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The use and misuse of regional data: perspectives, challenges and policy implications from across the UK

James Black[a], Kevin Connolly[a], Sharada Nia Davidson[a] and Mairi Spowage[a]

ABSTRACT

This paper investigates the challenges faced when producing regional statistics for policy analysis and using regional data in policy debates. We consider the UK, where devolution, Brexit and 'levelling up' have placed a spotlight on regional data. However, the issues explored are of international relevance. Drawing on perspectives from analysts in UK government departments and the devolved administrations, we analyse: the difficulties constructing regional statistics; the trade-offs between granularity, timeliness, comparability and different user needs; and how regional data can support policymaking. Levelling up, we argue, has spurred regional data improvements, but the resulting emphasis on directly comparable UK-wide data also poses risks.

KEYWORDS

data collection; survey methods; levelling up; regions; industrial policy

JEL C81, C82, C83, R12, R58

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1. INTRODUCTION

There is a large, growing demand across the world for high-quality regional economic data. This is required to support policymaking at the national and regional levels. Such data also play a vital role in academic research analysing regional policy (among many others, see Bachtrögler et al., 2020; Fleisher et al., 2010; Gagliardi & Percoco, 2017; and Okubo & Tomiura, 2012). However, the relationship between regional data and policymaking is less well understood. This paper contributes to the literature by analysing the challenges faced when producing regional statistics for policy analysis and using regional data in policy debates.

We focus on the UK, an important case, for several reasons. The UK has some of the highest levels of regional inequality in the industrialised world (Carrascal-Incera et al., 2020; McCann, 2020; Ralston et al., 2022). It is widely anticipated that the coronavirus pandemic and Brexit will widen these inequalities further, disproportionately affecting weaker regions (Billing et al., 2019; Blundell et al., 2021; Fetzer & Wang, 2020; Gathergood et al., 2021).

Addressing these spatial inequalities became a cornerstone of former Prime Minister Boris Johnson's domestic policy. In 2022, the White Paper *Levelling up the United Kingdom* was released by the Department for Levelling Up, Housing and Communities (DLUHC) (2022). However, the way in which the levelling up agenda has been delivered has been met with widespread criticism (Fransham et al., 2023; Ralston et al., 2022; Tomaney & Pike, 2020).

Spurred, in part, by the levelling up agenda, the Government Statistical Service (GSS) launched its subnational data strategy in 2021 just before the Levelling Up White Paper (LUWP) was published. Improving the timeliness, granularity, harmonisation and dissemination of subnational[1] data were among the key themes. While the data strategy will be coordinated by the Office for National Statistics (ONS), the UK's National Statistical Institute (NSI), close cooperation will be required with the devolved administrations (DAs) in Scotland, Wales and Northern Ireland. The DAs play a critical role in collecting and producing their own regional data and statistics, respectively. The needs of local users, for example, local authorities (LAs) and local government districts (LGDs), health boards and enterprise agencies will also drive local demand for regional data. This paper brings a new perspective to the levelling up literature, arguing that levelling up has driven improvements in regional data, but also led to an overemphasis on directly

CONTACT Sharada Nia Davidson sharada.n.davidson@strath.ac.uk
[a]Fraser of Allander Institute, Department of Economics, University of Strathclyde, Glasgow, UK

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comparable UK-wide data. The data strategy could therefore do more to support a wider range of policies and decisionmakers.

While recent shifts in the policy landscape have accelerated change, the UK's focus on regional data is longstanding. Independent reviews of UK economic statistics undertaken by Allsopp (2004) and Bean (2016) both feature sections dedicated to regional statistics with the latter also leading to the establishment of the ONS-funded Economic Statistics Centre of Excellence (ESCoE). The themes in this paper reflect sustained engagement with civil servants from 2019 to 2024 as part of research funded by ESCoE and HM Treasury's Economic Data Innovation Fund (EDIF). The ESCoE research culminated in a report (Davidson et al., 2022) evaluating challenges and opportunities associated with building a UK suite of subnational socio-economic indicators. The research was informed by 20 meetings with 15 senior ONS analysts participating on a rotational basis. We also engaged with the DAs via meetings and two presentations to the Devolved Economic Statistics Co-ordination Group, a subcommittee considering cooperation between the four nations on statistical matters in the context of the UK Concordat on Statistics.[2]

The EDIF research reviewed Northern Ireland's socio-economic data, focusing on data gaps and comparability relative to the rest of the UK (Catalano et al., 2024). We had six meetings with analysts from the Northern Ireland Statistics and Research Agency (NISRA), the Northern Ireland Office (NIO), the Department for the Economy Northern Ireland, ONS and DLUHC.

In December 2023 and January 2024, we conducted semi-structured interviews with 18 analysts from the ONS, Scottish Government, Welsh Government, NISRA, NIO, DLUHC and Greater London Authority (GLA). For further details and additional interview responses, see Appendix A in the supplemental data online.

The remainder of the paper is structured as follows. Section 2 provides an overview of insights from the academic literature. Section 3 outlines the challenges faced when producing regional statistics for policy analysis. Section 4 explores the use of regional data in policy debates, reflecting on transport connectivity data. Section 5 draws policy implications by evaluating the subnational data strategy. Section 6 concludes.

2. INSIGHTS FROM THE ACADEMIC LITERATURE

When considering how regional data can lead to incorrect policy inferences, several important issues emerge from the regional studies and economic geography literature (see Gripaios & Bishop, 2006, for a useful overview). First, this literature reveals the problems associated with focusing on a limited set of 'headline' indicators and the importance of evaluating whether a given economic indicator truly captures the concept in question. To explore these issues, we consider the literature on regional productivity.

Often, regional productivity is captured using a gross value added (GVA)-based measure. For instance, using GVA per hour worked, O'Leary and Webber (2015) evaluate the effect of structural change on regional productivity growth in 181 European regions between 1980 and 2007. Issues around GVA-based measures have existed for some time. It is now widely recognised that productivity measures should be workplace rather than resident based to account for the effects of commuting (Zymek & Jones, 2020). Furthermore, Beatty and Fothergill (2019) argue that some regions naturally have a lower GVA per head, for example, due to their industrial make-up, therefore appearing less productive. Starting with GVA per head, the authors develop a measure for regional efficiency by accounting for contextual factors such as industry mix, occupational mix and differences in hours worked. They find little evidence to support the argument that UK regions with low GVA per head are inefficient. This underscores the value of augmenting existing indicators with other regional data to better reflect the economic context. Coffey et al. (2022) are also critical of the use of GVA-based regional productivity metrics. By considering London and infrastructure projects seeking to reduce regional differences in productivity, the authors show that there is a lack of understanding regarding the way in which positive and negative agglomeration effects shape these productivity measures, again leading to policy-making which lacks criticality.

Our brief discussion of productivity shows that when policy is formulated, the data available can shape policy inferences leading to the wrong conclusions. Instead, though, policy questions should be used to improve existing regional data or inform which additional regional data should be collected. There are also several additional practises which should be emulated. In their study, Combes and Lafourcade (2005) develop a new method to compute transport costs. Notably, they outline the criteria that an accurate transport cost measure should meet. To study the relationship between high-speed rail and regional innovation in Japan, Komikado et al. (2021) use the number of patent applications per employee in each region as a proxy for regional innovation. They provide the possible advantages and disadvantages from using this measure, an approach all analysts should adopt.

A second important issue raised in the literature is the constraint placed on regional analysis by the sample sizes used in national surveys. This means it can become difficult, if not impossible, to produce some regional statistics giving rise to notable data gaps. In turn, such data gaps can become so embedded in the data landscape that they go unnoticed. Again, users can become focused on what data are available rather than what data they require to analyse a given policy. Ultimately, this can lead to the incorrect policy inferences being drawn. These issues are apparent in the literature on regional consumer price indices (CPIs). Dawber et al. (2022) attempt to estimate regional CPI using publicly available data from the UK's Living Costs and Food Survey. While they identify a potential method to undertake regional estimation, the

indices produced are too volatile due to the small regional sample sizes.

Without regional CPI measures, regional economic data (e.g., on wages, household income and GVA) cannot be adjusted to account for regional price disparities and living standards across regions cannot be accurately compared. Consequently, Hearne (2021) develops a new measure of relative regional prices with a focus on purchasing power parity (PPP). Utilising data on regional expenditure shares and the regional prices of different goods and services, the author finds that real incomes differ much less across the UK's 12 international territorial level (ITL)-1 regions than official nominal statistics suggests. Thus accounting for regional price differences is important for government policy, particularly in light of the UK's levelling-up agenda and industrial strategy.

Subnational price variation is not an issue exclusive to the UK. Results from Biggeri et al. (2017) (Italy), Montero et al. (2020) (Italy), Weinand and von Auer (2020) (Germany) and Wang et al. (2022) (China) echo those of Hearne (2021), suggesting there are significant differences in regional prices. Key across studies is that price levels tend to be spatially autocorrelated and higher in wealthier regions and urban areas. This has policy implications. Focusing on Poland, Rokicki and Hewings (2019) find that policy actions, such as the allocation of European Union (EU) Structural Funds, are likely to be biased since they deflate leading indicators such as per capita income using national PPP. Similarly, also considering European Cohesion Policy, Janský and Kolcunová (2017) find that 9% of EU regions were misclassified since regional price levels are not used.

Additional challenges associated with using survey data are also illustrated by the literature on regional input–output tables (IOTs) where trade-offs between cost and accuracy are apparent. Regional IOTs are extensively used to analyse the structure of the economy and are key inputs in ex-ante models which predict the consequences of economic disturbances. There are two main approaches for producing regional IOTs: bottom-up and top-down. Bottom-up approaches are resource and cost intensive, involving the collection of large amounts of data by NSIs. Additionally, surveys are typically designed and conducted with national not regional data collection in mind. Consequently, it is common for national IOTs to be produced using bottom-up or hybrid methods while regional IOTs are obtained through the 'top down' approach.

The 'top down' approach involves regionalising national IOTs and can be implemented with relative ease and at much lower cost. A range of methods can be used. When minimal data exists, two common approaches include RAS mathematical optimisation (Holy & Safr, 2022) and location quotients (LQs) with the Flegg location quotient (FLQ) commonly deployed (Flegg & Tohmo, 2013) or used as the basis for new approaches (Jahn, 2017; Pereira-López et al., 2020). Using RAS-based methods, a regional table is obtained which has the structure of the national table subject to some regional constraints. If using LQs, the national IOT is regionalised using proxies for sectoral regional specialisation such as wages or employment. While these methods allow regional IOTs to be produced in a timely manner, they are based on strong assumptions. For instance, the RAS method assumes that the regional table has the same economic structure as the national table. LQs, on the other hand, assume no cross-hauling (i.e., a sector does not simultaneously import and export the same commodity) and are sensitive to the choice of specialisation proxy.

In recent years, NSIs have shifted towards 'hybrid' approaches using a combination of regionalised data and country-specific data sources. In the UK, the Scottish and Northern Ireland IOTs are produced using this approach. While the academic literature has focused to a greater degree on top-down regionalisation, it would be beneficial for researchers to think more deeply about how regional IOTs are used in practise. For instance, it would be useful to assess when supplementary data can improve the performance of top-down regionalisation methods.

A final set of issues arise from determining the appropriate geography for policy analysis. Much of the academic literature has focused on large areas such as the EU nations and US states. Recently, however, policy needs have resulted in a growing trend towards analysis of small areas such as cities with the ONS now referring to subnational rather than regional statistics. A focus on what are still relatively large areas can lead to inferences which do not recognise substantial variation within a given area. For example, Miller and Vasan (2021) review the literature on the 'rural mortality penalty' in the United States, paying particular attention to the South. They find that existing research regards rural areas as homogenous, failing to account for geospatial variation in health risks by county, state, region, race and sex within the United States. They emphasise that the rates of morbidity and mortality are higher in the rural South than in other rural areas of the United States. In this case, it is therefore evident that distinguishing between rural and urban areas is not sufficient and that even smaller geographies are required. Thus context is key when using regional data to understand regional variation.

3. CONSTRUCTING REGIONAL STATISTICS FOR POLICY ANALYSIS

Following international conventions, in the UK, a range of surveys are used to collect the data required to produce national statistics.[3] This section outlines the difficulties that arise when trying to use the same data to construct regional statistics. We also consider issues relating to geographical granularity, comparability and conflicting user needs.

3.1. Challenges associated with collecting regional data

We first consider challenges associated with collecting regional data through surveys. These challenges are largely mirrored in other countries (e.g., see the discussion of

regional accounts in System National Accounts (SNA), 2008), but we note that there is greater cross-country heterogeneity in terms of approaches to regional apportionment which we will explore shortly. Across countries, business data are collected by surveying a sample of firms listed on the business register.

The UK's business register introduced in 1994 is the Inter-Departmental Business Register (IDBR). Key business data are collected from a firms' reporting unit (RU), which also provides some data on associated local units (LUs) (Figure 1). For instance, the RU for a large chain of retailers will provide data relating to the RU as a whole and all its LUs (e.g., the factory, stores and offices) across the UK. However, the UK has only two geographical classifications for RUs: Great Britain (GB) and Northern Ireland. A GB RU can therefore have LUs in all three of Scotland, England and Wales. Additionally, the LUs associated with a GB RU may have a different industrial classification to the RU. These issues pose a challenge if we wish to apportion activity out to LUs to obtain, say, 'Scottish' exports.

Regional apportionment involves using a proxy indicator to attribute a statistic to regions or other subnational geographies. Apportionment is a widespread challenge across countries, affecting any regional statistics developed using business data. One area where countries differ, however, is in the availability of proxy indicators at the LU level (for example, see de Vet's, 2016, survey of approaches to regionalising multi-regional enterprises' gross operating surplus across the EU). The UK typically uses LU employment to apportion activity to regions. However, the availability of other indicators is likely to improve the quality of apportionment. For example, data on wages and salaries collected at the LU level, available in countries such as Germany, are a better proxy for compensation of employees than LU employment. Similarly, in the UK, regional estimates of the output component of GVA, produced using the production approach, are apportioned based on a model considering regional employment. However, LU turnover data would be a more suitable proxy for the level of output produced by that LU.

> Apportionment is a key issue for business statistics … there's employment by local unit individual sites and an assessment of the major activity at each site. So the industrial activity is broken up on that basis. … If we could somehow get compensation of employees rather than just numbers of employees … this would really improve things.
>
> (UK government department (UKGD) analyst)

A prominent example of apportionment issues are the UK's regional measures of gross fixed capital formation (GFCF) which capture physical capital and some elements of intangible capital, two types of capital referenced in the LUWP. Unlike in many EU member states, for most industries, the UK adopted a top-down approach, regionalising national GFCF using data from the Annual Business Survey (ABS). Consequently, domestic publication of regional GFCF estimates was discontinued due to data quality concerns and insufficient suitable data sources.[4] Thus while the LUWP identified that physical and intangible capital can impact regional disparities (as inputs into the production process which affect productivity), regional estimates of these types of capital were not available. In contrast, countries such as Canada and Spain regularly produce high-quality regional GFCF estimates (Becker & Martin, 2023). Consequently, in 2022, to support delivery of the subnational data strategy and LUWP, the ONS began producing ITL3 estimates of asset-based regional GFCF which are more bottom-up.

Bottom-up and hybrid approaches reduce the need for top-down regional apportionment but are resource

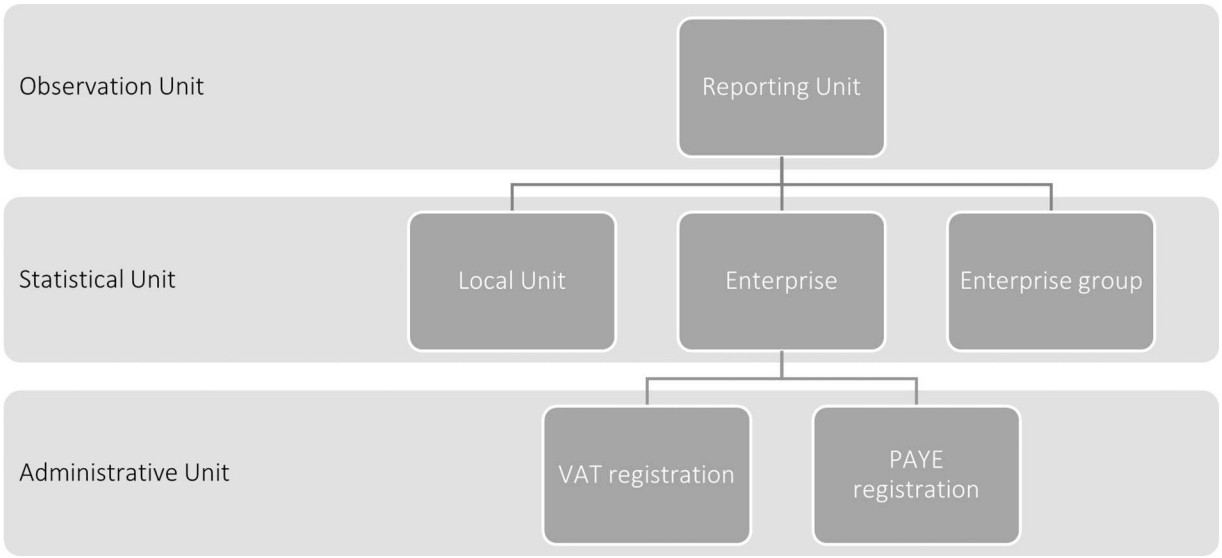

Figure 1. Sampling units on the UK's interdepartmental business register.
Source: Office for National Statistics (ONS) (2017), https://cy.ons.gov.uk/businessindustryandtrade/business/activitysizeandlocation/methodologies/ukbusinessactivitysizeandlocationmethodology/.

intensive. Consequently, annual estimates of UK regional GVA and regional gross domestic product (GDP) (and by implication output which is not published) are more top-down in nature. This is not uncommon with the top-down approach to producing regional GVA also dominating in Germany, for example. Notably, though, Scotland produces quarterly GDP estimates, adopting a hybrid approach similar to that used by the ONS to produce UK GDP figures. The ONS also introduced internationally advanced experimental estimates of quarterly regional GDP using a hybrid approach, but these have been paused, partly due to apportionment issues.[5]

Another challenge that can arise when using business survey data is business misclassification. Accurate industrial classification of businesses allows policymakers to analyse the business demography of different geographical areas and track the growth and decline of industries. In the UK, classification is based upon a set of rules that depend on the business' size, structure and available information from administrative or ONS data sources. However, in their review of the IDBR, the Office for Statistics Regulation (OSR) raised concerns regarding the accuracy of Standard Industrial Classification (SIC) coding of businesses, noting that business misclassification can affect ABS data quality.[6] The OSR therefore recommended that the ONS improve their knowledge of which data sources drive SIC changes. While the ONS have made clear that industrial classification is relatively stable across years with only 2.9% of unique businesses experiencing SIC changes in 2020,[7] this does not necessarily imply that classification is accurate. Additionally, 91.1% of changes were in small businesses with fewer than 10 employees. The industry is self-selected by businesses in some prioritised data sources, which is likely to contribute to misclassification, particularly when the business does not have a strong understanding of SICs.

Turning to household as well as business surveys, as highlighted in the academic literature, another key problem posed across countries is sample sizes. The UK has four key household surveys: the Living Costs and Food Survey (6000 households sampled per year), the Family Resources Survey (19,000 households per year), the Labour Force Survey (LFS) (40,000 households per quarter) and the Annual Population Survey (32,000 households per year). While these sample sizes may be large enough to produce national statistics, when moving to a more granular geography such as ITL1 the small sample size can become problematic (Dawber et al., 2022), yielding estimates which are more volatile and have a higher degree of uncertainty. Consequently, the DAs sometimes opt to pay for a boost to these surveys. There is then a trade-off between producing more granular estimates and cost as the required sample size increases. With a wide range of topics and increased local sample size relative to the UK national surveys, the data collected from DA surveys is also valuable. However, apart from the case where 'core' questions are repeated across three Scottish household surveys, direct survey estimates cannot be produced below LA level with sufficient precision.

> A percentage share based on population or the business population is not a good enough method to determine a sample size for a devolved region. … When the ONS are developing new surveys … consideration should be given as to whether or not the sample would … allow the DAs to access a subset of the data specific to their region to allow them to analyse the micro data and produce their own regional estimates.
>
> (DA analyst)

> We do have labour market data to [DA] level, but the confidence intervals around that data are pretty big. So it's very difficult to say if there are significant changes from one quarter to another.
>
> (DA analyst)

> Sometimes it is possible to expand sample sizes to generate more granular subnational estimates. … But this tends to be expensive, time-consuming and require long lead-in times – and [result in] lower response rates to social research surveys.
>
> (UKGD analyst)

Falling response rates are another challenge especially in surveys involving face-to-face interviews. These issues were exacerbated during the COVID-19 pandemic when changes in data collection directly contributed to a fall in LFS response rates across countries including the United States[8] and Canada.[9] In the UK, heightened data uncertainty resulted in the ONS suspending publication of LFS statistics in October 2023. The ONS (2023) subsequently published a plan to improve their data collection and methodology, reintroducing a fuller LFS-based dataset in February 2024.

To overcome issues with limited sample sizes and declining response rates, NSIs are increasingly using administrative, commercial and digital trace data (see also Hand, 2018). In Australia, survey estimates and administrative data are used to produce modelled estimates of regional employment and unemployment. These modelled estimates are recommended over direct survey estimates which can be volatile at the regional level.[10] To give another example, alternative data sources including retail scanner data are being used to improve the UK's CPI estimates.[11] This could ultimately make regional cost of living indices more feasible to produce.

We conclude this subsection by discussing survey weighting challenges. Weighting involves adjusting survey data so that statistics are more representative of the population. Design weights can be used to adjust for over or under sampling while non-response weights account for the fact that certain types of businesses/households are less likely to respond. Weighting requires even more consideration when producing regional statistics. For example, LAs in the UK differ considerably in size. Smaller LAs therefore need to be oversampled and reweighted to produce representative estimates.

> Sample bias by type of household and demographics is a big challenge. You've got to be able to make sure that you've got unbiased coverage. You've got noncompliance because

> people are people, and they don't like people coming around and asking them questions.
>
> (UKGD analyst)

Survey weighting, however, has several limitations: it is typically unclear how to apply weights when the goal is to obtain complex quantities such as regression coefficients; the weighting design must be correctly accounted for when calculating standard errors; and the resulting weights are often based on a series of arbitrary choices (Gelman, 2007). While weighting involves a design-based perspective (i.e., units sampled represent units in the population), several authors (e.g., Gelman, 2007; Little, 1993) have proposed adopting Bayesian model-based solutions. However, such solutions can lead to highly complex models which can be difficult to interpret and adopt in practise (Gelman, 2007).

3.2. Challenges associated with geographical granularity and comparability

We now turn to difficulties which arise when considering geographical granularity, comparability and conflicting user needs. While the challenges we discuss are present in other countries, their severity depends on: the degree and symmetry of decentralisation; the quality and availability of administrative data; the local tax structure; and data sharing legislation and culture. The extent to which regional governments co-determine national policy and data strategy is also key and varies across countries. In the UK, the DAs do not co-determine UK policy but are involved in data strategy. A concordat on statistics is in place between the UK Statistics Authority (UKSA), wider UK government and DAs, setting out a framework for statistical cooperation. Additionally, the UK's GSS comprises the ONS and statistics branches of the DAs.

> If you look at the UK regions, what the UK produces compared to other countries is actually very, very good. I think where it falls down is that in many ways it's slightly fragmented. I think some things that for instance [DAs] produce potentially could find a home with the ONS.
>
> (UKGD analyst)

Another factor shaping UK data developments is Brexit with the UK still in the process of establishing an arrangement on statistical cooperation with the EU. While the ONS will still conform to international conventions, it will no longer be bound by EU legislation, enabling the pursuit of domestic data priorities. However, with the UK no longer involved in European Commission data initiatives, this could have adverse consequences and decrease the comparability of UK and EU data. For instance, when building the case for Scottish independence, comparisons are often made between Scotland and EU countries such as Denmark and Sweden.[12] Making such comparisons and analysing whether they are appropriate becomes challenging if the UK adopts different data collection approaches or standards.

Across countries, adopting the appropriate spatial unit for policy analysis is an important task (Gripaios & Bishop, 2006). Importantly, though, the choice of geography is context dependent. There is typically a distinction between statistical geography, the hierarchy of areas relating to national and local statistics, and administrative geography, the hierarchy of areas relating to national and local government. Following Brexit, the UK-managed statistical classification is now referred to as UK ITLs which mirror their EU predecessor, the Nomenclature of Territorial Units for Statistics (NUTS). Utilising NUTS regions for European policymaking has proven controversial due to distortions which can arise from commuting flows (Gripaios & Bishop, 2006). Thus an important development across countries is the emphasis on functional urban areas (FUAs) which consist of cities and their commuting zones. In the UK, travel-to-work areas (TTWAs) are an important small-area geography (Table 1) similar to FUAs but covering the whole of the UK including rural areas.

Table 1. Small area geographies across the UK.

	Travel-to-work areas	Local authorities	Constituencies	Census-based small area geographies
Scotland	45	32	59 (Westminster) 73 (Scottish Parliament)	Data zones: 6976 Intermediate zones: 1279
Wales	18	22	40	Lower SOAs: 1909 Middle SOAs: 410
Northern Ireland	10	11[a]	18	SOAs: 890 Small areas: 4537
England	149	333	533	Lower SOAs: 32,844 Middle SOAs: 6791
Cross-border	6	n.a.	n.a.	n.a.
Total	228	398	650 or 664	n.a.

Note: [a]Local government districts in Northern Ireland.
SOA, super output area.

Several challenges emerge for data users since geographical areas are not standardised. First, administrative geographies often change. In France, 22 regions were reduced to 13 in 2016 following a significant reorganisation. Such changes, also discussed in Stats NZ (2023), make it difficult to compare areas over time and assess whether regional disparities are narrowing. Second, administrative geographies often differ considerably from other geographies used for policy analysis, such as TTWAs and health boards and trusts. Ireland's Health Service Executive, for example, recently created six health regions which commenced operation in 2024.[13] There is even less standardisation if considering regulated private sector entities such as water companies whose statistics are also of public interest. While each geography serves some users well, a lack of standardisation can make linking datasets challenging. For instance, if analysing the relationship between air quality and socio-economic outcomes, the UK's modelled background pollution data are provided in 1 × 1 km blocks[14] which are difficult to map to census-based small area geographies.

Issues around geographical standardisation are exacerbated in the UK due to the asymmetric nature of devolution. For instance, Scotland, England and Wales have LAs, while Northern Ireland has LGDs. To give another example, while the ONS's estimates of output-based regional GVA simultaneously achieve a high degree of sectoral and geographical granularity relative to, for example, Germany, the ONS urges caution when comparing small-area GVA estimates delivered via the subnational data strategy.[15] At the granular 'building block' level, GVA data are more volatile and the geographies used – lower super output areas (England and Wales), data zones (Scotland) and super output areas (Northern Ireland) – are defined differently across the UK (Table 1). The ONS therefore encourages users to aggregate 'building block' GVA to build and compare larger geographical areas.

In the UK, the importance placed on comparability varies across data users with national and local data users having different and sometimes conflicting needs. The focus of UKGDs such as the DLUHC is on supporting UK policymaking. The ONS is a UKGD but also has a broader remit as the UK's NSI. Nonetheless, at the national level, a greater emphasis is placed on the UK-wide comparability of statistics. Comparability is crucial when assessing the relative needs of different areas and allocating funding across the UK via initiatives such as the Levelling Up Fund (LUF). However, this approach means that the geography typically considered, LAs, facilitates comparisons but some specificity is lost, and variation is concealed.

> [the geography used] depends on the policy objective … LA level data has been most widely used to identify need throughout this spending review period for place selection and guided the LUWP missions … LA estimates can be more reliable due to larger sample size, and therefore have a wider availability of metrics related to levelling up data allowing for consistent comparison across GB (and sometimes across the UK) … [but] socioeconomic indicators at a LA level capture the average level of need within the area and mask deprivation in areas that are highly unequal. … It is preferred to capture the lowest level geography possible to better capture hyperlocal statistics and hyperlocal need. … However, a policy focus based on metrics lower than LA can produce a high burden of monitoring for LA and less flexibility in delivery.
>
> (UKGD analyst)

Understandably the focus of the DAs is on supporting devolved policymaking with regional statistics designed to reflect the specificity of their nation. While an understanding of how their nation compares to other parts of the UK is useful, building a detailed understanding of their own local areas takes precedence. For instance, in Scotland, LA data are available on six 'growth sectors' where it has been identified that Scotland has a comparative advantage. Regional data also support local policymaking and are significant in the context of the relationship between devolved and local government and how powers are transferred. Despite LAs receiving additional powers it can be difficult for them to effectively exercise them in the face of limited regional data. For example, the Scottish Government has transferred powers so that LAs can apply a levy on overnight visitors. However, local tourism data from the GB tourism survey lacks geographical granularity since estimates of the volume and value of domestic overnight tourism are only published at the ITL1 level. Additionally, tourism ministers for the UK, Welsh and Scottish governments have expressed concern regarding the international passenger survey's data quality.[16]

> My focus tends to be on getting a figure for [my devolved nation] but then beyond that in terms of comparisons we're less interested in individual regions of England as much as just having a figure for England as a whole.
>
> (DA analyst)

Further challenges relating to comparability can also arise. Across countries, decentralisation and devolution of specific policy areas can lead to different approaches, data collection strategies and definitions, hampering comparisons. This problem is less pronounced if we consider indicators which are economic in nature, for instance GDP, productivity and key labour market statistics such as unemployment. However, socio-economic indicators, for instance relating to education, skills, health and crime, are not always available at an appropriate level of geographical granularity and face greater comparability issues. For example, UK policymakers rely on the OECD's Programme for International Student Assessment (PISA) scores to compare pupil performance across the UK. However, PISA only records cognitive skills at age 15 and does not capture how these skills evolve over time (Sibieta & Fullard, 2021).

> Different organisations collecting similar data but with different questions being asked, different sampling methodologies, different timeframes, different coverage, etc all results in issues around comparability. … The ONS Coherence team have also been looking at some of these issues, with a focus on subnational trade statistics. They have been engaging with the DAs and we worked collaboratively to produce an explainer outlining the differences between the various survey sources available for trade data … what they have been doing here is a good example and could be rolled out to other types of data.
>
> (DA analyst)

4. THE ROLE OF REGIONAL DATA IN POLICY DEBATES

We now analyse the difficulties associated with using regional data in policy debates.[17] Such challenges occur internationally. For instance, issues with the availability and quality of regional data on socio-economic indicators, GVA and policy spending have hindered the evaluation of EU Cohesion Policy, making it difficult to assess whether the objective of improving conditions in poorer regions has been achieved (Gripaios et al., 2008; Polverari & Bachtler, 2014). To give another example, a United States International Trade Commission (2022) investigation into the distributional impacts of trade on workers recommended increasing the geographical coverage and granularity of some datasets. The report noted that without detailed geographical and industry data, the local impact of trade shocks on workers could be mis-estimated. Additionally, geographically granular data is required to analyse the effects of trade on different location types (e.g., rural and urban).

To further explore the role of regional data in policy debates this section focuses on UK transport connectivity metrics. We demonstrate that there is sometimes insufficient data to underpin levelling up but the LUWP has also shed light on regional data gaps, driving improvements. We also consider how we can develop policy-driven criteria when evaluating whether available regional statistics can support a given policy. The incomparability of UK health system performance metrics and policy implications were also explored in our interviews (see Appendix B in the supplemental data online).

> To a certain extent, the policy landscape has been accelerating at a faster pace than the data has been gathered and I think it's probably an issue … regional development goes in and out of favour at different points over the decades and it's currently in favour now and the policy is several steps ahead of where the data is.
>
> (UKGD analyst)

Improving transport connectivity can lessen regional disparities by lowering firms' costs, improving access to work and supply chains, and creating agglomeration effects (National Infrastructure Commission (NIC), 2018). However, data quality and quantity remain key issues when implementing transport policies (May et al., 2003) as evidenced by US[18] and Australian[19] reports highlighting transport data gaps. Turning to the UK, Mission Three of the LUWP states that 'by 2030, local public transport connectivity across the country will be significantly closer to the standards of London, with improved services, simpler fares and integrated ticketing' (DLUHC, 2022, p. xvii). However, several issues emerge if we consider transport connectivity metrics used in the LUWP and to allocate the LUF (Table 2, rows 1–6).

> If there's new policies sometimes been designed in London, then if the money's devolved, that doesn't necessarily mean to say that the money is being used for data to track that policy … if there's a focus through Levelling Up in terms of greater connectivity there needs to be money set aside to capture the data on this in a consistent way rather than just put that out into the regions and hoping there's going to be [improved transport] connectivity without any way to measure the outcomes.
>
> (UKGD analyst)

First, a definition of transport connectivity is not provided in the LUWP before the metrics are outlined. The NIC (2018, p. 5) defines connectivity as 'the effectiveness of the transport network (irrespective of mode) at getting people from one location to another', which, in turn, depends on the different destinations which can be reached within a given time via the network. In partnership with Prospective Labs, the NIC (2019) constructed different measures of transport connectivity for the 1000 most populated places in GB in 2011 and 2016 (Table 2, row 7). Urban connectivity, connectivity within places, was defined as the average travel time between each point in the place and its centre (the area with highest population density) weighted by demand (population or employment). A distinction was also made between different modes (car or public transport) and times of day (peak or off-peak).

Second, substantial geographical data gaps exist in terms of UK transport connectivity metrics. Four out of five metrics provided in the LUWP are available for England only. This focus on England persisted when allocating the first two rounds of the LUF.[20] LUF allocation involved two steps. First, UK-wide data were used to determine the number of priority slots in each nation. Second, within each nation LAs were ranked using nation-specific data. However, in this second step, transport connectivity data were only used to rank English LAs since there was no publicly available data on journey times, or equivalent alternative, for Scotland and Wales. This proved contentious since transport connectivity is likely to be more problematic in rural parts of Scotland and Wales. Spowage et al. (2021) show that failing to account for transport connectivity in Scotland and Wales may result in some LAs with a low population density being under-classified. This demonstrates that policy decisions are sensitive to the underlying regional data

Table 2. Overview of selected transport connectivity metrics in the UK.

Metric	Data source	Levelling up metric	Geographical coverage, source, last published
Usual method of travel to work by region of workplace	Labour Force Survey	Headline	Great Britain, countries and regions, DfT, 2019Q4 released in 2020
Average travel time (min) to reach nearest large employment centre (≥ 500 employees)	Commercial software calculation using information on road and path networks, traffic speeds and public transport timetables	Headline	England, LA, DfT, 2019 released in 2021
% of non-frequent bus services running on time	Public Service Vehicle Survey	Supporting	England, LA, DfT, 2022 released in 2023
Average excess waiting time for frequent (bus) services	Public Service Vehicle Survey	Supporting	England, LA, DfT, 2021/22 released in 2023
Public transport trips as a proportion of total trips per year	National Travel Survey	Supporting	England, regions, DfT, 2022 released in 2022
Average journey times to the nearest employment centre of at least 5000 jobs	Commercial software calculation using information on road and path networks, traffic speeds and public transport timetables	Levelling Up Fund (LUF) English Index	England, LA, DfT, 2019 released in 2021
Transport connectivity: average travel time weighted by demand	Census Data and Prospective Lab's Multimodal Transport Network	n.a.	Great Britain, 1000 'most built up' areas, 2011 and 2016, Prospective Labs for the National Infrastructure Commission (NIC), released in 2018
Areas people can feasibly travel to using public transport (increments of 15 min up to a maximum travel time of 60 min)	Bus and train timetable data, OpenTripPlanner	n.a.	England and Wales, output area (2021 census), Scotland, output area (2011 census), Northern Ireland, small area (2011 census), ONS Data Science Campus via Open Geography Portal
Transport performance metrics for urban centres	In development as of August 2023	n.a.	UK wide, ONS Data Science Campus via Open Geography Portal

Note: DfT, Department for Transport, LA, local authority, ONS, Office for National Statistics.

used. Furthermore, Spowage et al. highlight the lack of transparency around the LUF methodology. This was rectified in round two of the LUF with detailed spreadsheets being published.

> The extent to which current transport systems actually support economic activity in [subnational areas] was flagged as a key gap, as the provision of administrative data from numerous transport operators can be quite patchy.
>
> (DA analyst)

A third issue is that transport connectivity metrics used in the LUWP do not have appropriate geographical granularity. While the LUWP discusses improving local standards relative to London and makes reference to increasing connectivity in cities, towns and villages, the metrics considered do not facilitate the comparison of local areas. Only three out of five metrics consider LAs and these are available for England only. Moreover, while LAs were the geography of choice for allocating the LUF, they can be large and do not sufficiently capture local standards.

Fourth, the transport connectivity metrics adopted do not fully map to the mission's scope. For instance, the mission explicitly refers to public transport. However, this emphasis is not carried through to the corresponding headline metrics nor the transport connectivity proxy used to allocate the LUF. Similarly, the mission refers to improved services but supporting metrics currently only capture bus services.

Several themes emerge from our analysis considering the transport connectivity data available to support levelling up. First, when appraising whether available regional data can support a given policy, it is important to consider whether a dataset's features (e.g., granularity, comparability) map to the policy under consideration. Second, it is important that the metrics adequately match the policy scope and capture relevant concepts. This leads to six policy-driven criteria which can be used to assess available regional data. Regional data should have the: geographical

coverage (C1); geographical and sectoral granularity (C2); comparability within a region and/or between regions (C3); and timeliness, the frequency and publication lag (C4), which maps to the policy being considered. When assessing granularity, it is important that where survey data are used sample sizes are sufficient to support reliable inference. Additionally, regional data should adequately capture the policy scope (C5) and appropriate concepts (C6).

To illustrate, again consider transport connectivity metrics used to support levelling up. To meet the first two criteria, transport connectivity metrics should be UK-wide and capture local areas. To facilitate comparisons, particularly with London, metrics across the four nations should be directly comparable. Considering criterion 4, since regional disparities are slow-moving, transport connectivity metrics likely only need to be updated annually. Last, considering criteria 5 and 6 transport connectivity metrics supporting levelling up should focus in on public transport accessibility and performance and distinguish between different modes of travel and time of travel.

Having established our policy-driven criteria, we evaluate new metrics which have been developed or are in development since the LUWP was published (Table 2, rows 8–9). The first new metric, requested by DLUHC, captures areas people can feasibly travel to using public transport with the aim of understanding differences in public transport availability within a local area. The focus on public transport meets criterion 5 but this metric does not aim to facilitate comparisons between London and other areas. Thus additional metrics will be required to fully fulfil criterion 3. Criteria 1 and 2 are met since there is UK-wide coverage and high geographical granularity with an emphasis on 'hyperlocality'. To meet criterion 4, estimates should be produced annually but further analysis is required. For GB, estimates were produced using timetable data for 15 November 2022 while data for 6 December 2022 were used for Northern Ireland. These dates were chosen so that external factors such as industrial action and weather events did not influence the results. However, more work is needed to assess whether the results are sensitive to the time of year. Additionally, to fully meet criterion 6, it needs to be made clearer that this measure currently reflects peak travel.[21] Future work should analyse off-peak periods.

The ONS data science campus now also has transport performance metrics in development building on European Commission research (Poelman et al., 2020) to develop indicators describing public transport availability and performance in European cities. Notably, this was announced by the ONS in August 2023 with explicit reference to the LUWP.[22] The new metrics aim to facilitate further consideration of whether local transport connectivity across the UK is moving closer to that of London, allowing criteria 3 and 5 to be better met. The use of timetable data will again allow for granular UK-wide coverage, however, producing measures for the four nations which are directly comparable could still be challenging.

5. REGIONAL POLICY IMPLICATIONS: HOW REGIONAL DATA CAN EFFECTIVELY SUPPORT POLICYMAKING

In this section, we assess how regional data can effectively support policymaking. We do so by evaluating an existing attempt to improve regional data: the UK GSS's subnational data strategy. The UK is not the first country to implement a regional data strategy. In 1996, to support sales tax harmonisation, Canada embarked on the multi-year Project to Improve Provincial Economic Statistics (PIPES) which sought to accurately measure the final sales of goods and services by province and industry.[23] This involved: integrating all business surveys into one master survey programme; business register improvements; conducting larger, more frequent family expenditure surveys; and improving production of provincial IOTs.

> [W]e've said, 'You're so lucky to have all this data available in Canada,' [and] they say 'No, actually, it's that we just made some smart decisions about where we invested our money about 20 years ago and now we're reaping the benefits.'
>
> (DA analyst)

Turning to the UK, the GSS (2021) strategy has three ambitions: 'produce more timely, granular and harmonised subnational statistics'; 'build capability and capacity for subnational statistics and analysis'; and 'improve the dissemination of subnational statistics'. The first ambition is underpinned by proposals to improve the comparability and coherence of subnational data, break down statistics to a set of standardised geographies, enable reliable disaggregation at different geographies, and investigate alternative data sources and methodologies. The second seeks to exploit geospatial data and improve the way subnational data and methodologies are shared and discussed across the GSS. The third seeks to make subnational outputs easier to access with accompanying guidance provided alongside datasets.

The strong influence of the levelling up agenda on the strategy is clear with Andy Haldane, former head of the levelling up taskforce, contributing to the foreword. Levelling up has also been referenced in the ONS's subnational statistics workplans and publications with ONS Local, a new advisory service targeting local users, receiving funding from DLUHC. Together with our previous analysis, this demonstrates that by mapping missions to specific metrics, the LUWP has made key data gaps apparent, in turn, influencing the data strategy and driving improvements in regional statistics. However, while the strategy provides a clear and comprehensive overarching framework, it also faces challenges.

> levelling up is good to start the conversation, but there just needs to be instead of looking at the levelling up stuff, which is obviously a political policy, to go back and look at the whole suite of UK data.
>
> (UKGD analyst)

> [The subnational data strategy] is good to advance the cause of subnational data. I don't think it needed to have been framed quite so heavily in the levelling-up terminology.
>
> (DA analyst)

> I didn't know [the strategy] existed, which is something in and of itself.
>
> (DA analyst)

If we consider the first ambition, the strategy does not fully capture trade-offs between timeliness and geographical granularity or the need to prioritise different data features in different contexts. For example, given the increased sample sizes and resource required to produce more detailed estimates, there are often trade-offs between timeliness and the geographical or sectoral breakdown. This trade-off is demonstrated by the ONS's consultation on the future of population and migration statistics which proposes drawing on administrative data to improve the timeliness of outputs while retaining granularity. Notably, though, different outputs will prioritise different data features according to user needs and data availability.[24] Other countries have also sought to improve the disaggregation of their socio-economic data with Canada and Australia launching the Disaggregated Data Action Plan (DDAP) and Data Development Plan (DDP) in 2021 and 2022, respectively. DDAP and DDP seek to disaggregate socio-economic data by category (e.g., indigenous peoples, women) at the lowest level of geography possible to better understand the experiences of different population groups.

If we now consider the second ambition which seeks to improve collaboration across the GSS, the strategy does not fully capture issues regarding different user needs, budget pressures and organisational priorities. Levelling up requires indicators which can be directly compared across the four nations to facilitate the allocation of funding and comparison of outcomes across local areas. Consequently, the strategy notes that a key area of joint working between the ONS and DAs is to improve the coherence and comparability of indicators across the UK. Notably, though, UK government policy can undermine collaboration with, for instance, the LUF being administered so that the DAs are bypassed.

> Efforts to make statistics coherent face the barriers of time and resources across the Governments; if a department work is in a devolved area, why would they dedicate limited time/money to collect comparable UK-wide data.
>
> (UKGD analyst)

Additionally, UKGD priorities and the current focus on UK-wide comparability may not always align with the priorities of devolved and local users. While it is feasible to produce granular datasets which are directly comparable across the four nations (e.g., see statistical outputs from the England and Wales census), the DAs have autonomy to develop their own datasets. This leads to a trade-off between UK-wide comparability and the DAs ability to fulfil their remit and meet the needs of policymakers and data users at the devolved and local level. For example, all four nations separately produce an index of multiple deprivation, allowing areas to be ranked within each nation. However, these indices cannot be used to make comparisons across nations since they each use slightly different methodologies and small-area geographies. For instance, nation-specific data sources are leveraged when considering aspects of deprivation relating to devolved policy such as health. This specificity would be lost if constructing a single UK index of multiple deprivation.

> those multiple deprivation indicators, they are great, but obviously you can't compare – they rank areas within [each DA], but it would be fantastic to show a whole UK league table. … [It would help] Ministers who are often London-based to understand similar areas across the UK much more.
>
> (UKGD analyst)

The DAs are also likely to face greater resource and capacity constraints. This is demonstrated by the consultation on the future of population and migration statistics which only considers statistics produced by the ONS for England and Wales and does not discuss statistics produced by census agencies in Northern Ireland and Scotland. Where their priorities differ from UKGDs, DA needs may also go unmet. For example, the ONS's Low Carbon and Renewable Energy Economy (LCREE) Survey provides data on LCREE activity (e.g., turnover, number of employees) across different sectors (e.g., hydropower, bioenergy). However, country-level estimates can suffer from a high degree of uncertainty.[25] Improving their accuracy is likely to be more of a priority for the Scottish Government which aims to reach net zero five years earlier than the UK.

> when ONS start a transformation piece (e.g., Beyond 2021 Census/Transformation of Population Statistics System/ Transformation of LFS) this usually starts with a funding bid, with nothing factored in to cover DA involvement … this has serious implications for coherence and subnational statistics as the DAs are unable to secure match funding to implement the equivalent work plans.
>
> (DA analyst)

Importantly, tensions between different user needs can still arise in cases where regional data collection is centralised. The Australian DDP, for example, has prioritised frequent, state level estimates of Aboriginal and Torres Strait Islander life expectancy. However, the Australian Bureau of Statistics rely on the five-yearly census to produce these estimates.[26] Consequently, more frequent estimates cannot be produced. Additionally, estimates cannot be produced for states/territories where there are data limitations and the Aboriginal and Torres Strait Islander population is relatively small.

The third subnational data strategy ambition seeks to improve dissemination. When disseminating regional data, decentralisation tends to exacerbate challenges. For example, Germany has 14 statistical offices for the 16 federal states, with each office making regional data available

through their respective websites. These websites, however, are not standardised, which can make retrieving and comparing data challenging. While Germany has a regional database pooling information from across the states, the websites of regional statistical offices sometimes provide longer time series.

Turning to the UK, the strategy's emphasis on data which is comparable UK-wide has also influenced dissemination as demonstrated in the LUWP and subnational indicators explorer. The explorer, the first step towards an explore subnational statistics service, provides a useful starting point for comparing indicators across different LAs and LGDs, but has some notable issues. First, the choice of metrics closely relates to levelling up and is questionable. For instance, one dimension of the explorer seeks to capture metrics relating to 'productivity, pay, jobs and living standards' but does not include a measure of unemployment-related benefits claims even though this metric is key to understanding total household income, a key driver of living standards.

Second, in the explorer and LUWP when directly comparable indicators are not available across the UK, indicators are included for England (or GB) only and DA indicators are omitted. Consequently, despite being labelled as UK-wide, these outputs do not provide sufficient coverage of the DAs. At the time of writing, of 36 indicators included in the explorer, only 12 are available for Northern Ireland and 14 are available for Scotland and Wales. Omitted indicators tend to relate to devolved policy areas such as health and education. However, while DA data may not always be directly comparable with other parts of the UK, indicators which capture the same concepts are typically available. For instance, obesity prevalence statistics are available across the UK but have definitional differences.

> The ONS Subnational Indicator Explorer has real potential to be a useful and go-to source. … However, it is very heavily swayed towards providing data for English Regions. … A more coherent set of indicators that provide more representation for the DAs would greatly improve the utility of the data explorer and allow users to undertake interregional analyses on a range of topics.
>
> (DA analyst)

The current emphasis on direct comparability has important policy implications. First, omission of DA indicators from outputs may lead to the incorrect inference that there are larger data gaps in the DAs. Second, policymakers may lack an understanding of nuances around indicator comparability. As evidenced by ministers inaccurately comparing health system performance across the four nations (see Appendix B in the supplemental data online) it is important to explain differences in metrics across the four nations. These nuances are beginning to be captured via the GSS's Coherence Work Programme, which not only seeks to improve the comparability of UK-wide data but document and rationalise differences.

> Incomparability itself may hinder direct comparisons of some headline NHS performances, but what has really hindered the debate more is the lack of information out there to explain these differences.
>
> (DA analyst)

> I have seen limited evidence of what is actually happening as a result of the strategy. I know ONS have set up a Coherence team looking a range of indicators which is welcomed and they have engaged with us … to inform their work around sub-national trade. ONS have also been developing a product to build data from lower level geographies – small Area GVA estimates … I have not been engaged on anything beyond this, for example there has been no engagement with [us] from ONS Local – I'm not sure what the remit of ONS Local is, what their plans are, how we can work together, etc. Similarly, I am not aware of any progress on the 'Explore Subnational Statistics Service'.
>
> (DA analyst)

6. CONCLUSIONS

This paper analysed the interface between regional data and policymaking, investigating the challenges associated with constructing regional statistics and using these statistics in policy debates. We considered the perspectives of civil servants in UKGDs and the DAs but also stressed the international relevance of the issues explored, drawing on evidence from countries in North America, Europe and the Asia Pacific.

Our key conclusions are as follows. First, when NSIs are developing new statistics, the purpose of a given dataset should determine the dataset's features in terms of timeliness, granularity, coverage and comparability. Relatedly, it is important that metrics which are used to implement and evaluate policies have the appropriate features and reflect the appropriate concepts and policy scope. Where existing data does not fully meet users' needs, this should be used to inform improvements so that we work towards producing statistics which are desirable rather than relying on statistics which are available.

Second, producers should take a long-term view so that datasets and dissemination tools are not driven by one flagship policy and can support a range of users. Levelling up, for example, demonstrates that there can be unintended consequences when a single policy drives regional data improvements. To allocate funding and assess progress against the levelling up missions, subnational indicators are needed to compare outcomes across the UK. As evidenced by the LUWP and subnational indicators explorer, this has resulted in a focus on indicators which are directly comparable across the UK. In the LUWP and explorer, when directly comparable indicators are not available, as is common in devolved policy areas, indicators are included for England (or GB) only and DA indicators are omitted. However, indicators capturing the same concept (e.g., on adult obesity prevalence) are typically available across the four nations but cannot be

directly compared due to definitional or methodological differences. If these DA indicators are excluded, policymakers may believe that there are larger data gaps in the DAs or fail to understand nuances around indicator comparability. Across countries, it is therefore important that NSIs clearly communicate the shortcomings of and differences between datasets, particularly to policymakers.

Admittedly, there is a possible tension between the first conclusion (a dataset's features should be purpose driven) and second (data should not be solely driven by rapidly changing policy initiatives). Thus when determining a dataset's purpose, NSIs should not simply focus on recently enacted policy. Instead, they should adopt a holistic approach informed by the wider policy environment and consultation with users from different regions, sectors and population groups. Only through reconciling different priorities and needs can the purpose of different datasets be fully understood. Canada's PIPES programme, for example, was initiated due to sales tax harmonisation but led to wide-ranging improvements to business surveys and provincial data.

Third, caution is needed in terms of terminology. This has become clear when labelling indicators which are easily available or comparable as 'headline' indicators and other indicators as 'supporting' indicators. 'Headline' indicators may not be the 'best' or most representative of a specific characteristic. Policymakers should also rely on a range of indicators when formulating and evaluating policy, carefully considering the sensitivity of their findings. Where data has been used to support policymaking, the metrics and methodology should be transparently presented and replicable.

Fourth, we clearly illustrated that different users are likely to have different and sometimes conflicting priorities, for instance, depending on whether policymaking takes places at the national, devolved or local level. Multiple needs can be better met when there is collaboration among different data producers and users. However, in practise this can be difficult to achieve. The allocation of the UK's LUF illustrates that government policy can directly lead to the misalignment of incentives to collaborate while Australia's DDP demonstrates the practical challenges involved in representing different populations. Notably, academic stakeholders can also contribute further to policy debates by developing a deeper understanding of how regional data are used in practise, for example, in the creation of hybrid IOTs.

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DATA AVAILABILITY STATEMENT

Following procedures outlined in our approved ethics application, interviewees were advised that their responses would only be accessible to members of the research team. However, for additional quotations, see Appendix A in the supplemental data online.

DISCLOSURE STATEMENT

No potential conflict of interest was reported by the authors.

ETHICS STATEMENT

The authors' ethics application was approved by the Department of Economics Ethics Committee, University of Strathclyde. The authors followed the ethics procedure outlined in their approved application when interviewing all participants. Interviewees agreed that their quotations could be used directly within the paper and were provided with a copy of the quotations that would be used and given an opportunity to withdraw any they were unhappy with. It was agreed that interviewees' identity would be anonymised in any output and that we would only identify whether they belonged to a UK government department or devolved administration.

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NOTES

1. We use the terms 'regional' and 'subnational' interchangeably.
2. See https://uksa.statisticsauthority.gov.uk/publication/concordat-on-statistics/.
3. We use the terms 'data' and 'statistics' interchangeably, except when discussing the construction of regional statistics. In section 3, 'data' refer to data collected from businesses and households, while 'statistics' refers to statistics produced using regional data by NSIs.
4. See https://www.ons.gov.uk/economy/regionalaccounts/grossdisposablehouseholdincome/methodologies/regionalaccountsmethodologyguidejune2019/.
5. See https://www.ons.gov.uk/news/statementsandletters/pausingofquarterlyregionalgdpestimates/.
6. See https://osr.statisticsauthority.gov.uk/publication/assessment-report-uk-business-demography-statistics/.
7. See https://www.ons.gov.uk/businessindustryandtrade/business/activitysizeandlocation/articles/businessclassificationsontheinterdepartmentalbusinessregister/2022#:~:text=Between%20January%20and%20December%202020,

occurred%20across%2080%2C198%20unique%20businesses/.
8. See https://www.bls.gov/osmr/response-rates/.
9. See https://www150.statcan.gc.ca/n1/pub/75-005-m/75-005-m2023001-eng.htm/.
10. See https://www.abs.gov.au/statistics/labour/employment-and-unemployment/labour-force-australia-detailed/latest-release/.
11. See https://www.ons.gov.uk/economy/inflationandpriceindices/articles/introducingalternativedatasourcesintoconsumerpricestatistics/april2022/.
12. See https://www.gov.scot/publications/building-new-scotland-stronger-economy-independence-summary/.
13. See https://www.gov.ie/en/press-release/2e705-government-approves-hse-health-regions-implementation-plan/.
14. See https://uk-air.defra.gov.uk/data/pcm-data/.
15. See https://www.ons.gov.uk/economy/grossvaluaddedgva/datasets/uksmallareagvaestimates/.
16. See https://www.ons.gov.uk/economy/inflationandpriceindices/articles/introducingalternativedatasourcesintoconsumerpricestatistics/april2022/; and https://osr.statisticsauthority.gov.uk/wp-content/uploads/2019/08/20190819-Tourism-Ministers-to-Sir-David-Norgrove.pdf/.
17. Importantly, we do not seek to evaluate the policies themselves.
18. See https://rosap.ntl.bts.gov/view/dot/72943/.
19. See https://www.infrastructure.gov.au/sites/default/files/documents/appendix_c_gap_analysis_report_final.pdf/.
20. Variables and weights remained unchanged in LUF Round 2, but some changes were made to how variables were averaged.
21. Start times in 15-min increments from 07:15 to 09:15 hours were considered to ensure start times did not influence results.
22. See https://datasciencecampus.ons.gov.uk/comparing-international-transport-performance-in-urban-centres-upcoming-work/.
23. See https://publications.gc.ca/collections/collection_2017/statcan/CS68-0003-1997-eng.pdf/.
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ORCID

James Black http://orcid.org/0000-0002-7796-0910
Kevin Connolly http://orcid.org/0000-0003-2333-2211
Sharada Nia Davidson http://orcid.org/0000-0001-6964-3627
Mairi Spowage http://orcid.org/0000-0002-5973-5760

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