and professional occupations, and Lower managerial, administrative and professional occupations – these two groups would be expected to correspond to higher incomes compared to the other groups); and (2) to construct an area change classification which includes data on age, ethnic group, housing tenure, and NS-SeC.

Some 12% of LSOAs in England saw an increase in NS-SeC 1 between 2001 and 2021 of more than 5% and LSOAs were coded as 0 = change up to 5% and 1 = change greater than 5%. Cross-

tabulating these codes with the IoD trajectory classes produces Table 9. This table suggests that there are proportionally more LSOAs in class B that have seen an increase in NS-SeC 1 (at 13.8%) than is the case for the three classes which correspond to the highest deprivation levels (2.5% for Class A and 4.6% for class C). This suggests that, for a small minority of areas, a key factor in the trends observed for Class B is a growth in professional and managerial professions likely linked to processes of gentrification likely associated with home building programmes. In addition, areas in class D – corresponding to decreasing deprivation from a moderate level – have seen an increase in the share of people in professional and managerial professions. While a simple metric such as change in NS-SeC provides some context, a more wide-ranging measure is required.

	NS-SeC1: 2001-2021		
IoD class	<=5%	>5%	>5% as % of total
A (most)	3633	92	2.47
B	2669	427	13.79
C	3189	152	4.55
D	2337	557	19.25
E	3155	267	7.80
F	4186	453	9.77
G	2107	438	17.21
H	2167	563	20.62
I	3017	504	14.31
J (least)	3196	646	16.81

Table 9. Changes in NS-SeC 1 % between 2001 and 2021: counts of LSOAs.

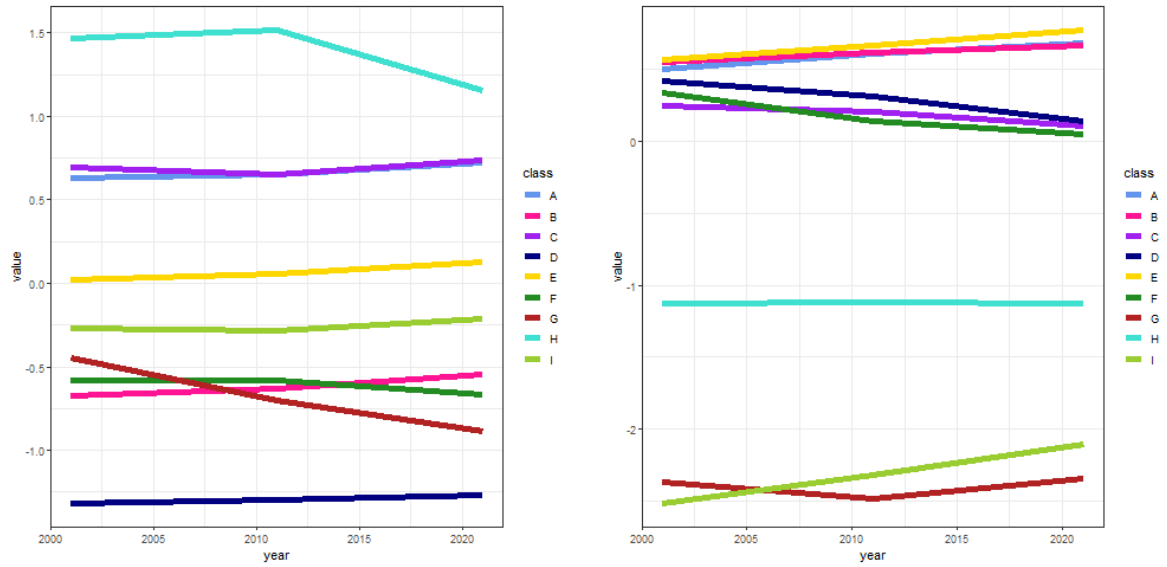
As a second stage, the IoD trajectory clusters were linked to a separate Census data classification for the period 2001 to 2021. A Census area change classification was created using the same approach as for the IoD trajectories but using *k*-means classification rather than the *k*-medians classification. The input variables were: age, NS-SeC 1 and 2 (as a percentage of people in all NS-SeC groups), White British (as a percentage of people in all ethnic groups), social rented households and private rented households (each as a percentage of all households). Each of the percentages was converted to *z*-scores so that a value above zero is above the average and a value below zero is below the average. Table 10 summarises the changes by variable and class. In this case, the z-score for each year and variable is coded as low if it is below -0.5, mod(erate) if it is between -0.5 and 0.5, and high if it is above 0.5. As one example, class B has low levels of people in NS-SeC 1 and 2 at all three time points (it is coded as low,low,low for NSSEC12). To understand each class it is necessary to consider a given row in the table. Taking class B for instance: the share of younger (up to 15 years old) and older (65 plus) people remains moderate over the period 20010-2011-2021. The share of people in the White British group remains high, while the share of people in NS-SeC 1 and 2 remains low. The share of households which are private rented or social rented remains moderate.

Class	Age0to15	Age65p	WBritish	NSSEC12	PRent	SRent
A	mod,mod,mod	mod,high,high	high,high,high	high,high,high	mod,low,low	low,low,low
B	mod,mod,mod	mod,mod,mod	high,high,high	low,low,low	mod,mod,mod	mod,mod,mod
C	mod,mod,mod	low,low,mod	mod,mod,mod	high,high,high	mod,mod,mod	low,low,low
D	high,high,high	mod,mod,low	mod,mod,mod	low,low,low	low,low,low	high,high,high

E	low,low,low	high,high,high	high,high,high	mod,mod,mod	mod,low,low	low,low,low
F	mod,mod,mod	mod,low,low	mod,mod,mod	low,low,low	high,high,high	mod,mod,mod
G	high,high,high	low,low,low	low,low,low	mod,low,low	mod,high,high	mod,mod,mod
H	low,low,low	low,low,low	low,low,low	high,high,high	high,high,high	mod,mod,mod
I	high,high,mod	low,low,low	low,low,low	mod,mod,mod	mod,mod,high	high,high,high

Table 10. Census area change classification summary: low is a z-score below -0.5; high is a z-score greater than 0.5; moderate is all z-score values between -0.5 and 0.5.

The plots in Figure 14 show how the input variables to the Census area classification change across time. As an example, Figure14a shows that LSOAs in Census area change class H have large percentages of people in NS-SeC classes 1 and 2 over all time periods.



a. NS-SeC1 and 2

b. White British

c. Social rented

d. Private rented

Figure 14. Census variable median z-scores by IoD trajectory class.

The Census change classes were linked to the IoD trajectory classes to provide context to the latter. Counts of LSOAs in each combination of the IoD classification and the Census areas change classification are provided in Table 11.

The majority of LSOAs in IoD class B are in Census change classes I (865 LSOAs), G (817), and D (631). As shown in Figure 14, Census change class I shows a slight increase in the share of NS-SeC1 and 2, an increase in the White British population, a decrease in social renting, and an increase in private renting. Census change class G corresponds to a decrease in NS-SeC1 and 2, a relatively stable White British population, a slight increase in social renting and an increase in private renting. Census change class D shows a slight increase in NS-SeC 1 and 2, a decreasing White British population, a slight increase in social renting and an increase in private renting from a low base. Census change class I could reflect (for some areas at least) processes of gentrification given the increasing share of people in NS-SeC 1 and 2 and changes in housing tenure. For Census change classes G and D this seems less likely to be the case. This context is important in understanding what the IoD trajectory classes may be telling us. In brief, the table suggests that the characteristics of areas with similar deprivation trajectories can be very different. This suggests that a 'one size fits all' approach to tackling persistent deprivation may not be appropriate.

Data provided as outputs from the project are accompanied by variables which can be used by analysts to provide context to deprivation changes in local areas.

			Census class (see Table 10)								
			A	B	C	D	E	F	G	H	I
IoD class	A	Most deprived	0	651	3	1656	38	843	462	40	32
	B		3	272	20	631	41	197	817	250	865
	C		5	1451	35	1621	131	52	44	0	2
	D		158	249	354	25	155	202	684	948	119
	E		249	1479	286	44	412	762	94	95	1
	F		920	1653	692	130	1120	82	40	2	0
	G		1378	88	211	0	584	53	61	168	2
	H		815	48	884	0	227	109	73	574	0
	I		1886	25	1220	0	320	32	11	27	0
	J	Least deprived	2140	93	898	2	681	17	0	11	0

Table 11. Counts of LSOAs by IoD trajectory class and Census area change class.

Deprivation trajectories in Wales

This section provides statistical summaries of current deprivation and deprivation trajectories in Wales. It uses data from two sources: Census data for the period 1971 to 2021 and the Welsh Index of Multiple Deprivation (WIMD) for 2008 to 2019. This part of the report is divided into three main sections. The first uses Census data for the period 1971 to 2021 to compute the Townsend deprivation index (TI), the second makes use of the WIMD, and the third considers area deprivation trajectories using both measures. This section is intended to provide an overview of deprivation in Wales, and to allow readers to assess how deprivation has changed in different areas since 1971.

The maps and data included in this section are, as for England, LSOAs. There are 1,917 LSOAs in Wales with an average population of 1621 (figures for 2021). Again, as for England, all of the data used in the profile are constructed for LSOAs as used in the 2021 Census. The Census data from 1971, 1981, 1991, 2001 and 2011, upon which the Townsend Indices have been based, and all the WIMD releases, were based on different sets of geographical units to 2021 LSOAs. Therefore, a GIS overlay procedure was used to convert these earlier datasets to the 2021 LSOAs.

Townsend Deprivation Index

The breakdown by TI deciles for England and Wales for each Census year from 1971 to 2021 (where decile 1 indicates the 10% of LSOAs with the lowest deprivation, and decile 10 represents the 10% of LSOAs with the highest deprivation) is shown in Table 12. In this table, the larger the values in the bottom rows (deciles 9 and 10), the more highly deprived neighbourhoods there are. Comparing the values between columns (that is, Census years) shows whether the percentage of LSOAs in, for example, the most deprived 10% has increased or decreased. In this table, the figures are relative to Wales *and* England. This table suggests that the share of LSOAs in the most deprived 10% is lower than in England (as a whole) – this is indicated by the values for decile 10 being less than 10. It is important to note that overcrowding, in particular, will result in higher deprivation scores for England than Wales and so any comparison must be made carefully.

Decile	1971	1981	1991	2001	2011	2021
1 (least)	6.1	5.5	7.0	5.7	8.1	10.7
2	5.7	6.2	6.7	7.0	9.2	11.3
3	9.1	7.3	9.5	8.2	10.7	11.4
4	11.4	9.5	9.0	10.3	11.7	12.6
5	12.5	12.4	12.8	14.6	13.2	13.6
6	14.8	15.2	14.6	14.8	15.5	14.2
7	13.8	16.3	14.7	14.6	12.3	11.4
8	12.2	11.5	11.8	12.6	10.5	8.2
9	9.5	9.2	8.8	9.0	6.2	5.2
10 (most)	5.1	6.9	5.1	3.4	2.6	1.5
Total	100.0	100.0	100.0	100.0	100.0	100.0

Table 12. Percentage of LSOAs by national Townsend decile, 1971 to 2021.

Table 13 shows mean changes in indicator scores for the four constituent TI indicators (as noted previously, the indicators are based on *z*-scores, and so Table 13 shows changes in the *z*-score values between successive iterations of the TI measure). The average values in Table 13 are for all LSOAs in Wales. In this case, an increase (a positive value) indicates an average absolute increase in deprivation on a given domain, while a decrease (a negative value) indicates an average absolute decrease in deprivation.

Period	Emp	Rnt	Car	Ovr
1971-1981	8.17	-7.83	-8.89	-2.33
1981-1991	-2.46	-9.98	-4.94	-1.05
1991-2001	-4.29	0.29	-5.89	-0.47
2001-2011	-1.68	3.32	-2.97	0.86
2011-2021	-1.84	1.57	-3.28	0.23

Table 13. Mean changes in TI indicator *z*-scores for all LSOAs.

As can be seen from Table 13, the indicator score which **increased** the most over the period 1971 to 1981 was **Employment**, with an average change of 8.17.

The indicator score which **decreased** the most over the period 1971 to 1981 was **Car access**, with an average change of -8.89.

The indicator score which **decreased** the least over the period 1981 to 1991 was **Overcrowding**, with an average change of -1.05.

The indicator score which **decreased** the most over the period 1981 to 1991 was **Rent**, with an average change of -9.98.

The indicator score which **increased** the most over the period 1991 to 2001 was **Rent**, with an average change of 0.29.

The indicator score which **decreased** the most over the period 1991 to 2001 was **Car access**, with an average change of -5.89.

The indicator score which **increased** the most over the period 2001 to 2011 was **Rent**, with an average change of 3.32.

The indicator score which **decreased** the most over the period 2001 to 2011 was **Car access**, with an average change of -2.97.

The indicator score which **increased** the most over the period 2011 to 2021 was **Rent**, with an average change of 1.57.

The indicator score which **decreased** the most over the period 2011 to 2021 was **Car access**, with an average change of -3.28.

Table 14 shows the percentage of LSOAs for adjacent TI releases where the change is largest (increases or decreases are noted separately) for a given indicator. This shows which indicators contribute most to changes in deprivation over each time period. As can be seen from Table 13, in the majority of LSOAs the largest increase over the period 1971 to 1981 - in 92.75% of LSOAs - was for **Employment**. For the period 1981 to 1991 the equivalent largest changes were for **None** (54.62% of LSOAs), while for 1991 to 2001, 2001 to 2011 and 2011 to 2010 it was for **Rent** (52.06%, 66.2% and 62.39% of LSOAs respectively). For 1971 to 1981 the largest decreases were for **Car access**, while for 1981 to 1991 it was **Rent**. For each of 1991 to 2001, 2001 to 2011, and 2011 to 2021 the largest decreases were for **Car access**.

	% LSOAs with largest *increase* by indicator				
	71-81	81-91	91-01	01-11	11-21
Emp	92.75	14.29	1.15	0.94	1.04
Rnt	5.48	11.32	52.06	66.20	62.39
Car	0.31	10.43	1.36	1.98	5.32
Ovr	0.10	9.34	12.31	26.71	19.93
None	1.36	54.62	33.12	4.17	11.32
	% LSOAs with largest *decrease* by indicator				
	71-81	81-91	91-01	01-11	11-21

	% LSOAs with largest *increase* by indicator				
	71-81	81-91	91-01	01-11	11-21
Emp	0.05	8.97	30.62	27.75	26.08
Rnt	40.85	61.66	9.23	4.49	6.52
Car	50.50	26.55	58.74	62.65	64.63
Ovr	7.98	1.88	0.94	1.30	2.24
None	0.63	0.94	0.47	3.81	0.52

Table 14. Percentages of LSOAs by the largest change for each TI indicator: (a) indicators with largest increases and (b) indicators with largest decreases

Figure 15 shows the TI scores in 2021 in Wales. Note that, for all maps, the range of values included refer to Wales specifically. As noted already, positive values indicate higher levels of deprivation, while negative values indicate lower than average levels of deprivation according to this measure. Figure 16 shows changes in the TI scores between 1971 and in 2021. Positive values indicate increased levels of deprivation while negative values indicate decreased levels of deprivation over this time period.

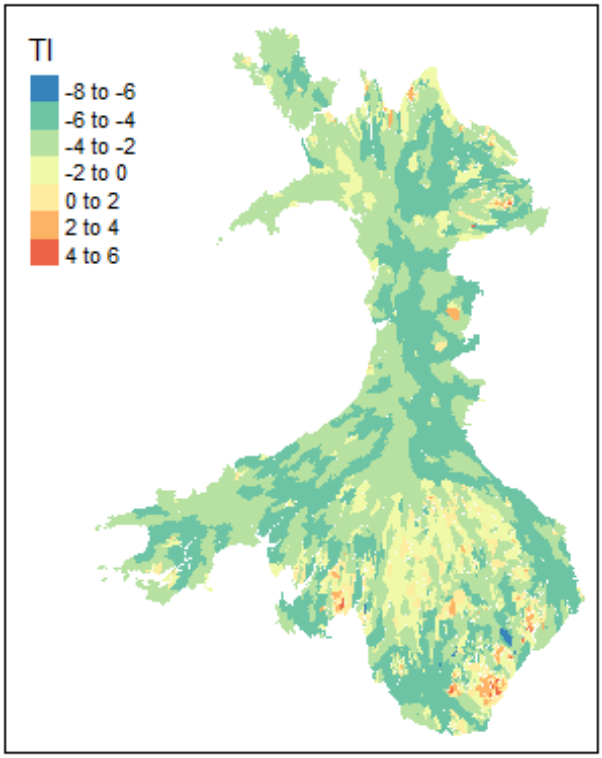


Figure 15. Townsend index score, 2021.

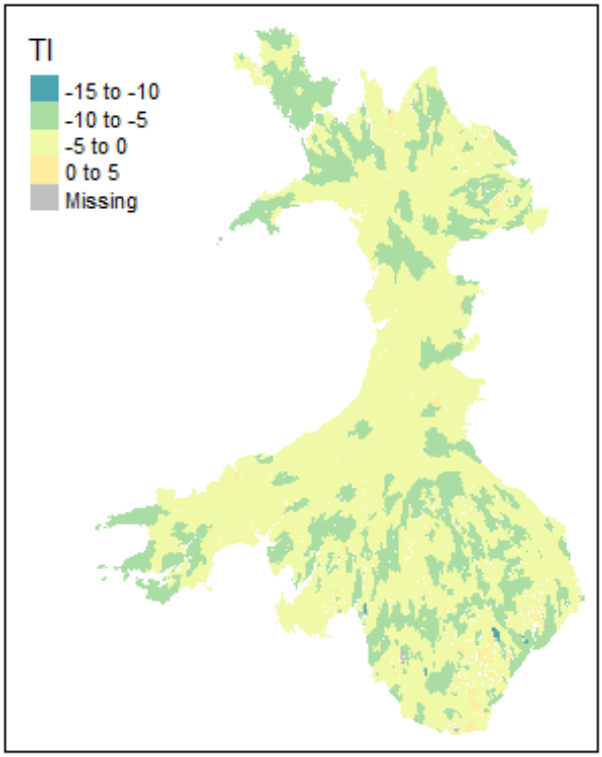


Figure 16. Townsend index score, 1971-2021.

As for England, the k-means clustering method was used to group the four constituent indicator scores for each TI calculated separately for each of the six Census years to generate area trajectory classes. The five classes have been labelled as follows:

- A: Persistently deprived - deprivation levels were very high at the start of the period (1971) and remained high until the end (2021).
- B: Moderately deprived - deprivation levels were relatively high at the start of the period and moderate by the end.
- C: Stalled improvement - deprivation levels, at their lowest in 2001 but were relatively high in 2011 and 2021.
- D: Less deprived - deprivation levels are moderately high at the start of the period and much lower by the end.
- E: Persistently not deprived - deprivation levels are low at the start of the period and very low by the end.

Figure 17 shows the median TI ranks by the five trajectory classes identified across all LSOAs in England and Wales (although the remainder of this section refers only to Wales). In this chart, trends in absolute deprivation are shown. In all cases, median deprivation in 2021 is lower than it was in 1971. With cluster C the difference between 1971 and 2021 is very small.

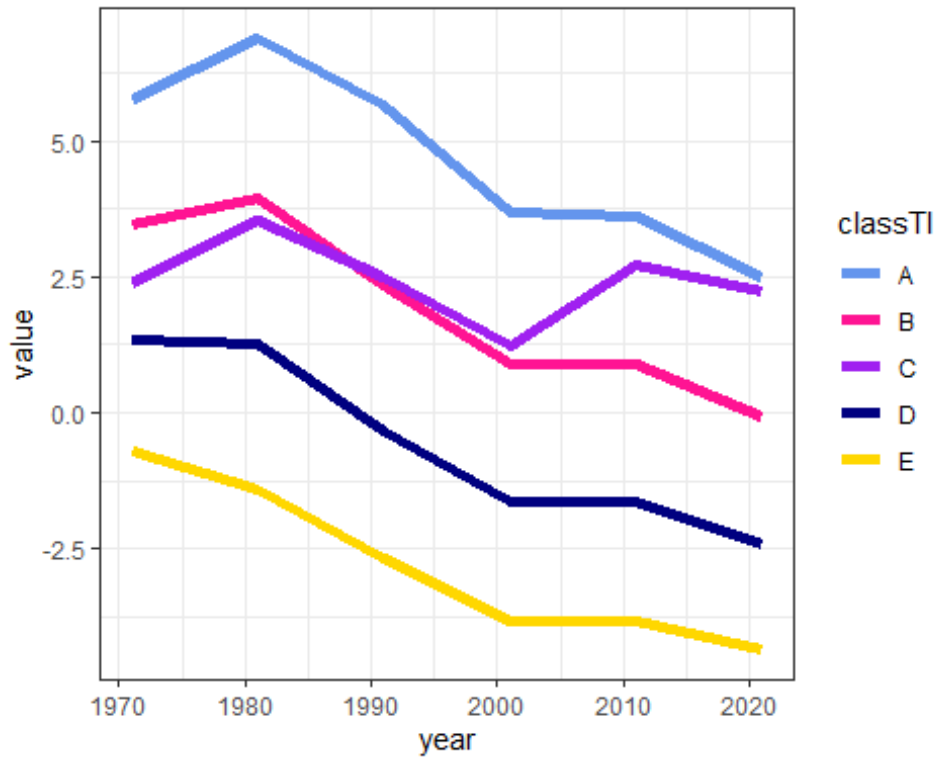


Figure 17. Median Townsend index scores by trajectory class.

Figure 18 shows the distribution of the trajectory classes across Wales using the same colours per class as in Figure 17.

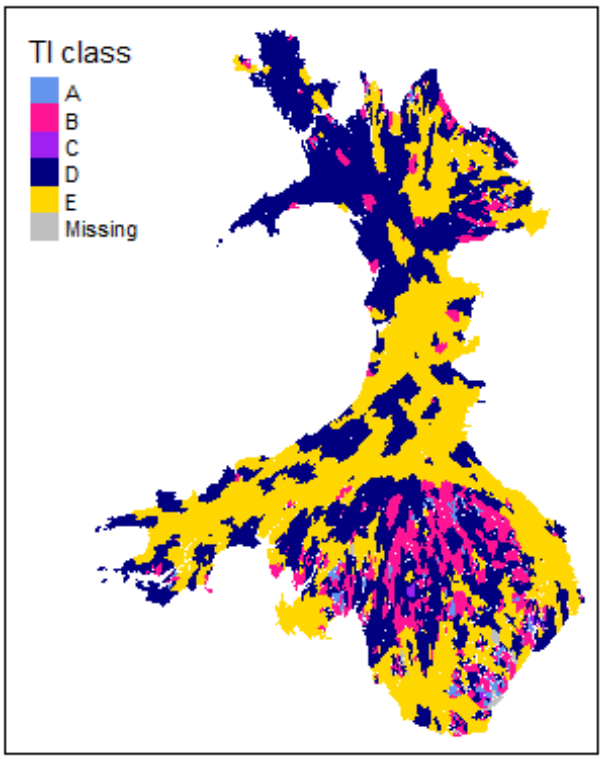


Figure 18. TI trajectory clusters.

Table 15 indicates the number of LSOAs within each 2021 TI decile (where 1 is least deprived and 10 is most deprived) and TI trajectory class. We can see that LSOAs in (for example) the most deprived 2021 TI deciles are spread across different trajectory classes. This demonstrates how the current TI decile masks very different deprivation histories and thus contrasting challenges.

	Most deprived				Least deprived
Dec	A	B	C	D	E
1 (least)	0	0	0	10	193
2	0	1	0	44	167
3	0	0	0	110	104
4	0	4	0	198	37
5	0	29	0	218	10
6	0	124	0	148	0
7	2	166	0	45	0
8	28	119	5	2	0
9	52	37	8	1	0
10 (most)	26	1	0	0	0

Table 15. Number of LSOAs in each TI trajectory cluster and TI 2021 decile.

Welsh Index of Multiple Deprivation

The WIMD comprises eight domains, each based on a set of indicators. These eight domains are combined together into an overall composite WIMD using explicitly defined domain weights. The weights applied in creating the overall WIMD 2019 (Welsh Government, 2019) measure are as follows:

1. Income (Inc) 22%
2. Employment (Emp) 22%
3. Health (Hea) 15%
4. Education (Edu) 14%
5. Access to Services (Acc) 10%
6. Housing (Hou) 7%
7. Community Safety (Saf) 5%
8. Physical Environment (Liv) 5%

Note that the 2005 WIMD was considered for inclusion in the analysis but, since it comprises only seven domains (Community Safety was included for the first time in the 2008 WIMD), it was decided to start the WIMD analysis with the 2008 release. Each domain is composed of multiple indicators, with there being 47 indicators in the 2019 iteration of the WIMD.

As noted for England, the WIMD and TI are very different in nature, although they both attempt to measure the multidimensional nature of socio-economic deprivation at neighbourhood level. One notable difference (again, as for England) is in the relative contribution of overcrowding (households with more than one person per room) to the two measures. Overcrowding is a major component of the TI (accounting for one quarter of the overall score) but just one element within one domain of the WIMD (the Housing Domain - which is itself assigned a domain weight of 7%). Therefore, LSOAs with high levels of overcrowding are likely to have relatively high levels of overall deprivation according to the Townsend score but not necessarily according to the WIMD.

It is possible to assess change in the overall WIMD (as shown above), and also each of the eight constituent domains that make up the WIMD. A key interest in this profile is in LSOAs which have seen large changes in deprivation rank on particular domains - either a relative increase in deprivation, or a relative decrease. Like the overall WIMD score, the WIMD domain scores are relative, and thus a reduction in WIMD domain ranks in a specific area would indicate that deprivation has declined in that area relative to other areas across the nation.

Table 15 shows the percentage of LSOAs for adjacent WIMD releases where the change is largest for a given domain. This indicates which domains contribute most to changes in deprivation over each time period. In this case, domain weights are applied so that change in, for example, income (WIMD weight of 22%) is emphasized compared to physical environment (WIMD weight of 5%). Note that some domain scores were carried over from previous WIMD releases and so they did not change over time.

As can be seen from Table 16, in the majority of LSOAs the largest increase over the period 2008 to 2011 - in 22.43% of LSOAs - was for **Health**. For the periods 2011 to 2014 and 2014 to 2019 the equivalent largest changes were for **Access** (23.47% and 20.92% of LSOAs respectively). The largest decreases for 2008 to 2011 for **Health**, while for 2011 to 2014 and 2014 to 2019 it was **Access**.

	% LSOAs with largest *increase* by indicator		
	08-11	11-14	14-19
Inc	21.18	11.22	9.23
Emp	17.63	13.25	9.75
Hea	22.43	14.61	15.28
Edu	13.93	10.22	14.40
Acc	1.83	23.47	20.92
Hou	0.00	9.75	9.18
Saf	7.51	6.99	5.11
Env	15.49	9.81	15.75
None	0.00	0.68	0.37
	% LSOAs with largest *decrease* by indicator		
	08-11	11-14	14-19
Inc	20.55	12.47	8.19
Emp	16.85	14.50	10.22
Hea	25.67	14.87	15.23
Edu	14.19	9.18	15.13
Acc	0.00	23.58	19.93
Hou	0.00	8.92	10.54
Saf	6.57	5.79	4.64
Env	14.29	10.07	15.75
None	1.88	0.63	0.37

Table 16. Percentages of LSOAs by the largest change for each TI indicator: (a) domains with largest increases and (b) domains with largest decreases

Figure 19 shows the WIMD scores for 2008, while Figure 20 shows the equivalent for 2019. The WIMD values are shown as national deciles, where decile 1 is the least deprived 10% and decile 10 is the most deprived 10%. Both maps show the same broad trends with the highest deprivation values most commonly found in south Wales – around Cardiff and Newport and the former coalfields. More rural areas tend to have lower levels of deprivation by these measures.

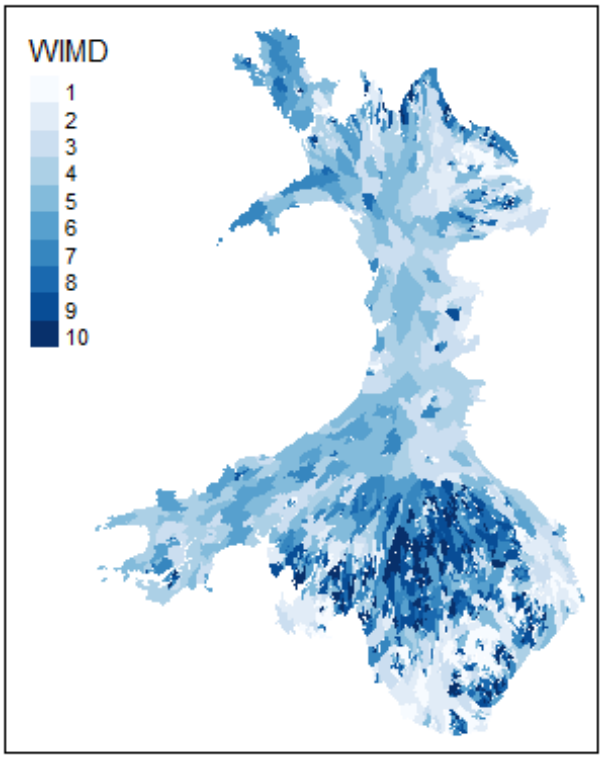


Figure 19. Index of deprivation national decile, 2008.

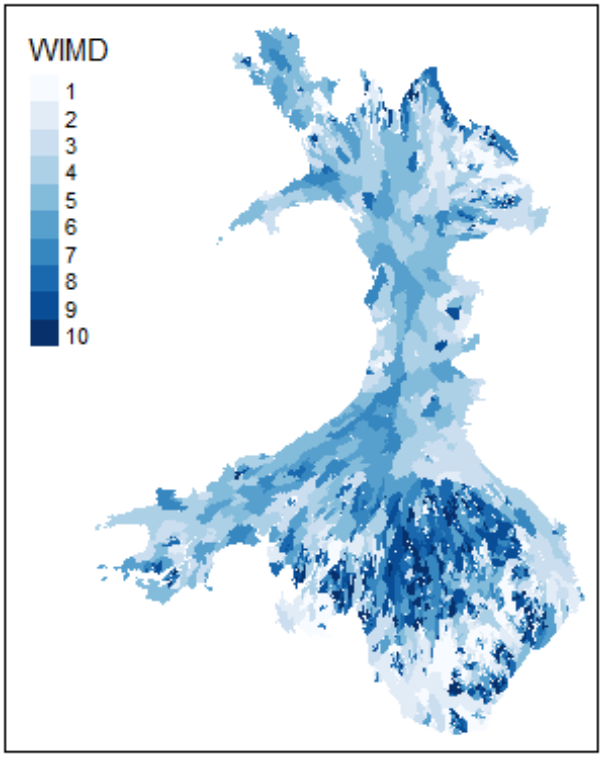


Figure 20. Index of deprivation national decile, 2019.

Clusters of trajectories were computed for the WIMD ranks for each of the eight domains and for each WIMD release (2008, 2011, 2014, 2019). Ten WIMD clusters were identified through this process, each showing identifiable patterns across the data.

- A: Persistently highest deprivation - deprivation is, and persistently has been, amongst the highest in these LSOAs between 2008 and 2019.
- B: Persistent high deprivation - very similar to class A, but with very slightly lower levels.
- C: Higher deprivation, declining - high levels of deprivation but with a gradual decrease since 2011.
- D: Moderate deprivation, increasing - moderately high levels of deprivation but with a gradual increase since 2011.
- E: Moderate deprivation, decreasing - moderate levels of deprivation but with a gradual decrease since 2011.
- F: Lower deprivation, declining - lower levels of deprivation with a clear decrease since 2011.
- G: Lower deprivation, increasing - lower levels of deprivation with an increase since 2014.
- H: Low deprivation, increasing - relatively low levels of deprivation with an increase after 2011.
- I: Low deprivation, decreasing - low levels of deprivation with a decrease after 2014.
- J: Lowest deprivation, increasing - very low levels of deprivation with a slight increase after 2014.

Figure 21 shows the median WIMD ranks by the ten trajectory classes identified.

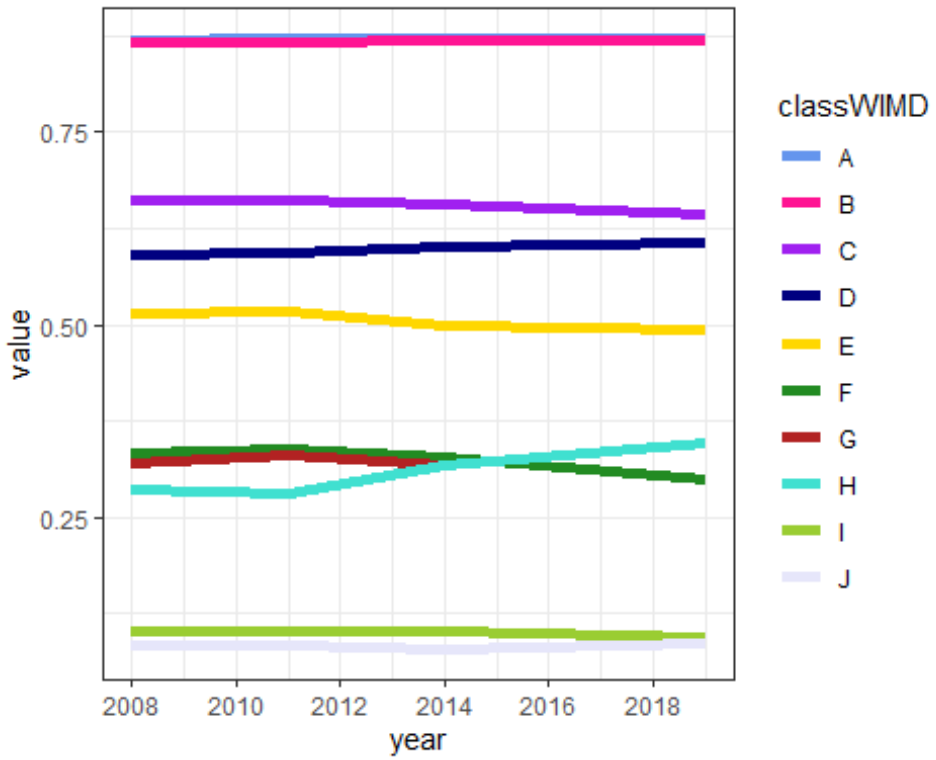


Figure 21. Median WIMD ranks by trajectory class.

The WIMD trajectory classes in Wales are mapped in Figure 22. The map uses the same colours per class as in Figure 21.

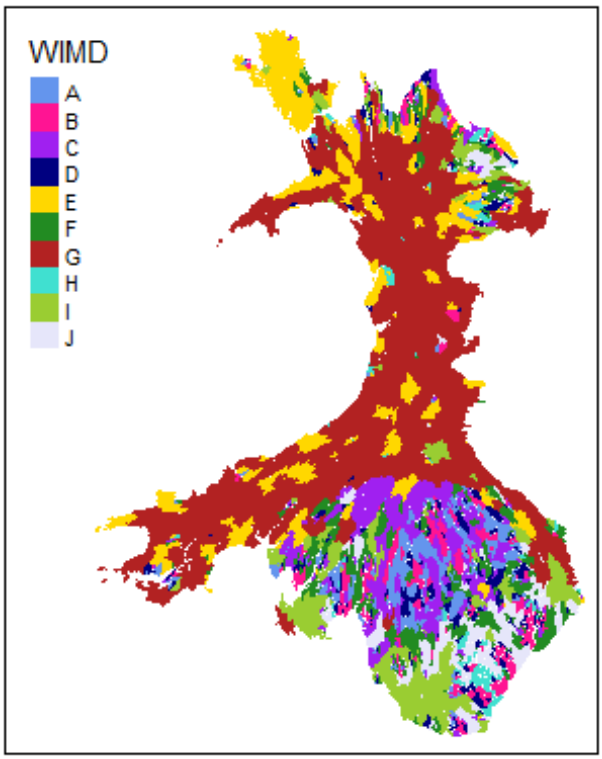


Figure 22. WIMD trajectory clusters.

Combined analysis
Table 17 shows LSOA membership of both sets of trajectory clusters. This provides a summary of the ways in which LSOAs have changed according to both TI and WIMD trajectory clusters. Linking both sets of clusters helps to identify, for example, LSOAs which have had high deprivation levels by both measures as distinct from, as an example, LSOAs which may have seen increasing deprivation levels in recent years (as judged using the WIMD) but which do not have long histories of deprivation (as judged using the TI).

	Most deprived									Least deprived
	A	B	C	D	E	F	G	H	I	J
A (most)	49	56	0	1	0	0	0	2	0	0
B	153	166	63	59	11	1	0	28	0	0
C	1	11	0	0	0	0	0	1	0	0
D	30	26	126	150	118	150	81	64	11	20
E (least)	0	0	2	0	5	76	127	6	145	150

Table 17. TI trajectory clusters and WIMD trajectory clusters.

Deprivation trajectories in Scotland

This section of the report provides statistical summaries of deprivation and deprivation trajectories in Scotland. It uses data from two sources: Census data for the period 1971 to 2021 and the Scottish Index of Multiple Deprivation (SIMD) for 2006 to 2020. The report is divided into three main sections. The first uses Census data for the period 1971 to 2021 to compute the Townsend deprivation index (TI), the second makes use of the SIMD, and the third considers area deprivation trajectories using both measures. This section is intended to provide an overview of deprivation in Scotland, and to allow readers to assess how deprivation has changed in different areas since 1971.

The maps and data included in this section provide information on population and housing for areas called Data Zones (DZs). There are 6,976 DZs in Scotland with an average population of 780 (figures for 2022).

All of the data used in the profile are constructed for DZs as used in the 2011 Census (2011 DZs were used to report data from the 2022 Census). The Census data from 1971, 1981, 1991, and 2001, upon which the Townsend Indices have been based, and some SIMD releases, were based on different sets of geographical units to 2011 DZs. Therefore, a GIS overlay procedure was used to convert these earlier datasets to the 2011 DZs.

Townsend Deprivation Index
Table 18 shows mean changes in indicator scores for the four constituent TI indicators (as noted in Appendix B, the indicators are based on z-scores, and so Table 18 shows changes in the z-score values between successive iterations of the TI measure). The average values in Table 18 are for all DZs in Scotland. In this case, an increase (a positive value) indicates an average absolute increase in deprivation on a given domain, while a decrease (a negative value) indicates an average absolute decrease in deprivation.

Period	Emp	Rnt	Car	Ovr
1971-1981	6.23	-8.54	-9.59	-4.75
1981-1991	-1.04	-15.59	-4.79	-9.39
1991-2001	-6.24	-8.37	-6.67	-1.21
2001-2011	1.04	-6.75	4.99	-0.73
2011-2021	-1.30	6.86	-10.98	0.90

Table 18. Mean changes in TI indicator z-scores for all DZs

As can be seen from Table 18, the indicator score which **increased** the most over the period 1971 to 1981 was **Employment**, with an average change of 6.23.

The indicator score which **decreased** the most over the period 1971 to 1981 was **Car access**, with an average change of -9.59.

The indicator score which **decreased** the least over the period 1981 to 1991 was **Employment**, with an average change of -1.04.

The indicator score which **decreased** the most over the period 1981 to 1991 was **Rent**, with an average change of -15.59.

The indicator score which **decreased** the least over the period 1991 to 2001 was **Overcrowding**, with an average change of -1.21.

The indicator score which **decreased** the most over the period 1991 to 2001 was **Rent**, with an average change of -8.37.

The indicator score which **increased** the most over the period 2001 to 2011 was **Car access**, with an average change of 4.99.

The indicator score which **decreased** the most over the period 2001 to 2011 was **Rent**, with an average change of -6.75.

The indicator score which **increased** the most over the period 2011 to 2021 was **Rent**, with an average change of 6.86.

The indicator score which **decreased** the most over the period 2011 to 2021 was **Car access**, with an average change of -10.98.

Table 19 shows the percentage of DZs for adjacent TI releases where the change is largest (increases and decreases are shown separately) for a given indicator. This shows which indicators contribute most to changes in deprivation over each time period. As can be seen from Table 18, in the majority of DZs the largest increase over the period 1971 to 1981 - in 74.23% of DZs - was for **Employment**. For the periods 1981 to 1991 and 1991 to 2001 there were no increases in deprivation for any indicator in, respectively, 49.24% and 53.02% of DZs. For 2001 to 2011 the largest increase was for **Car access** (56.19% of DZs), while for 2011 to 2021 it was for **Rent** (67.46% of DZs). Then largest decreases for 1971 to 1981 were for **Rent**. This was also the case for each of 1981 to 1991, 1991 to 2001, and 2001 to 2011. For 2011 to 2021 the largest decreases were for **Car access**. The largest decreases for 1971 to 1981, 1981 to 1991, 1991 to 2001, and 2001 to 2011 were for **Rent**. For 2011 to 2021, the largest decreases were for **Car access**.

(a)	% DZs with largest *increase* by indicator				
	71-81	81-91	91-01	01-11	11-21
Emp	74.23	27.75	3.70	13.37	2.34
Rnt	15.64	7.02	20.11	25.66	67.46
Car	1.56	15.32	5.66	56.19	13.13
Ovr	2.49	0.66	17.50	1.40	13.56
None	6.08	49.24	53.02	3.37	3.51
(b)	% DZs with largest *decrease* by indicator				
	71-81	81-91	91-01	01-11	11-21
Emp	0.14	1.39	24.47	4.77	6.38
Rnt	37.00	59.86	45.13	57.86	16.10
Car	35.81	12.17	27.55	20.73	74.40
Ovr	23.51	26.26	2.38	11.68	0.89
None	3.54	0.32	0.47	4.96	2.24

Table 19. Percentages of DZs by the largest change for each TI indicator: (a) indicators with largest increases and (b) indicators with largest decreases

Figure 23 shows the TI scores in 2021 in Scotland. Note that, for all maps, the range of values included refer to Scotland specifically. As noted already, positive values indicate higher levels of deprivation, while negative values indicate lower than average levels of deprivation according to this measure. Figure 24 shows changes in the TI scores between 1971 and in 2021. Positive values indicate increased levels of deprivation while negative values indicate decreased levels of deprivation over this time period.

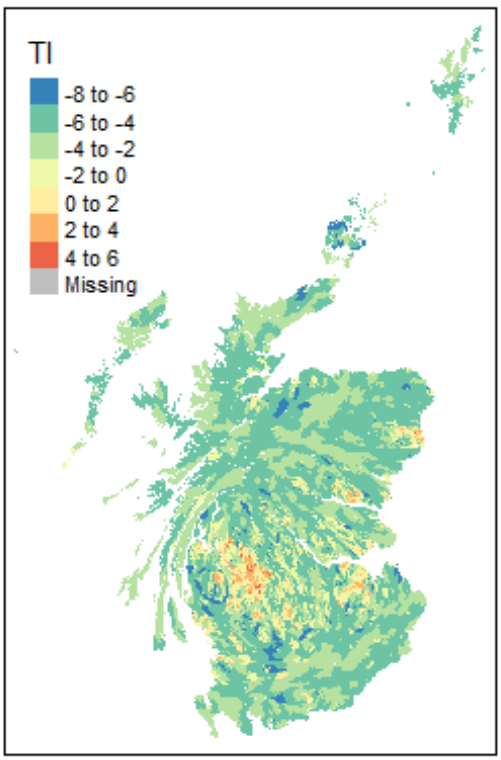


Figure 23. Townsend index score, 2021.

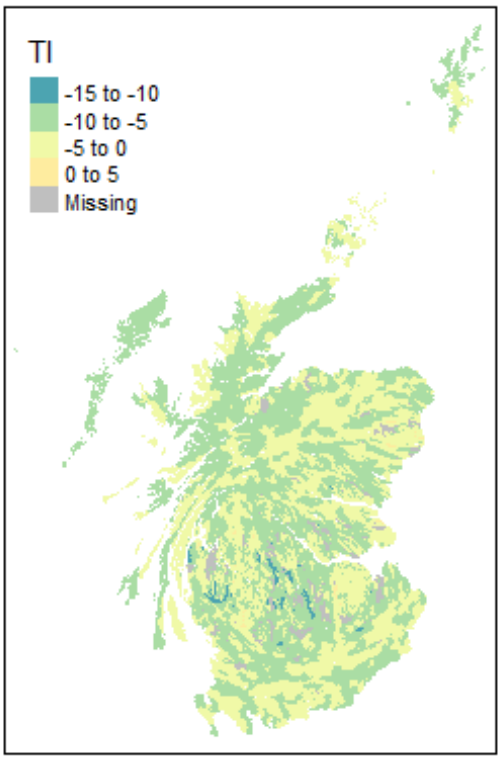


Figure 24. Townsend index score, 1971-2021.

The five Townsend index trajectory classes have been labelled as follows:

- A: Persistently deprived - deprivation levels were very high at the start of the period (1971) and remained high until the end (2021).

- B: Moderately deprived - deprivation levels were relatively high at the start of the period and moderate by the end.
- C: Stalled improvement - deprivation levels were relatively high at the start of the period, declined up to 2001 and then increased slightly.
- D: Less deprived - deprivation levels are moderately high at the start of the period and much lower by the end.
- E: Persistently not deprived - deprivation levels are low at the start of the period and very low by the end.

Figure 25 shows the median TI ranks by the five trajectory classes identified across all DZs in Scotland. In this chart, trends in absolute deprivation are shown. In all cases, median deprivation in 2021 is lower than it was in 1971.

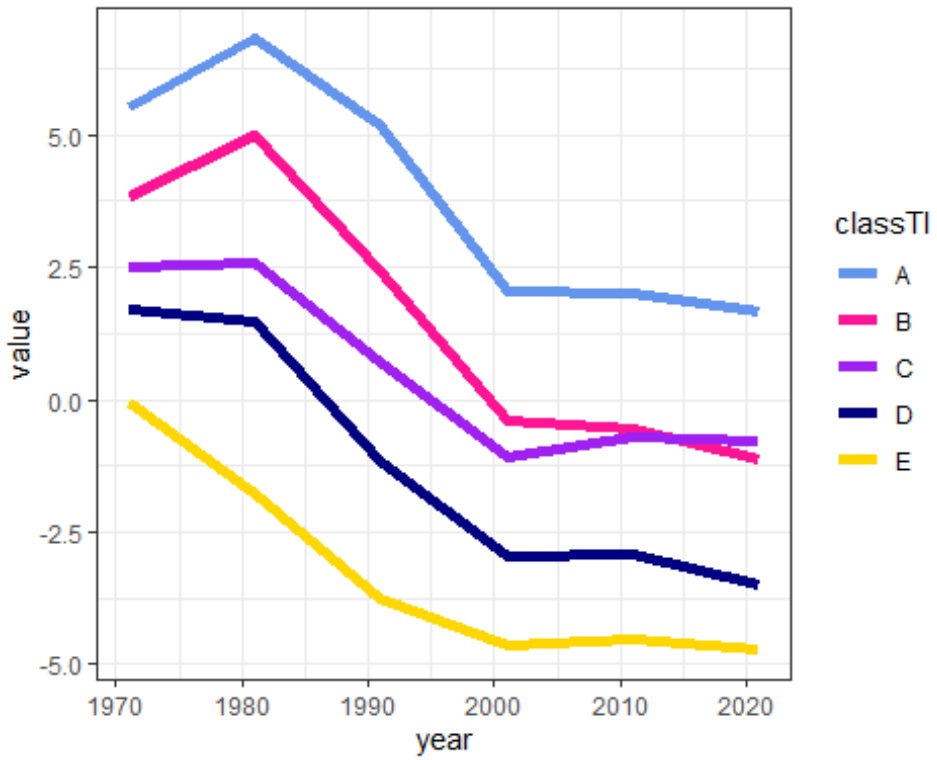


Figure 25. Median Townsend index scores by trajectory class.

Figure 26 shows the distribution of the trajectory classes across Scotland using the same colours per class as Figure 25. Thar map shows that the most persistently deprived areas appear around Glasgow (and to, a lesser degree, Edinburgh) and in the north east (including Aberdeen). There are many areas in the persistently not deprived group in the outskirts of the same areas.

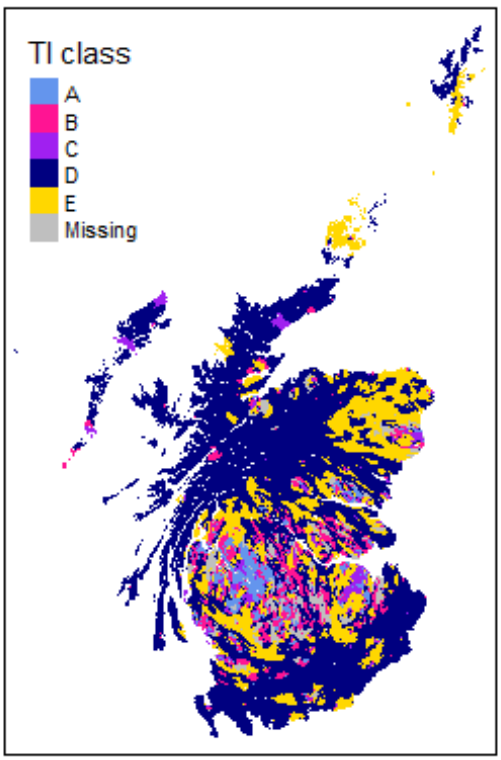


Figure 26. TI trajectory clusters.

Table 20 indicates the number of DZs within each 2021 TI decile and TI trajectory class. We can see that DZs in (for example) the most deprived 2021 TI deciles (decile 10 is most deprived) are spread across different trajectory classes. This demonstrates how the current TI decile may mask very different deprivation histories and thus contrasting challenges.

	Most deprived				Least deprived
Dec	A	B	C	D	E
1 (least)	0	3	0	83	460
2	0	3	0	212	370
3	0	15	1	340	280
4	0	46	10	429	165
5	3	155	43	390	69
6	11	319	126	200	24
7	24	416	184	48	3
8	104	399	172	7	0
9	340	203	146	1	0
10 (most)	604	12	62	0	0

Table 20. Number of DZs in each TI trajectory cluster and TI 2021 decile.

Scottish Index of Multiple Deprivation

The SIMD comprises seven domains. Each domain is composed of multiple indicators, with 33 indicators in the 2020 iteration of the SIMD (Scottish Government, 2020). These seven domains are combined together into an overall composite SIMD using explicitly defined domain weights. The weights applied in creating the overall SIMD 2019 measure are as follows:

1. Income (Inc) 28%
2. Employment (Emp) 28%
3. Health (Hea) 14%
4. Education (Edu) 14%
5. Geographic access to Services (Acc) 9%
6. Crime (Cri) 5%
7. Housing (Hou) 2%

Note that the 2004 SIMD was considered for inclusion in the analysis but, since it comprises only six domains (Crime was included for the first time in the 2006 SIMD), it was decided to start the SIMD analysis with the 2006 release. The analysis included the SIMDs for 2006, 2009, 2012, 2016, and 2020.

As indicated previously, the SIMD and TI are very different in nature, although they both attempt to measure the multidimensional nature of socio-economic deprivation at neighbourhood level. One notable difference is in the relative contribution of overcrowding (households with more than one person per room) to the two measures. Overcrowding is a major component of the TI (accounting for one quarter of the overall score) but just one element within one domain of the SIMD (the Housing Domain - which is itself assigned a domain weight of 2%). Therefore, DZs with high levels of overcrowding are likely to have relatively high levels of overall deprivation according to the Townsend score but not necessarily according to the SIMD.

It is possible to assess change in the overall SIMD (as shown above) and also each of the seven constituent domains that make up the SIMD. A key interest in this profile is in DZs which have seen large changes in deprivation rank on particular domains - either a relative increase in deprivation, or a relative decrease. Like the overall SIMD score, the SIMD domain scores are relative, and thus a reduction in SIMD domain ranks in a specific area would indicate that deprivation has declined in that area relative to other areas across the country.

Table 21 shows the percentage of DZs for adjacent SIMD releases where the change is largest for a given domain. This indicates which domains contribute most to changes in deprivation over each time period, showing separately the domains with the largest increases and the largest decreases. In this case, domain weights are applied so that change in, for example, income (SIMD weight of 28%) is emphasized compared to housing (SIMD weight of 2%). As can be seen from Table 21, in the majority of DZs the largest increase over the periods 2006 to 2009, and 2009 to 2012 were for **Income** (22.62% and 19.52% of DZs respectively). For 2012 to 2016 it was for **Access** (17.39% of DZs). For 2016 to 2020 it was for **Education** (19.88% of DZs). The largest decreases for 2006 to 2009 and 2009 to 2012 were for **Income**. For 2012 to 2016, the largest decreases were for **Health**, while for 2016 to 2020 it was for **Education**.

	% DZs with largest *increase* by indicator			
	06-09	09-12	12-16	16-29
Inc	22.62	19.52	14.64	18.76
Emp	21.67	17.23	15.52	19.27
Hea	10.36	17.50	15.54	10.84
Edu	16.01	16.24	13.95	19.88
Acc	14.84	15.42	17.39	14.22
Cri	11.83	11.61	10.79	14.61

	% DZs with largest *increase* by indicator			
	06-09	09-12	12-16	16-29
Hou	2.67	2.47	8.33	2.31
None	0.00	0.00	3.84	0.11
	% DZs with largest *decrease* by indicator			
	06-09	09-12	12-16	16-29
Inc	22.41	19.42	16.77	18.86
Emp	22.19	16.79	17.93	18.81
Hea	11.41	17.39	18.29	10.78
Edu	16.94	16.21	14.08	20.60
Acc	12.14	16.83	14.98	14.29
Cri	12.03	11.14	8.17	13.52
Hou	0.00	0.00	6.51	0.09
None	2.88	2.22	3.27	3.05

Table 21. Percentages of LSOAs by the largest change for each TI indicator: (a) domains with largest increases and (b) domains with largest decreases

Figure 27 shows the SIMD scores for 2006, while Figure 28 shows the equivalent for 2020. The SIMD values are shown as national deciles, where decile 1 is the least deprived 10% and decile 10 is the most deprived 10%. The highest deprivation values are concentrated around Glasgow and parts of Edinburgh, with very low values in the suburbs of both cities.

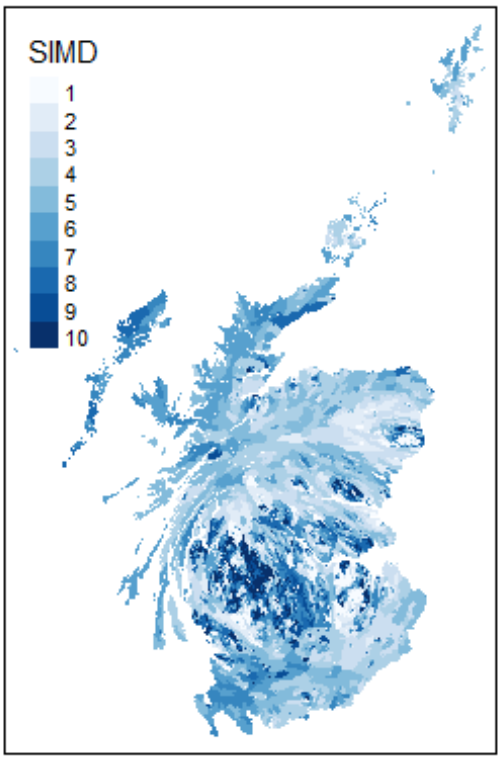


Figure 27. Index of deprivation national decile, 2006.

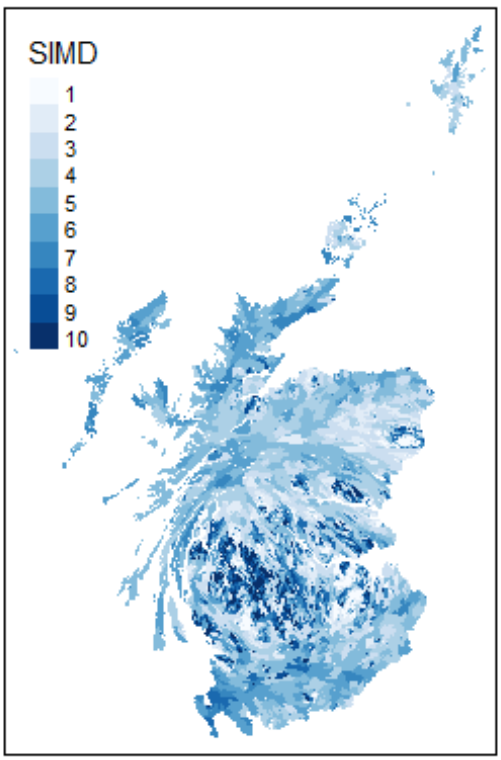


Figure 28. Index of deprivation national decile, 2020.

Clusters of trajectories were computed for the SIMD ranks for each of the seven domains and for each SIMD release (2006, 2009, 2012, 2016, 2020). Ten SIMD clusters were identified through this process, each showing identifiable patterns across the data:

- A: Persistently highest deprivation - deprivation is, and persistently has been, the highest in these DZs between 2006 and 2020.
- B: Higher deprivation, worsening - high levels of deprivation but with a gradual increase.
- C: Moderately high deprivation, worsening - moderately high levels of deprivation but with a gradual increase over the period.
- D: Moderately high deprivation, persistently declining - moderately high levels of deprivation but with a gradual decrease.
- E: Moderately high deprivation - persistent moderately high deprivation.
- F: Lower deprivation - persistent lower deprivation.
- G: Lower deprivation, gradually worsening - lower deprivation with an increase since 2012.
- H: Low deprivation, declining - low deprivation, systematically decreasing.
- I: Low deprivation, gradually worsening - low deprivation increasing slightly.
- J: Persistently lowest deprivation - very low levels of deprivation with a small increase over the period.

Figure 29 shows the median SIMD ranks by the ten trajectory classes identified.

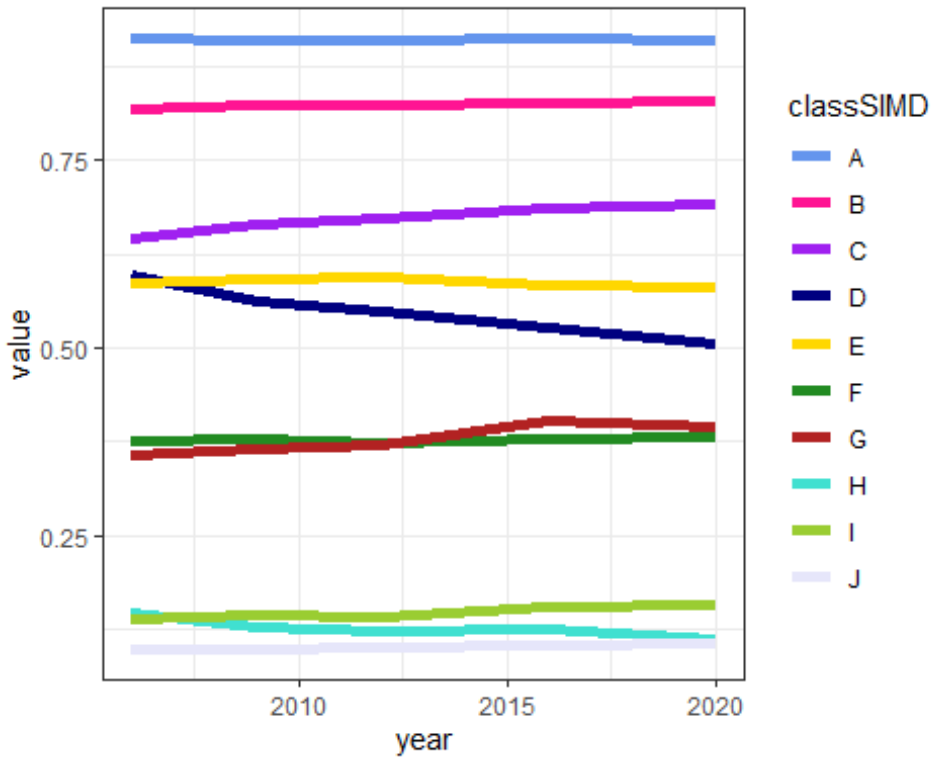


Figure 29. Median SIMD ranks by trajectory class.

The SIMD trajectory classes in Scotland are mapped in Figure 30. The map uses the same colours per class as in Figure 29. The largest concentration of persistently deprived areas are in Glasgow, with most rural areas in classes F or I. and a band of DZs in class E in the suburbs of Glasgow and Edinburgh.

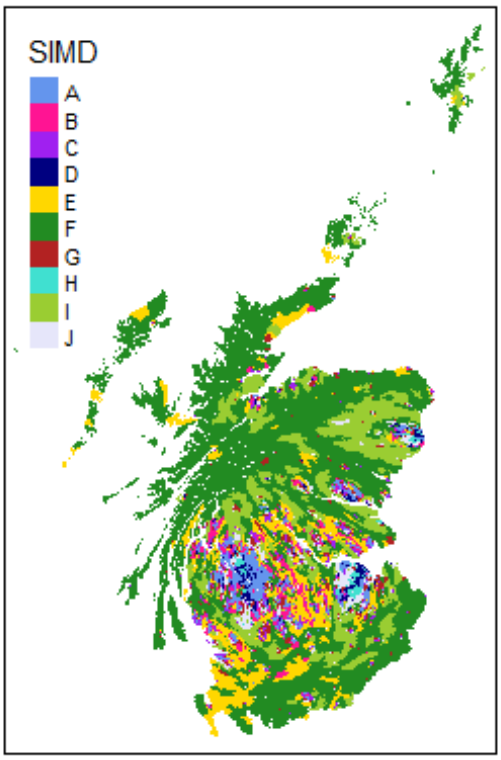


Figure 30. SIMD trajectory clusters.

Combined analysis
Table 22 shows DZ membership of both sets of trajectory clusters. This provides a summary of the ways in which DZs have changed according to both TI and SIMD trajectory clusters. Linking both sets of clusters helps to identify, for example, DZs which have had high deprivation levels by both measures as distinct from, as an example, DZs which may have seen increasing deprivation levels in recent years (as judged using the SIMD), but which do not have long histories of deprivation (as judged using the TI). The table suggests that most LSOAs are in, for example, clusters which correspond to persistently high deprivation for both measures. There are, however, exceptions such as those LSOAs in TI trajectory cluster A, but which are also in SIMD trajectory cluster H. This shows that places with common long-term deprivation histories by one measure may have quite different medium-term deprivation histories by another measure.

	Most deprived									Least deprived
	A	B	C	D	E	F	G	H	I	J
A (most)	754	251	12	63	1	0	0	5	0	0
B	156	477	440	45	361	14	76	1	1	0
C	60	17	215	212	33	7	56	141	0	3
D	0	1	50	34	250	671	448	33	132	91
E (least)	0	0	1	0	8	179	92	37	551	503

Table 22. TI trajectory clusters and SIMD trajectory clusters.

Deprivation trajectories in Northern Ireland

This section provides statistical summaries of deprivation and deprivation trajectories in Northern Ireland. It uses data from two sources: Census data for the period 1971 to 2021 and the NI Multiple Deprivation Measure (MDM) for 2005, 2010, and 2017. The section is divided into three main parts. The first uses Census data for the period 1971 to 2021 to compute the Townsend deprivation index (TI), the second makes use of the MDM, the third considers area deprivation trajectories using both measures. The section is intended to provide an overview of deprivation in Northern Ireland, and to allow readers to assess how deprivation has changed in different areas since 1971.

The maps and data included in this report provide information on population and housing for areas called Super Data Zones (SDZs). There are 850 SDZs in NI with an average population of 2239 (figures for 2021).

All of the data used in the profile are constructed for SDZs as used in the 2021 Census. The Census data from 1971, 1981, 1991, 2001 and 2011, upon which the Townsend Indices have been based, and all the MDM releases, were based on different sets of geographical units to 2021 SDZs. Therefore a GIS overlay procedure was used to convert these earlier datasets to the 2021 SDZs.

Townsend Deprivation Index
Table 23 shows mean changes in indicator scores for the four constituent TI indicators (as noted in Appendix B, the indicators are based on z-scores, and so Table 23 shows changes in the z-score values between successive iterations of the TI measure). The average values in Table 23 are for all SDZs in Northern Ireland. In this case, an increase (a positive value) indicates an average absolute

increase in deprivation on a given domain, while a decrease (a negative value) indicates an average absolute decrease in deprivation.

Period	Emp	Rnt	Car	Ovr
1971-1981	8.84	-3.38	-3.35	0.11
1981-1991	-0.70	-12.59	-3.56	1.69
1991-2001	-11.84	-6.73	-8.30	-4.15
2001-2011	0.93	3.30	-2.43	-0.91
2011-2021	-2.27	1.78	-3.44	0.83

Table 23. Mean changes in TI indicator z-scores for all SDZs

As can be seen from Table 23, the indicator score which **increased** the most over the period 1971 to 1981 was **Employment**, with an average change of 8.84.

The indicator score which **decreased** the most over the period 1971 to 1981 was **Rent**, with an average change of -3.38.

The indicator score which **increased** the most over the period 1981 to 1991 was **Overcrowding**, with an average change of 1.69.

The indicator score which **decreased** the most over the period 1981 to 1991 was **Rent**, with an average change of -12.59.

The indicator score which **decreased** the least over the period 1991 to 2001 was **Overcrowding**, with an average change of -4.15.

The indicator score which **decreased** the most over the period 1991 to 2001 was **Employment**, with an average change of -11.84.

The indicator score which **increased** the most over the period 2001 to 2011 was **Rent**, with an average change of 3.3.

The indicator score which **decreased** the most over the period 2001 to 2011 was **Car access**, with an average change of -2.43.

The indicator score which **increased** the most over the period 2011 to 2021 was **Rent**, with an average change of 1.78.

The indicator score which **decreased** the most over the period 2011 to 2021 was **Car access**, with an average change of -3.44.

Table 24 shows the percentage of SDZs for adjacent TI releases where the change is largest, with increases and decreases shown separately, for a given indicator. This shows which indicators contribute most to changes in deprivation over each time period.

As can be seen from Table 24, in the majority of SDZs the largest increase over the period 1971 to 1981 - in 87.65% of SDZs - was for **Employment**. For the period 1981 to 1991 the equivalent largest changes were for **Overcrowding** (52.71% of SDZs), while for 1991 to 2001 in the majority of SDZs (76.12%) there was no indicators which increased their values. For 2001 to 2011 and 2011 to 2021, the largest changes were for **Rent** (67.29% and 52.35% of SDZs respectively). The

largest decreases for 1971 to 1981 and for 1981 to 1991 were for **Rent**. For 1991 to 2001 it was for **Employment**, while for 2001 to 2011 and 2011 to 2022 the largest decreases were for **Car access**.

(a)	% SDZs with largest *increase* by indicator				
	71-81	81-91	91-01	01-11	11-22
Emp	87.65	21.29	0.00	20.94	0.94
Rnt	8.47	7.18	21.88	67.29	52.35
Car	1.65	10.59	1.18	1.41	1.18
Ovr	1.53	52.71	0.82	2.94	38.00
None	0.71	8.24	76.12	7.41	7.53
(b)	% SDZs with largest *decrease* by indicator				
	71-81	81-91	91-01	01-11	11-22
Emp	0.24	3.29	48.94	0.59	29.53
Rnt	51.76	74.12	23.29	6.82	15.18
Car	35.41	13.76	17.29	57.41	53.76
Ovr	8.82	3.41	10.35	29.29	0.47
None	3.76	5.41	0.12	5.88	1.06

Table 24. Percentages of SDZs by the largest change for each TI indicator: (a) indicators with largest increases and (b) indicators with largest decreases.

Figure 31 shows the TI scores in 2021 in Northern Ireland. Note that, for all maps, the range of values included refer to Northern Ireland specifically. As noted already, positive values indicate higher levels of deprivation, while negative values indicate lower than average levels of deprivation according to this measure. Figure 32 shows changes in the TI scores between 1971 and in 2021. Positive values indicate increased levels of deprivation while negative values indicate decreased levels of deprivation over this time period.

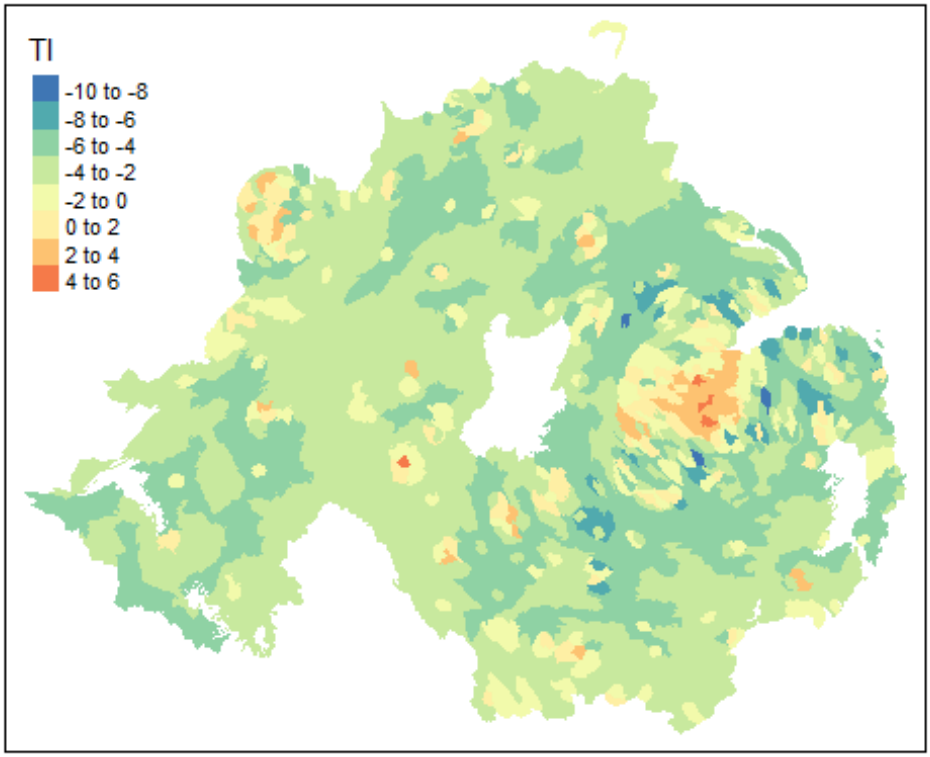


Figure 31. Townsend index score, 2021.

Figure 32. Townsend index score, 1971-2021.

The *k*-means clustering method was used to group the four constituent indicator scores for each TI calculated separately for each of the six Census years to generate area trajectory classes. The five classes have been labelled as follows:

- A: Persistently deprived - deprivation levels were very high at the start of the period (1971) and remained high (albeit at a lower level) until the end (2021).
- B: Moderately deprived - deprivation levels were relatively high at the start of the period and moderate by the end.
- C: Lower deprivation - deprivation levels were relatively high at the start of the period and very low by the end.
- D: Less deprived - deprivation levels are moderately high at the start of the period and much lower by the end.
- E: Persistently not deprived - deprivation levels are low at the start of the period and very low by the end.

Figure 33 shows the median TI ranks by the five trajectory classes identified across all SDZs in NI. In this chart, trends in absolute deprivation are shown. In all cases, median deprivation in 2021 is lower than it was in 1971.

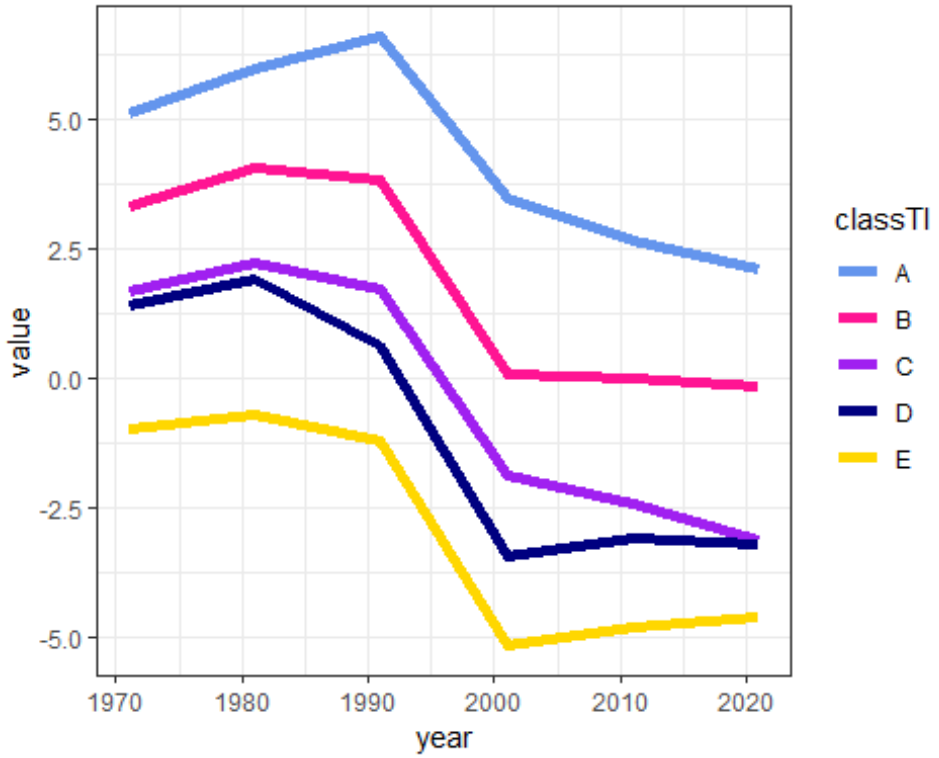


Figure 33. Median Townsend index scores by trajectory class.

Figure 34 shows the distribution of the trajectory classes across NI using the same colours per class as Figure 33. Persistently high deprivation is clearly focused on urban areas including Belfast and Derry / Londonderry. There is a pronounced contrast between the east and west of NI, with a predominance of class C (Lower deprivation) in the west and class E (Persistently not deprived) in much of the east.

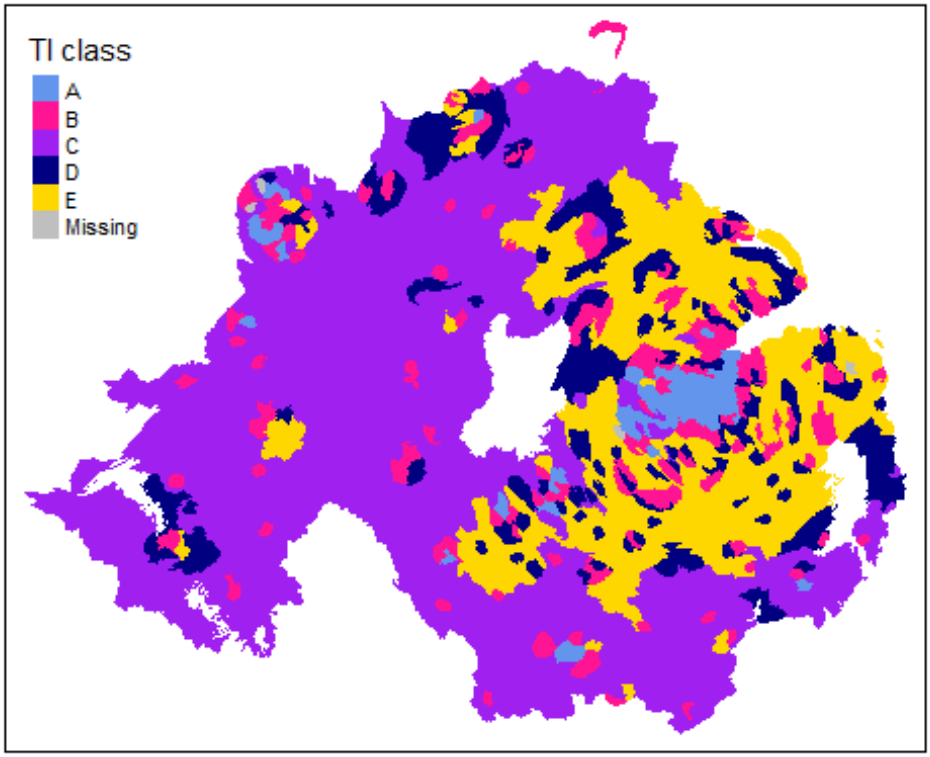


Figure 34. TI trajectory clusters.

Table 25 indicates the number of SDZs within each 2021 TI decile (where 10 is the most deprived) and TI trajectory class. We can see that SDZs in (for example) the most deprived 2021 TI deciles are spread across different trajectory classes. This demonstrates how the current TI decile may mask very different deprivation histories and thus contrasting challenges.

	Most deprived				Least deprived
Dec	A	B	C	D	E
1 (least)	0	0	4	7	74
2	0	0	14	19	52
3	0	0	30	20	34
4	0	1	43	25	16
5	0	1	47	27	9
6	0	9	44	27	5
7	0	42	24	18	1
8	5	66	6	8	0
9	22	62	1	0	0
10 (most)	62	20	0	1	0

Table 25. Number of SDZs in each TI trajectory cluster and TI 2021 decile.

Multiple Deprivation Measure

The MDM comprises seven domains, each based on a set of indicators. These seven domains are combined together into an overall composite MDM using explicitly defined domain weights. The weights applied in creating the overall MDM 2017 (NISRA, 2017) measure are as follows:

1. Income Deprivation (Inc) 25%
2. Employment Deprivation (Emp) 25%
3. Health Deprivation and Disability (Hea) 15%

4. Education, Skills and Training Deprivation (Edu) 15%
5. Access to Services (Acc) 10%
6. Crime Domain (Cri) 5%
7. Living Environment Deprivation Domain (Liv) 5%

Each domain is composed of multiple indicators, with 38 indicators in the 2017 iteration of the MDM.

As noted previously, the MDM and TI are very different in nature, although they both attempt to measure the multidimensional nature of socio-economic deprivation at neighbourhood level. One notable difference is in the relative contribution of overcrowding (households with more than one person per room) to the two measures. Overcrowding is a major component of the TI (accounting for one quarter of the overall score) but just one element within one domain of the MDM (the Living Environment Domain - which is itself assigned a domain weight of 5%). Therefore, SDZs with high levels of overcrowding are likely to have relatively high levels of overall deprivation according to the Townsend score but not necessarily according to the MDM.

It is possible to assess change in the overall MDM (as shown above) and also each of the seven constituent domains that make up the MDM.

Table 26 shows the percentage of SDZs for adjacent MDM releases where the change is largest for a given domain (increases and decreases are shown separately). This indicates which domains contribute most to changes in deprivation over each time period. In this case, domain weights are applied so that change in, for example, income (MDM weight of 25%) is emphasized compared to living environment (MDM weight of 5%).

As can be seen from Table 26, in the majority of SDZs the largest increase over the period 2005 to 2010 - in 27.06% of SDZs - was for **Health**. For the period 2010 to 2017 the largest increases were for **Income** (35.65% of SDZs). For 2005 to 2010 the largest decreases were for **Health** while for 2010 to 2017 the largest decreases were for **Income**.

(a)	% SDZs with largest *increase* by indicator	
	05-10	10-17
Inc	9.53	35.65
Emp	18.47	16.47
Edu	15.53	10.00
Hea	27.06	10.82
Acc	8.94	7.76
Liv	12.47	11.18
Cri	5.41	6.24
None	2.59	1.88
(b)	% SDZs with largest *decrease* by indicator	
	05-10	10-17
Inc	12.94	35.18
Emp	18.12	16.71
Edu	14.12	8.82
Hea	26.12	9.76

(a)	% SDZs with largest *increase* by indicator	
	05-10	10-17
Acc	6.47	12.00
Liv	13.88	11.41
Cri	6.82	4.59
None	1.53	1.53

Table 26. Percentages of LSOAs by the largest change for each TI indicator: (a) domains with largest increases and (b) domains with largest decreases

Figure 35 shows the MDM scores for 2005, while Figure 36 shows the equivalent for 2017. The MDM values are shown as national deciles, where decile 1 is the least deprived 10% and decile 10 is the most deprived 10%. The highest deprivation values are found in Belfast and Derry / Londonderry and in a few scattered locales elsewhere with the lowest deprivation values in a band around Belfast.

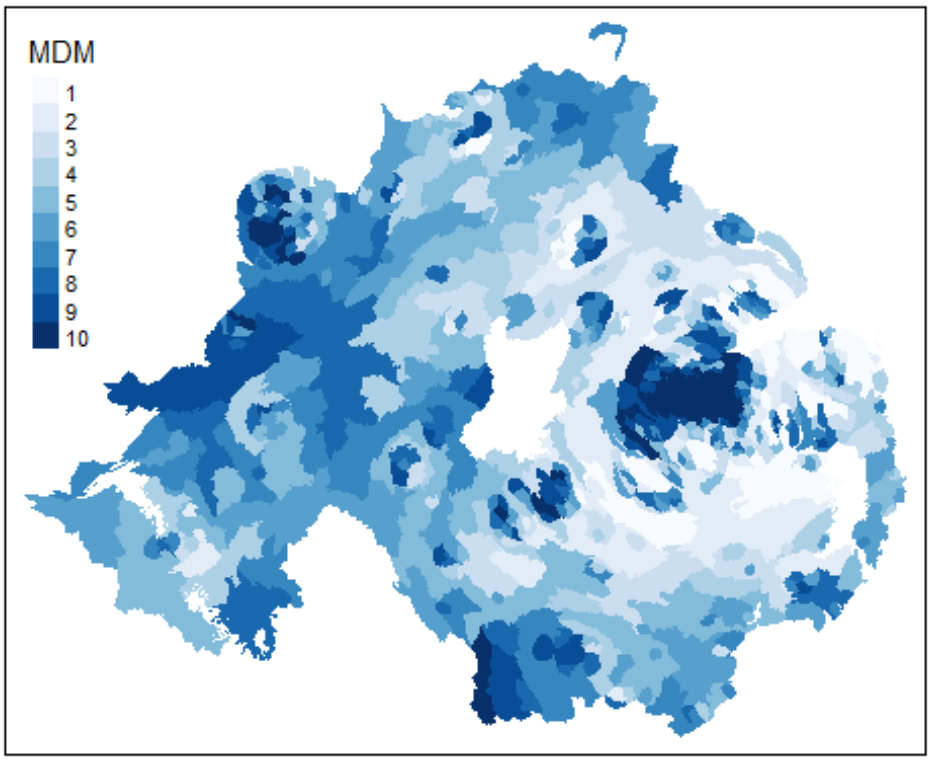


Figure 35. Multiple deprivation measure decile, 2005.

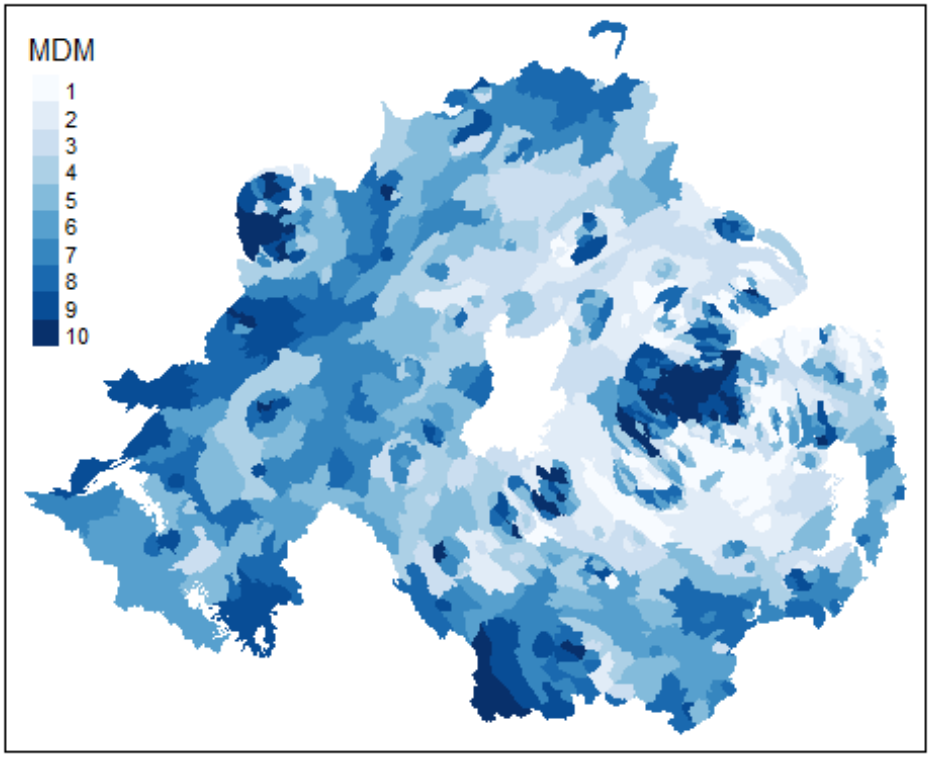


Figure 36. Multiple deprivation measure decile, 2017.

Clusters of trajectories were computed for the MDM ranks for each of the seven domains and for each MDM release (2005, 2010, 2017). The clusters for the MDM were generated using a variant of k-medians classification adapted for longitudinal (time series) data. Ten MDM clusters were identified through this process, each showing identifiable patterns across the data.

- A: Persistently highest deprivation - deprivation has persistently been amongst the highest in these SDZs between 2005 and 2017.
- B: Higher deprivation, declining - high levels of deprivation but with a gradual decrease since 2010.
- C: Higher deprivation, worsening - high levels of deprivation but with a gradual increase since 2010.
- D: Moderate deprivation - persistent moderately high levels of deprivation.
- E: Moderate deprivation, decreasing - moderate levels of deprivation with an increase after 2005 and a decrease from 2010 to 2017.
- F: Moderate deprivation, increasing - moderate levels of deprivation with a decrease after 2005 and an increase from 2010 to 2017.
- G: Lower deprivation, increasing - lower levels of deprivation with an increase since 2010.
- H: Low deprivation, decreasing - relatively low levels of deprivation with a decrease from 2005 to 2010 and from 2010 to 2017.
- I: Low deprivation, increasing - low levels of deprivation with a small increase between 2005 and 2017.
- J: Lowest deprivation - very low levels of deprivation with a slight increase between 2005 and 2017.

Figure 37 shows the median MDM ranks by the ten trajectory classes identified.

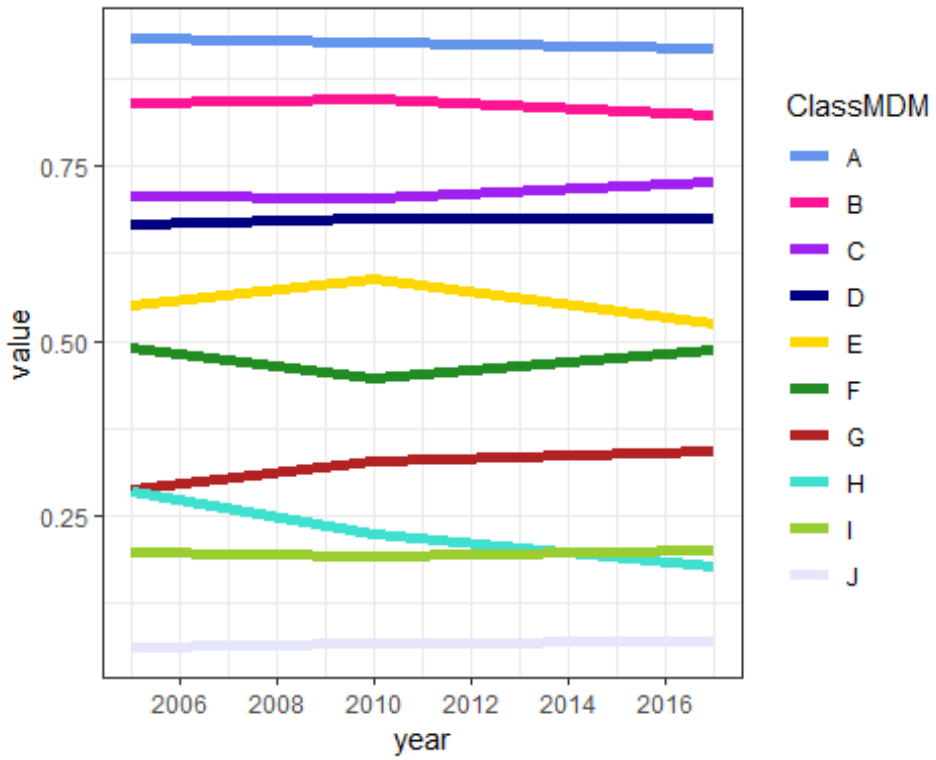


Figure 37. Median MDM ranks by trajectory class.

The MDM trajectory classes in Northern Ireland are mapped in Figure 38. The map uses the same colours per class as in Figure 37. The map shows that areas of persistently high deprivation are most commonly found in (west and north) Belfast and in Derry / Londonderry, with the lowest levels of deprivation found in areas around Belfast, stretching out to the north of the Ards peninsula.

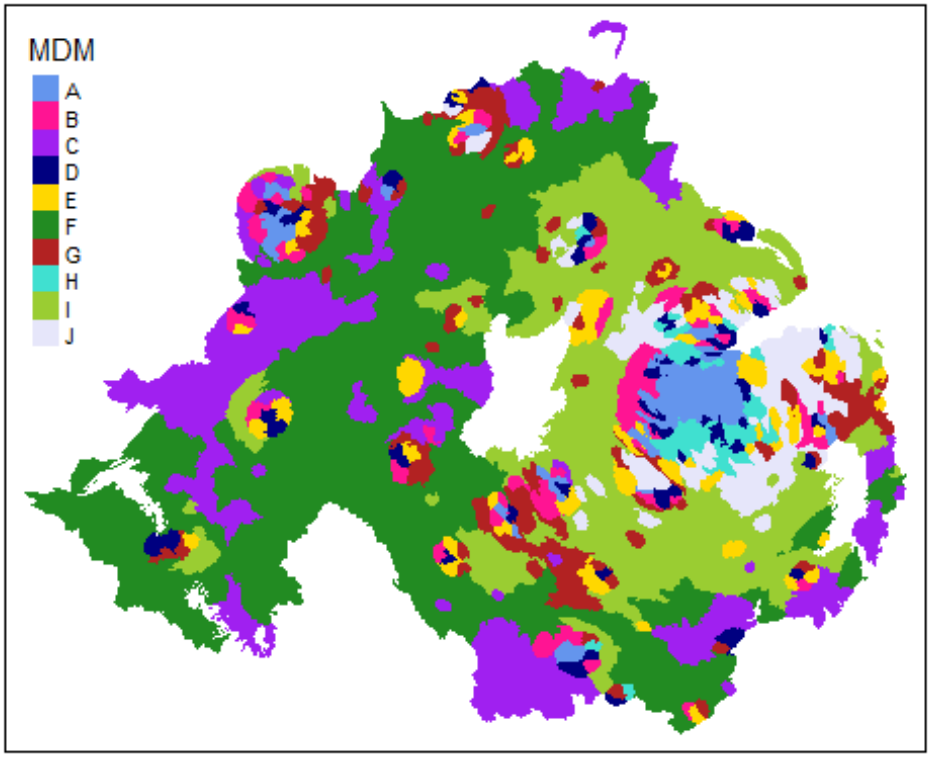


Figure 38. MDM trajectory clusters.

Combined analysis

Table 27 shows SDZ membership of both sets of trajectory clusters. This provides a summary of the ways in which SDZs have changed according to both TI and MDM trajectory clusters. Linking both sets of clusters helps to identify, for example, SDZs which have had high deprivation levels by both measures as distinct from, as an example, SDZs which may have seen increasing deprivation levels in recent years (as judged using the MDM), but which do not have long histories of deprivation (as judged using the TI).

The table suggests that most SDZs are in, for example, clusters which correspond to persistently high deprivation for both measures. Exceptions include those SDZs in TI trajectory cluster E, but which are also in MDM trajectory cluster B. Thus, in common with other parts of the UK, places with common long-term deprivation histories by one measure may have very different medium-term deprivation histories by another measure.

	Most deprived									Least deprived
	A	B	C	D	E	F	G	H	I	J
A (most)	67	17	0	4	0	0	0	1	0	0
B	35	44	16	41	44	3	9	9	0	0
C	0	6	53	7	13	93	18	1	22	0
D	1	3	4	11	26	7	36	18	29	17
E (least)	0	2	0	4	11	2	30	23	43	76

Table 27. TI trajectory clusters and MDM trajectory clusters.

Understanding deprivation trajectories

A core component of the 'Trajectories of Deprivation in the UK' project was to seek to understand the main drivers behind the deprivation trajectories. This understanding was developed in two ways: firstly, by reviewing relevant publications (principally reports from LAs and other bodies) and, secondly, via engagement with LA analysts.

Davey et al. (2022) undertake a review of evidence on interventions aimed at reducing health inequalities. As a part of this work, they establish a framework for policy makers which is appropriate at national, regional and local level. The framework comprises five principles: (1) healthy-by-default and easy to use initiatives; (2) long-term, multi-sector action; (3) locally designed focus; (4) targeting disadvantaged communities; and (5) matching of resources to need. Their review leads to the conclusion that, while there are many studies which seek to identify and understand inequalities, more work is needed on the impacts of particular programmes and policies and the mechanisms via which they reduce inequalities. Despite this general shortcoming, there are numerous published assessments of the potential impact of interventions which were intended to reduce spatial inequalities in local areas. These include reviews of the impacts of regeneration schemes, including how far these may have helped people living in deprived communities. There are few direct assessments of how far changes in deprivation index values might relate to specific policies or interventions.

In an article in the *Guardian* newspaper, Presser (2016) discusses the notable reduction in relative deprivation in Newham in particular and in east London in general, comparing the English IoD for 2015 to the previous release (for 2010). In Newham, several possible drivers behind these changes are mooted. Presser argues that the changes pre-date visible signs of gentrification. The long-term impact of 2012 Olympics regeneration projects in the area is suggested as one possible factor. Politicians in Newham also point to the Workplace jobs scheme which they argue has been much more successful than the UK Government's Work Programme in that some 80% of Newham residents who found jobs through Workplace sustained their employment for at least six months, compared to 52% for the Work Programme across London.

Discussions with LA analysts for this project focused on areas with formerly high deprivation levels which have reduced in recent years. Analysts provided examples of interventions which may have contributed to this. They also sought to interpret the maps of deprivation trajectory classes shared with them by the project team, commenting on how far the patterns observed accord with their knowledge of changes in their areas.

In Birmingham, a city in which many neighbourhoods show declining deprivation according to the IoD deprivation trajectory classes, the findings were seen to contradict city-wide summaries of changes in the IoD. The IoD rank at city level was 16 in 2004 and 7 in 2019 (where a smaller value indicates higher relative deprivation). However, income and employment deprivation have become relatively lower with large changes between the 2010 and the 2015 IoD releases. Local authority analysts argue that these changes themselves do not accord with experience 'on the ground' with respect to labour market participation, benefit dependency, low household income, and child poverty. Differences in deprivation change by domain are at least a partial explanation for this and this emphasizes why it is important to be aware that change in one deprivation domain does not necessarily correspond to change in another.

Tower Hamlets, like other London LAs, has many neighbourhoods with decreasing relative deprivation levels. Here, a variety of schemes have been suggested as potential factors behind decreasing deprivation. The Low Income Family Tracker (LIFT) dataset produced by Policy in Practice[7] was mentioned as an important dataset tool, which the Tower Hamlets anti-poverty service use to try to ensure sure that people receive the benefits they are entitled to. This includes free school meal auto-enrolment (although these are now universal in the area, the enrolment ensures schools receive the pupil premium) and signposting people to claim pension credits. In Tower Hamlets, linking administrative datasets to drive service uptake (via LIFT and more generally) is viewed as increasingly important; the Tower Hamlets anti-poverty team recently got around 300 households onto pension credits, thereby shielding them (and potentially impacting on their LSOAs) from the cut to winter fuel payments. Other interventions by the council in Tower Hamlets suggested as possibly having played a role in driving decreased deprivation included educational maintenance allowance (EMA) schemes, university bursary schemes, universal free school meals, free swimming lessons, and youth clubs.

LIFT has also been used in Lewisham to support free school meals auto-enrolment. The LIFT dataset was matched to the school census in order to identify eligible households that weren't registered - thus making the service opt-out rather than opt-in[8]. It was suggested in discussions that moves to nudge or even auto-enrol people for services in Tower Hamlets and elsewhere may have played a part in protecting communities from deprivation.

Discussions with analysts raised the issue of community wealth building, whereby procurement agreements are entered by institutions anchored in local communities (for example, councils, healthcare centres, universities) to use local suppliers thus ensuring that investment recirculates locally[9]. It was suggested that such frameworks may be having a positive impact on reducing deprivation.

There were several areas where significant interventions have been made in recent years but deprivation trajectories suggest a relative increase in deprivation. One such case was Halton, where a neighbourhood in IoD trajectory class C (Higher deprivation, worsening) has been subject to a programme of flats being replaced with houses and a new shopping square, health centre, and community centre. Similarly, Basingstoke and Deane have seen new housing developments, yet deprivation persists. This could suggest that some forms of deprivation (for example, unemployment, education and skills, etc.) are less likely to be affected by such regeneration efforts, or possibly that it takes longer for these impacts to be seen.

In Salford, improvements in many areas (IoD trajectory class B) can be linked to large-scale construction of new apartment blocks in areas such as Salford Quays, which have supplanted existing housing in areas with very high levels deprivation. Elsewhere, however, very high levels of relative deprivation persist, and in others areas there is a suggestion of improvement which may reflect, for example, an outcome of the Salford Landlord Accreditation Scheme (LAS) which "serves to benefit both landlord and tenant by improving the image and standards of private rented accommodation"[10]. The powers available to Salford's city mayor – particularly in relation to provision of housing – were also mentioned as being one possible factor behind some of the reductions in relative deprivation evidence in the city in recent years, as was the existence of Dérive Salford – a housing company wholly owned by Salford City Council, which was credited with helping reduce spatial inequalities within the city. Other important factors include the focus of the

[7] https://policyinpractice.co.uk/low-income-family-tracker/
[8] https://schoolsweek.co.uk/councils-800-exercise-results-in-1-2m-school-funding-boost/
[9] https://cles.org.uk/community-wealth-building/what-is-community-wealth-building/
[10] https://www.salford.gov.uk/housing/information-for-landlords/landlord-accreditation/

Salford Public Health team's efforts on breaking down barriers to access to healthcare support for new communities, which may have affected its rank in the health domain of the IoD.

Detailed assessments of regeneration schemes have been undertaken for many (principally urban) areas across the UK. These include the GoWell research and learning programme which "aimed to investigate the impact of investment in housing, regeneration and neighbourhood renewal in Glasgow on the health and wellbeing of individuals, families and communities"[11]. This includes assessments of impacts in local areas which were the focus of particular regeneration schemes as compared to those which were not. Detailed linking of the deprivation trajectory classifications with the areas of focus in GoWell are in process, alongside discussions around the impact of regeneration schemes in other areas, including Manchester (e.g., see Parveen, 2018).

Some analysts noted possible issues with the Townsend index for measuring deprivation given that some relatively affluent areas with older housing stock converted to flats may be classed as deprived. Examples were given of such areas in Bristol which contain properties which are privately rented, with high levels of overcrowding (but often very large flats), low rates of car ownership (not needed as very central locations), and possibly with high rates of unemployment or economic inactivity (sometimes older households or students). These areas may have similar levels of measured deprivation as outlying LA housing estates where unemployment rates are relatively high, lack of car access is problematic, there are mostly social rented households, and with lower levels of overcrowding given the family orientated housing stock.

Bristol includes some areas which the Townsend index indicates have deprivation which worsening and this accords with expectation given knowledge of the areas. In contrast, the IoD trajectory classification suggests that deprivation is declining. Such contrasts are not uncommon given the different inputs and time periods for the Townsend index and the IoDs. In some areas, such as the Upper Horfield Estate in Bristol, which was subject to extensive regeneration over the period 1999-2007,[12] the TI deprivation trajectories point to improvement but the IoD trajectory classification identifies the area as 'Persistently highest deprived'. This is partly a function of the time period covered by the IoD analysis (mostly post-dating the regeneration period).

As the Trajectories of Deprivation in the UK project resource is more widely disseminated, it is expected that deeper insights into deprivation changes and the drivers behind them will be revealed.

How can this information be used?

The project outputs provide a resource for LAs and others to assess how their neighbourhoods have changed, and to learn about interventions in other areas with similar deprivation trajectories which have helped reduce inequalities. Potential for such interventions to be translated to other geographical settings can then be explored. The dataset and associated LA deprivation change profiles contain information on which TI indicators and which IMD domains have changed the most between data time points. This provides insights into the nature of changes seen in particular local areas and also supports strategies for reducing spatial inequalities by highlighting the challenges faced in local areas.

[11] https://www.gowellonline.com/

[12] https://www.govint.org/good-practice/case-studies/bristols-pride-of-place-partnership/objectives/

Scale and deprivation in England and Wales

Measuring deprivation at neighbourhood level is crucial for designing and targeting interventions to support people in need. In England and Wales, the respective national indices of multiple deprivation (IMD) have been widely used for targeting resources at the most deprived neighbourhoods for many years. However, could the choice of geographical unit used to present these statistics affect which parts of the country are identified as being the 'most deprived' and therefore deemed most in need of support to tackle deprivation? In this section, we present our new 'Employment and Qualifications Index' (EQI), which is based on the recently released 2021 Census data. We use our new EQI to investigate the importance of geographical scale for identifying the 'most deprived areas' across England and Wales. Two domains are selected as these are both direct measures of deprivation (not proxy measures) and they map on to equivalent domains of the IMD. In addition, using two domains makes comparisons across scales more straightforward. The EQI combines information on: (1) unemployment and (2) qualifications. With regards to the qualifications indicator, anyone who does not achieve 'level 2' qualifications is deemed to be deprived, with 'level 2' being defined as achieving five or more GCSEs (A* to C or 9 to 4) or equivalent.

Often, geographical areas are referred to as being amongst the 'most deprived' if they are within the ten per cent of areas with the highest deprivation levels nationally (i.e. the top decile). Since the early 2000s, the respective national indices of multiple deprivation for England and Wales have been constructed at Lower layer Super Output Area (LSOA) level, which has enabled geographical pockets of deprivation at LSOA level to be identified within LAs. LSOAs are now commonly used as the basis for publishing a range of socio-economic statistics. Below, we construct our new EQI measure at LSOA level and also at the more detailed level of Output Area (OA). We then compare the LSOA and OA level results on our EQI measure to assess the extent to which the act of choosing a more fine-grained local geography (i.e. OAs) helps to identify pockets of deprivation that might otherwise be missed if using the LSOA level geography.

Table 1 shows the number of OAs by OA and LSOA-level deciles; here, decile 1 indicates the most deprived 10%. As an example, those OAs in OA decile 1 and LSOA decile 1 are in the most deprived 10% of both sets of areas. Those OAs in OA decile 1 but in LSOA decile 2 or above, are examples of where the extent of OA-level deprivation is, to some degree, masked if looking at LSOAs (because the high level of deprivation in particular OAs is offset by lower levels of deprivation in other OAs within that same LSOA). Deprived populations in OAs in this situation might miss out on support if only the most deprived 10% of LSOAs are allocated funding. As can be seen by focusing on the top row of Table 1, of the 18,888 OAs in OA decile 1 of the England and Wales distribution, 11,616 (62%) are also within LSOAs in decile 1. An additional 4,009 OAs (21%) from OA decile 1 are located in LSOA decile 2. The remaining 3,262 (17%) of OAs in OA decile 1 are spread across LSOA deciles 3 to 10. It is evident that six OAs from OA decile 1 were actually located in LSOA decile 10, meaning that these six highly deprived OAs were located within the least deprived decile of LSOAs.

OA dec.	LSOA deciles 1	2	3	4	5	6	7	8	9	10	Total
1	11,616	4,009	1,699	830	374	173	108	50	23	6	18,888
2	4,388	6,207	3,955	2,109	1,115	561	318	131	78	26	18,888
3	1,473	4,295	4,779	3,557	2,196	1,289	710	348	186	55	18,888
4	518	2,185	3,637	4,039	3,289	2,326	1,514	829	428	123	18,888
5	193	968	2,273	3,447	3,769	3,208	2,312	1,543	877	298	18,888
6	110	466	1,246	2,286	3,141	3,603	3,196	2,536	1,623	681	18,888
7	38	239	691	1,382	2,474	3,237	3,599	3,308	2,610	1,310	18,888
8	33	115	344	772	1,471	2,464	3,405	4,058	3,809	2,417	18,888
9	17	71	187	430	794	1,484	2,568	3,834	4,852	4,651	18,888
10	9	46	99	227	389	667	1,294	2,354	4,512	9,291	18,888
Tot.	18,395	18,601	18,910	19,079	19,012	19,012	19,024	18,991	18,998	18,858	188,880

Table 26. EQI 2021: Number of OAs by both OA-level and LSOA-level deprivation deciles (with decile 1 being the most deprived)

An alternative way of analysing Table 1 is to focus on LSOA decile 1 (i.e. the most deprived ten per cent of LSOAs across England and Wales), and examine the composition of OAs that fall within this particular decile of LSOAs. To do this, we focus on the left-most column of Table 1. Here we can see that the most deprived decile of LSOAs was composed primarily of OAs in OA decile 1 (the same 11,616 OAs as noted in the paragraph above), plus an additional 4,388 OAs that are within OA decile 2, and so on. Indeed, it is also evident that nine of the OAs located within LSOAs in the most deprived LSOA decile actually fell within OA decile 10, meaning that these nine OAs were in the least deprived OA decile nationally. In short, therefore, differences in deprivation within LSOAs can be considerable.

The main message from Table 1 is that a sizeable proportion of the most deprived OAs across England and Wales are not located within the most deprived LSOAs, and therefore any resource allocation that focuses solely on the most deprived LSOAs would exclude these highly deprived OAs.

In this section, we focus mainly on those OAs that are in the most deprived OA decile but which are located in somewhat less deprived LSOA deciles. In other words, these are the small geographical areas which might qualify for resource allocation if the funding mechanism was based on OAs, but which would miss out on resources if the funding mechanism was based only on LSOAs. We illustrate this issue by highlighting local authority districts where this issue is particularly prevalent.

Figure 39 shows a stacked bar chart in which all 331 LAs in England and Wales are represented. The chart displays two metrics in tandem: (i) the overall height of the bars represents the percentage of the total OAs in each local authority that are within the most deprived OA decile on the EQI, and the LAs are ordered along the x-axis according to this percentage value; and (ii) the different colours of the stacked bars shows which of these highly deprived OAs are located within the most deprived LSOA decile, and which are located in less deprived LSOA deciles. To help illustrate the interpretation of the chart, the discussion below highlights three exemplar LAs: Sandwell, Merthyr Tydfil, and Eastbourne.

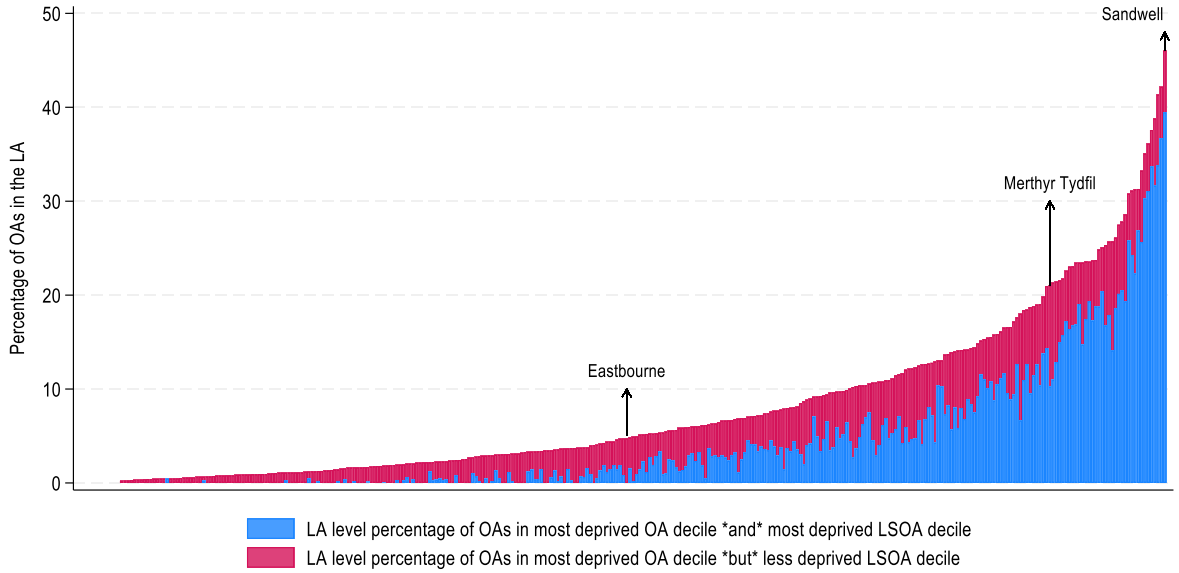


Figure 39: EQI 2021: Percentage of OAs in the most deprived OA decile by Local Authority in England & Wales, according to whether the OA is also in the most deprived LSOA decile or not

Sandwell is the local authority with the highest percentage of its total OAs within the most deprived OA decile on the EQI measure. Indeed, of the 978 OAs across Sandwell as a whole, 450 are within the most deprived OA decile, equating to 46% of Sandwell's OAs. It is evident from the relative sizes of the blue and red stacked bars for Sandwell in Figure 39 that the vast majority of these 450 highly deprived OAs are also located in the most deprived LSOA decile (i.e. the blue portion of the vertical bar). Indeed, from the underlying data, we can see that 39% of the total OAs in Sandwell are in the most deprived OA decile and located in the most deprived LSOA decile, while 7% of the total OAs in Sandwell as in the most deprived OA decile but are located in less deprived LSOA deciles (i.e. the red portion of the vertical bar).

The second exemplar local authority highlighted in Figure 39 is Merthyr Tydfil, where 21% of the OAs are in the most deprived OA decile on the EQI measure. This 21% of highly deprived OAs is composed of 10% where the highly deprived OA is also located within the top LSOA decile (blue bar), plus 11% where the highly deprived OA is located in a less deprived LSOA decile (red bar). So, for Merthyr Tydfil, if resources were allocated solely on the basis of the most deprived decile of LSOAs, then the majority of its most deprived OAs would miss out on those resources. In Eastbourne, which is the third exemplar local authority highlighted in Figure 2, we can see that 5% of the total OAs in the local authority are classed within the most deprived national OA decile on the EQI measure, but none of these are located within the most deprived LSOA decile (hence there is no blue in Eastbourne's bar). If resources were allocated to neighbourhoods solely on the basis of the most deprived LSOAs, then none of Eastbourne's most deprived OAs would benefit from such funding.

One of the most clearly observable features of the data shown in Figure 39 is that those LAs with the greatest proportions of highly deprived OAs (such as Sandwell) tend to have the largest proportions of these OAs that also fall in the most deprived LSOA decile. This is as we would expect, because the more highly deprived OAs there are in a local authority, the more likely it is that these OAs will aggregate up to high-deprived LSOAs. So, for areas such as Sandwell, the 'added value' of using an OA-based targeting approach rather than an LSOA-based approach is somewhat marginal, as an LSOA-based approach would target the vast majority of the most deprived OAs in the respective local authority anyway.

However, for LAs such as Merthyr Tydfil, where the overall percentage of OAs in the most deprived OA decile is somewhat lower than authorities such as Sandwell (although the overall percentage in Merthyr Tydfil is still high compared to most LAs nationally), there is clear 'added value' in using an OA-based targeting approach in order to encompass more of the most deprived OAs than would be captured through an LSOA-based approach. Similarly, areas such as Eastbourne would benefit from an OA-based targeting mechanism, as adopting an LSOA-based approach would entirely miss this local authority's most deprived OAs.

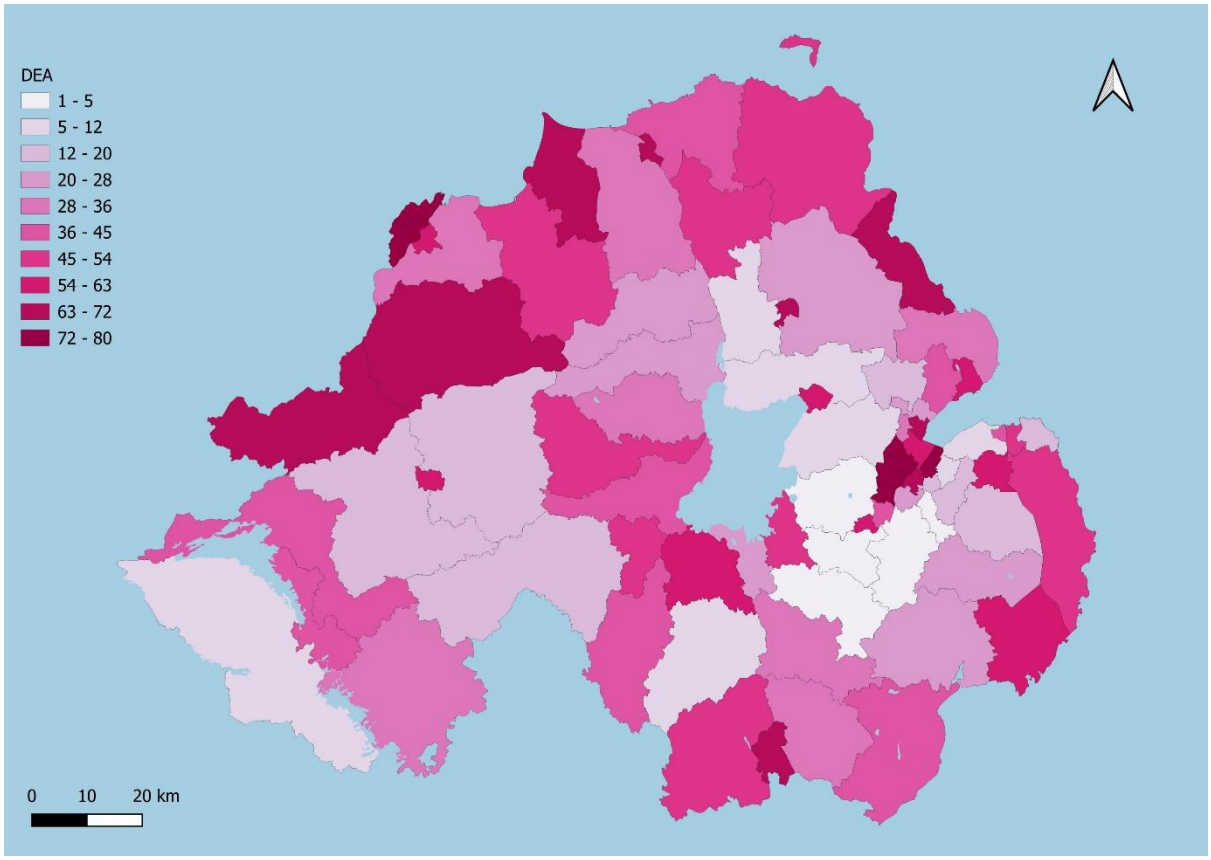
Based on these results, it is recommended that LAs make use of OA-level data and measures, such as the EQI, alongside existing LSOA measures such as the national Indices of Deprivation, to better understand the geography of need in their areas and to better shape the design and delivery of interventions aimed at reducing deprivation and spatial inequalities.

Scale and deprivation in Northern Ireland

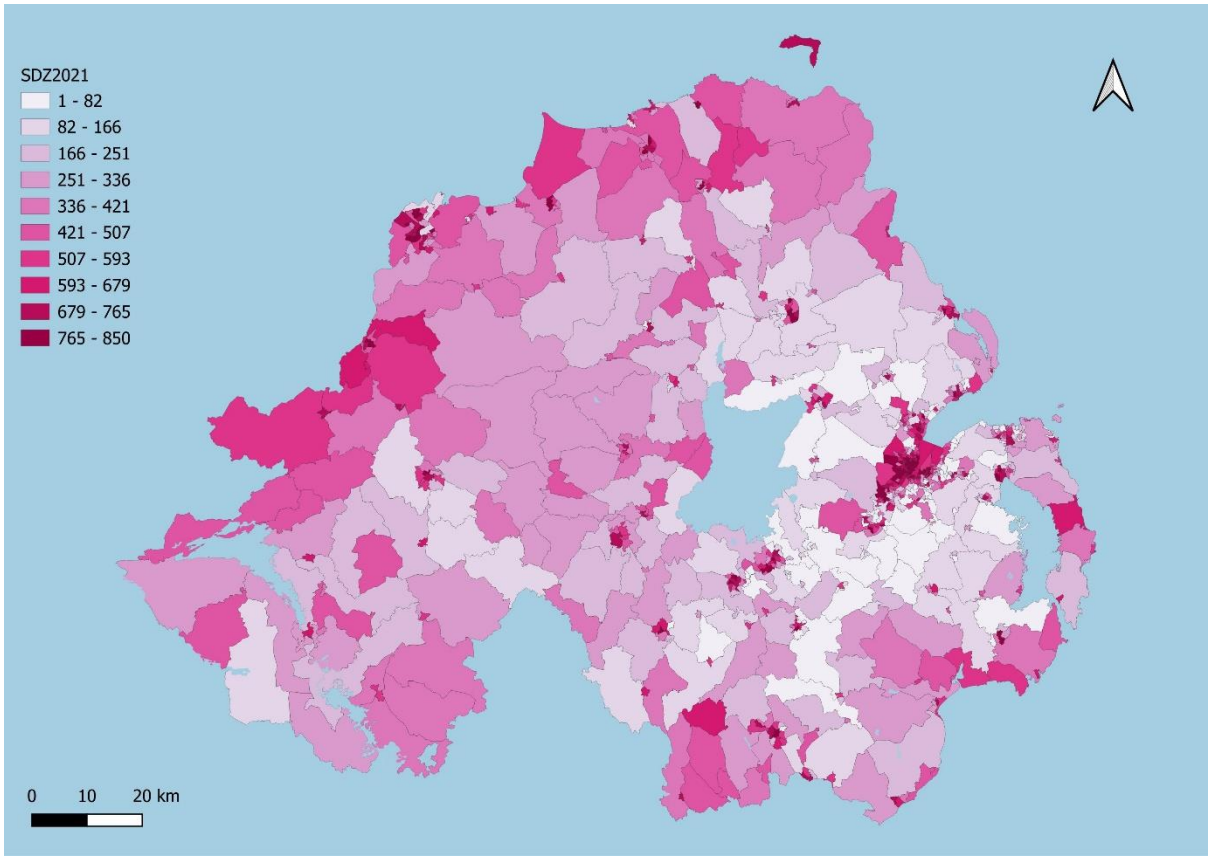
As discussed in the preceding section, small area measures of deprivation are used widely for developing policies aimed at reducing spatial inequalities and for targeting resources to vulnerable populations. Like any area-based measure, deprivation indices are subject to scale effects which mean that results of analyses are, at least in part, a function of the size and shape of the geographical zones for which data are available. This paper capitalises on Census 2021 data for five different geographical units for Northern Ireland. A deprivation measure is constructed using the same methodology as the NI Multiple Deprivation Measure comprising four domains of employment, education, health, and housing. The process is replicated using data for Data Zones (DZs; equivalent of Output Areas in England and Wales), Super Data Zones (SDZs), District Electoral Areas, and 1km and 100m grid squares. The indices for each of these geographical units are shown in Figure 40. The number of zones in each case and their mean populations are specified in Table 27.

Geography	# in NI	Average usual resident population
Local Government District	11	173,016
District Electoral Area	80	23,789
Super Data Zone	850	2239
Data Zone	3,780	503.49
1km Grid Square	6,548	290.65
100m Grid Square	20,415	93.22

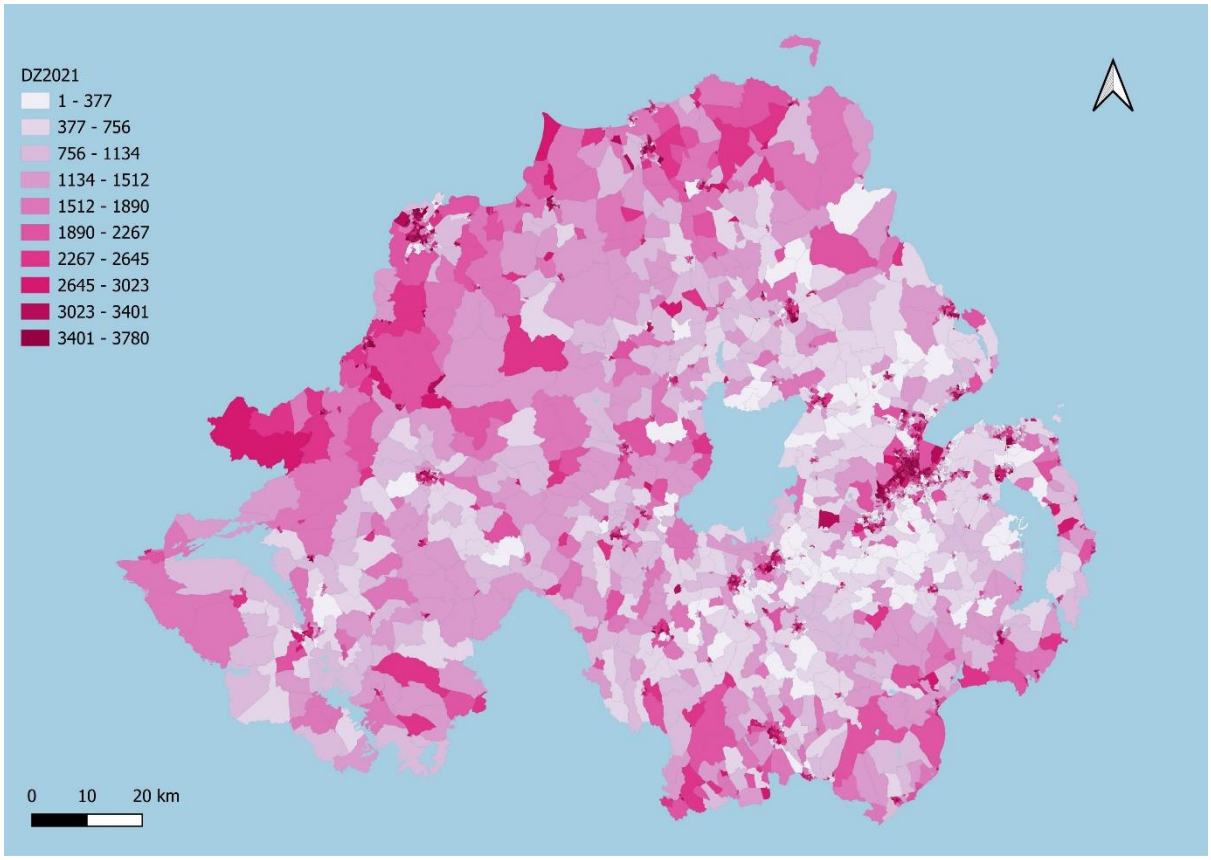
Table 27. Geographical zones with their number and mean average populations.



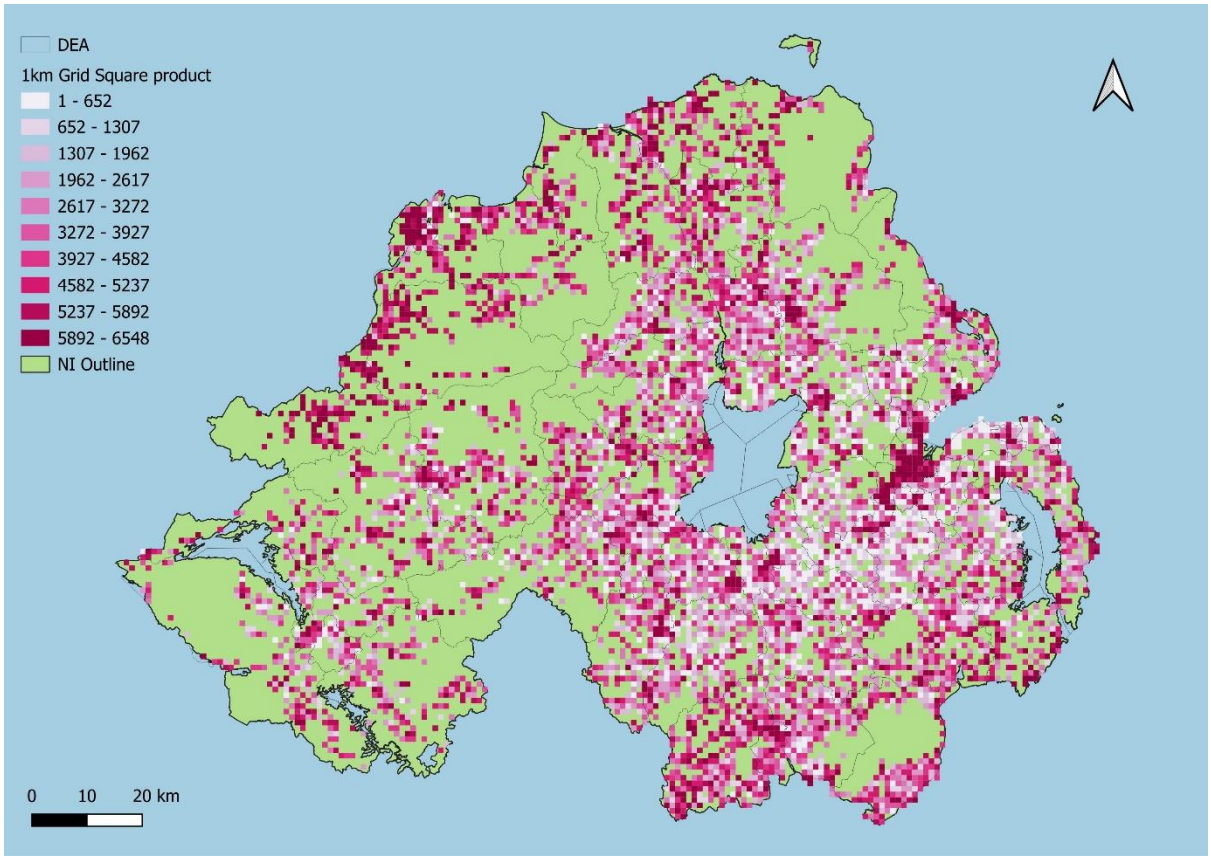
A. District Electoral Areas.



B. Super Data Zones.



C. Data Zones.



D. 1km grid squares.

E. 100m grid squares.

Figure 40. 2021 Census deprivation index for NI.

The results show pronounced pockets of deprivation in many areas which are masked if larger geographical zones are used. As examples: in some urban areas, 100m grid cells show high levels of deprivation within DZs with only moderate levels. Similarly, there are many urban and rural SDZs which contain DZs with very different levels of deprivation. In rural areas, 1km grid squares represent population 'gaps' well and enable assessment of, for example, geographical isolation of populations. In densely populated urban areas, 100m grid cells and SDZs most accurately depict the geographies of deprivation. It is argued that analysts and policy makers should carefully consider the geographical scale(s) which best represent population structures in their regions of focus.

The analysis demonstrates how the quality of Census data and the flexibility with which alternative spatial aggregations may be derived enables detailed analyses of deprivation, and potentially an array of other population and housing characteristics. The use of the smallest statistical zones available in each of the four UK nations is encouraged where possible and provision of administrative data for these zones – such as used to produce Small Area (2011 NI Census areas equivalent to OAs) level measures for the 2017 NIMDM – would better enable identification of vulnerable communities and better facilitate targeting of support to those most in need.

Summary and conclusions

The Trajectories of Deprivation in the UK project outputs include measures of deprivation on consistent geographical units from 1971 to 2021 (2022 in Scotland). There are two sets of

deprivation trajectory classifications for each nation of the UK – one based on data drawn from the Censuses of each nation from 1971 to 2021/22 and the other based on recent releases of the indices of multiple deprivation. The provision of these data on consistent units is, in itself, novel and provides a powerful means for analysts to assess how deprivation has changed in local areas across the UK. The classifications produced for each set of measures encapsulate the complex ways in which deprivation has changed and enable analysts to assess the different experiences of deprivation across neighbourhoods in their areas of interest. By linking these trajectories to interventions it is possible to start to identify examples of good practice which may have narrowed spatial inequalities and also to better understand the challenges faced in areas with persistent deprivation.

As a second related strand, the analyses of spatial scale of deprivation presented here have shown how crucial it can be to assess how far deprivation may be found in pockets in larger areas. By using commonly-applied geographical units it is likely that many people will miss out on vital support. Guidance offered by the project will enable analysts to better support deprived communities in their areas of responsibility.

Next steps

The Trajectories of Deprivation in the UK project has developed resources which are likely to have considerable value to analysts in local, devolved, and UK central government and NGOs. While representatives of many such bodies have been involved in the research and have provided detailed comments on the findings, there are many others who would benefit from these findings. Further targeted promotion of the project findings – data and LA specific reports – will be key to ensuring that the findings are to reach all relevant audiences and that they ultimately inform and shape policy aimed at reducing spatial inequalities. The project team will continue to work with analysts to develop case studies which demonstrate how information on deprivation trajectories can be used to develop new approaches to tackling neighbourhood deprivation.

Future plans include workshops focusing on the deprivation trajectories for each of the four UK nations. In addition, new audiences will be sought via webinar series with well-established audiences. These will add to a webinar already offered as a part of the Royal Geographical Society (with the Institute of British Geographers) *Geography in Practice* series[13]. The formal launch of the project's web-based mapping tool will act as a further means to promote the project as well as enabling access to the data the project team has developed (see https://www.qub.ac.uk/research-centres/GIS/Research/Deprivation/).

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[13] https://www.rgs.org/events/talks-on-demand/geography-in-practice-trajectories-of-neighbourhood-deprivation-in-england

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Appendix A: Project outputs

The key project outputs as of October 2025 are detailed below.

Consistent geographies for:
1971, 1981, 1991, 2001, 2021 Census of England and Wales
2004, 2007, 2010, 2015, 2019 English Indices of Deprivation
2005, 2008, 2011, 2014, 2017, 2019 Welsh Index of Multiple Deprivation
1971, 1981, 1991, 2001, 2021 Census of Northern Ireland
2005, 2010, 2017 Northern Ireland Multiple Deprivation Measure
1971, 1981, 1991, 2001, 2021 Census of Scotland
2004, 2006, 2009, 2012, 2016, 2020 Scottish Index of Multiple Deprivation (first batch of small area data released August 2024)

Deprivation trajectory classifications for:
1971-2021 Census of England and Wales
2004-2019 English Indices of Deprivation
2008-2019 Welsh Index of Multiple Deprivation
1971-2021 Census of Northern Ireland
2005-2017 Northern Ireland Multiple Deprivation Measure
1971-2021 Census of Scotland
2006-2020 Scottish Index of Multiple Deprivation

Additional variables for :
1971-2021 Census of England and Wales
1971-2021 Census of Northern Ireland
1971-2021 Census of Scotland

Census-based deprivation measures at multiple spatial scales for 2021 for England, Wales, Northern Ireland, and Scotland.

Local authority deprivation change profiles – for all LAs in the UK.

Web-based mapping resource including all of the above data and profiles via the project website: https://www.qub.ac.uk/research-centres/GIS/Research/Deprivation/

Journal article setting the scene to the project with England as a focus.
Lloyd, C.D., Norman, P.D. and McLennan, D. (2023) Deprivation in England, 1971–2020. *Applied Spatial Analysis and Policy*, 16, 461–484. https://link.springer.com/article/10.1007/s12061-022-09486-8

Journal article detailing methods for creating consistent geographies and Townsend deprivation index trajectories for England and Wales:
Norman, P., Lloyd, C., McLennan, D. Ferguson, S. and Catney, G. (2024). 50-year deprivation trajectories: Local area change in England and Wales, 1971–2021. Applied Spatial Analysis and Policy, 17, 1183–1208. https://doi.org/10.1007/s12061-024-09583-w

Appendix B: Townsend index technical summary

The Townsend deprivation score (Townsend et al., 1988, and see Senior 2002) is constructed using four sets of percentages:

- Unemployed persons (% of employed plus unemployed)
- Non owner-occupied households (% total households)
- Households without access to a car or van (% total households)
- Households with more than one person per room (% total households)

In this analysis, the percentages of unemployed persons and households with more than one person per room (overcrowding) were logged (after addition of 1; this allows for the tendency for skewed distributions of these percentages).

The four variables (two percentages and two logged percentages) are then converted to z-scores (also referred to as standard scores).

z-scores are computed with: (percentage-mean) / standard deviation. The resulting values can be derived for different variables and then added together to create a composite deprivation index. Positive values of the index indicate areas with higher levels of deprivation while negative values indicate lower levels of deprivation.

It is worth noting that composite deprivation scores such as the Townsend score can be computed using z-scores based on (1) per-year means (e.g., the mean unemployment % for 2011) or (2) the mean across all years (e.g., the mean unemployment % for all Census years from 1971 to 2011 inclusive). In this case, the latter approach is used to enable for direct comparisons across time.