UK2070 Commission *Go Local:* The socio-economic landscape of combined and local authority areas in England

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Spatial Policy & Analysis Lab, Manchester Urban Institute, University of Manchester

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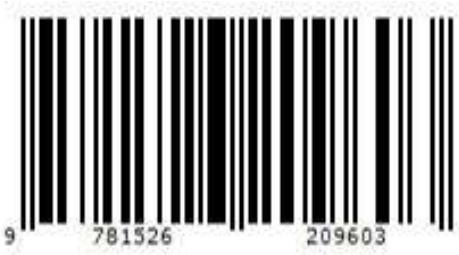

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FOREWORD

The level of inequality in social conditions and economic performance across the UK is not only unacceptable but is also avoidable. It has been tolerated for too-long. With the changing global economic competitiveness of the UK, these inequalities are no longer just a cost on the economy but now have become a brake on it.

It is imperative that the current policy aspirations in the Levelling Up White Paper do not end up as the latest in the long line of well-intended but failed attempts to rebalance the UK economy.

This report, *UK2070 Commission Go Local*, is a timely reminder that the problems are structural but highly differentiated from one part of the country to another. It confirms the UK2070 Commission's findings that the UK requires large scale, comprehensive and long-term action that is not only delivered locally but is framed locally.

This report also deepens our understanding on the scale and depth of the problem of spatial inequality in the UK. It challenges the simplistic assumption about the relationship of economic growth and productivity. It illustrates the potential for new clusters of economic growth outside the 'Golden Triangle' of Oxford-London-Cambridge. It explores the relationship of urban form, connectivity and labour markets and highlights the link between economically successful places and the livelihood and wellbeing of local residents.

Most importantly, it reinforces the value of devolving power and resources. As demonstrated in the UK2070 report '*Go Big: Go Local',* the UK is the most centralised major developed economy. This extreme centralisation inhibits national economic growth and productivity and erodes the capacity for local action and for innovation and flexibility.

The sheer variations in local circumstances mean that formulaic national policies are inappropriate - a *one-size-fits-all* policy does not work. Building of local capacity through further devolution of power and resources and a levelling-up access to funds is needed which allows places to progress through different levels of devolution according to local ambition.

I therefore welcome this research report by Professor Wong and Dr. Zheng of Manchester University, which makes a valuable contribution to our knowledge base for promoting and implementing the shared goals for a fairer and stronger nation.

Lord Bob Kerslake
Chair, UK2070 Commission

Labelled "the productivity puzzle", the UK's decline in productivity since the 2008-2009 Global Financial Crisis has been called the "defining economic question of our age"1

Samiri & Millard, 2022

INTRODUCTION

The debate over the so called 'productivity puzzle' of the UK relates to significantly lower level of productivity growth after its sharp fall at the peak of the global financial crisis in 2008 and 2009 when compared to other advanced economies. Based on ONS' latest 2021 international comparisons of productivity, UK's output per hour worked growth was the second slowest among the G7 countries and the UK's output per hour worked was lower than France, Germany and the United States[2]. Against this national context, the disparities between productivity increases around the London region and stalled or decreasing productivity in some of the northern regions have been particularly apparent over the last two decades. Since productivity is inextricably linked to living standards and consumption, as well as health outcomes and hence this gap is concerning. These gaps and differences are acknowledged in the Levelling Up White Paper and various explanations for the regional and intra-regional productivity gaps have been put forward[3], along with many proposals for narrowing the gaps.

The UK2070 Commission set out a 10-Point Plan to tackle the deep-rooted regional/spatial inequalities in the UK by rectifying unjust social conditions and re-balancing economic performance across the country. Since the publication of the Plan, the entrenched unequal spatial landscape of development has been exacerbated by the differential spatial impact brought by COVID-19 and more recently, the energy and inflation crises.

Devolution of power and collaboration across council boundaries are key recommendations of the Commission to allow more effective and better targeted policy and action. It is essential that there is now a regionally and locally based conversation, as well as the on-going national conversations about delivery of this agenda. Devolution deals have transferred various power and budgets from central government to the ten combined authorities in England and they are central to the implementation of the action required.

This report, through GIS mapping and statistical analysis, aims to provide a better understanding of the emerging spatial landscape of productivity and employment change and to examine whether the spatial patterns are related to different labour market conditions and infrastructure provisions across England. The analysis will lay bare the spatial patterns of different socio-economic conditions and challenges faced by different authorities, as well as highlighting opportunities for more creative spatial thinking to exploit synergies across different places within and beyond local and combined authority boundaries.

It is important to acknowledge that the report does not set out to provide a comprehensive account of the underlying reasons for differential local economic performance. The purpose is, however, to provide a useful snapshot through consistently mapping out different indicators to open debate on the uneven spatial development across different parts of England. The analysis will pay specific attention to the ten combined authority areas, given that most levelling up debates and devolution deals are focused on these areas. This does not only help to promote dialogues between national government and regional and local actors, but also informs the 'Go Local' agenda of the UK2070 Commission to achieve its 10-Point Action Plan.

[1] https://www.niesr.ac.uk/blog/geography-skills-and-productivity

[2] Note: Japan was excluded from the analysis due to a lack of data, see https://www.ons.gov.uk/economy/economicoutputandproductivity/productivitymeasures/bulletins/internationalcomparisonsofproductivityfinalestimates/2021

[3] https://www.bankofengland.co.uk/-/media/boe/files/speech/2018/the-fall-in-productivity-growth-causes-and-implications

PRODUCTIVITY ANALYSIS

There are different measures of productivity, however, most studies have focused on analysing labour productivity, that is, Gross Value Added (GVA) per hours worked. Commentators also focus on analysing national and regional trends, but rarely on local spatial patterns. This is partly due to the challenge to access reliable and updated data at the sub-regional level. The trend and the spatial pattern of GVA per hour worked are analysed in this section, with attention paid to the combined authority (CA) areas and the Greater London Authority (GLA) area is used as a contextual comparison, with the purpose of illustrating the disparities of economic performance and changes across England.

Trend analysis of GVA per hour worked

The long-term labour productivity trends in Figure 1 show that there has been a persistent spatial divide between the GLA area and the CA areas in terms of GVA per hour worked, as well as a north-south divide with the West of England and Cambridgeshire & Peterborough CAs out-performing the other CA areas. The impact of COVID-19 is particularly notable, as the GVA levels have declined across the board between 2019 and 2020.

Before the COVID-19 pandemic in 2019, the rate of GVA per hour worked in the GLA area was £49.63, followed by West of England's £36.68 and Cambridgeshire & Peterborough's £34.25 (see Table 1). It is, however, interesting to note that Greater Manchester has been catching up since 2015, reaching £33.22 in 2019; which represented an increase of 14.69% in real terms during 2004-2019, out-performing GLA area's 9.41% growth. North of Tyne was another strong performing area with an increase of 10.57%. Despite having the third highest level of GVA per hour worked, the long-term performance in Cambridgeshire & Peterborough was most sluggish at 1.71%; followed by Liverpool City Region's 1.84%. South Yorkshire was the only CA area with GVA per hour below the £30 mark in 2019. GLA area has been holding strong, both in terms of its GVA per hour level and its growth rate.

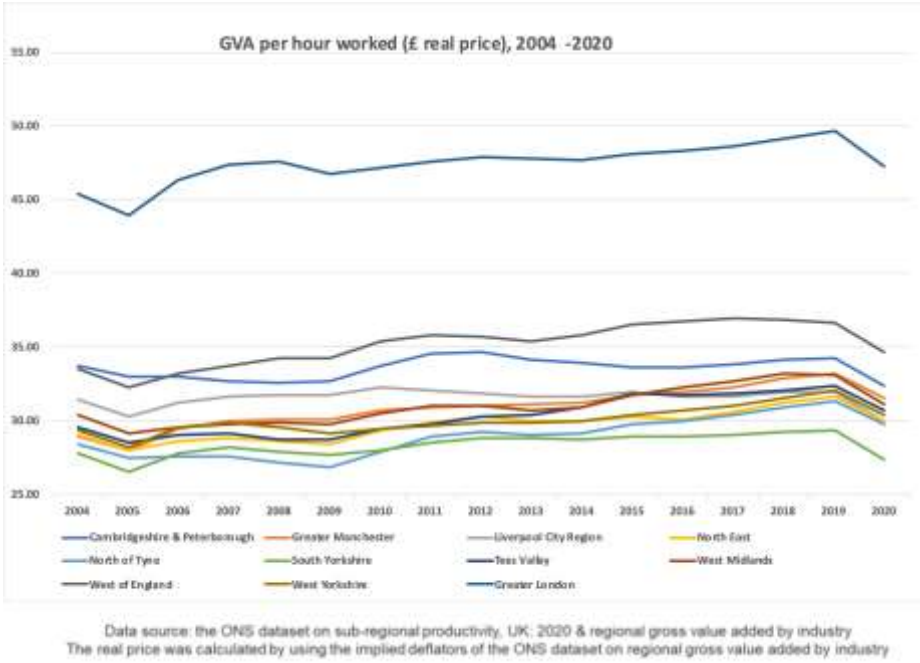

Figure 1 GVA per hour worked (£) in real price, 2004-2020

When analysing the more recent trend between 2015 and 2019 (see Table 1), five CA areas enjoyed growth in labour productivity for over 4.4% in real terms (West Yorkshire, North of Tyne, Greater Manchester, North East, and West Midlands), which outperformed Greater London's 3.19% increase. The impact brought by COVID-19 on labour productivity has been detrimental to all areas: ranging from -4.79% in Greater London to -6.93% in South Yorkshire. Indeed, the situation was particularly challenging in South Yorkshire, Liverpool City Region and Cambridgeshire & Peterborough CA areas, as their GVA per hour rate in 2020 was even lower than that in 2004 in real terms.

Table 1 GVA per hour worked and compound GVA annual growth rate

	GVA per Hour Worked (in real price)						
	2004 (£)	2015 (£)	2019 (£)	2020 (£)	2004-19 (%)	2015-19 (%)	2019-20 (%)
Cambridgeshire & Peterborough	33.67	33.59	34.25	32.31	1.71	1.96	-5.66
Greater Manchester	28.96	31.74	33.22	31.49	14.69	4.66	-5.20
Liverpool City Region	31.37	31.94	31.95	29.91	1.84	0.04	-6.39
North East	28.99	30.25	31.66	29.93	9.22	4.65	-5.48
North of Tyne	28.36	29.80	31.36	29.70	10.57	5.24	-5.28
South Yorkshire	27.72	28.91	29.36	27.33	5.90	1.56	-6.93
Tees Valley	29.52	31.86	32.39	30.70	9.72	1.68	-5.23
West Midlands	30.35	31.69	33.11	31.06	9.09	4.47	-6.19
West of England	33.49	36.51	36.68	34.71	9.53	0.47	-5.38
West Yorkshire	29.38	30.34	32.00	30.33	8.92	5.47	-5.21
Greater London	45.36	48.10	49.63	47.25	9.41	3.19	-4.79

Spatial analysis of GVA per hour worked

There were major spatial variations in productivity levels across different local authority districts (LADs) in 2020, as illustrated by the GVA per hour worked index (UK=100) in Figure 2. Many LADs in the CA areas had performance below the UK level, though with some pockets performing above the UK average. Better performing LADs included South Gloucestershire (129.97) in West of England; Solihull (122.73) in West Midlands; Salford (101.73) and Trafford (100.97) in Greater Manchester; and Stockton-on-Tees (101.68) in Tees Valley. There are different reasons that underpin their performance, but probably related to the industries and business activities in these areas such as the aerospace industry in South Gloucestershire, the car industry in Solihull (Land Rover) and Sunderland (Nissan), as well as chemical industry in Stockton-on-Tees. This will be further explored later in the report.

The GLA area has performed very well because many of its LADs had index value above the UK average, with City of London (185.77), Tower Hamlets (179.17), Westminster (153.91) and Hounslow (163.73) occupying the top ten positions in England. Other best performing areas included LADs in the Home Counties, serving as the commuter belt to London. Indeed, the best performing areas were Rushmoor (196), Elmbridge (182.27), Runnymede (172.31), Three Rivers (160.92) and Slough (159.93). Outside the South East, the best performing LAD was South Derbyshire (155.7) where major companies such as Toyota and Rolls-Royce located.

The recent trend of labour productivity change (in real price) for LADs between 2015 and 2019 is mapped in Figure 3, which shows wide variations ranging from 70.51% increase in Rushmoor to a 19.22% drop in Reigate & Banstead. It is also important to note that many LADs in both shire and metropolitan areas were performing well. All LADs in the North East, West Yorkshire and Greater Manchester CA areas had shown positive growth. It is also notable that relatively strong improvement was found in North Yorkshire.

Some LADs in the CA areas had growth level above the England average of 4.26%, they included: North Tyneside (16.26%) and Newcastle upon Tyne (8.16%) in North of Tyne; Gateshead (6.06%) in the North East; Hartlepool (9.40%) and Darlington (13.09%) in Tees Valley; Calderdale (18.33%), Wakefield (9.24%) and Kirklees (9.23%) in West Yorkshire; Doncaster (12.44%) and Rotherham (11.02%) in South Yorkshire; Trafford (6.17%), Oldham (6.40%) and Manchester (4.96%) in Greater Manchester; Sefton (6.75%) in Liverpool City Region; Sandwell (16.02%), Birmingham (5.91%) and Wolverhampton (4.74%) in West Midlands; Peterborough (9.41%) and Huntingdonshire (6.79%) in Cambridgeshire & Peterborough. However, the picture was a mixed one, especially as some economically buoyant LADs such as South Cambridgeshire (-3.81%), Cambridge (-1.85%) and Solihull (-2.41%) had already experienced negative growth even before the strike of the pandemic.

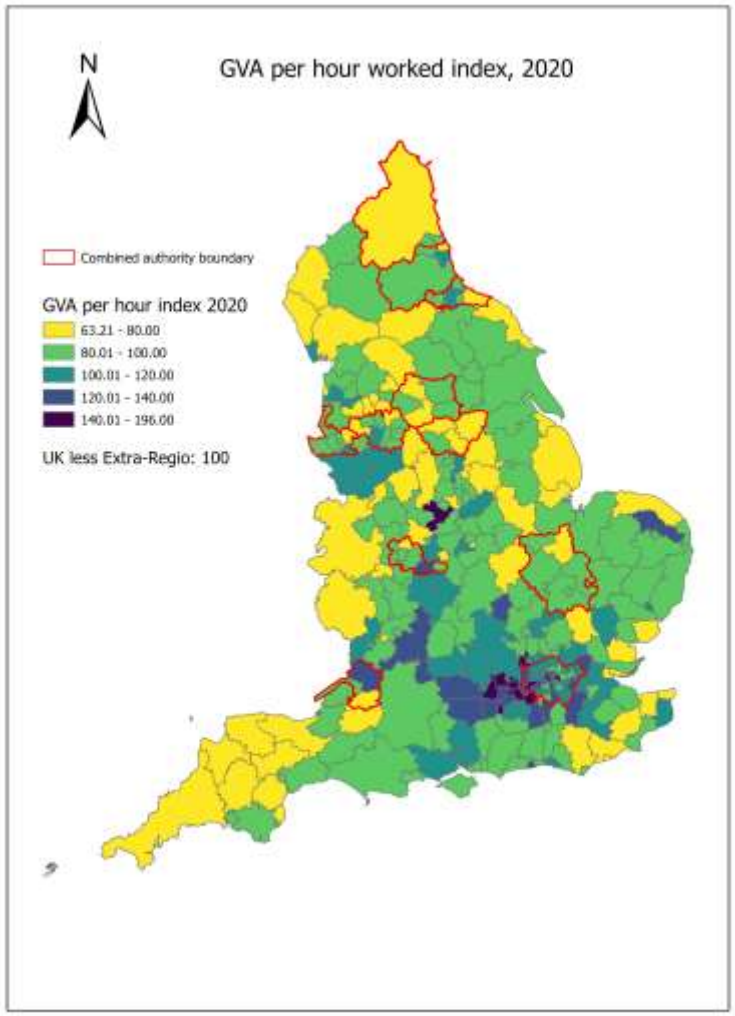

Figure 2 GVA per hour worked index, 2020

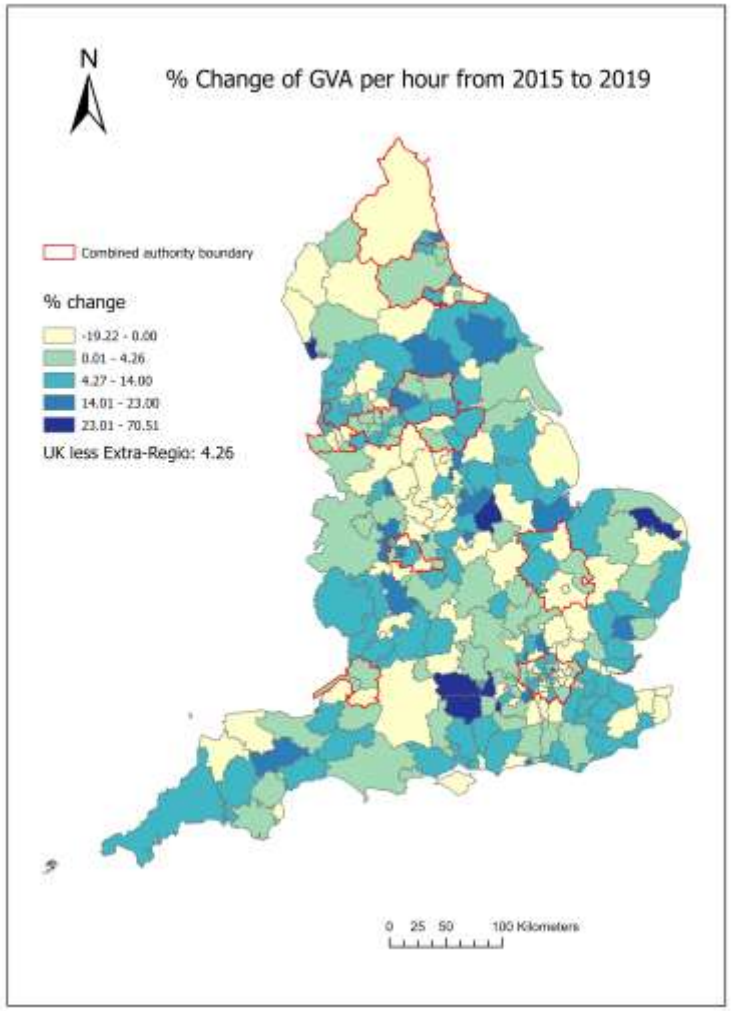

Figure 3 Change in GVA per hour worked, 2015-2019

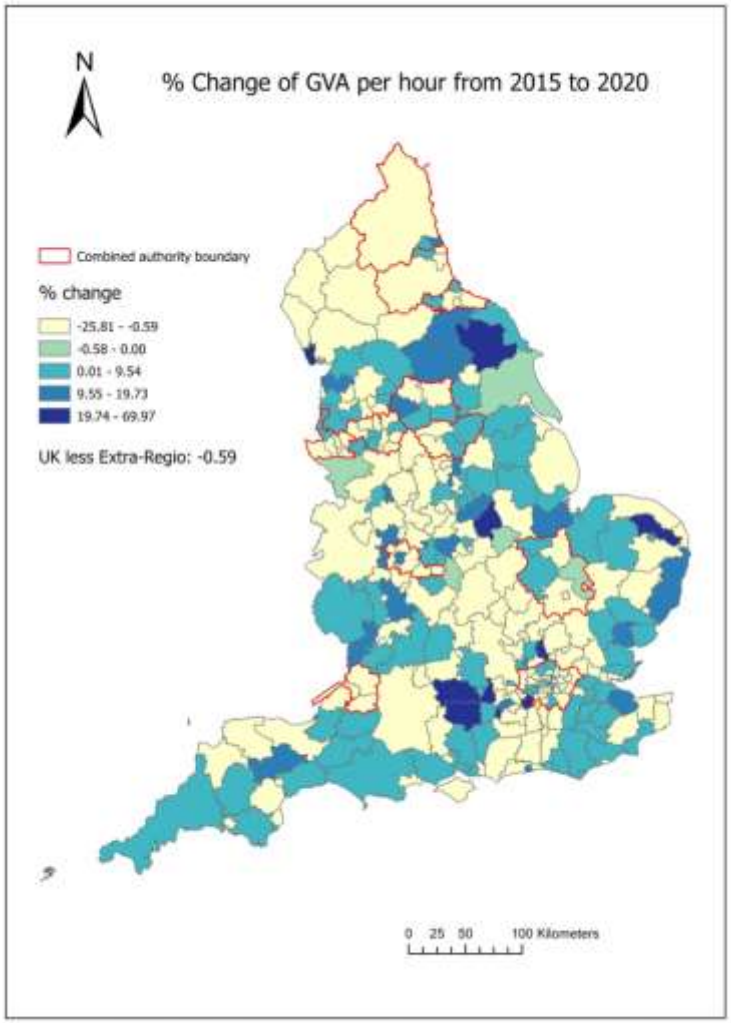

Figure 4 Change in GVA per hour worked, 2015-2020

The performance of LADs in the GLA area between 2015 and 2019 was also a mixed picture, with the fastest growth rates found in Hackney (14.71%), Croydon (9.56%), Westminster (8.6%), Hounslow (8.22%), Enfield (7.6%), Camden (7.5%) and Richmond upon Thames (7.23%). Some LADs suffered from negative growth such as Barking & Dagenham (-6.62%); Kensington & Chelsea (-10.64%), Tower Hamlets (-6.70%), Brent (-6.39%), Wandsworth (-4.71%) and Merton (-3.76%). It is interesting to note that even City of London had a negative rate of -0.72%.

The latest published GVA per hour worked data for LADs is for 2020 when economic performance was badly affected by COVID-19 and Figure 4 shows the growth rate between 2015 and 2020. Only 6 shire LADs in England - Wokingham, Hart, Welwyn Hatfield, Gravesham, Richmondshire and Forest of Dean - showed resilience to the impact of COVID-19 as they still had very low level of growth between 2019 and 2020. The data for all other LADs in England recorded decline rather than any growth at all. When comparing Figures 3 and 4, we can see that COVID-19 has dampened the growth rate of GVA per hour worked across England.

To find out whether COVID-19 brought differential spatial impact on productivity, statistical analysis of the relationship between the 2019 and the 2020 data series for GVA per hour worked (R=0.996***) as well as the relationship between the two sets of growth rates (R=0.982***) was carried out. The very high correlation coefficients suggest that the impact of COVID-19 was spreading across England with very small local differentials. Further discussion on the statistical relationship between different GVA measures will be examined later in the report.

The spatial landscape of GVA growth

Another way to examine changing economic performance is to look at the overall size of local GVA and the associated annual growth rate since the recovery from the global financial crisis. To establish the impact of the COVID-

19 pandemic, the annual growth rate was calculated for the periods of 2015-2019 and 2015-2020 in Table 2.

Table 2 Compound annual GVA growth rate

	2015-2019	2015-2020
Cambridgeshire & Peterborough	2.14%	0.03%
Greater Manchester	3.16%	0.54%
Liverpool City Region	1.16%	-1.14%
North East	0.76%	-1.68%
North of Tyne	2.08%	-0.41%
South Yorkshire	1.68%	-0.71%
Tees Valley	0.55%	-1.61%
West Midlands	1.79%	-0.84%
West of England	2.06%	-0.07%
West Yorkshire	2.12%	-0.31%
Greater London	2.54%	0.11%

The compound annual GVA growth rates up to 2019 show that, though starting on a much lower basis, the Greater Manchester CA area had the highest annual growth rate at 3.2%, which outpaced the GLA area's 2.5%. This could be due to a major boost of population and economic activities, including the devolution deals and major transport and infrastructure projects. When including the 2020 figures, the impact brought by COVID-19 is obvious as the annual growth rate turned from positive to negative for most areas, except for Greater Manchester and Cambridgeshire & Peterborough CA and the GLA areas.

The variations in the compound annual GVA growth rate for LADs are mapped in Figures 5 and 6 for 2015-2019 and 2015-2020 respectively. The annual GVA growth rate for England was 2.02% during the 2015-2019 period, with major variations across its LADs ranging from -5.47% in Reigate & Banstead to +16.68% in Rushmoor. LADs with the highest annual growth rate were in shire areas: Rushmoor (16.68%), Basingstoke and Deane (12.45%), Welwyn Hatfield (10.87%), Broadland (8.07%) and Wokingham (7.63%).

Of the CA areas, Manchester LAD had the highest annual growth rate of 5.42%, followed by Solihull (4.73%), North Tyneside (4.41%) and Doncaster (4.0%). It is notable that many LADs in CA areas were performing above the England average level. In Greater London, the best performer was Hackney (7.09%), followed by City of London (5.14%), Southwark (4.36%) and Westminster (4.08%).

By examining GVA change during the 2015-2020 period, the impact brought by COVID-19 was manifested by the negative compound annual GVA growth rate of many LADs, with England's average at -0.43%. When comparing the two sets of figures in Table 2, the impact of COVID-19 on all areas was at least -2.1% point difference; with the largest impact found in West Midlands (-2.64% point) and Greater Manchester (-2.63% point). The high correlation between the two sets of compound annual GVA growth rates (*R=0.892****), suggests a wide spatial spread of impact brought by COVID-19 with small local differentials.

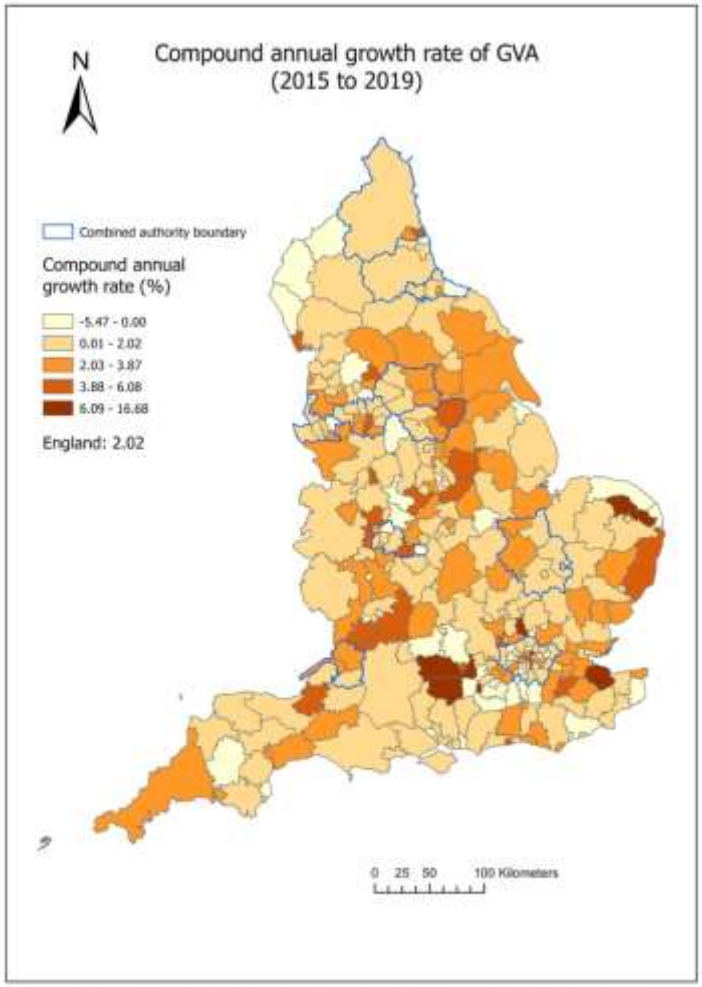

Figure 5 Compound annual GVA growth rate, 2015-2019

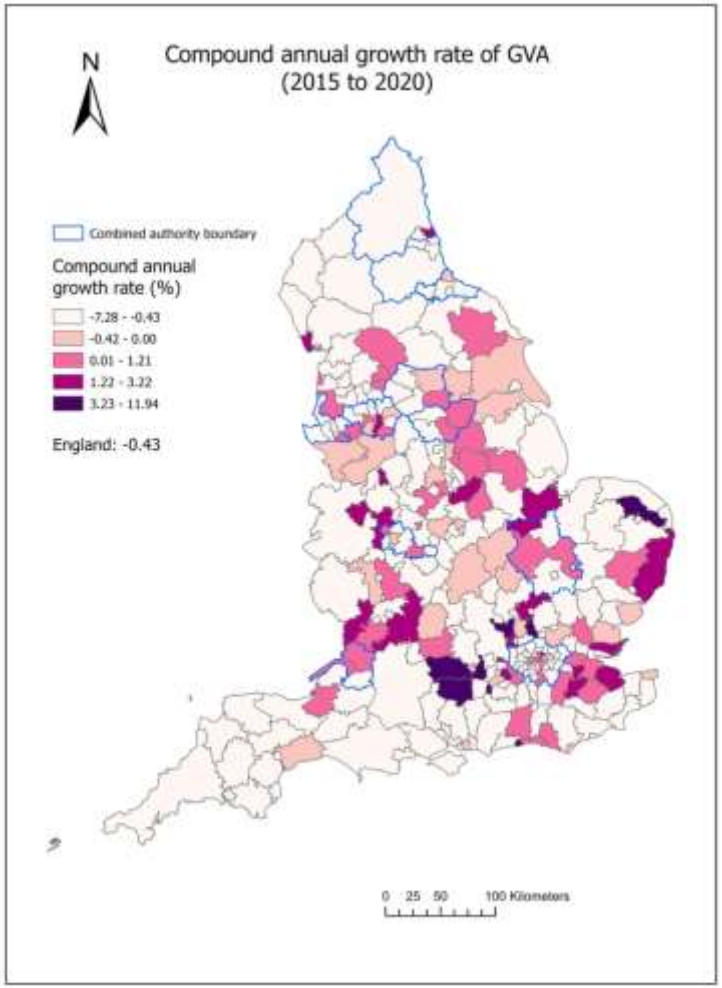

Figure 6 Compound annual GVA growth rate, 2015-2020

EMPLOYMENT CHANGE

The recovery from the global financial crisis since 2015 has been mixed in terms of employment growth across the CA areas, ranging from 0.24% in Tees Valley to 12.94% in Greater Manchester (see Table 3). While West of England (12%) and Cambridgeshire & Peterborough (9.09%) both exhibited high level of growth, there was a high performing Mersey Belt with both Greater Manchester and Liverpool City Region (11.04%) CA areas having over 10% employment growth.

Industrial mix vs place competitiveness

Shift-share analysis [4] was performed to breakdown the components of employment change by analysing the 99 two-digit Standard Industrial Classification sub-sectors for the CA and GLA areas. The analysis aims to find out: to what extent local employment change could be attributed to an area's industrial mix, based on the national growth rate of each industrial sector; and, to what extent employment change was related to differential place competitiveness conditions where local growth could neither be explained by the national trend of industrial change nor the overall economic climate?

Variations in employment change during the period of 2015-2021 were mainly related to differential place competitiveness conditions rather than local industrial mixes (see Table 4). After decades of industrial restructuring, the impact of industrial mix on employment change was found to be relatively small, ranging from -0.98% to +1.15%. Greater London's growth however gained advantage from its more positive industrial mix by 1.15%, though fared less well on its place competitiveness share (+0.86%) when compared with other better performing CA areas. It is important to note that the relatively high levels of employment growth witnessed in Greater Manchester (7.67%) and Liverpool City Region (5.48%) were largely attributed to their improved place competitiveness advantages. The West of England CA area, nonetheless, enjoyed growth from both its favourable industrial mix (+0.88%) as well as place competitiveness condition (+5.93%). Both the North East (-3.32%) and Tees Valley (-5.07%) CA areas had less than 1% growth in employment, which was mainly due to their less favourable local competitiveness conditions.

Table 3 Shift-share analysis of employment change, 2015-2021

	Actual Growth Rate (%)	National Growth Rate (%)	Industrial Mix Share (%)	Place Competitiveness Share (%)
Cambridgeshire and Peterborough	9.09	5.19	0.12	3.78
Greater Manchester	12.94	5.19	0.08	7.67
Liverpool City Region	11.04	5.19	0.37	5.48
North East	0.89	5.19	-0.98	-3.32
North of Tyne	5.52	5.19	-0.10	0.43
South Yorkshire	4.53	5.19	-0.14	-0.52
Tees Valley	0.24	5.19	0.11	-5.07
West Midlands	5.98	5.19	-0.16	0.95
West of England	12.00	5.19	0.88	5.93
West Yorkshire	4.94	5.19	-0.31	0.07
Greater London	7.20	5.19	1.15	0.86

Major spatial variations were also found when performing shift-share analysis on employment change for LAD areas. Indeed, industrial mix only explained 1.3% (*R=0.114**) [5] of the employment change at LAD level, with place competitiveness condition accounting for the lion's share of 98.2% (*R=0.991****) of employment change between 2015 and 2021. Employment share by local industrial mix varied from +3.79% in City of London to -3.29% in East Lindsey (see Figure 7). LADs in Greater London tended to have a more

[4] Detailed explanations and illustrative examples can be found in, for example, https://kb.economicmodelling.co.uk/all-about-shift-share/

[5] R is Pearson Correlation to show the relationship, range from 0 to 1, * significance level at <0.05; *** <0.001

favourable industrial mix than the CA areas. Within the CA areas, the better performing LADs included South Cambridgeshire (+1.47%), Manchester (+1.27%), Solihull (+1.24%), Bristol (+1.18%) and Cambridge (+1.16%). South Cambridgeshire, top of the CA area league, is the centre of excellence in high tech research and manufacturing and home of the Cambridge Science Park.

Place competitiveness condition was found accountable for over 98% of employment change at LAD level. The high level of employment growth in Greater Manchester CA area (see Figure 8) was because 8 out of its 10 LADs (except Oldham and Wigan) benefitted from high level of place competitiveness improvement: Salford (15.99%), Manchester (12.12%), Stockport (9.72%), Bolton (9.47%) and Trafford (7.15%). Likewise, the strong competitiveness in Liverpool City Region was reflected in its LAD level (except Wirral), especially Knowsley (10.44%), Liverpool (9.82%) and Halton (5.61%). The two North West CA areas, together with the strong performance from Warrington LAD (9.96%), exhibited improved sub-regional strength along the Mersey Belt. Place competitiveness condition was also very strong in Solihull (19.97%) within the West Midlands CA area. All LADs in the Cambridgeshire & Peterborough and West of England CA areas also had favourable local conditions.

The picture was more mixed in Greater London, though some LADs such as Hackney (23.83%), Newham (20.84%) and City of London (20%) exhibited favourable local conditions of growth. The two places with the largest improvement in place competitive advantage were Dacorum (76.95%) and Welwyn Hatfield (20.45%) in Hertfordshire where they enjoy good transport links to London and being the home of Information and communication as well as professional, scientific and technical employment (see Figure 9).

It is important to note that shift-share analysis only performs an accounting procedure for employment change. Since local competitiveness condition is the residual value after discounting for employment change in relation to the national economic situation and the local industrial mix, it is very difficult to work out what constitutes local competitive condition in different local areas.

Employment trajectories of different industrial sectors

Figure 9 maps data for employment, employed and self-employed, in the manufacturing, information & communication (IC) and professional, scientific & technical (PST) sectors from the Business Register and Employment Survey. The total number of persons employed in manufacturing was just over 2 million in 2021 in England, which was lower than the employment in the PST sector's 2.55 million, but higher than the 1.24 million jobs in the IC sector. Manufacturing was widely dispersed over different LADs in England and even the largest share was only 1.6% in Birmingham, which was closely followed by Leeds (1.5%), Kirklees (1.5%) and Bradford (1.3%).

The spatial distribution of the IC and PST sectors had a cliff edge around central London; with Westminster and the City of London taking 11.19% of England's total share of IC jobs and 11.12% of all PST employment. Other strong performing LAD areas in the IC sector included Camden, Islington, Leeds, Tower Hamlets, Southwark, Birmingham, Hounslow, Hammersmith & Fulham, and Manchester (over 1.5%). LADs with large shares of PST employment were Camden, Southwark, Manchester, Islington, Birmingham, Tower Hamlets, and Leeds (2% and above). As shown in Figure 9 many areas, particularly in and around Greater London and along the M4 corridor, showed an above England level of employment in these two sectors.

Since new technologies, including Internet of Things, cloud computing and data analytics, and AI and machine learning are increasingly integrated into the production facilities and operations of manufacturing industries, there is closer partnership and integration between manufacturing industry and service platforms. Figure 9 highlights areas with the largest share of employment in manufacturing, IC and PST sectors. Within the CA areas, LADs with above England mean values in all three sectors included: Leeds and Bradford in West Yorkshire; Birmingham, Solihull and Coventry in West Midlands; Manchester,

Trafford and Salford in Greater Manchester; Sheffield in South Yorkshire; Liverpool in Liverpool City Region; South Cambridgeshire in Cambridgeshire & Peterborough; South Gloucestershire and Bristol in West of England. Westminster, Ealing and Hillingdon in Greater London also had values above the England average.

However, it is important to point out that some of the very strong performing areas on these three sectors were found in the nearby shire areas beyond major metropolitan areas. For instance, Cheshire next to Greater Manchester and Liverpool City Region, and Wiltshire to the east of the West of England CA area; and West Northamptonshire and Buckinghamshire with easy transport access to Greater London. This prompts the need to consider the spatial relationship of different places beyond the metropolitan and combined authority areas.

Another important fast growing industrial sector is life science. Figure 10 shows the broad locational distribution of the 3,820 life science companies in England, with the large majority (68%) of them clustering around the so-called golden triangle around London, Cambridge and Oxford. Although life science companies were found distributed across different parts of England, there was a clear north-south divide along the Severn-Wash line. When examining the data at LAD level (see Figure 14), Westminster alone took 9.55% of England's total, followed by South Cambridgeshire (5.86%), Camden (5.73%), Oxford (4.69%), City of London (4.14%), Cambridge (4.01%), Vale of White Horse (3.12%), Islington (2.33%), Buckinghamshire (2.17%), Manchester (1.60%) and Cheshire East (1.57%).

Other than South Cambridgeshire, Cambridge and Manchester, other LADs in CA areas performing well included Birmingham (1.13%), Leeds (0.99%), Bristol (0.97%), Sheffield (0.81%) and Newcastle upon Tyne (0.71%); which shows the importance of city locations for life sciences companies as many of these cities also host the country's research-intensive universities (see Figure 12).

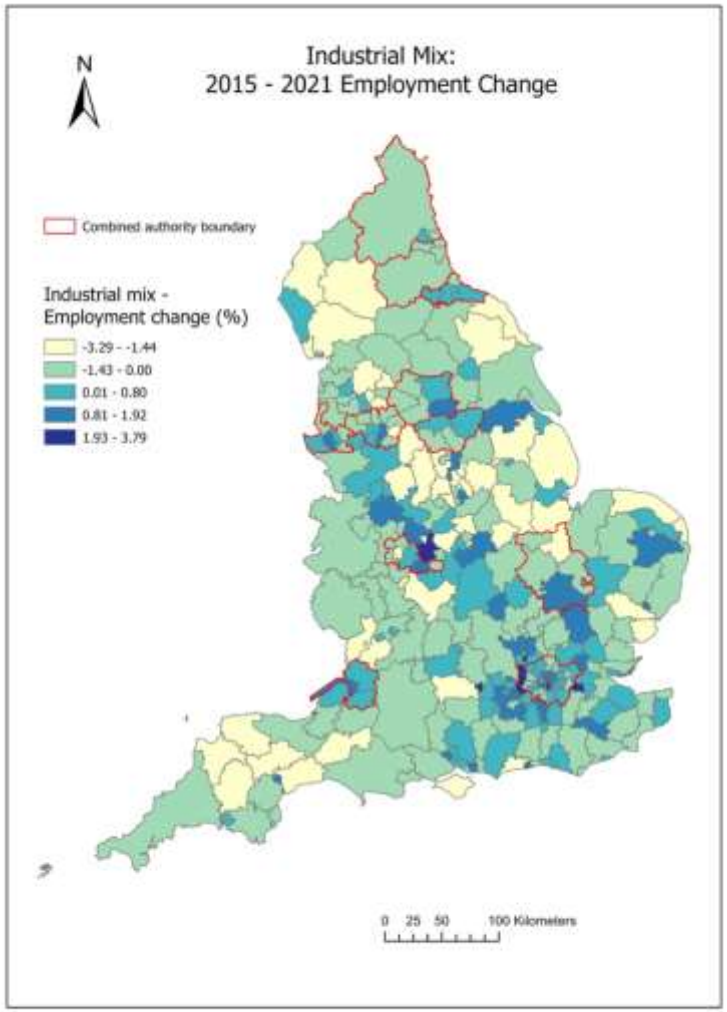

Figure 7 Industrial mix share of employment change, 2015-2021

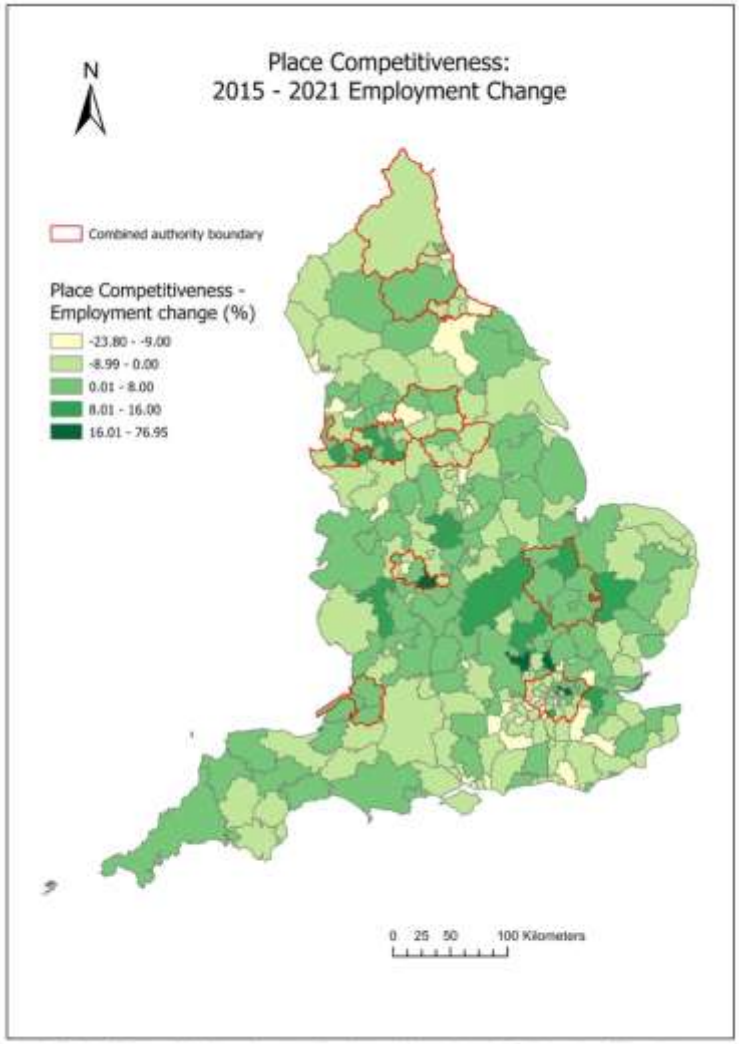

Figure 8 Place competitiveness share of employment change, 2015-2021

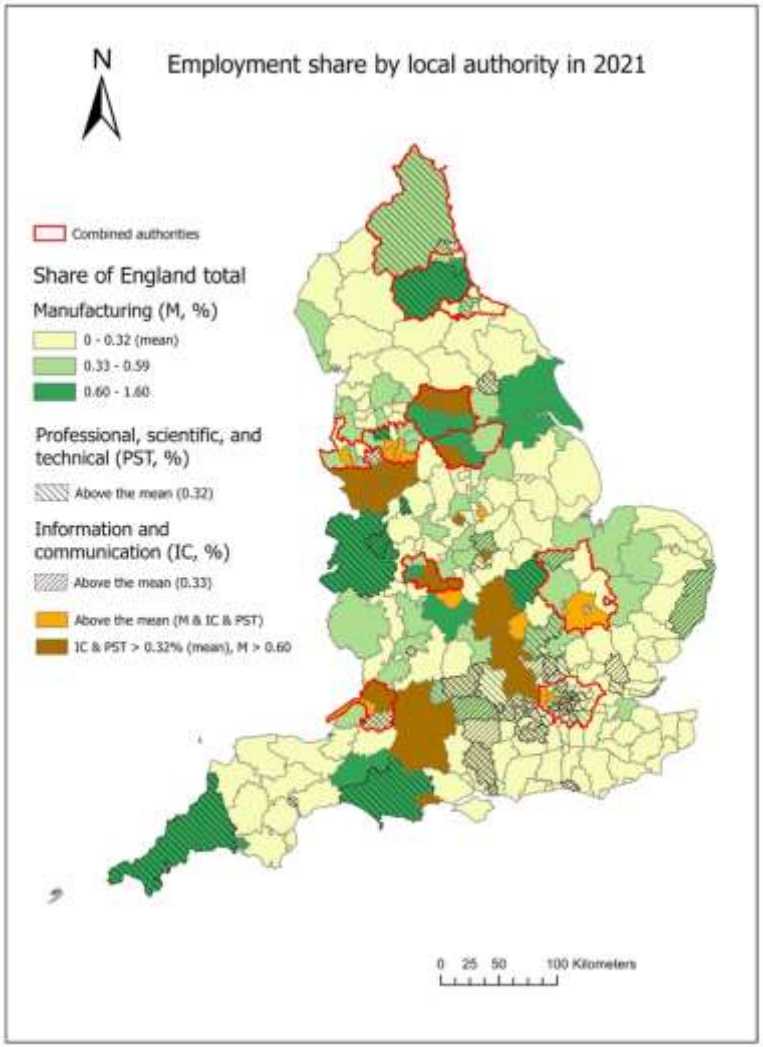

Figure 9 Key industrial sector employment share, 2021

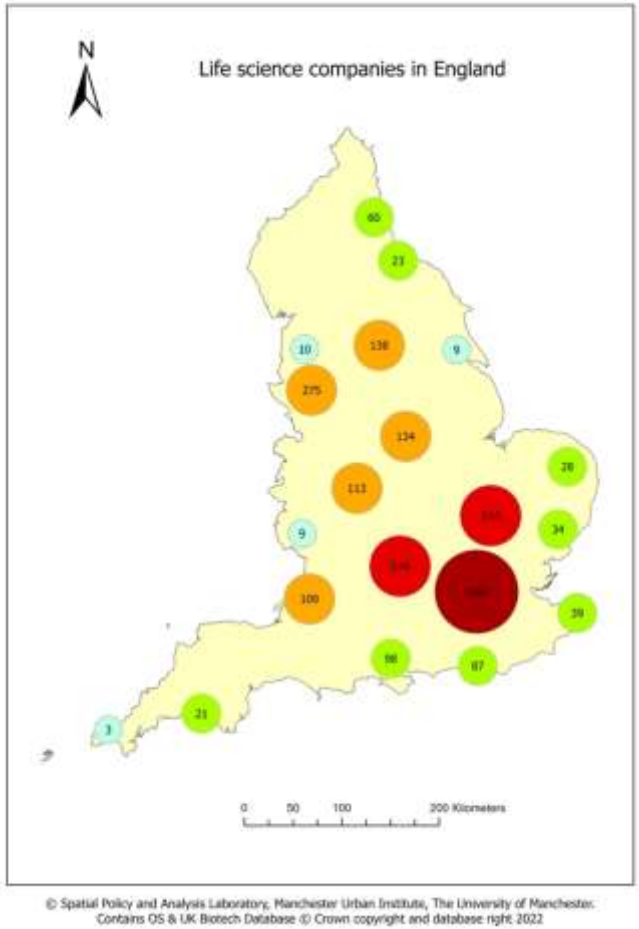

Figure 10 Distribution of life science companies, 2021

DRIVERS OF PLACE COMPETITIVENESS CONDITIONS

Given that the highly centralised economy with differential regional economic performance is identified as the key factor that plays a part in the UK's productivity puzzle, it is important to understand the differential economic performance conditions and drivers in the country that might affect this.

Research & development expenditure and research capacity

The unusually long tail of 'unproductive' companies with poor management practices that are slow to adopt new technology'[6] was seen as the culprit of the productivity puzzle by Andy Haldane, the Bank of England's chief economist. This links to the widely held argument that a chronic lack of R&D expenditure has resulted in UK's low R&D intensity and slow productivity growth[7]. Based on ONS's new methodology[8], the UK spent £61.8 billion on R&D in 2020, with 71% coming from the business sector, followed by the higher education sector's 22% and the government sector's 5%. While this total figure represented an increase from the previous years, it was indeed a decrease of £1.7billion from 2019 and £1.9 billion from the 2018 spends in real terms.

The latest 2019 regional gross domestic expenditure on R&D (GERD) data is mapped in Figure 11. There is a clear Severn-Wash divide, with over 60.87% of GERD concentrated in three regions: the South East took 22.06% of England's GERD share; 20.20% for the East of England; and 18.61% for London. At the other end of the spectrum, only 2.17% of England's GERD was spent in the North East region and the other five regions shared less than 37% of England's total expenditure.

[6] https://www.ft.com/content/f5e074ae-9734-11e8-b67b-b8205561c3fe
[7] https://www.businessinsider.com/uks-productivity-puzzle-and-the-lack-of-rd-spending-2016-12?r=US&IR=T
[8] the methodology used to produce estimates of R&D performed in the business and higher education sectors has been improved to better reflect all R&D activity in these sectors; values of total expenditure on R&D performed in the UK, by all sectors, in 2018 and 2019 are both £21.1 billion higher than previously published. https://www.ons.gov.uk/economy/governmentpublicsectorandtaxes/researchanddevelopmentexpenditure/bulletins/ukgrossdomesticexpenditureonresearchanddevelopment/2020

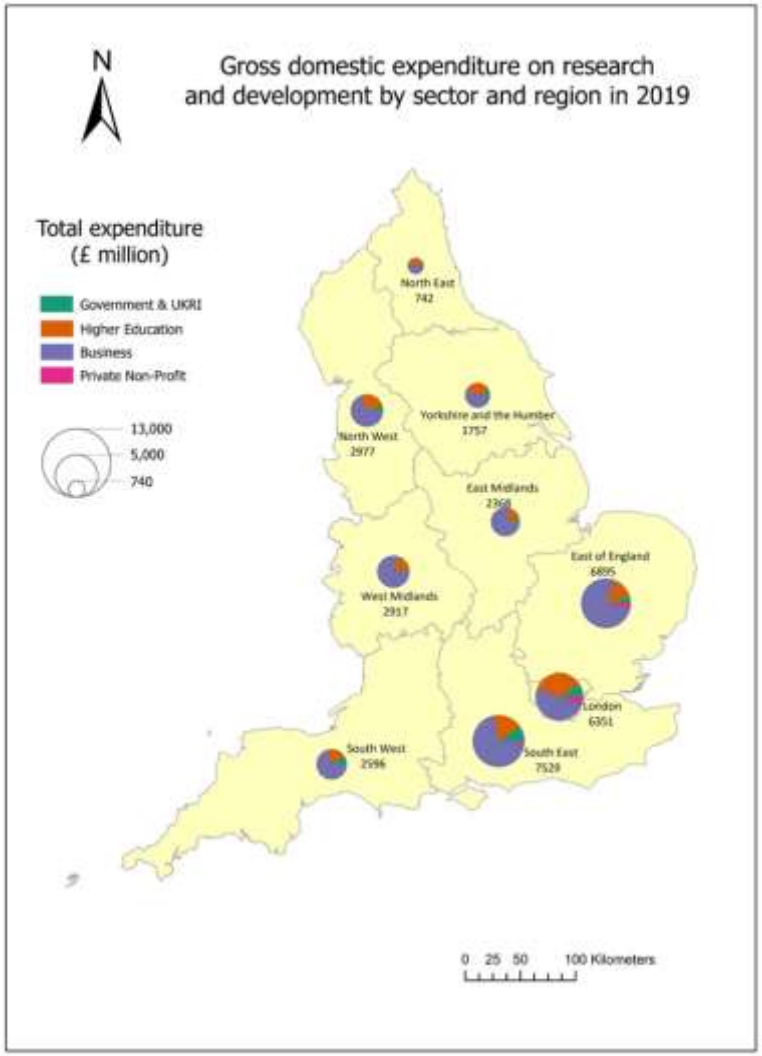

Figure 11 Gross domestic expenditure on R&D, 2019

It is also important to examine the sectoral share of GERD as they varied widely across different regions (see data in Table 4). Looking at the government sector (including UKRI) spend, nearly a quarter went to London, 30.45% to the South East, another 12.51% to East of England, and 11.19% to the South West; which disproportionately boosted these regions' total GERD. In contrast, the remaining 21.52% expenditure was shared by the 5 regions in the Midlands and Northern England where eight out of the ten CAs are located. It is important to note that the South East, London and East of England regions further enjoyed a large share of higher education R&D spend, taking 61.01% of the England total.

While 24.32% of government money went to London, only 13.61% of business sector investment followed. In other words, only about half of London's R&D spend came from the business sector, with 34.58% from the higher education sector and 9.31% from the government (see Figure 11). The opposite was true for both the East and West Midlands regions when over 80% of their GERD came from the business sector, but only 3.8% and 2.61% of their respective spend was from the government.

More nuanced spatial differentiation of GERD is shown in Figure 13 for ITL2 data. The three areas with the largest share of England's GERD spend in 2019 were East Anglia (12.05%), Berkshire, Buckinghamshire and Oxfordshire (11.94%) and Inner London-West (11.56%). Outside the south of England, the ITL2 areas with the largest shares of GERD were Derbyshire & Nottinghamshire (4.56%), Herefordshire, Worcestershire & Warwickshire (3.91%), West Midlands (3.73%), Cheshire (2.79%) and Greater Manchester (2.48%). The magnitude of the spatial divide of GERD has been persistent and stark.

The differential GERD spatial landscape has been exacerbated by the spatial biased GERD investment strategy of the government which has been much

criticised[9]. The government has since committed to increase its investment in R&D outside the Greater South East by at least 40% by 2030 in its Levelling Up White Paper[10] and it remains to be seen if this promise will be fulfilled.

Table 4 Gross domestic expenditure on R&D by sector, 2019

ENGLAND share (%)	Total	Government & UKRI	Higher Education	Business	Private Non-Profit
North East	2.17	2.06	3.38	1.75	3.8
North West	8.72	7.28	9.88	8.73	2.03
Yorkshire and The Humber	5.15	5.35	8.23	4.31	0.63
East Midlands	6.94	3.7	4.76	8.18	0.38
West Midlands	8.55	3.13	6.34	10.03	1.77
East of England	20.2	12.51	13.05	22.91	30.25
London	18.61	24.32	29.61	13.61	46.33
South East	22.06	30.45	18.35	22.67	12.91
South West	7.61	11.19	6.39	7.81	1.9
England	100	100	100	100	100

Besides the uneven landscape of GERD, the research capacity of UK universities is also heavily concentrated in the golden triangle (Figures 12 and 13). A Research Market Share Index[11] was developed by the Times Higher Education by taking the research quality profile and the staff numbers and applying the 'quality-related volume' score to the 2021 UK Research Excellence Framework (REF) results. In England, the major players are the University of London (with its different colleges) (14.76%), University of Oxford (5.75%), University of Cambridge (4.99%) and Imperial College (2.89%). Outside the golden triangle, the best performing universities are scattered over different parts of the country including the Universities of Manchester (3.44%), Bristol (2.49%), Nottingham (2.43%), Leeds (2.42%), Birmingham (2.28%) and Sheffield (2.26%).

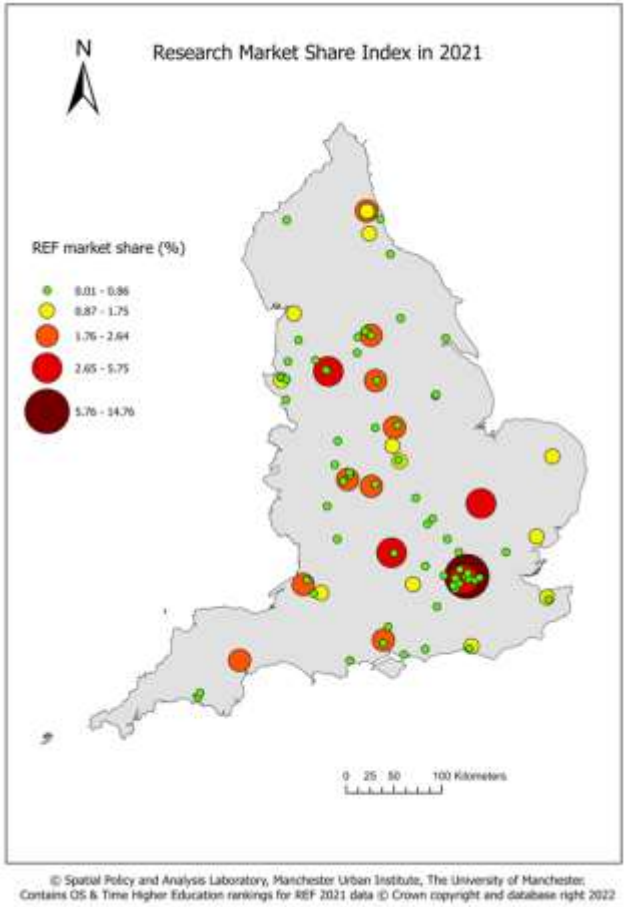

Figure 12 Research Market Share Index, 2021

[9] Forth, T. & Jones, R.A.L. (2020) The missing £4 billion: making R&D work for the whole UK. https://media.nesta.org.uk/documents/The_Missing_4_Billion_Making_RD_work_for_the_whole_UK_v4.pdf

[10] HM Government (2022) Levelling Up White Paper, 2022, p. 170

[11] https://www.timeshighereducation.com/news/ref-2021-times-higher-educations-table-methodology

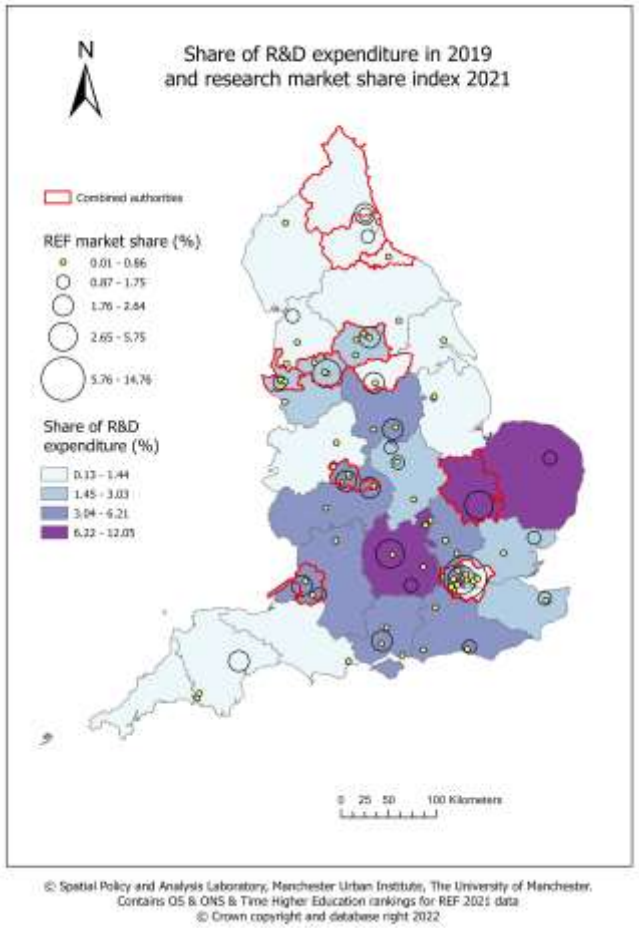

Figure 13 Share of R&D expenditure and Research Market Share Index

International studies[12] also show that many biotechnology companies are spin-out companies from universities and that such business-university alliances are therefore crucial for research capacity building and innovation. Figure 14 maps the relationship between the location of life science companies and the Research Market Share Index. It clearly shows the dominance of the business-university alliances in the golden triangle of London-Cambridge-Oxford. There is also a cluster around Manchester-Liverpool-Cheshire in North West England. It is interesting to note that a regional 'Science and Innovation Audit' for Greater Manchester and Cheshire East[13], rather than for the wider geography of the Mersey Belt and Cheshire, was carried out in 2016. It was one of five studies commissioned by the Department for Business, Energy & Industrial Strategy. This spatial pattern implies that there are opportunities to develop more creative partnerships between universities and life science companies by working across different administrative and institutional boundaries.

Infrastructure and Locational advantage

The interplay between physical location and the dynamics of infrastructure development, such as transport accessibility and communication networks has resulted in differential locational advantages and outcomes. The importance of understanding the place-based approach for infrastructure development has been recognised by the National Infrastructure Commission[14]:

> *The role that infrastructure can play in levelling up economic opportunities across towns and cities in English regions is one of three strategic themes shaping the Commission's work programme leading up to the second National Infrastructure Assessment.*

[12] See for examples, George, G., Zahra, S.A. and Wood, D. R. (2002) The effects of business–university alliances on innovative output and financial performance: a study of publicly traded biotechnology companies, Journal of Business Venturing, 17 (6), 577-609; and Blumenthal, D., Gluck, M., Louis, K.S. and Wise, D. (1986) Industrial support of university research in biotechnology, Science, 231, 242-246.

[13] New Economy and University of Manchester (2016) Greater Manchester and Cheshire East: a Science and Innovation Audit Report, sponsored by the Department for Business, Energy and Industrial Strategy. http://documents.manchester.ac.uk/display.aspx?DocID=30337

[14] https://nic.org.uk/themes/place/

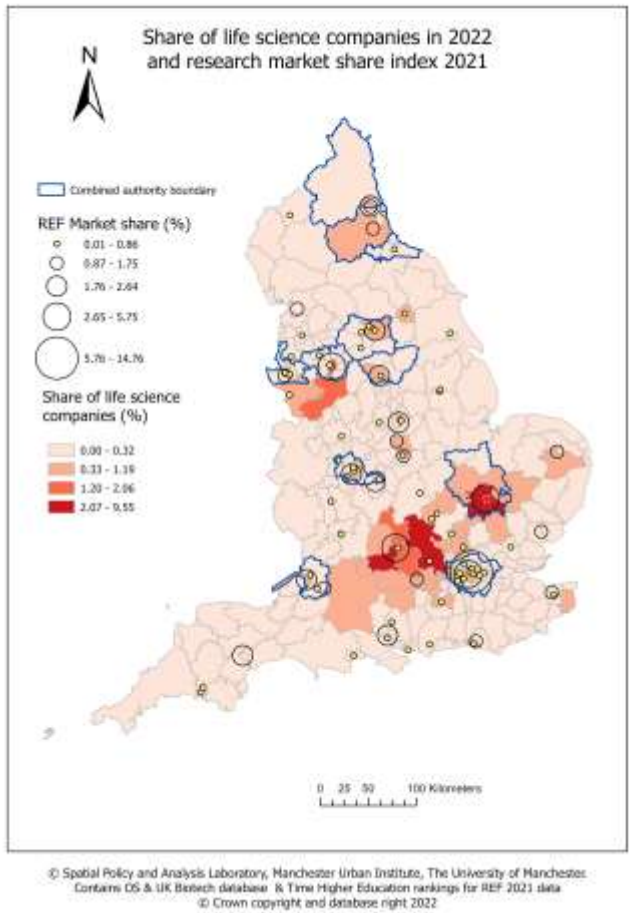

Figure 14 Share of life science companies and Research Market Share Index

With the advance of digital technology and the internet, high quality, reliable and good coverage of telecommunication infrastructure is critical to economic development. The COVID-19 pandemic has rapidly shifted how we exploit the internet to conduct our daily life, with a rapid increase in home and hybrid working and online shopping. Speed does matter in broadband accessibility as it affects the internet search and high frequency trading, uploading and downloading speed, as well as ensuring stable online access without being affected by the number of simultaneous users.

Based on the Department for Digital, Culture, Media & Sport's 2018 report[15], every £1 invested in faster broadband connections brought £12.28 benefit for businesses and resulted in a £9 billion increase in business turnover. An Ofcom commissioned research study[16] found that between 2002 and 2016, the impact of broadband investment and speed improvements had resulted in an increase in the UK GDP at 0.47% per annum (mounting to a 6.7% total GDP increase during the 15-year period).

According to Ofcom's 2022 report[17], there has been rapid rollout of 5G coverage and the level provided outside of premises by at least one mobile network operator is at 67-77%. Superfast broadband, with speeds of at least 30Mbit/s, is available to 97% of UK homes. Whilst the UK has good coverage of superfast broadband, around 80,000 premises still cannot get a decent broadband service of at least 10Mbit/s download speed and 1Mbit/s upload speed from either fixed or wireless networks.

[15] Department for Digital, Culture, Media & Sport (2018) Evaluation of the Economic Impact and Public Value of the Superfast Broadband Programme Final Report, London, DCMS. https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/734855/Superfast_Integrated_Report.pdf

[16] Koutroumpis, P. (2018) The Economic Impact of Broadband: evidence from OECD countries. https://www.ofcom.org.uk/__data/assets/pdf_file/0025/113299/economic-broadband-oecd-countries.pdf

[17] Ofcom (2022) Connected Nations, UK report. https://www.ofcom.org.uk/__data/assets/pdf_file/0034/249289/connected-nations-uk-report.pdf

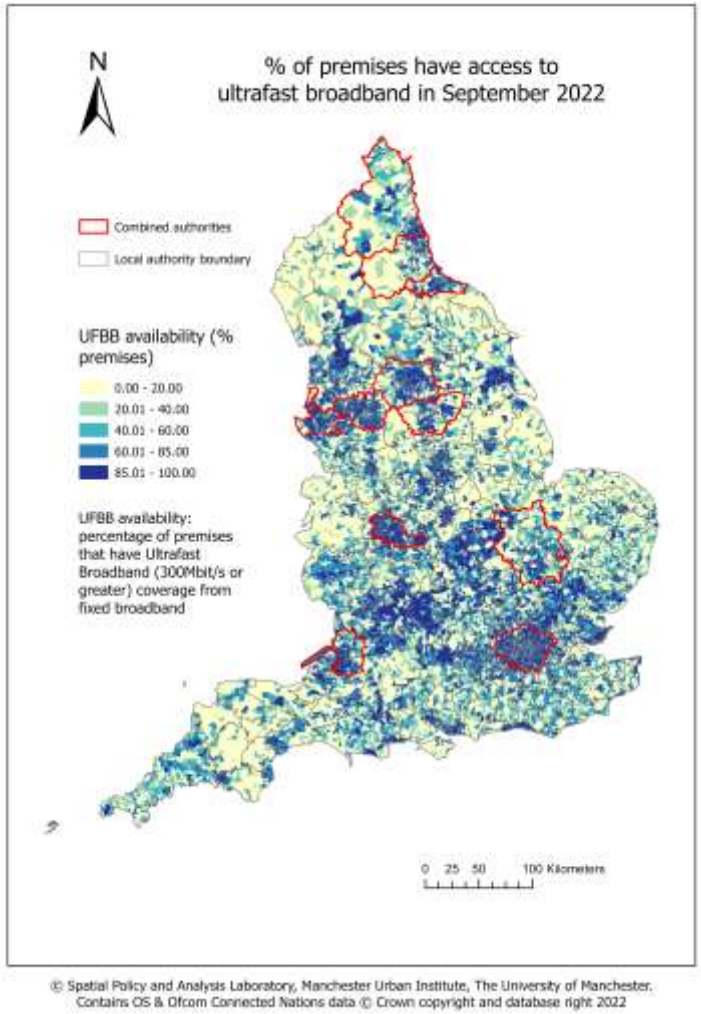

Figure 15 Access to ultrafast broadband, 2020

There has been major improvement in the provision of ultrafast broadband, with downloading speeds of at least 300 Mbit/s available to most UK properties. This is mainly through the provision of full-fibre broadband which is available to 12.4m homes (42%) in the UK. In addition, gigabit-capable broadband[18] is also available to 20.8m homes (70%) and users can buy different speeds ranging from 30Mbit/s to 900 Mbit/s depending on the service offered by the internet service provider.

Based on the latest available small area data, Figure 15 maps the coverage of ultrafast broadband provision in 2022. There were visible differential densities of ultrafast broadband coverage, with dense coverage in major urban areas with high population density, especially in Greater London. Of the CA areas, West Midlands, Greater Manchester and Liverpool City Region all had very good coverage. The coverage was, however, less dense in certain area of the Cambridgeshire & Peterborough, North Tyneside and North East CA areas, which is probably due to the fact that these are the shire areas with lower population densities.

With the importance of global connection for economic development, how to accommodate UK's future aviation capacity has stimulated heated debate. In 2021, 46.3 million passengers passed the airports in England for international trips, of which 95.6% were scheduled flights. Since many flights were still subject to COVID-19 restrictions imposed by different countries in 2021, 69.3% of all international scheduled flight passengers (44.2 million) were for European destinations and 30.7% were for other international destinations.

The existing air travel capacity is very much dominated by the four major London airports; together they accounted for 72.02% of England airports' passengers in 2021. After Heathrow (37.73%) and Standsted (14.52%) Airports in London, Manchester Airport accounted for 11.60% of all passengers, closely followed by Gatwick Airport (10.82%). When only considering international

[18] this includes full fibre and upgraded cable networks that are capable of delivering download speeds of 1 Gbit/s or higher

scheduled flights (Figure 16), the dominance of London area airports continues. In total, they accounted for 73.72% of all England airports' international scheduled passengers, with Heathrow accounting for 39.23%, Stansted for 15.03% and Gatwick for 10.16% of the England total in 2021; though Manchester Airport came third with its 10.8% share. It is important to note that the passenger flows in Stansted overtook Gatwick in 2021, which might be related to COVID-19 restrictions outside Europe which had a disproportionate impact on Gatwick since it had a much larger non-European international passenger share. Meanwhile, Stansted's passenger numbers in 2022 was up 226% on its 2021 figure and its strong performance was related to its extensive European route network[19].

The recent political debate has been focusing on the options of whether to build a new airport in London or to expand one of the existing London airports to meet future aviation demand. However, 7 out of the 10 CA areas have closer proximity to Manchester Airport. This means that passengers outside the South East will continue to travel to London or other European hubs (e.g. Amsterdam) to make international connections for most international destinations.

Besides air transport, port traffic is also vital to our economy. In 2021, a total of 310.9 million tonnes of cargo were handled by all main and small ports in England, of which over 80% was international trade. London (16.65%) and Grimsby & Immingham (16.09%) were the two largest ports in terms of their share of England ports' total tonnage. The other major ports for international freight traffic included Liverpool (11.08%), Southampton (8.88%), Tees & Hartlepool (8.63%), Felixstowe (6.91%) and Dover (6.39%). As shown in Figure 17, these major ports with over 2 million annual tonnage tended to be dominated by international freight activities as 83-99% of their tonnage was for international cargo, though London and Tees & Hartlepool ports had over one-fifth and a quarter of their respective freight tonnage for domestic cargo. At the other end of the spectrum, ports such as Ramsgate, Heysham and Great Yarmouth specialised in handling domestic cargo.

It is interesting to note that international port freight is no longer heavily concentrated in the South East and East of England. Besides Grimsby & Immingham, there has been a rapid increase in international freight tonnage from Liverpool (since 2017), which overtook Southampton and Felixstowe as England's third major port in 2021. This is related to the £400m investment in the Liverpool2 terminal and the associated logistics. There has also been expansion in the Tees & Hartlepool port and it overtook Felixstowe and Dover as England's fifth largest port in 2021.

[19] https://www.adsadvance.co.uk/stansted-rounds-off-2022-with-strong-passenger-performance.html

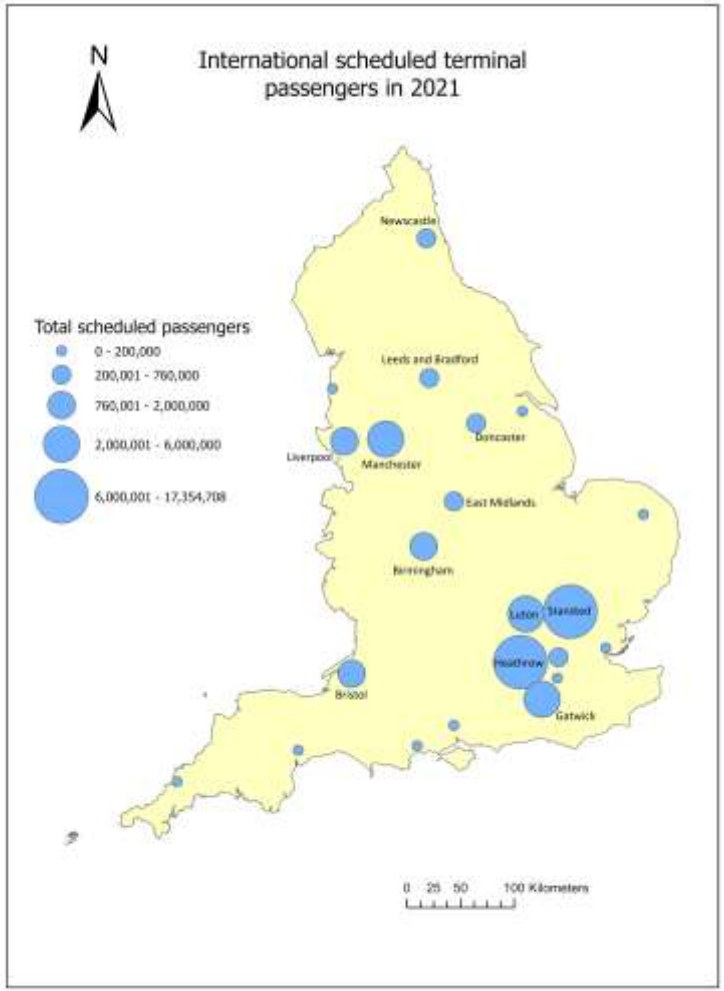

Figure 16 International scheduled flight passengers, 2021

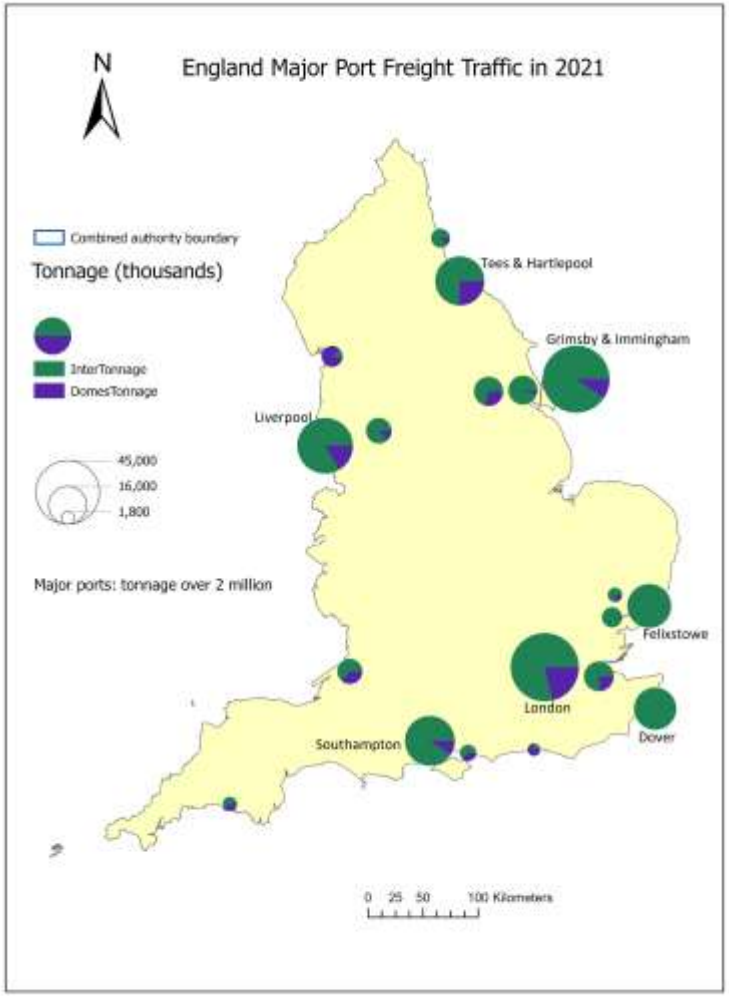

Figure 17 Major port traffic, 2021

LABOUR MARKET DYNAMICS

Productivity and economic growth trajectories are closely related to labour market conditions. Areas with a rapidly growing workforce can reap the demographic dividend and boost their overall GVA growth, whereas economic growth in areas with an ageing or shrinking workforce has to be derived from productivity increases. As highlighted by a McKinsey Global Institute report[20], the COVID-19 pandemic has accelerated trends in remote working and e-commerce. The disruption of jobs with high physical proximity and the advance of digital and automation technology lead to a rising concern about possible major job losses. The report estimates that almost all growth in labour demand will be in high-wage jobs, which means the displaced low-wage workers may need to change jobs and acquire new skills[21]. It is, therefore, critical to embrace the changes and undergo the transition by having an educated and adaptable workforce that is ready to acquire new skills involving emotional intelligence and cognitive flexibility.

Labour supply: quantity and quality

Given the rapid transitions in the demand of the labour market due to the move towards automation, a dynamic labour market is not just about the quantity but also about the quality of the workforce. Figure 18 maps the projected population change between 2018 and 2043 and shows that highest growth was projected around the Midlands and that the shire areas were projected with higher growth than the urban areas. Across England, there was a projected population growth of 10.3% over the 25-year period, but with wide variations ranging from 34.38% projected growth in North West Leicestershire to a 31.45% decline in the Isles of Scilly.

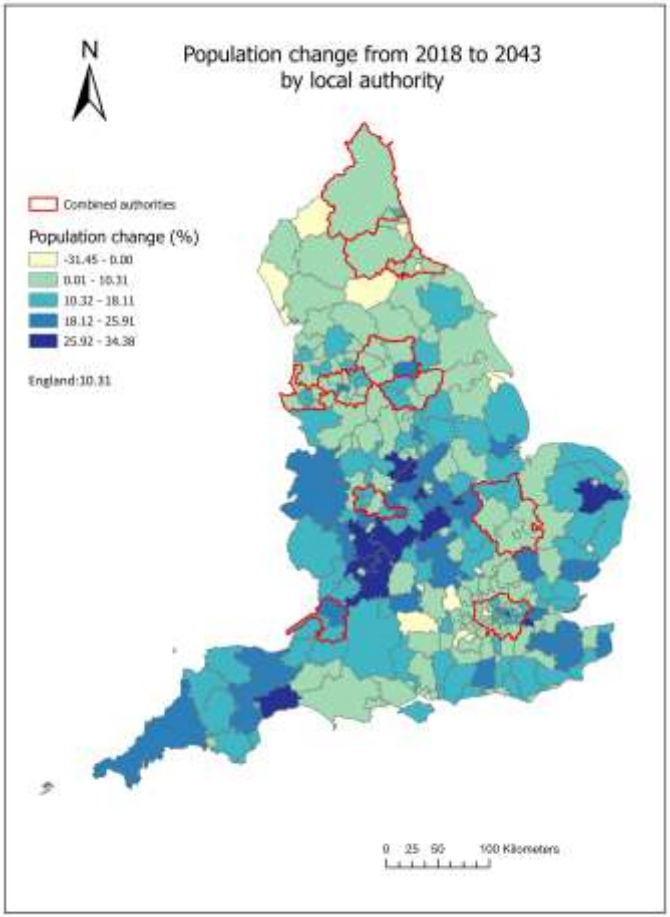

Figure 18 Projected population change, 2018-2043

[20] MGI (2021) The future of work after COVID-19 report, https://www.mckinsey.com/featured-insights/future-of-work/the-future-of-work-after-covid-19

[21] https://www.mckinsey.com/capabilities/strategy-and-corporate-finance/our-insights/the-workforce-of-the-future#/

It is notable that many LADs within the CA areas were projected with growth below the England average, especially those in the North East region. All LADs in West of England CA area were projected with above the England growth level, with the largest growth projected in South Gloucestershire at 25.34%. Except for Birmingham, all LADs in the West Midlands CA area were projected with above England's average growth level, with the largest growth found in Coventry (24.43%). For other CA areas, LADs projected with above England's growth level included North Tyneside (10.37%) in North of Tyne; Salford (19.45%), Rochdale (14.04%), and Oldham (11.72%) in Greater Manchester; Wakefield (21.4%) in West of Yorkshire; Barnsley (13.13%) and Sheffield (11.32%) in South Yorkshire; Fenland (17.19%) and Peterborough (16.49%) in Cambridgeshire & Peterborough. In the GLA area, both central and eastern areas were projected to have higher population growth rates than the England average level, with Tower Hamlets (29.86%), Camden (20.31%) and Westminster (18.05%) having the highest growth rates.

The picture of workforce quality in Figure 19 shows both a north-south and an urban-shire divide. In 2021, 43.2% of workforce aged 16-64 in England achieved at least level 4 (i.e. HND, degree and higher degree level qualifications) of National Vocational Qualification (NVQ)[22]. Only 64 out of 309 local authorities in England reached the 50% threshold. The City of London had the largest proportion of qualified workforce (93.9%%), followed by eleven other London boroughs (all with over 66%). As shown in Figure 18, local authorities in London and the South East regions tended to have a larger proportion of the workforce with NVQ4+.

Most CA areas had a lower proportion of workforce with NVQ4+ qualification in 2021. Those LADs within CA areas with a higher level than that of England included: Newcastle upon Tyne (44.3%) in North of Tyne; Trafford (54.9%), Manchester (45.1%) and Stockport (46.7%) in Greater Manchester; Liverpool (44.1%) in Liverpool City Region; Leeds (46.2%) in West Yorkshire; Sheffield (45.1%) in South Yorkshire; Bristol (56.5%) in West of England; and Cambridge (63.5%) and South Cambridgeshire (63%) in Cambridgeshire & Peterborough. It is notable that the core city areas in many of the CA areas had a higher concentration of qualified workforce. However, only a low proportion of qualified workforce was found in the West Midlands CA area.

Since a workforce needs to be adaptable to acquire new skills to meet with the transition towards higher wage employment, the big challenge for many areas would be a population without any qualifications. Indeed, the pattern of lack of qualification in Figure 20 is a mirror image of that of high qualification shown in Figure 19. In 2021, 6.4% of all population in England did not manage to achieve 5 GCSEs at Grades A-C. This issue was found to be problematic in many CA areas, especially in the northern and midlands CAs. The lack of qualification problem was found to be particularly severe in Sandwell (11.5%) and Birmingham (10.9%) in the West Midlands CA area; Newcastle upon Tyne (10.4%) in North of Tyne; Sunderland (10.2%) in North East; Bradford (12.3%) in West Yorkshire; Rochdale (11%), Oldham (10.6%) and Manchester (10.4%) in Greater Manchester; and Fenland (12.8%) in Cambridgeshire & Peterborough.

It is notable that Liverpool and Manchester LADs had above the England level of highly qualified population as well as above England level of population without any qualifications. Such a polarised labour market situation suggests that there could be two very different labour markets in operation within the same urban space. The lack of qualified residents would inevitably trigger commuting from other places within the CA area and even further afield beyond the city-regional boundary. The commuting flow patterns in Figure 21 illustrates this clearly.

[22] https://www.gov.uk/what-different-qualification-levels-mean/list-of-qualification-levels

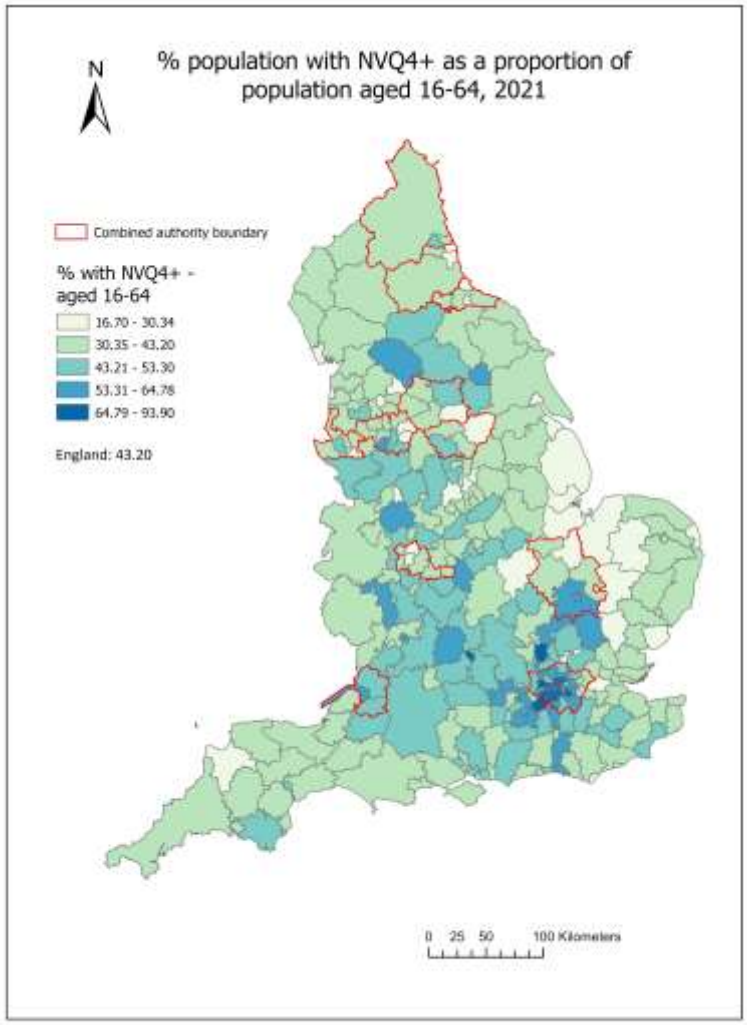

Figure 19 Population with NVQ 4+ qualification, 2021

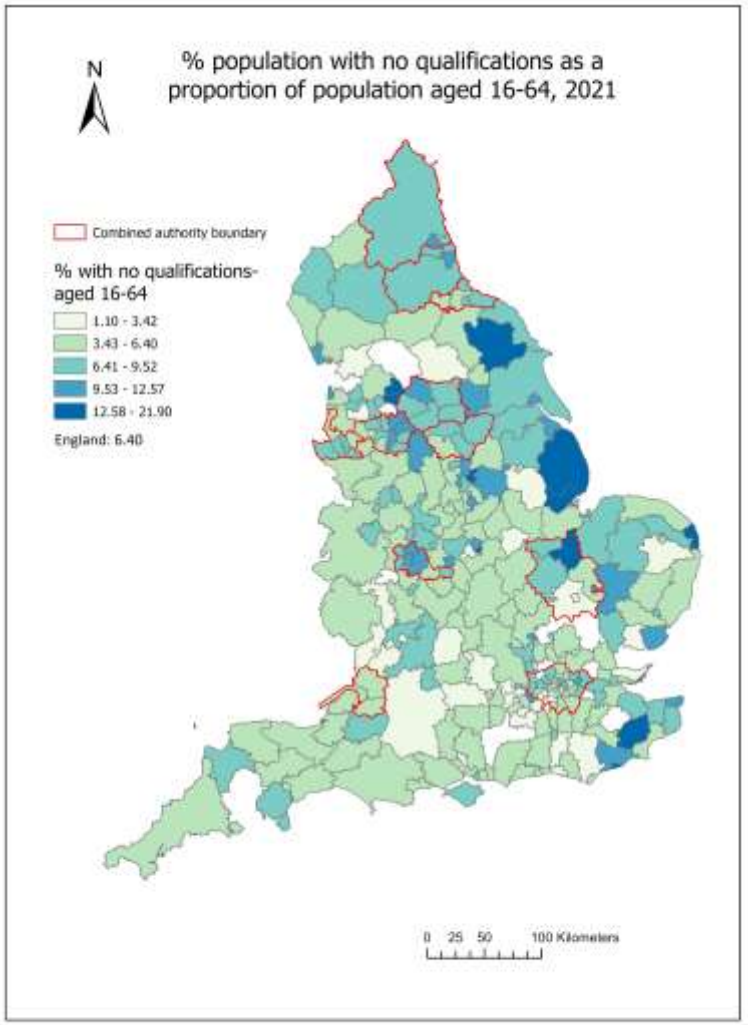

Figure 20 Population with no qualifications, 2021

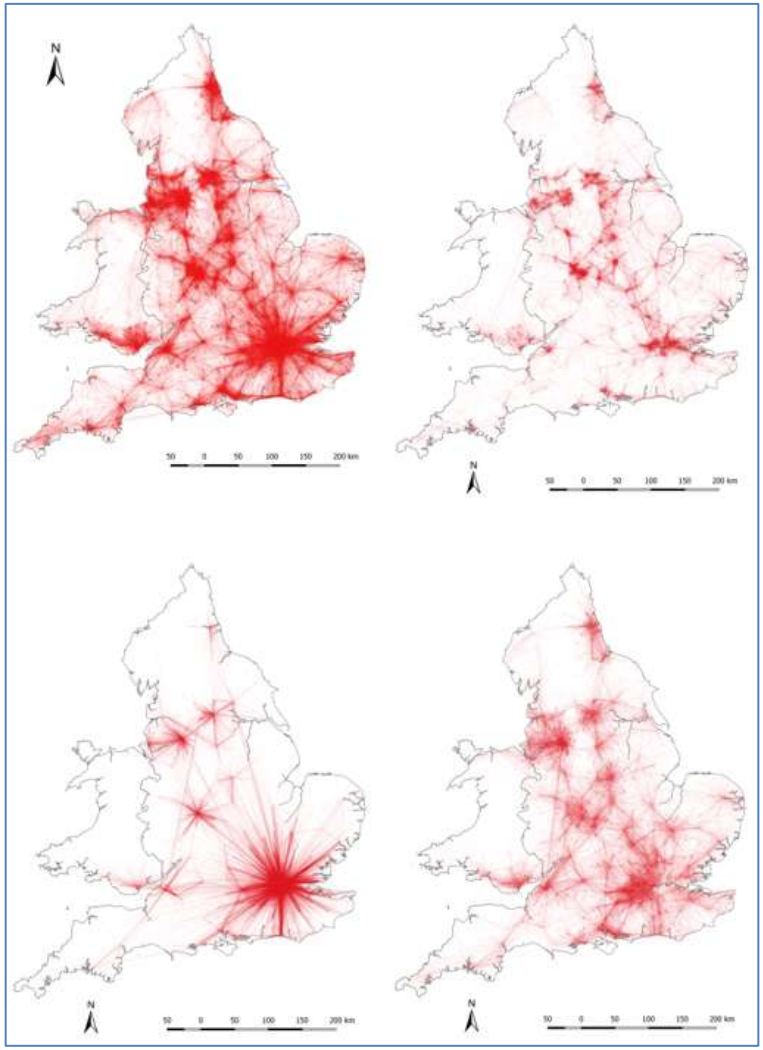

Figure 21 Commuting flows based on the 2011 Census data: (a) all; (b) Blue Collar Traits; (c) High Flyers; (d) Tech and City Type (clockwise from top left hand corner)

Job density and hourly pay

Figure 22 shows job density distribution across different parts of England in 2020, with 1.0 indicating a balance between the number of jobs and the number of resident population of economically active age (16-64). Only 46 out of 309 local authorities had more jobs than their economic active aged population. Many high job density areas tended to concentrate in central London and some shire areas, which exhibited a broad Severn-Wash line with the average value for England at 0.85 jobs per capita. The City of London, as the primary central business district of London, stood out from the rest as there were over 83 jobs per capita. Other London boroughs with very high job density included Westminster (3.93), Camden (1.97), and Kensington & Chelsea (1.41). LADs in the CA areas with a job density of 1 or above included: Manchester (1.16), Trafford (1.13), Solihull (1.17), Cambridge (1.54), Peterborough (1.05), South Cambridgeshire (1.0) and Bristol (1.0). These areas also tended to exhibit a higher level of GVA per hour worked and have larger commuting flows. On the other hand, all LADs in the North East, North of Tyne, Tees Valley, South Yorkshire, West Yorkshire and Liverpool City Region CA areas had a job density value of less than 1.0.

The average pay level will be shaped by the supply and demand of labour. Figures 23 and 24 show the distribution of hourly pay rates of residents and workers in each LAD across England in 2022. It is clear that the pay levels for both residents and workers in the London and the South East regions were much higher than the rest of England (England average at £16.48) and such a contrast was more stark for the pay of residents. For the rest of England, many shire areas had higher rate of hourly pay than urban areas. When comparing different CA areas, again, there was a divide between those to the south of the Severn-Wash line and those on the northern side.

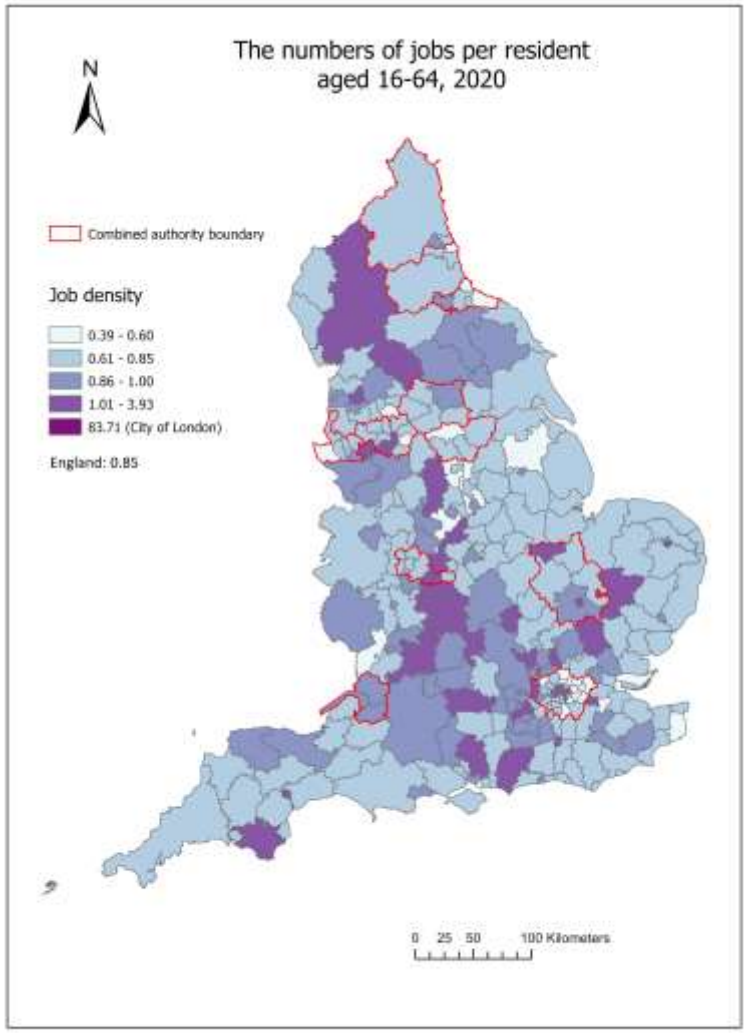

Figure 22 Job density, 2020

There were pockets in the CA areas that were doing well in terms of residents' hourly pay level, they included: Trafford (£19.23) and Stockport (£17.76) in Greater Manchester; Solihull (£18.93) in the West Midlands; Cambridge (£20.06) and South Cambridgeshire (£21.12) in Cambridgeshire & Peterborough. Indeed, all LADs in West of England earned over £17 per hour. In terms of workers, there were again high earning pockets in CA areas: Manchester (£17.36) in Greater Manchester; Sohihull (£20.45) in West Midlands; Bristol (£17.51) and South Gloucestershire (£18.44) in West of England; Cambridge (£18.32) and South Cambridgeshire (£19.15) in Cambridgeshire & Peterborough.

Figure 25 maps the differential between residents and workers' hourly pay level, which closely reflects the different labour market dynamics that were discussed earlier in this report in relation to population qualifications and job density; and often links to the commuting and the wider travel to work areas beyond the CA areas. The analysis at the LAD level is inevitably constrained by the administrative boundaries and the pattern needs to be examined with their neighbouring areas to reflect the wider commuting hinterland. From the local government perspective, the implication of residents earning less than the workers in an area is that local residents are not benefitting from the economic growth of the local authority area and that there is a mismatch between the residents' skills and the jobs created.

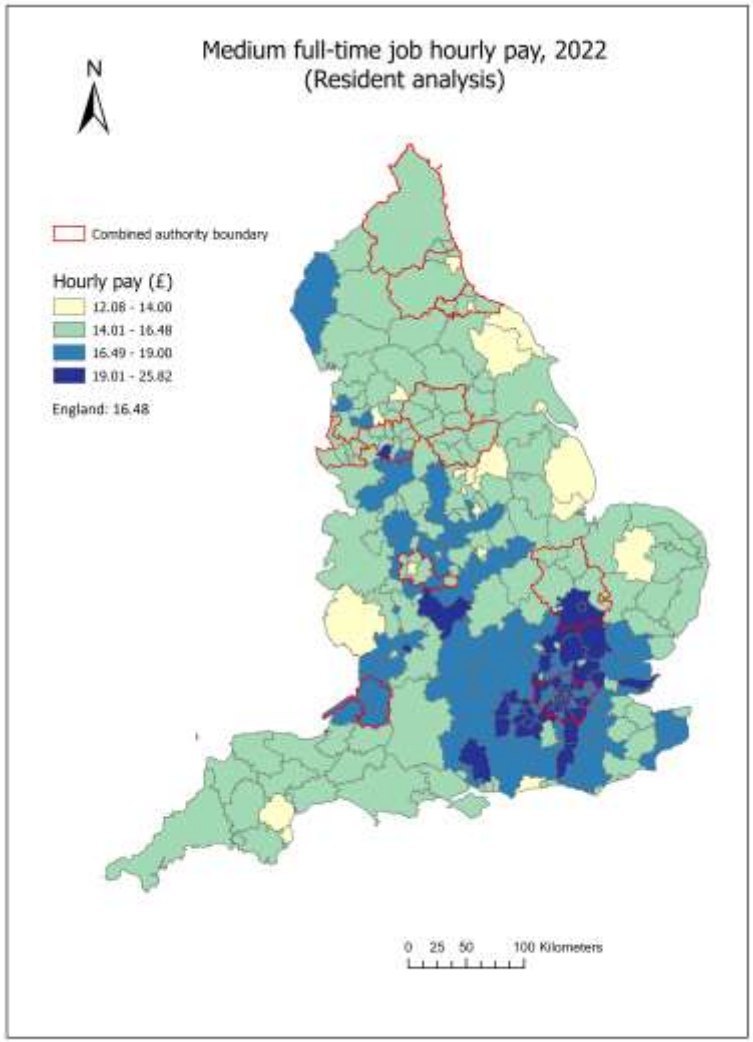

Figure 23 Hourly pay of residents, 2022

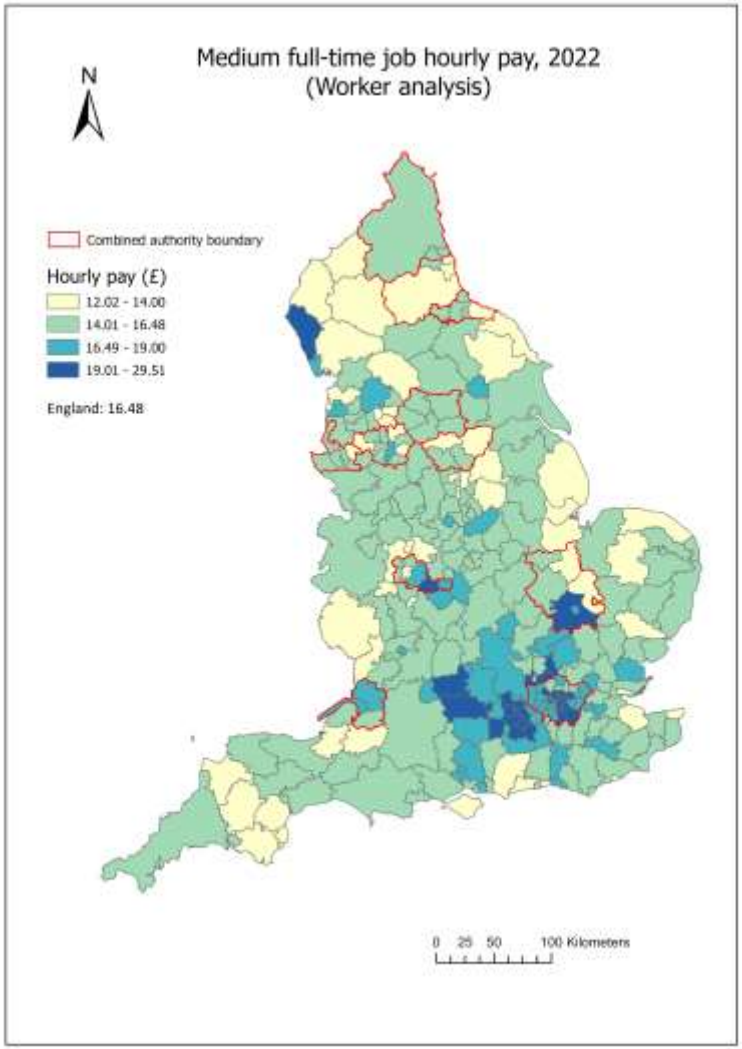

Figure 24 Hourly pay of workers, 2022

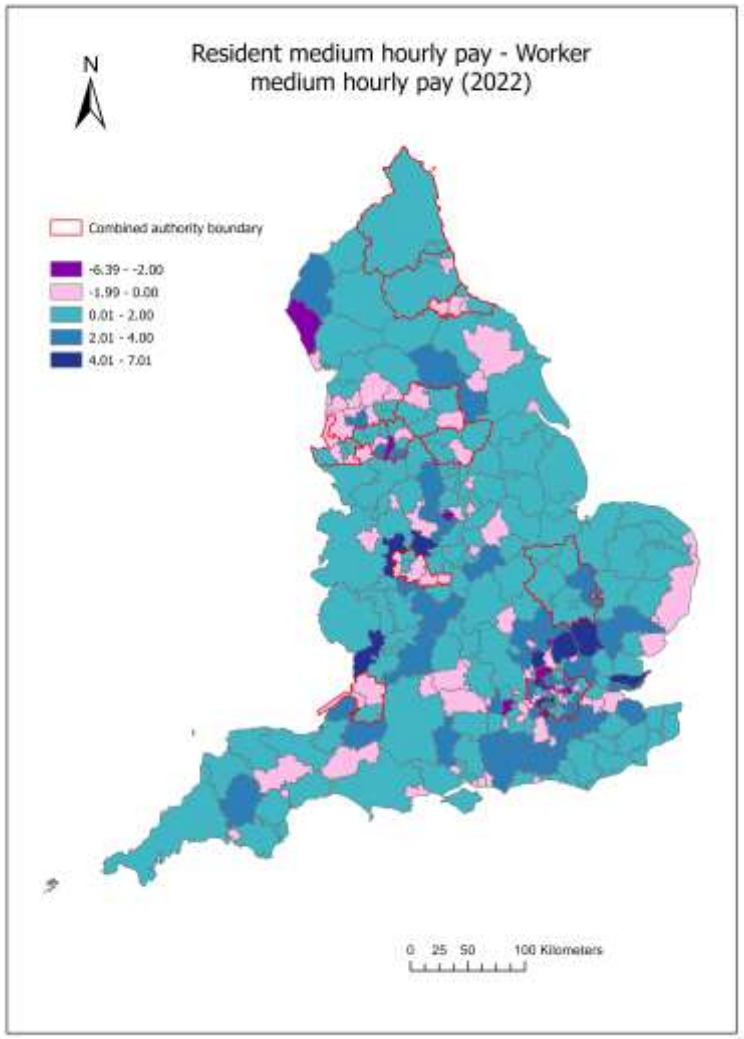

Figure 25 Differential hour pay between residents and workers

Unemployment, income deprivation and health

The health of a local labour market is related to its economic activities and unemployment levels. Figure 26 shows the distribution of economic inactivity rates between July 2021 and June 2022. The average level of economic inactivity in England was 21.2% and there was higher inactivity level in the urban and coastal areas than the shire areas. The problem of economic inactivity was less problematic in the West of England and Cambridgeshire & Peterborough CA areas, but more severe for other CA areas. It is notable that Westminster (25.1%) and Camden (26.4%) in the GLA area also had high economic inactivity rates.

There were also major intra-variations within the CA areas, with over a quarter of the population was found to be economically inactive in some LADs, which included: Redcar & Cleveland (31.8%), Middlesbrough (29.3%) and Hartlepool (26.9%) in Tees Valley; Newcastle upon Tyne (26.5%) in North of Tyne; Sunderland (26%) in North East; Barnsley (28.1%) and Doncaster (26.2%) in South Yorkshire; Rochdale (32.1%), Manchester (25.4%), Bolton (28.1%), Oldham (28%) and Salford (26.8%) in Greater Manchester; Sandwell (30.3%) and Birmingham (29.5%) in West Midlands; and Wirral (26.2) and Liverpool (23.1%) in Liverpool City Region.

Many areas with economic inactivity challenges also suffered from higher levels of unemployment, as shown in Figure 27. There was a clear divide between shire areas and urban and coastal areas. While the unemployment rate of England stood at 3.7% in July 2022, the situation was worst in most CA areas except West of England (2.6%) and Cambridgeshire & Peterborough (3%). The West Midlands (6.5%) and Greater Manchester (5%) had the highest unemployment level amongst the CA areas. Table 5 shows that COVID-19 had a major impact across all areas, with slow recovery in 2021 and 2022; however, for most CA areas as well as the GLA area, they have not bounced back to their pre-COVID unemployment levels. The three CAs in northern England - North East, North of Tyne and Tees Valley - were more resilient and recovered the quickest back to pre-pandemic levels.

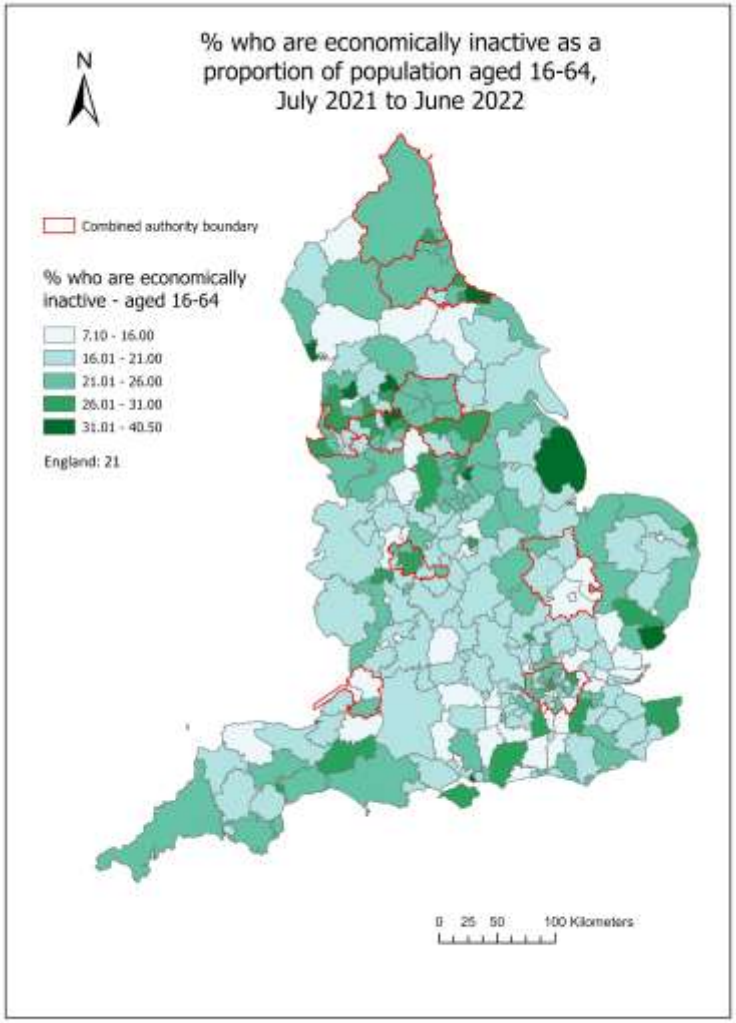

Figure 26 Economic inactivity rate, 07/2021-06/2022

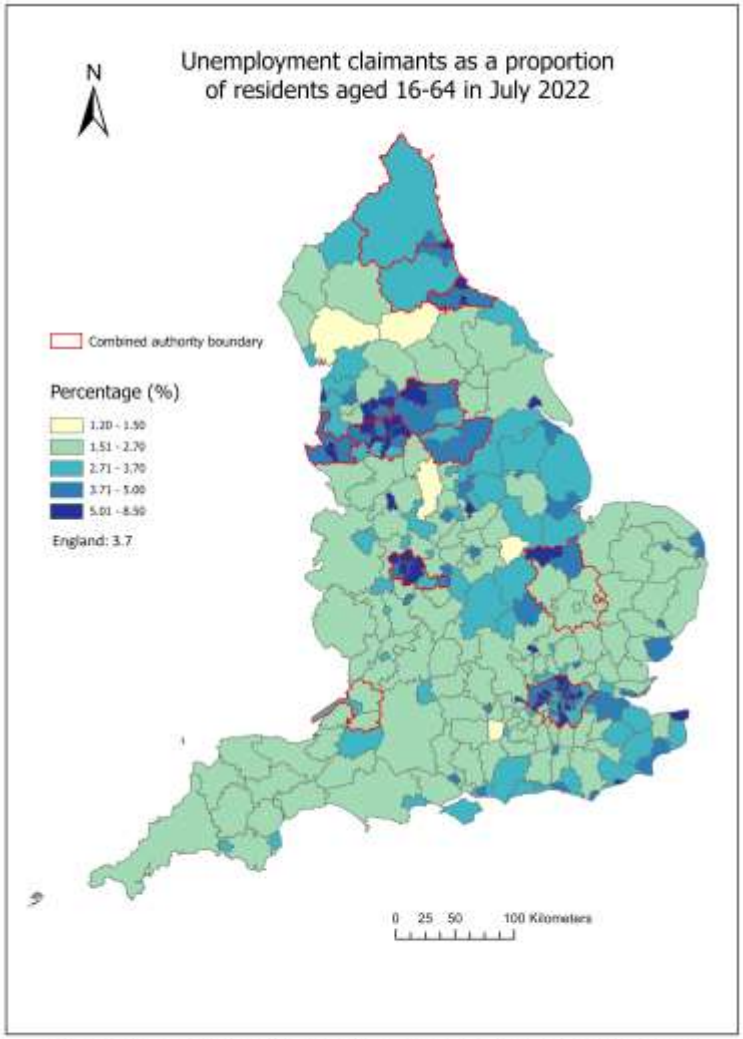

Figure 27 Unemployment rate, July 2022

Table 5 Unemployment claimants (% of aged 16-64 residents), July figures

	2019	2020	2021	2022
Cambridgeshire & Peterborough	1.8	4.9	4.2	3
Greater Manchester	3.8	7.8	6.8	5
Liverpool City Region	4	7.7	6.6	4.6
North East	4.4	7.5	6.1	4.2
North of Tyne	3.7	6.6	5.5	3.7
South Yorkshire	3.1	6.6	5.8	4.1
Tees Valley	4.8	8.1	6.7	4.7
West Midlands	4.9	9	8.4	6.5
West of England	2	5.1	4.1	2.6
West Yorkshire	3.4	7.3	6.5	4.7
Greater London	2.8	7.6	7.1	4.6
ENGLAND	2.7	6.4	5.4	3.7

Economic inactivity level is highly related to the health and well-being of residents. Analysis of the relationship between different health indicators shows that poor health outcomes are highly related to deprivation, especially income deprivation. The spatial variations in life expectancy for the period of 2016-2020 were large, ranging from 74.3 to 90.4 years (England=79.5 years) for males and 79.3 to 90.7 years (England=83.2 years) for females. Figures 28 and 29 show the spatial patterns of life expectancy for males and females respectively and their relationship with income deprivation. LADs with the lowest level of life expectancy tended to have above the England level of income deprivation. The two maps also highlight a north-south divide as well as an urban-rural divide in life expectancy. Life expectancy inequality was found to be more problematic in many CA areas, especially those in Northern England, including Greater Manchester, South Yorkshire, Tees Valley and North East. Some of their LADs such as Middlesbrough (Female: 79.8, Male: 75.3), Manchester (Female: 79.7; Male: 75.6) and Liverpool (Female: 80; Male: 76.1) were performing at the bottom end of the spectrum, which reinforces the spatial patterns detected earlier in terms of high concentration of residents with no qualifications and low earnings.

Economic inactivity is also affected by a high level of premature deaths which could be preventable. Figure 30 shows that the level of premature deaths in 2020 tended to be much higher in CA areas in the Midlands and Northern England where there was also a concentration of households in poverty. The problem of premature death (benchmarked against an England value of 100%) was found particularly challenging in some LADs: Sandwell (140.5%) in West Midlands; Middlesbrough (168.4%) and Hartlepool (144.5%) in Tees Valley; South Tyneside (147.8%) and Sunderland (141.1%) in North East; Liverpool (162.4%) and Knowsley (158%) in Liverpool City Region; as well as Manchester (164.9%), Oldham (142.8%), Rochdale (148.7%) and Salford (151%) in Greater Manchester.

Some of the diseases such as respiratory illness are highly related to the conditions of the built environment, such as air pollution. Figure 31 shows the high level of spatial concentration of PM2.5 in the GLA and West Midlands CA areas in 2021. Liverpool City Region and Greater Manchester CA areas also had a higher level of PM2.5 concentration than the average level of England.

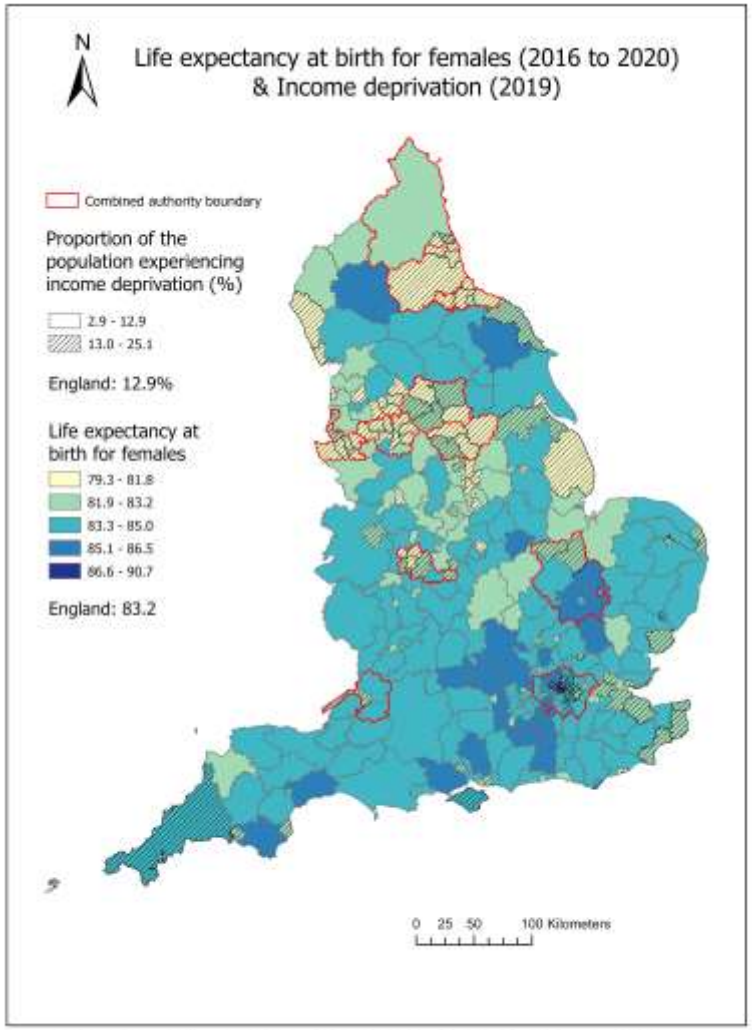

Figure 28 Female life expectancy and income deprivation

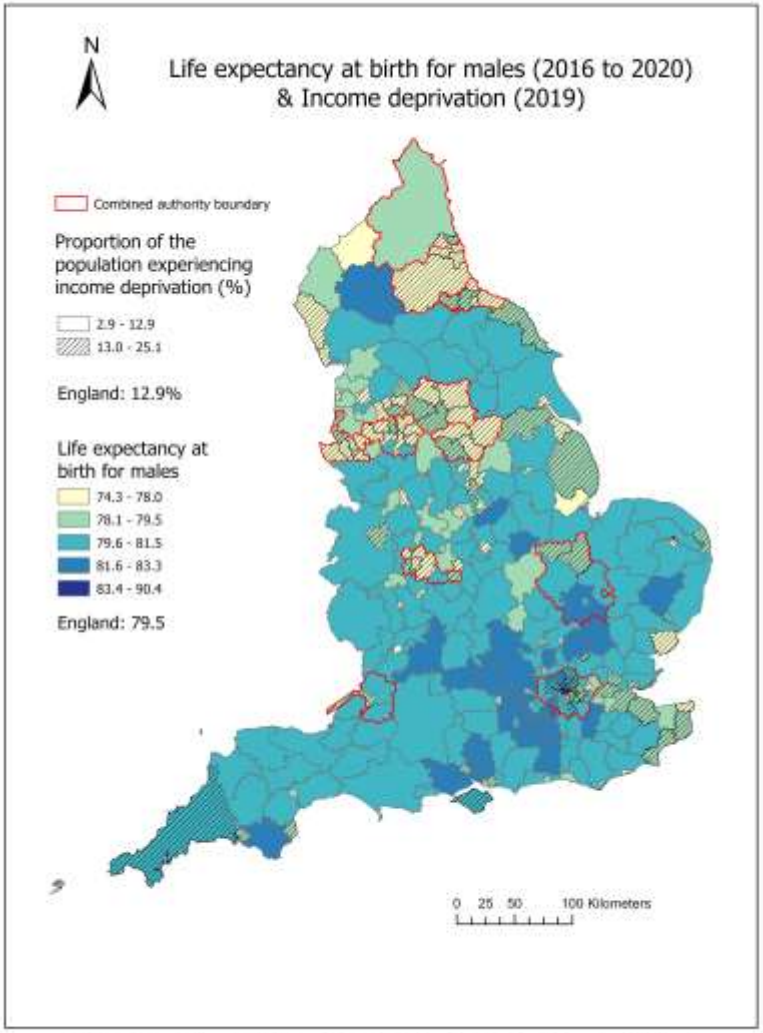

Figure 29 Male life expectancy and income deprivation

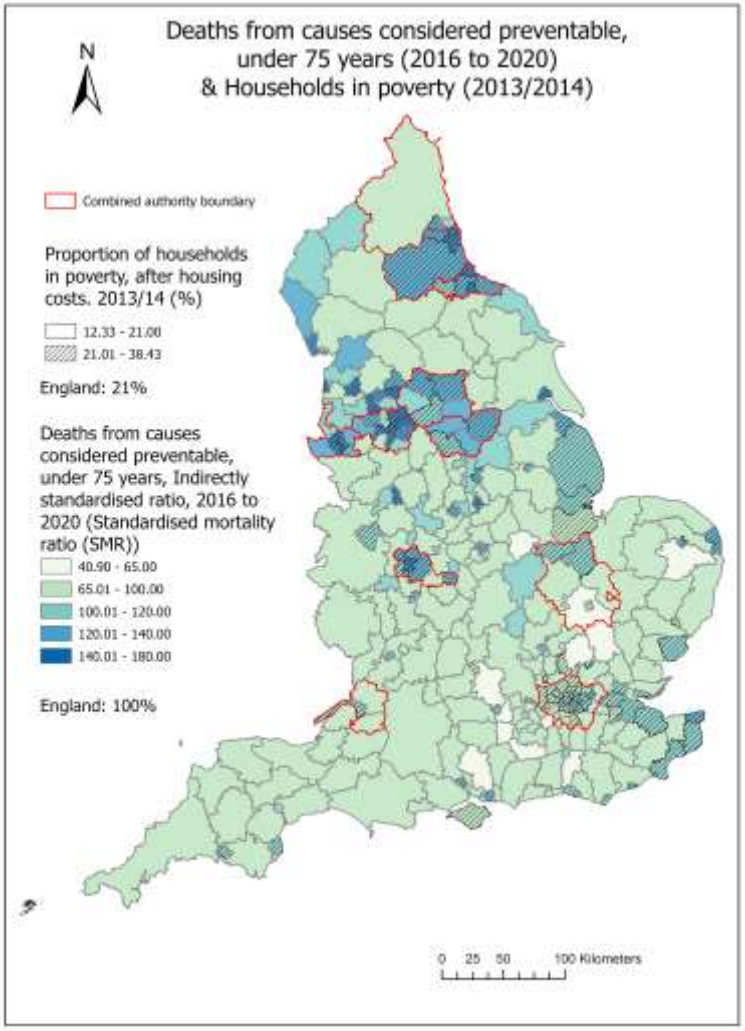

Figure 30 Deaths (preventable causes) and household poverty

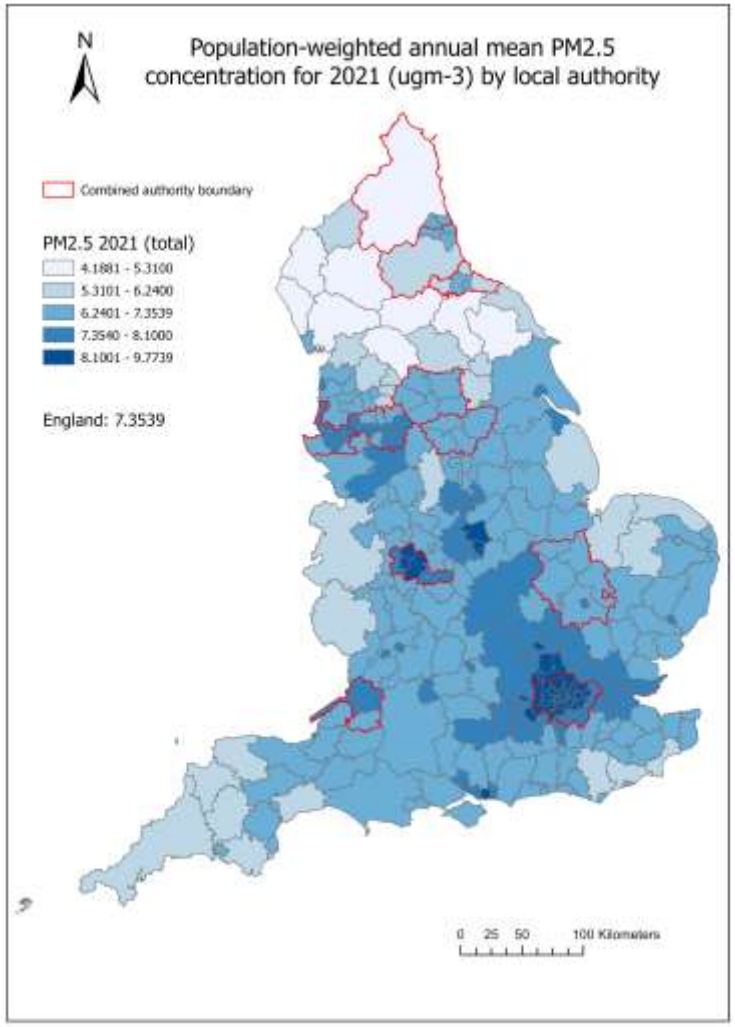

Figure 31 PM2.5 concentration level

THE PARADOXICAL RELATIONSHIP BETWEEN PRODUCTIVITY AND EMPLOYMENT GROWTH

This section tries to examine the relationship between and among different productivity and employment measures. To compare the data on a consistent temporal basis, rather than using the latest published data for different indicators as shown earlier in the report, the analysis here uses data in 2020 for all indicators. Of course, it is important to bear in mind that year 2020 was at a time when the economy and labour market were very much affected by COVID-19.

Relationship between different productivity measures

The earlier part of the report has examined three types of GVA measures: the level of GVA per hour worked and its change rate, as well as the compound annual growth rate of GVA. The first two measures examine labour productivity, whereas the last measure focuses on the overall size of the economy. Table 6 provides a summary of the statistical relationship, based on Pearson correlations, between different GVA measures for LADs in England.

While there was some relationship between 'GVA per hour worked index' and its change rate, regardless of using the 2019 or 2020 data series, the relationship was very weak as only less than 10% of the variance in performance could be explained. This means places that performed very well on GVA per hour worked did not necessarily perform that well on the productivity growth front, and vice versa, as shown in Figure 32. The productivity puzzle is, therefore, not just about the lagging behind regions, but also some traditionally high performing areas in the London and South East regions that had halted their growth or even experienced decline in their GVA per hour worked level before COVID-19 struck (see Figure 3).

The relationship between labour productivity growth (in terms of change in GVA per hour worked) and increase in the size of economy (measured by compound annual GVA growth rate) was found to be stronger, as they were moderately related to each other. Before the COVID-19 pandemic, such a relationship accounted for 41.47% of performance variance but this relationship weakened after the COVID-19 pandemic and only explained 35.52% of the variance.

Table 6 Relationship between GVA indicators for LADs in England

GVA Indicator	Pearson Correlation Coefficient
GVA per hour worked Index 2019 & Change in GVA per hour worked (2015-2019)	**0.242*** (5.86% variance)**
GVA per hour worked Index 2020 & Change in GVA per hour worked (2015-2020)	**0.302*** (9.12% variance)**
Compound annual GVA growth rate (2015-2019) & Change in GVA per hour worked (2015-2019)	**0.644*** (41.47% variance)**
Compound annual GVA growth rate (2015-2020) & Change in GVA per hour worked (2015-2020)	**0.596*** (35.52% variance)**
Significance level *<0.05; ** <0.01; *** <0.001	

Relationship between different employment measures

As discussed earlier, local competitiveness condition was found to be highly related to total employment change and accounted for 98.8% of the varied growth level across LADs in England (see Table 7). Since shift-share analysis only performs an accounting procedure, it is a challenge to work out what constitutes local competitive conditions. However, none of the labour market indicators such as qualifications and economic activity rates were found to bear any significant relationship with it.

Table 7 Relationship between employment measures for LADs in England

Employment measure	Pearson correlation coefficient
Employment change (2015-2020) & Industrial mix share	0.160** (2.56% variance)
Employment change (2015-2020) & Place competitiveness share	0.994*** (98.80% variance)
Industrial mix share & Place competitiveness share	not significant
Employment change (2015-2020) & Share of manufacturing jobs	not significant
Employment change (2015-2020) & Share of information and communication jobs	0.157** (2.46% variance)
Employment change (2015-2020) & Share of professional, scientific and technical jobs	0.192*** (3.69% variance)
Employment change (2015-2020) & Share of life science companies	0.153** (2.34% variance)
Share of information and communication jobs & Share of professional, scientific and technical jobs	0.934*** (87.23% variance)
Share of information and communication jobs & Share of life science companies	0.764*** (58.37% variance)
Share of information and communication jobs & Share of manufacturing jobs	not significant
Share of professional, scientific and technical jobs & Share of life science companies	0.740*** (54.76% variance)
Share of professional, scientific and technical jobs & Share of manufacturing jobs	0.167** (2.79% variance)
Share of manufacturing jobs & Share of life science companies	not significant
Significance level *<0.05; ** <0.01; *** <0.001	

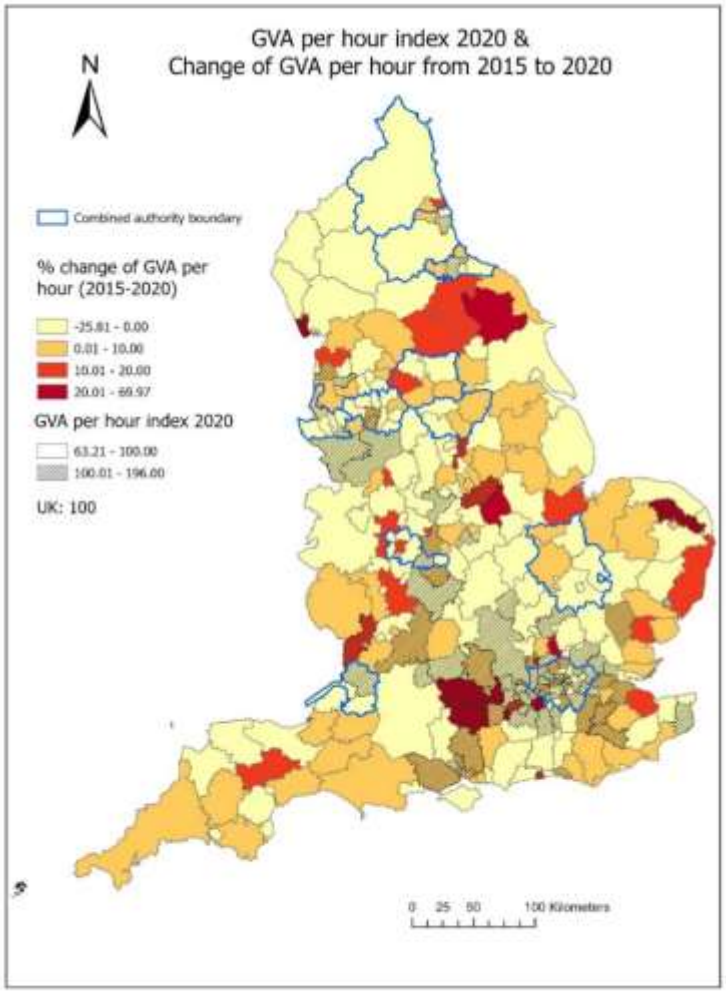

Figure 32 GVA per hour (2020) and change of GVA per hour (20150-2020)

Meanwhile, local industrial mix only explained 2.56% of the varied employment change level. It is, therefore, not a surprise to find that local employment growth was hardly related to the local share of England's employment in the 'sunrise' industrial sectors (such as information & communication (IC) and professional, scientific & technical (PST) sector) nor to the share of England's life science companies.

On the other hand, the 'sunrise' sectors themselves were related to each other. LADs with a large share of England's IC jobs also enjoyed a large share of PST jobs and they accounted for 87.23% of variations. These sectors' relationship with life science companies was found to be moderate, but still accounted for 55-58% of the variations. Even though IC and PST sectors are increasingly seen as important to integrate into the manufacturing process to meet with the challenge of Industry 4.0, the relationship between them was found minimal when examining the employment data.

Relationship between GVA and employment measures

The slowing down of productivity growth in the UK after the global financial crisis coincided with a period with employment growth. It is, therefore, important to examine how this relationship pans out at the local level during the period between 2015 and 2020.

Correlation analysis in Table 8 confirms that the GVA per hour worked Index bore no significant statistical relationship with either total employment change or place competitiveness share of employment change. However, the 'local share of England's IC jobs' was found to explain 22.85% of the variation in the GVA per hour worked index value. Other measures showing weaker correlation with the GVA index value included 'local share of England's PST jobs' (15.76% variance); 'industrial mix share of employment change' (10.43%); and 'share of England's life science companies' (9.18%).

The GVA index was also found to be related to other labour market indicators, especially with workers' hourly pay *(R=0.638***, 40.7% variance)*, residents' hourly pay *(R=0.573***, 32.83% variance)* and population with NVQ4+ qualification *(R=0.491***, 24.11% variance)*.

Table 8 Relationship between GVA and employment measures for LADs in England

GVA and employment measures	Pearson correlation coefficient
GVA per hour worked index 2020 & Employment change (2015-2020)	not significant
GVA per hour worked index 2020 & Place competitiveness share (2015-2020)	not significant
GVA per hour worked index 2020 & Industrial mix employment share (2015-2020)	0.323*** (10.43% variance)
GVA per hour worked index 2020 & Share of information and communication jobs (2020)	0.478*** (22.85% variance)
GVA per hour worked index 2020 & Share of professional, scientific and technical jobs (2020)	0.397*** (15.76% variance)
GVA per hour worked index 2020 & Share of life science companies (2020)	0.303*** (9.18% variance)
Change of GVA per hour (2015-2020) & Employment change (2015-2020)	-0.175** (-3.06% variance)
Change of GVA per hour (2015-2020) & Place competitiveness employment share (2015-2020)	-0.167** (-2.79% variance)
Change of GVA per hour (2015-2020) & Industrial mix employment share (2015-2020)	not significant
Compound annual GVA growth rate (2015-2020) & Employment change (2015-2020)	0.397*** (15.76% variance)
Compound annual GVA growth rate (2015-2020) & Place competitiveness employment share (2015-20)	0.390*** (15.21% variance)
Compound annual GVA growth rate (2015-2020) & Industrial mix employment share (2015-2020)	not significant
Significance level *<0.05; ** <0.01; *** <0.001	

When turning our attention to the change of GVA per hour worked over the same period, it is interesting to note that improvement in labour productivity between 2015 and 2020 was found weakly, but negatively, related to overall employment change in the same period (-3.06%) and the associated place competitiveness employment share of change (-2.79%). However, change in labour productivity did not bear any significant relationship with the local industrial mix employment share.

The findings suggest that the absolute level of labour productivity bears some weak relationship to the industrial mix but stronger with the presence of certain 'sunrise' industrial sectors, whereas the change in labour productivity is marginally and negatively associated with the change in employment level. Since the analysis was carried out at the LAD level, rather than functional economic regions, another way to understand the complex situation is through GIS mapping overlay analysis.

Figure 33 shows the relationship between the labour productivity level (GVA per hour worked index) and the two employment indicators of industrial mix share and total employment change. There is a major divide between the London and South East Regions and the rest of England in terms of GVA per hour worked. A high GVA level area was found stretching out from central London to Berkshire along the M4 Business Corridor where many IC and PST businesses are located. When examining in detail, it is notable that most LADs in this area tended to have a relatively favourable industrial mix. Elsewhere in England, only pockets exhibit high GVA levels such as South Gloucestershire (aerospace industry) and South Derbyshire (car and engineering sectors) where favourable industrial mix was also found. However, these areas did not enjoy high employment growth[23].

Only a few LAD areas show a high GVA level as well as high employment growth with favourable industrial mix. They were the City of London (PST, IC, financial), Croydon (PST, IC and health sectors) and Solihull (car manufacturing, PST and business services sectors) and, to a less extent, Salford (in relation to its recent specialisation in specialised materials, AI and robotics) and Halton (health and PST sectors and chemical industry).

Figure 34 maps the relationship between change in GVA per hour worked and industrial mix and employment change. What is seen in Figure 34 is very different from the pattern in Figure 33. The spatial pattern of change in GVA per hour worked between 2015 and 2020 was very patchy and the growth tended to concentrate sporadically in shire district areas, though some of these might have started from a low GVA level basis.

LAD areas with high level of growth in GVA per hour worked included West Berkshire, Basingstoke & Deane and Rushmoor in Berkshire and Ryedale, Hambleton and Harrogate in North Yorkshire. These areas did not necessary exhibit a favourable industrial mix nor a high level of employment growth. Most areas experiencing high employment growth tended to be in LADs with low or even negative change in GVA per hour worked, which runs against the assumption that employment growth should go to areas with improved labour productivity. Indeed, employment growth was found to be negatively correlated to GVA per hour worked. The situation is rather intriguing as labour market indicators such as qualifications and economic activity rate had no significant relationship with either employment growth or change in GVA level. This will require further research to unravel where employment growth was found, and in which sector, in areas with declining labour productivity.

[23] Based on 1 standard deviation of the England average, that is, above 9.15%, as the watershed.

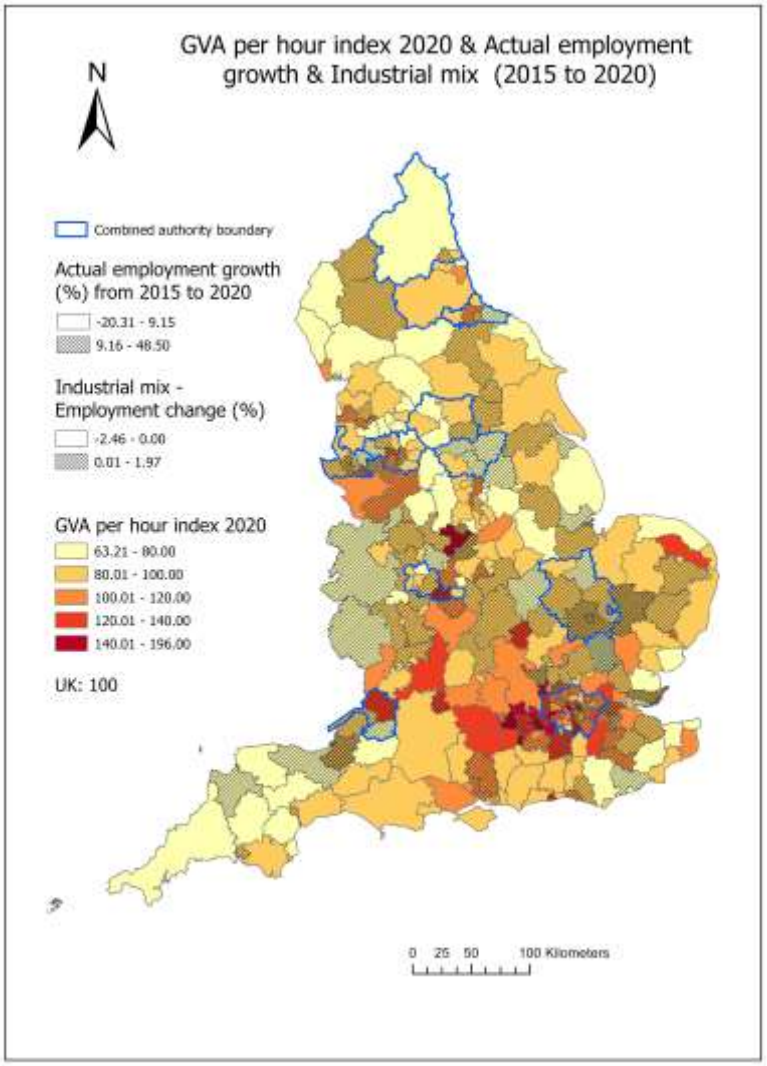

Figure 33 GVA per hour worked index and employment change

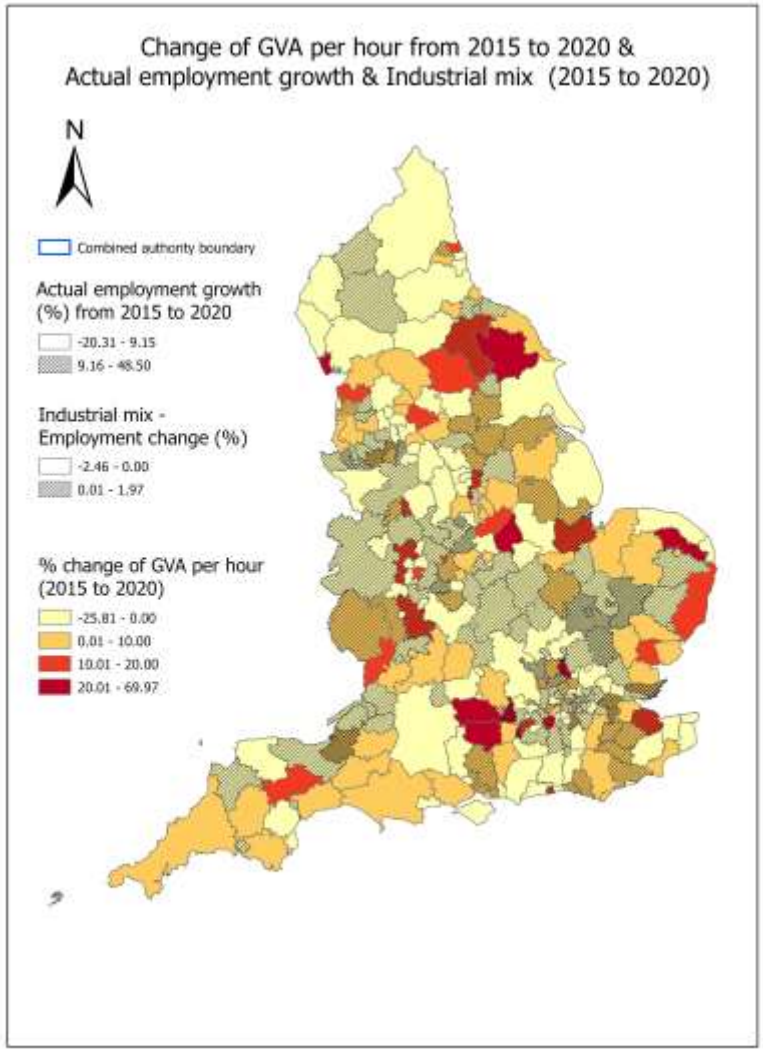

Figure 34 Change in GVA per hour worked and employment change

Taking Figures 33 and 34 together, the story is that local areas have very different development trajectories and patterns and it is not easy to pin down the relationship between different GVA and employment measures. Martin et al. (2018)[24] carried out analysis on functional city areas and found that "structural change – and especially the shift from manufacturing to services – has had a negative impact on productivity growth across all cities, but that within-sector productivity developments, while positive and outweighing structural change effects, have also declined over the past 45 years, as well as varying across cities". Based on the analysis here, there is some support towards their arguments but further work to examine the industrial composition of different types of areas would be needed.

Spatial cluster analysis of GVA and employment measures

Another way to show the spatial landscape of economic development is to examine the spatial relationship between each LAD and its neighbours on an indicator to derive statistically significant spatial clusters[25]: (1) high value cluster (HH); (2) low value cluster (LL); (3) high to low value outlier (HL); and (4) low to high value outlier (LH). Areas in the HH cluster are spatially associated as they have similar values of performance levels that are higher than the mean of all England LADs, whereas the opposite is true for areas in the LL cluster. Both the LH and HL outliers show spatial association of dissimilar values, with LH indicating an area with a performance level below the England mean being surrounded by neighbours with above the mean value, and the reverse for the HL cluster. Travel-to-work areas are also overlaid onto the spatial groups to highlight the functional connections of different areas.

Figures 35 and 36 map the four spatial cluster and outlier types derived from the 2019 and the 2020 GVA per hour worked index data respectively. While there are minor differences, both maps show a very clear Severn-Wash divide with the London and South East Regions classified as high labour productivity (HH) cluster, but they are surrounded by LADs (LH outliers) with lower performance. This contrasts sharply with the cluster to the north of the divide as most areas are in the low labour productivity (LL) cluster, though there are some pockets of better performing LAD areas (HL outliers) such as Manchester, Salford, Trafford, Halton, Stockton-on-Tees and Sunderland surrounding by weaker performing neighbours. A few LADs in the West Midlands, East of England, and South West are classified as the non-significant group, which suggests the spatial pattern of observed GVA per hour worked values is the result of random spatial processes regardless whether their attribute values are high or low.

Figures 37 and 38 shows the spatial clusters derived from the employment change data for the period of 2015-2019 and 2015-2020 respectively. It is interesting that the high growth spatial cluster has shifted towards the Midlands on both maps and the cluster is larger in size when including the 2020 data.

Based on the industrial mix component of shift-share analysis of employment change, two maps are produced for the periods of 2015-2019 (see Figure 39) and 2015-2020 (see Figure 40). The patterns in Figure 39 show a clear north-south divide, though many LAD areas are outliers among both the high value and the low value industrial-mix clusters. When the COVID-19 pandemic year is included in Figure 40, the size of the clusters shrinks - as many areas were found to be too statistically insignificant to be included in the clusters. This also implies that many areas have lost their favourable industrial mix during COVID-19.

[24] Martin, R, Sunley, P; Gardiner, B; Evenhuis, E & Tyler, P (2018) The city dimension of the productivity growth puzzle: the relative role of structural change and within-sector slowdown, Journal of Economic Geography, 18 (3): 539-570.

[25] Based on Local Moran I's statistics, the relationship between each LAD and its neighbours can be established. The Local Moran's I index together with its computed z-score and p-value were used to derive four statistically significant spatial groups. See Barreca, A., Curto, R., Rolando, D., 2017. Assessing social and territorial vulnerability on real estate submarkets. Buildings 7, 94 and Dubé, J., Legros, D., 2014. Spatial autocorrelation, in: Spatial Econometrics Using Microdata. Wiley Online Library, pp. 59–91.

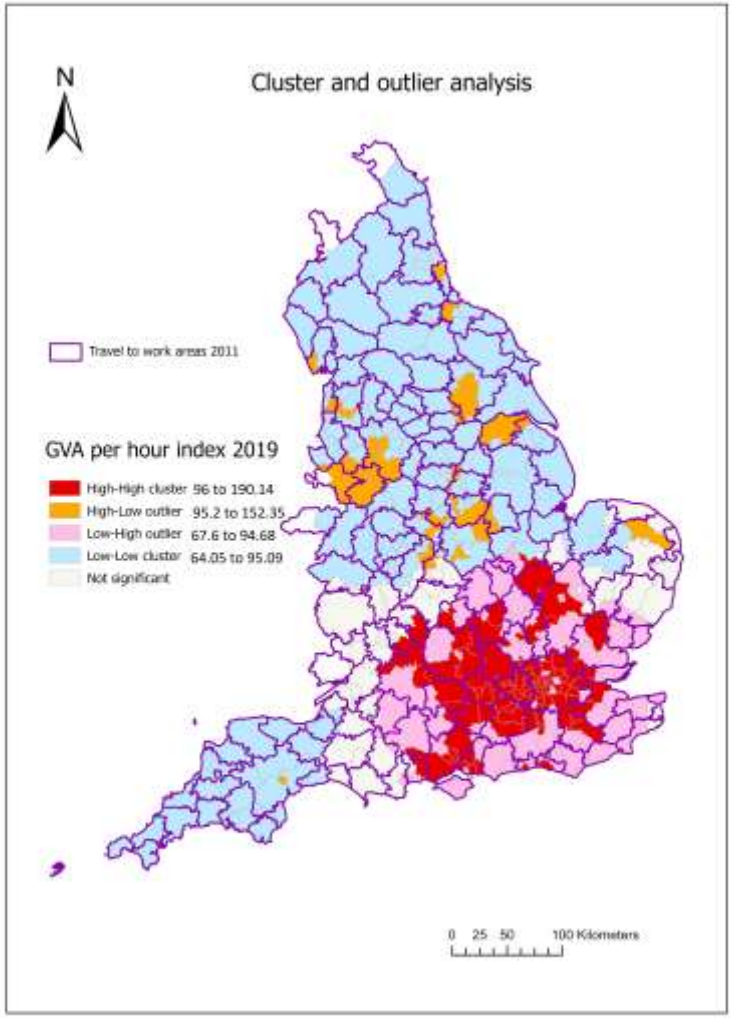

Figure 35 GVA per hour index spatial clusters, 2019

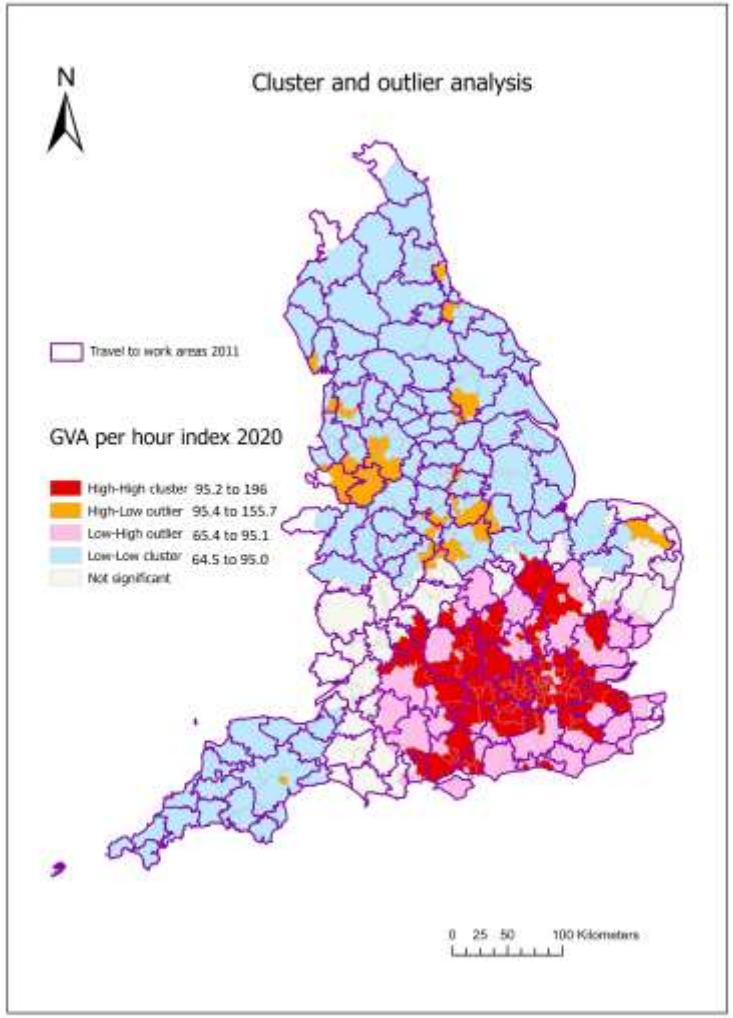

Figure 36 GVA per hour index spatial clusters, 2020

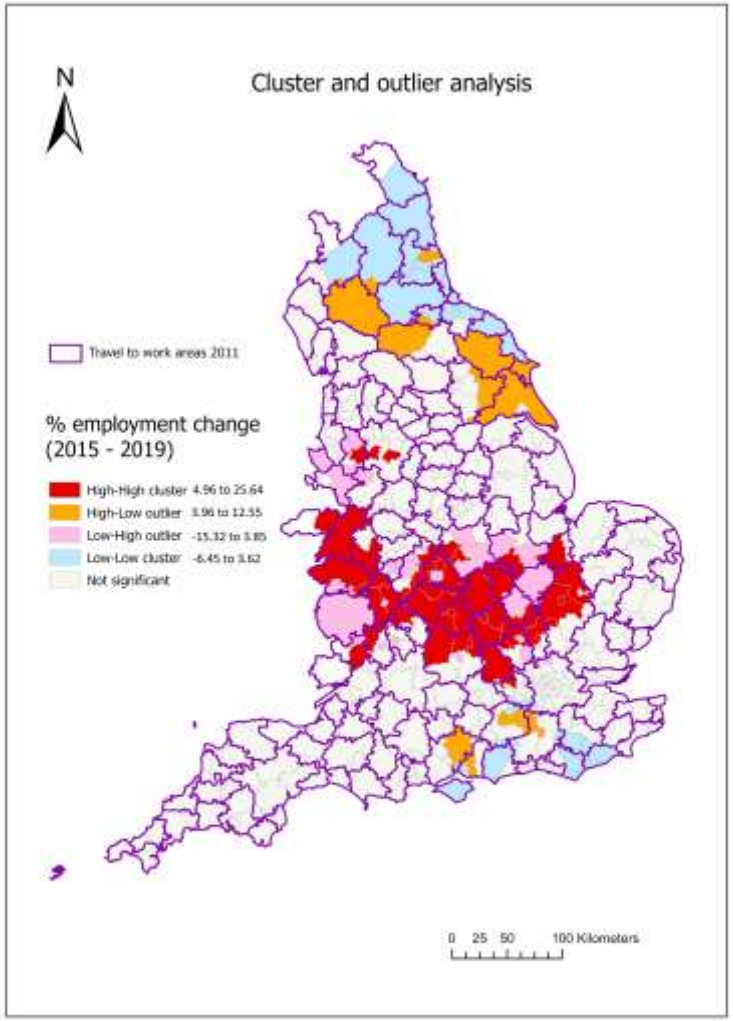

Figure 37 Employment change spatial clusters, 2015-2019

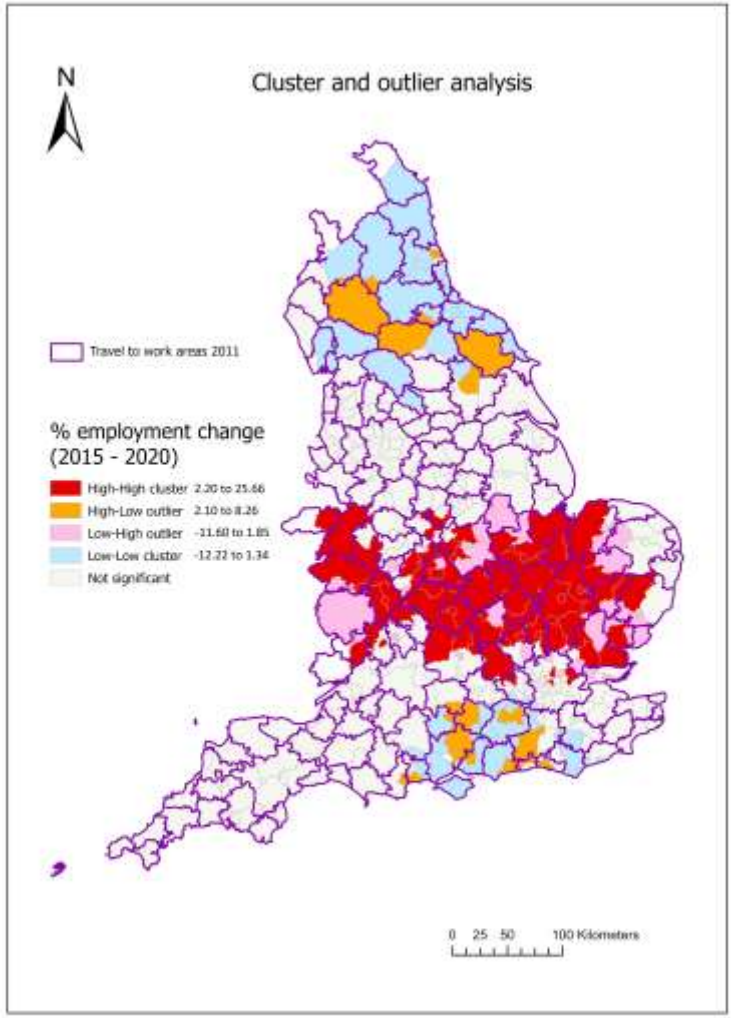

Figure 38 Employment change spatial clusters, 2015-2020

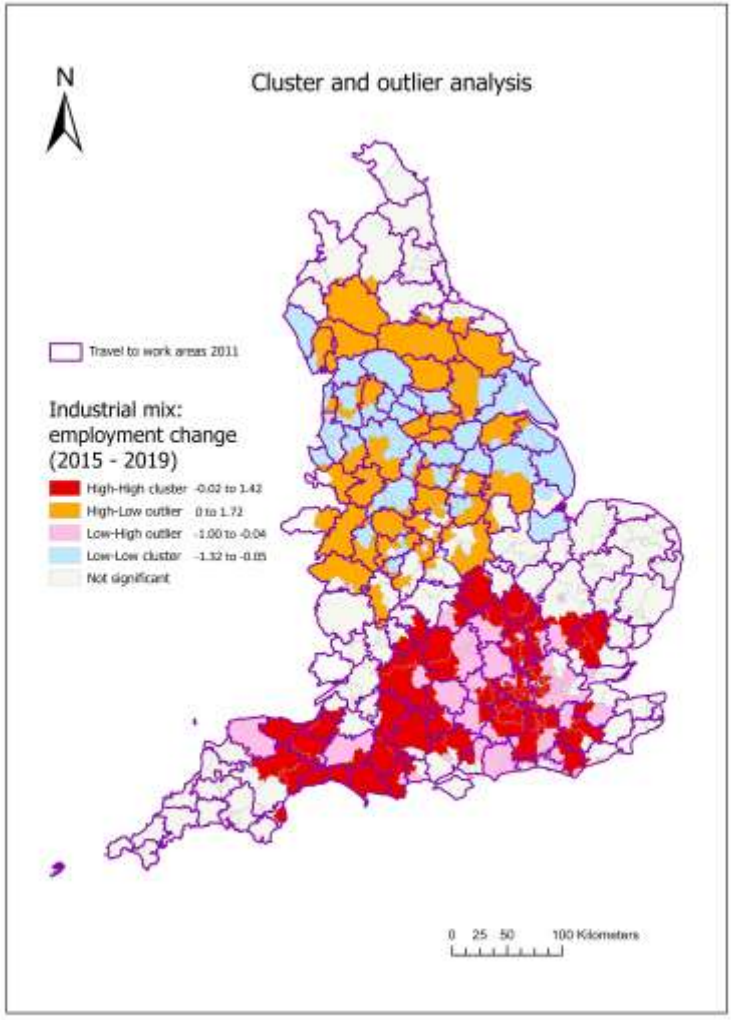

Figure 39 Industrial mix employment share spatial clusters, 2015-2019

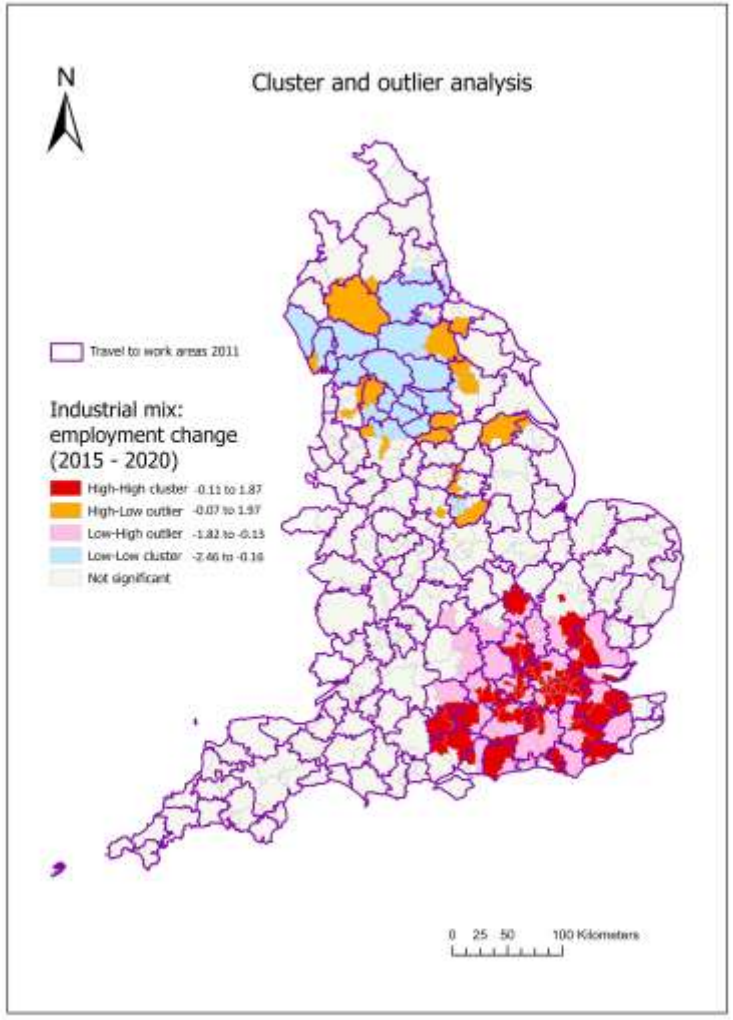

Figure 40 Industrial mix employment share spatial clusters, 2015-2020

CONCLUSION

The analysis of local area socio-economic development in this report highlights the complex trajectories and spatial dynamics of local development across England. Based on the findings, we would like to draw several key messages to inform the UK2070 Commission's Go Local actions.

Productivity puzzle conceals spatial puzzle

While the disparities between productivity increases around the London region and stalled or decreasing productivity in some of the northern regions have been widely accepted as one of the explanations behind the UK's productivity puzzle. Our analysis shows that there is very weak correlation between 'GVA per hour worked index' and its change rate. This points to the fact that places that performed very well on GVA per hour worked did not necessarily perform that well on the productivity growth front, and vice versa. It also means that the productivity puzzle is not just about the broad-brush painting of the successful and lagging behind regions, as some traditionally high performing areas in the London and the South East have halted their growth or even experienced decline in their levels of GVA per hour worked before COVID-19 struck. Indeed, many LADs in combined authorities were performing above the England average level in term of change in GVA per hour worked and the aggregate GVA growth though starting from a much lower basis. Our findings also show that many areas experiencing high employment growth in recent years tended to have low or even negative change in GVA per hour worked and this bore no relationship with different labour market indicators. The decoupling of labour productivity and employment change just shows the complexity of local economic dynamics and there is a need to understand different spatial contexts to devise effective policy.

Intertwining forces of Brexit and COVID-19

The mapping and statistical analysis shows that different areas have very different trajectories of labour productivity change, regardless of their level of GVA per hour worked - some had their growth halted even before COVID-19 arrived, whereas others were more resilient to the downturn brought by COVID-19. When examining the relationship of the 2019 and 2020 data for different GVA and employment measures to check the impact of COVID-19, the findings suggest that the spatial impact brought by COVID-19 has been sweeping across the country with small local differentials. It is important to wait for the publication of new GVA data to see whether the impact of COVID-19 has subsided or aggravated. Of course, another major external driver of productivity change since 2015 was Brexit. According to a senior official of the Bank of England[26], Britain has suffered a loss of £29 billion business investment since the Brexit referendum. However, it is unclear to what extent it has differentially impacted on different areas, especially when the forces of Brexit and COVID-19 are combined.

Spatial synergy and industrial clusters

The level of GVA per hour worked is found having some association with the concentration of specific types of high paid industrial sectors such as IC, PST and life science. Indeed, IC and PST sectors tend to be concentrated in similar locations around Greater London and along the M4 Corridor. With the new form of industrial revolution, the proximity of IC, PST and manufacturing is seen as important to drive economic growth. Some of the very strong performing areas in these three sectors were found in the shire areas neighbouring major metropolitan areas such as Cheshire next to the Greater Manchester and Liverpool City Region CA areas and Wiltshire to the east of the West of England CA area. Likewise, there is evidence of close spatial connection between R&D investment, research-intensive universities and life science companies around the Golden Triangle of London-Oxford-Cambridge and, to a less extent, the

[26] https://scottishfinancialreview.com/2023/02/13/brexit-hit-uk-growth-by-29bn-central-bank-official/

Mersey Belt around Manchester-Liverpool-Cheshire. The spatial cluster analysis also highlights major employment growth clusters in the Midlands. These suggest that there are opportunities for more creative spatial thinking to exploit synergies across different places within and beyond local and combined authority boundaries.

Labour market mismatch

The problem of lack of qualifications of the local population is found to be prevalent in many combined authority areas, especially in the West Midland and the Northern regions. Meanwhile, it is notable that the core city areas in many of the combined authority areas have a higher concentration of qualified workforce. For examples, Liverpool and Manchester LADs experience a polarised situation as they have both an above England level of highly qualified population as well as an above average proportion of population without any qualifications. The lack of sufficient levels of qualified population in a high job-density city can result in differential hourly pay levels between residents and workers and often link to commuting and wider travel to work areas beyond the combined authority area. The analysis further confirms that these areas also suffer from very high levels of economic inactivity, unemployment, income deprivation and lower life expectancy. This means that there is a need to link economic growth and success to local residents' livelihood and wellbeing. Given that economic deprivation is the main indicator affecting different forms of health conditions, the differential hourly pay of workers vs residents does shed light to the debate. There is thus a need to further unravel local performance by examining a wider range of socio-environmental indicators.

Devolved power and Local action

The mapping and spatial cluster analysis, while confirming the broad spatial divide, also highlights that many areas in the combined authority areas are improving, though with varied performance on different indicators. When compared to London and the South East, less areas are consistently performing well except in some pockets such as Solihull, South Gloucestershire, Salford and Halton which are performing well on GVA per hour worked, employment growth and positive industrial mix. However, most combined authorities face the challenge of a less favourable labour market situation with their local population. This suggests that, while there has been short-term improvement in employment growth and in GVA per hour worked, the challenge is enormous and entrenched as many started from a rather low basis. These differential spatial trajectories require long-term strategic policy actions, rather than a one size fits all policy logic, and will need to build local capacity through further devolution of power and resources.

Redressing spatial inequality of investment

It is interesting to note that international port freight is no longer heavily concentrated in the South East and East of England. With major investment in the Liverpool and Tees and Hartlepool ports, they are overtaking some of their southern counterparts as the third and fifth major ports in England respectively. This shows that major investment in infrastructure can address the uneven spatial landscape. However, the situation is less clear on R&D expenditure. With the 2020 GERD representing a decline in real terms from the 2018 and 2019 levels and the spatial bias of spend in the three southern regions, there is a need to see drastic government action to rectify rather than perpetuate the situation. The gravity of challenge facing different places will require concerted and coordinated government policies to set out a strategic spatial framework to address spatial inequalities of investment across government departments.

APPENDIX: DATA SOURCES AND NOTES

Figure	Theme	Unit	Data source	Note
Figure 1	GVA per hour worked (£) in real price, 2004-2020	Combined authority areas and Greater London Authority	Office for National Statistics (https://www.ons.gov.uk/economy/economicoutputandproductivity/productivitymeasures/datasets/subregionalproductivitylabourproductivitygvaperhourworkedandgvaperfilledjobindicesbycityregion)	The real price was calculated by using the implied deflators of the ONS dataset on regional gross value added by industry
Figure 2	GVA per hour worked index, 2020	Local authority	Office for National Statistics: Subregional productivity: labour productivity indices by local authority district (https://www.ons.gov.uk/employmentandlabourmarket/peopleinwork/labourproductivity/datasets/subregionalproductivitylabourproductivityindicesbylocalauthoritydistrict)	Current Price (smoothed) GVA (B) per hour worked index. UK less Extra-Regio: 100
Figure 3	Change in GVA per hour worked, 2015-2019	Local authority	Office for National Statistics: Subregional productivity: labour productivity indices by local authority district (https://www.ons.gov.uk/employmentandlabourmarket/peopleinwork/labourproductivity/datasets/subregionalproductivitylabourproductivityindicesbylocalauthoritydistrict) Implied deflator obtained from the dataset "Regional gross value added (balanced) by industry: local authorities by ITL1 region" (https://www.ons.gov.uk/economy/grossdomesticproductgdp/datasets/regionalgrossvalueaddedbalancedbyindustrylocalauthoritiesbyitl1region)	Real price of GVA per hour worked for each year was calculated based on current price and implied deflator. Change in GVA per hour worked was calculated as % change
Figure 4	Change in GVA per hour worked, 2015-2020	Local authority		
Figure 5	Compound annual GVA growth rate, 2015-2019	Local authority	Office for National Statistics: Regional gross value added (balanced) by industry: local authorities by ITL1 region	based on chained volume measures

Figure 6	Compound annual GVA growth rate, 2015-2020	Local authority	(https://www.ons.gov.uk/economy/grossdomesticproductgdp/datasets/regionalgrossvalueaddedbalancedbyindustrylocalauthoritiesbyitl1region	
Figure 7	Industrial mix share of employment change, 2015-2021	Local authority	Nomis Business Register and Employment Survey (https://www.nomisweb.co.uk/sources/bres)	Based on shift-share analysis of the 99 two-digit Standard Industrial Classification sub-sectors for LADs
Figure 8	Place competitiveness share of employment change, 2015-2021	Local authority		
Figure 9	Key industrial sector employment share, 2021	Local authority	Nomis Business Register and Employment Survey (https://www.nomisweb.co.uk/sources/bres)	Calculated as '% of England total'
Figure 10	Distribution of life science companies, 2022	Company location	UK Biotech Database (http://ukbiotech.com/uk/portal/map.php)	The locations of life science companies were extracted from the website and processed by the research team in December 2022.
Figure 11	Gross domestic expenditure on R&D, 2019	Region	Office for National Statistics: https://www.ons.gov.uk/economy/governmentpublicsectorandtaxes/researchanddevelopmentexpenditure/datasets/ukgrossdomesticexpenditureonresearchanddevelopmentregionaltables	
Figure 12	Research Market Share Index, 2021	University	Times Higher Education (https://www.timeshighereducation.com/content/ref2021mainonlinetable)	Market share was calculated by using quality weightings, along with submitted FTEs to produce a score.
Figure 13	Share of R&D expenditure and Research Market Share Index	Share of R&D: ITL2 region; Research market share: University	**R&D expenditure**: Office for National Statistics, UK gross domestic expenditure on research and development (GERD) by sector of performance and region, 2015 to 2020 (https://www.ons.gov.uk/economy/governmentpublicsectorandtaxes/researchanddevelopmentexpenditure/adhocs/15124ukgrossdomesticexpenditureonresearchanddevelopmentgerdbysectorofperformanceandregion2015to2020) **Research market share**: see details in the data source of Figure 12	Overlay map

Figure 14	Share of life science companies and Research Market Share Index	Share of Life science companies: local authority; Research market share: University	**Share of life science companies**: UK Biotech Database (http://ukbiotech.com/uk/portal/map.php) **Research market share**: see details in the data source of Figure 12	Overlay map
Figure 15	Access to ultrafast broadband, 2020	Output area	Ofcom Connected Nations 2022 (https://www.ofcom.org.uk/research-and-data/multi-sector-research/infrastructure-research/connected-nations-2022/data)	Ultrafast broadband: A data service that can deliver download speeds of at least 300 Mbit/s.
Figure 16	International scheduled flight passengers, 2021	Airport	Civil Aviation Authority - Annual Airport Data 2021 (https://www.caa.co.uk/data-and-analysis/uk-aviation-market/airports/uk-airport-data/uk-airport-data-2021/annual-2021/)	
Figure 17	Major port traffic, 2021	Port	Maritime and shipping statistics - Port freight annual statistics 2021 (https://www.gov.uk/government/statistics/port-freight-annual-statistics-2021)	
Figure 18	Projected population change, 2018-2043	Local authority	Nomis – Population estimates/projections (https://www.nomisweb.co.uk/sources/pest)	2018-based population projections
Figure 19	Population with NVQ 4+ qualification, 2021	Local authority	Nomis – Annual population survey (https://www.nomisweb.co.uk/sources/aps)	NVQ 4+: e.g. HND, Degree and Higher Degree level qualifications or equivalent.
Figure 20	Population with no qualifications, 2021	Local authority	Nomis – Annual population survey (https://www.nomisweb.co.uk/sources/aps)	No Qualifications: no formal qualifications held.
Figure 21	Commuting flows based on the 2011 Census data		See the interactive portal: http://www.commute-flow.net/ and Hincks, S., Kingston, R., Webb, B. and Wong, C. (2017) A new geodemographic classification	
Figure 22	Job density, 2020	Local authority	Nomis – Job density (https://www.nomisweb.co.uk/sources/jd)	Jobs density is defined as the total number of filled jobs in an area

				divided by the resident population aged 16-64 in that area.
Figure 23	Hourly pay of residents, 2022	Local authority	Nomis – Annual survey of hours and earnings (https://www.nomisweb.co.uk/sources/ashe)	Resident analysis: full-time medium hourly pay
Figure 24	Hourly pay of workers, 2022	Local authority		Worker analysis: full-time medium hourly pay
Figure 25	Differential hourly pay between residents and workers	Local authority	Nomis – Annual survey of hours and earnings (https://www.nomisweb.co.uk/sources/ashe)	
Figure 26	Economic inactivity rate, 07/2021-06/2022	Local authority	Nomis – Annual population survey (https://www.nomisweb.co.uk/sources/aps)	
Figure 27	Unemployment rate, July 2022	Local authority	Nomis – Claimant count (https://www.nomisweb.co.uk/sources/cc)	Claimants as a proportion of residents aged 16-64; Claimant count: the number of people claiming Jobseeker's Allowance plus those who claim Universal Credit who are out of work.
Figure 28	Female life expectancy and income deprivation	Local authority	Office for Health Improvement and Disparities (https://www.localhealth.org.uk/#c=indicator&view=map11)	Overlay map
Figure 29	Male life expectancy and income deprivation	Local authority	Office for Health Improvement and Disparities (https://www.localhealth.org.uk/#c=indicator&view=map11)	Overlay map
Figure 30	Deaths (preventable causes) and household poverty	Local authority	Office for Health Improvement and Disparities (https://www.localhealth.org.uk/#c=indicator&view=map11)	Overlay map
Figure 31	PM2.5 concentration level	Local authority	Department for Environment Food & Rural Affairs – Modelled background pollution data (https://uk-air.defra.gov.uk/data/pcm-data)	
Figure 32	GVA per hour (2020) and change of GVA per hour (2015-2020)	Local authority	See details in the data sources of Figures 2 and 4	Overlay map
Figure 33	GVA per hour worked index and employment change	Local authority	See details in the data sources of Figures 2 and 7	Overlay map
Figure 34	Change in GVA per hour worked and employment change	Local authority	See details in the data sources of Figures 4 and 7	Overlay map
Figure 35	GVA per hour index spatial clusters, 2019	Local authority	**GVA per hour index**: See details in the data source of Figure 2	Cluster and outlier analysis by Anselin Local Moran's I

Figure 36	GVA per hour index spatial clusters, 2020	Local authority	**Travel to work areas**: ONS geoportal (https://geoportal.statistics.gov.uk/search?collection=Dataset&sort=name&tags=all(BDY_TTWA%2CDEC_2011)	Cluster and outlier analysis by Anselin Local Moran's I
Figure 37	% employment change spatial clusters, 2015-2019	Local authority	**Employment:** Nomis Business Register and Employment Survey (https://www.nomisweb.co.uk/sources/bres) **Travel to work areas**: ONS geoportal (https://geoportal.statistics.gov.uk/search?collection=Dataset&sort=name&tags=all(BDY_TTWA%2CDEC_2011)	Cluster and outlier analysis by Anselin Local Moran's I
Figure 38	% employment change spatial clusters, 2015-2020	Local authority		Cluster and outlier analysis by Anselin Local Moran's I
Figure 39	Industrial mix employment share spatial clusters, 2015-2019	Local authority		Cluster and outlier analysis by Anselin Local Moran's I
Figure 40	Industrial mix employment share spatial clusters, 2015-2020	Local authority		Cluster and outlier analysis by Anselin Local Moran's I
Table 1	GVA per hour worked and compound GVA annual growth rate of combined authority and Greater London authority areas	Combined authority and Greater London authority	See details in the data source of Figure 1	
Table 2	Compound annual GVA growth rate of combined authority and Greater London authority areas	Combined authority and Greater London authority	Office for National Statistics - Regional gross value added (balanced) by industry: city and enterprise regions (https://www.ons.gov.uk/economy/grossvalueaddedgva/datasets/regionalgrossvalueaddedbalancedbycombinedauthoritycityregionsandothereconomicandenterpriseregionsoftheuk)	
Table 3	Shift-share analysis of employment change, 2015-2021, for combined authority and Greater London authority areas	Combined authority and Greater London authority	Nomis Business Register and Employment Survey (https://www.nomisweb.co.uk/sources/bres)	Based on shift-share analysis of the 99 two-digit Standard Industrial Classification sub-sectors for CAs
Table 4	Gross domestic expenditure on R&D by sector, 2019	Region	Office for National Statistics - Gross domestic expenditure on research and development, by region, UK (https://www.ons.gov.uk/economy/governmentpublicsectorandtaxes/researchanddevelopmentexpenditure/datasets/ukgrossdomesticexpenditureonresearchanddevelopmentregionaltables)	

Table 5	Unemployment claimants (% of aged 16-64 residents), July figures	Combined authority and Greater London authority	Nomis – Claimant count (https://www.nomisweb.co.uk/sources/cc)	
Table 6	Relationship between GVA indicators for LADs in England			Correlation analysis results
Table 7	Relationship between employment measures for LADs in England			Correlation analysis results
Table 8	Relationship between GVA and employment measures for LADs in England			Correlation analysis results