GREATER MANCHESTER INDEPENDENT PROSPERITY REVIEW

# AUDIT OF PRODUCTIVITY

A technical report for the research on **Productivity**

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Greater Manchester Combined Authority Research Team produces high quality research and intelligence to form the evidence base underpinning policy and strategy for the city region.

The School of Social Sciences at The University of Manchester is home to nearly 3000 undergraduate students and over 400 postgraduate students The School carry out theoretically-informed, empirical research, addressing major issues of private and public concern. Their work is founded on a unique combination of six disciplines within the School, including Economics, Politics, Sociology, Social Anthropology, Social Statistics and Philosophy.

The Office for National Statistics are the UK's largest independent producer of official statistics and its recognised national statistical institute. The ONS Subnational Analysis team are located within the newly formed Centre for Subnational Analysis, created to produce new insights on areas of particular – and often cross-cutting – policy interest; utilising new sources of data; adopting the latest tools and approaches; and working in collaboration with others to deliver new insight.

The views expressed in this report are those of the authors and, as usual, errors and omissions in this report remain the responsibility of the authors alone.

The Greater Manchester Independent Prosperity Review was commissioned to provide a detailed and rigorous assessment of the current state, and future potential, of Greater Manchester's economy. Ten years on from the path-breaking Manchester Independent Economic Review, it provides a fresh understanding of what needs to be done to improve productivity and drive prosperity across the city region.

Independent of local and national government, the Prosperity Review was carried out under the leadership of a Panel of six experts:

**Professor Diane Coyle**
Bennett Professor of Public Policy, University of Cambridge, and
Chair of the Greater Manchester Independent Prosperity Review

**Stephanie Flanders**
Head of Bloomberg Economics

**Professor Ed Glaeser**
Fred and Eleanor Glimp Professor of Economics, Harvard University

**Professor Mariana Mazzucato**
Professor in the Economics of Innovation & Public Value and Director of UCL Institute for Innovation and Public Purpose

**Professor Henry Overman**
Professor of Economic Geography, London School of Economics, and
Director of the What Works Centre for Local Economic Growth

**Darra Singh**
Government and Public Sector Lead at Ernst and Young (EY)

The Panel commissioned studies in four areas, providing a thorough and cutting edge analysis of key economic issues affecting the city region:

- Analysis of productivity, taking a deep-dive into labour productivity performance across Greater Manchester (GM), including a granular analysis of the 'long tail' of low-productivity firms and low pay;
- Analysis of education and skills transitions, reviewing the role of the entire education and skills system and how individuals pass through key transitions;
- Exploration of the city region's innovation ecosystems, national and international supply chains and trade linkages; and sources of global competitiveness, building on the 2016 Science and Innovation Audit; and
- Work to review the infrastructure needs of Greater Manchester for raising productivity, including the potential for new approaches to unlock additional investment.

A call for evidence and international comparative analysis, developed in collaboration with the Organisation for European Cooperation and Development (OECD) and European Commission, also supported this work.

All of the Greater Manchester Independent Prosperity Review outputs are available to download at **www.gmprosperityreview.co.uk**.

This technical report is one of a suite of Greater Manchester Independent Prosperity Review Background Reports.

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# Executive summary

*'Productivity isn't everything, but, in the long run, it is almost everything'*[1]

### *Productivity and the Independent Prosperity Review*

Paul Krugman's famously-qualified endorsement of the importance of productivity to long-run economic change provides a good guide to the way it has been understood for the purposes of the Independent Prosperity Review. On one hand, economic history demonstrates that the transformation of living standards seen since the industrial revolution has been built upon productivity improvements enabled by growing human ingenuity and successive technological innovations. Improvements in productivity also support competitiveness, help trading performance, enable wage growth and build the tax base that supports public services and investments.

As this paper makes clear, we also know, more recently, that:

- UK productivity levels have long trailed those attained in other advanced national economies.
- Despite a period of catch-up in the decade leading up to the global financial crisis, when productivity growth in the UK was high by international standards, the post-crisis period has witnessed a UK 'productivity puzzle' that has seen productivity growth flat-line and lag behind international competitors once more.
- Productivity levels and productivity growth in Greater Manchester (GM) have consistently trailed UK averages that are inflated by the country's one exceptional performer – London – and the slow recovery in output achieved in GM over the last decade has been built on growth in employment rather than improved productivity.

For all these reasons it is clear that increased productivity, as the National Industrial Strategy suggests and the Manchester Independent Economic Review concluded, remains crucial to future improvements in prosperity and wellbeing, be they at the national or GM levels. On the other hand, it is clear that productivity measurement has its limitations. In technical terms, productivity refers to the efficiency with which measurable 'inputs' are turned into 'outputs'. It is calculated by dividing a measure of output, usually Gross Value Added (GVA), by a measure of input, usually based on actual or potential labour supply or a combination of labour and capital inputs.

It makes a difference which measures are chosen. Previous research by Greater Manchester Combined Authority (GMCA)[2], for example, has demonstrated that 20-25% of the £10 billion 'output gap' in GM – that is, the additional output GM would generate if productivity levels matched the UK average – is accounted for by lower-than-average employment levels (i.e., lagging GVA per person of working age, including those who are not working, many of whom experience poor mental or physical health). The rest is explained by lower-than-average productivity amongst people in work, (i.e. lagging GVA per employment, and GVA per hour worked).

The work on productivity reported on here has focused mainly on a specific labour productivity measure - the nationally recognised ONS time series of Real Gross Value Added (GVA) per Employment (Full Time Equivalent Employees) – because it is the best and most up-to-date available.[3] It is important to recognise, however, that concerns are increasingly expressed about what labour productivity measurement can and cannot tell us. Most of these centre upon the adequacy of GVA as a measure of output.

Amongst the criticisms voiced are that GVA measures do not accurately capture the value of services, and particularly of public services,[4] of unpaid work, or the importance of the free information inputs to activities enabled by new technologies; and that they fail to distinguish between wealth-creating and wealth-extracting activities.[5] These concerns suggest that we should not rely exclusively on productivity measurements as indicators of the positive economic changes that industrial strategies seek to bring about. For all the imperfections of the standard data available, however, it remains the case that productivity trends remain a crucial indicator of sustainable improvements in prosperity.

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[1] Krugman, P.R. (1994) The Age of Diminished Expectations (Washington, DC: The Washington Post Company), p11

[2] GMCA (2016): Sector Deep Dives; and GMCA (2017): Productivity in Greater Manchester

[3] It was not possible to repeat the Total Factor Productivity analysis provided by the Manchester Independent Economic Review in 2009 because no reliable, updated figures on capital stock were available

[4] For a review, see 'Measurement of Government Output and Productivity for the National Accounts' (The Atkinson Report), HMSO 2004

[5] For reviews of the limitations of GVA and GDP as output measures, see Coyle. D. (2014) GDP: A brief but affectionate history; and, Mazzucato. M. (2018) The Value of Everything: Making and taking in the global economy

### *Greater Manchester's productivity performance in context*

GM's experience of growth over the last 20 years is impressive by the standards of most UK city-regions. A £62.7 billion economy (2016, latest), GM's economy makes up 4% of the UK, and just over 19% of the Northern Powerhouse total GVA.[6] During the period from 1998 to 2008, real-GVA grew by 2.6% per annum, ahead of the UK (excluding London) average of 2.4% per annum; and similar to the UK's 2.7% average growth; over the same period real-productivity grew by 1.6% per annum in GM, the same as the UK rate of 1.6%, and ahead of the UK (excluding London) average of 1.4% per annum.

Growth was particularly strong from 2003/04 to 2007/08, which coincides with several transformational projects in GM including, for example, the Spinningfields development, Metrolink extensions, major motorway improvements, MediaCityUK, the beginning of the Oxford Road transformation, as well as growth in the International Airport.

When comparing absolute levels of productivity, GM has remained at approximately 90% of UK average productivity (89.9% in 2016 versus 92.2% in 1998). Despite a widening of the gap during the recession, GM's performance on productivity has mirrored that of the UK and other city-regions, that is, almost a decade of low productivity growth. Other areas were able to return to pre-recession productivity levels quicker, most notably London, which arguably received significant support due to the banking crisis; and Birmingham, with growth arguably from a resurgent automotive sector, on the back of favourable exchange rates, as well as major inward investment.

The evidence shows two striking phases in GM's recent (20 year) economic history: the pre-recession period up to 2007/Q2-2008, when GM and many northern city regions outpaced national productivity growth; and the post-recession period when growth across the board has been slower, with fewer places seeing productivity growth. In addition, in this second period of low productivity growth, jobs growth has held up strongly (GM saw 117,000 net new jobs created post-recession between 2010 and 2016, compared with 130,000 between 1998 and 2008).

In terms of UK and international comparators, the city region with the highest productivity level outside of London in the UK is Bristol. Following this, a group of city-regions in the Midlands and North of England – Birmingham, Greater Manchester, and Leeds – emerge as the next leading city regions in terms of productivity. Looking at international comparators, GM's productivity falls behind other leading European city regions such as Barcelona, Munich, and Helsinki-Uusimaa. As the study findings reveal, the main endowments within GM, such as skills performance and human capital, innovation, R&D investment, propensity and value of trade, and availability of high value work have a large role to play in explaining performance compared to faster growing city-regions like London.

At the aggregate level, there is considerable difference in the average productivity levels of GM's main sectors – at the GM level and also by local authority area – with sectors in the regional centre[7] more likely to have higher average aggregate productivity, in particular for traded service-based industries. However, as our firm level analysis shows, the **differences in productivity within sectors account for more significant variations in productivity throughout GM.** That is, across all sectors, there tends to be a 'top 20%' of higher performing 'frontier' firms, sitting alongside a much longer tail of lower productive firms.

That said, comparative analysis of firm level data (GM vs national productivity) at a granular level suggests that GM has relative specialisms in parts of manufacturing (materials, paper and textiles), health innovation (scientific research), and parts of digital and creative industries (broadcasting). These observations are confirmed by the more detailed analysis undertaken for the Review's 'Global Competitiveness and Innovation' study.

A high-level review of the links between health, wellbeing and productivity echoes the findings of research across the UK, with a particular focus on the cities of the North of England, which

[6] Source: Greater Manchester Forecasting Model (GMFM-2018); 19% of total workplace employment, 18% of total resident population, and 20% of Northern Powerhouse businesses

[7] The regional centre covers Manchester City Centre, inner Salford and Trafford Wharfside

estimates that up to **30% of the productivity gap with the UK average could be reduced by raising participation in the workforce through addressing ill health.**

This research finds that working people experiencing a spell of ill health in the North of England are 39% more likely to lose their job compared to their counterparts in the rest of England; and decreasing rates of ill health by 1.2% and decreasing mortality rates by 0.7% would reduce the gap in productivity between the North and the rest of England by 10%.[8]

### *What factors explain Greater Manchester's aggregate productivity performance?*

A comparative econometric analysis carried out for this paper identifies the main factors associated with differences in productivity levels between GM and its main comparator city-regions. It shows that:

- There is a significant relationship in all city-regions between productivity and levels of human capital. Differences in higher-value employment and the utilisation of skills appear to be the most important factors driving differences in local economic performance.
- The proportion of highly-skilled residents, proportion of managerial and professional jobs, and the proportion of science and technology jobs are the factors most strongly correlated with higher levels of productivity across the UK.
- There is also a positive, albeit weaker correlation between higher productivity and factors such as the share of workers in the Digital and Creative industries, along with the share of new enterprises (start-ups) and high-growth firms. The share of start-ups in particular appears to be a more significant driver of productivity performance for GM, compared to other city-regions.
- Further evidence on scale-ups highlights that no single sector, age of business or location accounts for success, suggesting that intangible factors are critical to success, such as entrepreneurs' business models, capacity, ability, and confidence are critical to success.
- The evidence-base provides no firm conclusions on whether positive or negative externalities of city size dominate, however the analysis suggests that there is a relationship between density and productivity. However, the evidence is much more certain that GM's productivity levels do not match the scale or density of the city-region.
- Despite success in business start-up, GM's performance in terms of human capital and higher value jobs, has some way to go if it is to at least raise high value outputs and start to reach a critical mass which closes the gap with leading city-regions.
- The results of regression modelling suggest again that skills, share of professional occupations, share of science and technology jobs, as well as density, are important considerations for productivity; and in the case of London, density is more important than in all other city regions.
- Recent research also highlights the importance of supporting people in their entry to work. It identifies that having a healthy, productive and highly skilled workforce is one of the main factors which will help improve productivity growth across both GM and the North of England.[9]

### *Which factors explain firm-level productivity?*

Analysis of ONS firm-level data shows that productivity differences within industries are more important than the mix of industries in an area in explaining overall differences in productivity. The analysis reveals specific characteristics are associated with higher and lower productive firms:

- There is no clear relationship between productivity and firm size or age. However it does suggest that firms over 20 years of age in GM typically fall into one of two categories, either micro-size or large (over 250 employees) suggesting that there are a significant proportion of older small firms that have not decided to, or, been able to scale-up.
- There are highly productive and very low productive firms in all industry sectors in GM. However, there is a clear trend in the likelihood of firms falling in the top or bottom 20% of the productivity distribution based on a broad industrial classification:

[8] Bambra, Munford, Brown et al (2018) Health for Wealth: Building a Healthier Northern Powerhouse for UK Productivity

[9] Research by the Northern Powerhouse demonstrates the impact of tackling health inequalities across the North of England. It finds that up to 30% of the productivity gap with the UK average could be reduced by raising participation in the workforce through addressing ill health. Bambra, Munford, Brown et al (2018) Health for Wealth: Building a Healthier Northern Powerhouse for UK Productivity.

- Firms in Business and Professional Services, Digital and Creative Industries, Construction, Health Innovation, and Manufacturing are more likely to fall in the group of most productive.
- Firms in Hospitality, Tourism, and Sport; Retail and Wholesale; and Health and Social Care are more likely to fall in the group of least productive firms/organisations.

- There is little difference in the productivity distributions of firms in the foundational/routine economy (retail, hospitality, social care), which are almost identical between city-regions, with the exception of London. The main characteristics associated with higher performing firms are those that have international trade (exporting), and this applies across all business age groups, and firms' sizes.
- Foreign-owned firms in GM are on, average, more likely to have higher productivity than non-foreign owned firms, and this applies across all sizes of firm. However, the data also show that these types of firms are more likely than the national average to be in the bottom 20% least productive firms in all GM, suggesting a role to target higher value investment.

***Key issues for consideration***

Our research findings emphasise the importance of the accumulation of human capital, making improvements to internationalisation and trade, investment in science and innovation, and making GM attractive to businesses and employees. They are also suggestive of some additional observations on GM's comparative advantages that are supplemented by other studies in the Review.

With respect to **aggregate productivity and enterprise**, these include:

- **Addressing 'effective' density.** GM has yet to show the full productivity gains that reflect the size of the city region. This suggests the need to continue to improve transport networks and accessibility across the city-region and with neighbouring regions, encouraging development around key public transport hubs and city- and town-centres, and developing new sites in accessible locations that have strong demand.
- **Helping businesses to scale-up.** The evidence suggests that increasing the rate of high value start-ups and supporting small firms to scale up - in particular, those showing the opportunity, ability and desire to grow - could help raise overall productivity.
- **Raising the value of work.** GM businesses, overall, are less productive than their equivalents in London and the Greater South East. This suggests the importance of encouraging firms to improve their positions in national supply chains, to ensure that more high value activity is relocated into GM. It also highlights the importance of attracting high-value firms to GM and facilitating trade linkages.

With respect to raising the value of, and deployment of, **human capital**, they are:

- **Lifelong investment in education and skills.** The long-term success in building a productive, high-value, high-skill economy will depend on the quality of pre-schooling, primary and secondary education, and continued 'lifetime' investment in the skills of GM's workforce.
- **A healthy and prosperous workforce.** Research has highlighted the importance of investing in a healthy workforce - in terms of raising in-work productivity levels - but also the importance of helping all residents to access work, in terms of wellbeing and prosperity.
- **Raising the quality of jobs in 'foundation economy'.** Promoting the use of new technologies and high-performing business practices, in particular the importance of investing in people and ensuring good pay and conditions within high employment, low productivity sectors such as Hospitality, Tourism and Sport; Retail, and Health and Social Care.
- **Raising employers' demand for skills.** Working with employers to adopt higher skill and higher wage business models, and demonstrating the potential returns to investment in people; and helping to promote careers and development opportunities to attract and retain talent.
- **Investing in leadership and management skills.** In particular, promoting learning from high performing foreign owned firms in GM, demonstrating the returns to investment in skills; and sharing best practice in the discovery and adoption of leading innovations.

With respect to growing the propensity and value of **trade and investment**, they are:

- **Exporting and supply chains.** Working with firms to change their positions in national supply chains or organisational structures, to ensure that more high value activity occurs in GM; and raising the ability of firms to trade outside the city-region and potentially export.
- **Attracting high value** foreign and domestic inward investment, but with a greater emphasis on attracting high performing / higher value-added operations, and high wage jobs to GM; and ensuring that these firms are 'plugged-in' to local supply chains after relocation.
- **Capitalising on GM's key assets and their competitive advantage.** Whilst firms appear to benefit more from being in a dense and diverse city region with a large labour market than from proximity to firms in the same sector, it will still be important to promote GM's unique assets and strengths, in particular its university and research and development specialisms.

A final challenge is the need to manage the balance of responses that improve the labour market, and those that improve firm productivity. The two are not mutually exclusive. At the firm level, boosts to productivity should increase sales and potentially jobs growth. In a similar way, it is wrong to believe that productivity will fall if more 'less skilled' workers are drawn into the workforce. If potential outputs are improved by expanding the effective labour force (in terms of good quality jobs) then there is no reason to expect the overall efficiency of GM's economy to fall - in terms of labour productivity - as the job market expands in the long-term.

# 1. Introduction and scope

## 1.1 Context

Productivity improvement and high and stable levels of employment are central to long-term economic performance and living standards - both for Greater Manchester (GM), and the United Kingdom (UK) as a whole. In the decade leading up to the financial crisis, the UK economy experienced strong labour productivity growth, as did GM, and a narrowing of the long-standing productivity gap between the UK and other leading international economies. For example, between 1997 and 2010, economic output or Gross Value Added (GVA) per hour was second only to the US, and ahead of France, Germany, Italy and Japan.[10]

As is well-known, UK labour productivity suffered a negative shock during the financial crisis and recession that ensued, and productivity growth has remained stubbornly low ever since.[11] As a result productivity levels in the UK and GM lag those in peer economies, meaning that output growth has depended largely on increases in employment. This low post-crisis growth is known as the '*productivity puzzle*' and is *"One of the most pressing issues facing the UK's economy today".* [12]

Equally, productivity is important for national growth, and depending on how it is achieved – for national and local prosperity. As Paul Krugman famously noted: *"Productivity isn't everything, but, in the long run, it is almost everything. A country's ability to improve its standard of living over time depends almost entirely on its ability to raise its output per worker."* [13]

Research suggests that the scope for substantial future employment gains is limited, as the unemployment rate is around historic lows and the rate of net immigration of workers, in particular from the EU to the UK is starting to slow.[14] Therefore, transformation in economic performance will increasingly depend on the ability of firms to raise output per worker. However, that said research on GM shows that 75-80% of the 'prosperity gap' (GVA per Head [15]) with the UK average is due to lower 'in-work' labour productivity; and the 20% to 25% due to lower resident economic activity rates so there are potentially significant gains to be made from focusing on employment gains in the city-region.[16,17]

Since the publication of the Manchester Independent Economic Review (MIER),[18] the gaps identified in GM's productivity performance have persisted, both in terms of growth rates, as well as the gap with the UK and leading city-regions (for example London and Bristol) averages. Whilst MIER identified that GM was one of the main city regions which, given its scale is bigger than Bristol, has the potential to raise local productivity levels, and was best placed to take advantage of any potential benefits of urban density to increase its growth. It also found that, alongside Liverpool and Leeds-Bradford – GM had higher productivity than other city-regions elsewhere in the North.

The main reasons given by MIER for this historic underperformance, was that firms in the city-region were not exploiting 'agglomeration' benefits. There was little evidence to suggest that density has had a significant impact on individual firms; and there was little evidence to suggest that the clustering of particular sectors, with one or two exceptions,[19] is important for productivity. However, the research did highlight benefits for local firms from being located in a large, diverse city-region - including investment spill-overs from domestic firms, and the importance of connecting to the best innovation, wherever it was in the world, and sharing these across local supply chains.

[10] Corry, D. et al. CEP (2011): UK economic performance since 1997. Growth, productivity, and jobs

[11] Schneider, P. (2016) There are Two Productivity Puzzles, Bank of England , Bank Underground

[12] The UK's Productivity Problem. Speech given by Andrew G Haldane, Chief Economist, Bank of England, 28 June 2018

[13] Krugman (1994). *op.cit*.

[14] ONS (2018): Quarterly Migration Bulletin – November 2018. There are different patterns for EU and non-EU migration. Due to increasing numbers arriving for work and study, non-EU net migration is now at the highest level since 2004. In contrast, EU net migration, while still adding to the population as a whole, is at the lowest since 2012

[15] See Annex 1 for definitions of prosperity and productivity terms used throughout this work

[16] New Economy (2017): Productivity in Greater Manchester, and New economy (2016) Greater Manchester Sector Deep Dives

[17] McCann, P. (2018), Productivity perspectives synthesis. An evidence review

[18] Manchester Independent Economic Review (2009). At: http://manchester-review.co.uk

[19] For example, as identified in MIER, where there have been large 'sunk-costs' in critical infrastructure, and potentially alongside a legacy of other 'lead' organisations and their suppliers, for example Media-City (BBC, ITV), Daresbury and Harwell Campus

MIER also highlighted that the labour force's skills were: "A *large part of the explanation for the productivity gap between the Southeast and the rest*." It showed that GM does well in terms of skills and higher value jobs compared to other cities in the North, but not compared to the London and Southeast and Bristol. The productivity of its skilled workers was lower than that of skilled workers in the latter two comparators.

Finally, MIER found that inadequate transport networks within GM are an important cost of increasing the size of the city, and improvements would provide the largest economic payoff. The work suggested that there may be net economic benefits to investment in some external links to other cities which could become more connected to the GM economy, but highlighted the importance of intra-regional transport, in particular as the city-region grows; and MIER also highlighted, based on price data that there *"is a mismatch between housing supply and demand*".

As this paper demonstrates, whilst there have been improvements in the performance of GMs economy up to 2008, ONS data on productivity shows that GM took longer to recover from the 2007/8 recession than many other city-regions in the UK, particularly London which suffered deeper impacts, but equally quicker recovery.[20] However, it is important to note that GM has recovered from the deepest and longest recession in almost recent history, and despite the slow recovery (and persistent gap with London and the UK average) the evidence suggests that GM is still one of the leading city-regions outside London to help address the UK's productivity puzzle.

## 1.2 Aims

The aim of this study was to analyse the productivity performance of GM with special reference to labour productivity. It will help to locate GM in relation to the nation as a whole and to selected comparator regions in respect of its productivity and the factors that determine that performance; and by examining the determinants of productivity within a comparative framework, take a first step in the necessary process of investigating areas in which policy initiatives could be most impactful.

More specifically, it addressed the following questions:

- What are the main factors which explain **aggregate labour productivity** performance in GM?
- What are the **main determinants that explain firm-level labour productivity** in GM?
- To what extent does the **density of firms and skills** explain GM's level of productivity?
- How do the findings **compare relative** to other 'comparator' city-regions?[21]
- What are the **implications** of the analysis, for policy and further research?

## 1.3 Structure of the report

The report is structured as follows:

- **Section 2, Literature review,** an overview of economic concepts and empirical evidence - including an assessment of wider determinants of productivity which are more difficult to capture in standard economic datasets (such as health and wellbeing).
- **Section 3, Productivity performance,** including headline performance of GM's economy compared to other benchmark city-regions, and a summary of performance under each of Government's main 'foundations of productivity'.
- **Section 4, Determinants of productivity,** presenting new evidence for GM which identifies the main determinants of productivity, and uses regression analysis to understand which (combination) of factors are more important in describing the findings in each area.
- **Section 5,** Firm level survey data at the city-region level showing which firm characteristics help explain GM's level of productivity compared to other city-regions in the UK.
- **Section 6, concludes,** by drawing upon the main findings of this study, and those of other studies in the review, and starts to raise key issues for consideration in policy thinking.

[20] 'Real' given the effects of inflation are removed from the data

[21] The rationale for the benchmarks used in this report is detailed later, and full list of definitions in the annex

# 2. Literature Review

## 2.1 What is productivity?

Before moving onto the evidence of productivity performance, it is important to set out how productivity is measured by the Office for National Statistics(ONS), and to set out some of the strengths and weaknesses of the approaches, including reference to other measures of economic performance.

In its everyday usage, productivity refers to the efficiency with which 'inputs' are turned into 'outputs' across the full range of human activities. Common sense tells us we are more productive when we are able to generate or achieve more for less. Economic history demonstrates that the transformation of living standards experienced since the industrial revolution has been built upon the productivity improvements from growing human ingenuity and technological innovation.[22]

In technical terms, productivity is calculated by dividing a measure of output, usually Gross Value Added (GVA[23]) at the city-region level, by a measure of input. The most commonly-used input measures relate to actual or potential labour or to an index of all of a firm or organisation's production factors, such as labour, capital, managerial effectiveness and so on. Hence productivity is generally expressed as GVA per person in employment or per hour worked, or as Total Factor Productivity (TFP) which reflects how all the different factors are combined together to contribute to average aggregate levels.

Because output measurement relies substantially upon surveys of employers, productivity measures are most reliable at the aggregate level (i.e. for a whole country) and become steadily more approximate as the areas examined become smaller. The use of Office for National Statistics (ONS) surveys means that it is only possible to analyse some aspects of productivity at city-region level. This report only deals with labour productivity as more detailed data on capital inputs is not readily available for smaller areas – such as GM and other city-region benchmarks.

Concerns have also been raised, in particular, about what the standard output data (GDP/GVA) do and do not measure and account for.[24] This includes whether they are able to capture the output of services, and especially public services, effectively, and the extent to which they are useful to understanding the distribution of benefits that flow from productive activity to particular places and social groups. That is, how helpful they are in demonstrating the extent of inclusive growth.[25] Notwithstanding these concerns, a focus on productivity is important because:

- Productivity improvements were identified, by the MIER, as a crucial determinant of future living standards and life chances in GM.[26]
- An understanding of the difference between the productivity of people in employment and of the GM population as whole is useful when identifying the nature of GM's economic and social challenges.
- Making use of ONS data on productivity, for all its imperfections, enables us to track and compare GM's economic performance consistently over time.

There are limitations to what aspects of the economy the measures capture, for example the measure counts activity that happens inside the money economy and will miss activities such as volunteering, unpaid childcare, increasing involvement in customers in 'routine' transaction processes, and the utility gained from 'freeware' software-applications. They also do not measure quality/value, wealth, and most glaringly, they do not capture the distribution of growth, and as a result cannot reflect inequality, nor do they capture the full environmental impacts and other negative externalities of the activity being undertaken.

22 Haldane A (2017): Productivity Puzzles: Speech by Andy Haldane, Chief Economist, Bank of England, London July 2017

23 ONS (2018) Gross Value added (GVA), is a measure of the increase in the value of the economy. It is measured at current basic prices, which include the effect of inflation, excluding taxes (less subsidies) on products (for example, Value Added Tax).

24 Coyle, D. (2014): GDP: A Brief but Affectionate History'; and Mazzucato, M. (2018):The value of Everything

25 Inclusive Growth Commission (2018): Making our economy work for everyone. The RSA

26 Overman, H. et al. (2009): The Case for Agglomeration Economies. Manchester Independent Economic Review (MIER 2009)

Further, some businesses prefer to think about operational efficiency, profit and loss accounts, and others quality and impact; and workers will focus on how much they can get paid for a day's work, alongside work satisfaction. Equally, not all industries think about productivity in the same way. Consider the 'productivity' of saving lives, or the time spent caring for an elderly person, or ability of a hairdresser to cut more than one person's hair at a time.

Potential improvements in productivity here are marginal at best, and 'productivity' may not be an appropriate measure at all. There also is a growing recognition that how we are doing as a nation is at least as much about people's health and well-being as it is about the country's economic health.[27,28] These factors are explored in more detail later in this report.

## 2.2 Definitions and limitations

### *2.2.1 Labour productivity*

The full method note, including definitions used throughout the study, is included in the Annex accompanying this report. Headline labour productivity is defined as the total economic output (or Gross Value Added – GVA, crudely profit plus wages) divided by the number employed in those industries. This is regarded by ONS and OECD as one of the main measures of productivity:

*"When assessing (sub)regional economic performance, it is recommended to use the productivity measures GVA per hour worked or GVA per job filled rather than GVA per head, particularly important when there are large net commuting flows."* [29]

The analysis focusses upon labour productivity – given that data is more readily available at the city-region level, for GM and its range of comparator areas (defined in the Annex);[30] and the links to the Government's 'five foundations'[31], alongside wider considerations such as health and other alternative measures of prosperity. The majority of the variables used to analyse the determinants of productivity are sourced from ONS, NOMIS, and Eurostat, using the latest year available and time-series that go back to 2009/10, and where possible showing pre- and post- recession trends. However, there are challenges in terms of obtaining consistent data over time – for example the decade before and after the recessions - which limits parts of the analysis.

The study also makes reference to 'high' and 'low' productivity businesses. More detail is provided throughout this report, in particular relating to both absolute and relative levels. For example, financial services firms in GM may have high absolute levels of productivity, but in relative terms – compared with say the City of London – productivity levels may be 70 to 80% of the UK or London average. These comparisons are defined throughout the work. Equally, the Independent Prosperity Review analysis defines 'low productivity' firms as those in the bottom 20% in terms of GVA per employment at UK and local GM levels; and low productivity sectors as those with below or around £30,000 GVA per employment.[32]

### *2.2.2 Approach*

This research breaks new ground for GM as a result of access to firm level datasets obtained through partnership working with the Office of National Statistics (ONS). Access to the Secure Research Server has enabled us to explore the Business Structural Database in more detail to understand firm-level productivity at a granular level. This data is taken from survey of local plant operations in GM (referred to as 'firms' throughout the report). It is important to note that weightings are used to make sure that the data are representative of the UK and GM's 'non-

[27] Leijten, F. et al (2014): The Influence of Chronic Health Problems on Work Ability and Productivity at Work:

[28] De Vol R and Bedroussian A (2007) An Unhealthy America: The economic burden of chronic disease, charting a new course to save lives and increase productivity and economic growth

[29] ONS (2018) Sub-regional Gross Value Added methodology note

[30] NUTS - Nomenclature of Units for Territorial Statistics, standard areas used for international statistics in Europe

[31] HMG (2018): Industrial Strategy. The Five Foundations: Ideas: the world's most innovative economy; People: good jobs and greater earning power for all; Infrastructure: a major upgrade to the UK's infrastructure; Business Environment: the best place to start and grow a business; Places: prosperous communities across the UK

[32] In its 2018 Business Productivity Review call for evidence, the Department for Business, Energy, and Industrial Strategy defined low-productivity businesses as "a business with levels of productivity below the UK median".

financial' economy. That is, the survey covers most of the economy apart from Financial Services and parts of the public sector.[33]

A mixed method approach has been taken to understanding labour productivity. The analysis includes decomposition analysis to understand the relative importance of industry-mix vs firm productivity; and uses detailed econometric work to understand the main determinants of GM's performance. It is important to note that the majority of work is at the GM level, given the availability of data, but where possible statistics are given to a lower level for local authority areas – in particular average aggregate productivity levels.

The work also aimed to trial work on Total Factor Productivity (TFP), however due to data limitations, the advice from external reviewers and ONS was to focus on Labour Productivity. Revisiting TFP will be an important step beyond the Review, and will require additional work on data availability at lower spatial levels, including information on capital stock, and measuring intangible assets at the firm level. Much of the cutting edge literature on productivity points to the importance of TFP, and understanding how new technology is generated, and the speed at which it is shared/diffused, and embedded within a local economy.

Much of this thinking sits outside existing orthodox economic frameworks, and the issues include factors such as corporate structures, the organisation of local and international supply chains, intellectual property rights, public and private spending on research and development, and the incentives and motivations of entrepreneurs. While outside the scope of the formal analytical framework used for this review, these issues are also explored in this report.

## 2.3 What is the challenge and does raising productivity matter?

Almost every advanced economy has seen a sharp slowdown in productivity in the last decade.[34] However, the UK has been amongst the most affected, and the gap with competing economies is getting wider. The UK's output per hour is 76% of that of the US, 78% of the French, and 79% of Germany.[35] However, recent research by the OECD suggests that the gap between the UK and comparators could be narrower depending on how Gross Value Assed is measured.[36] That said, research by ONS highlights a decade of stagnation, with UK output per hour not that significantly different to the level in 2007. This comes after a decade of productivity 'catching-up' between the UK and other advanced economies from 1997 to 2007/08.[37]

This slowdown, or secular stagnation' in growth, is often referred to as '**the productivity puzzle'**.[38] There has been considerable debate over the slowdown in productivity growth, whether it is temporary or permanent, and what a solution to the gap should be.[39] There are several plausible views as to why productivity growth (in the UK and globally) has remained flat, such as:[40]

- **The long tail,** whilst productivity growth remains fast in some of the most dynamic businesses, the tail of low productivity business, sectors, and places has grown longer.[41]
- **Stalling innovation and business dynamism**, technological progress no longer produces the same gains, and despite rising start-up rates, the performance of 'frontier firms' is weaker.[42,43]
- **Falling investment**, and decline in the contribution of capital deepening, and slower Total Factor Productivity - how different factors (technology, skills, etc.) are combined into output.[44]

[33] The data used in this analysis is sourced from the ONS Annual Business Survey (ABS), which is the main structural business survey conducted by ONS. It surveys around 65,000 firms nationally on an annual basis to collect financial information from firms in the production, construction, distribution and services industries, representing approximately two-thirds of the UK economy. The data necessary to estimate impacts on productivity are only available if a firm is sampled to complete more detailed information in the survey.

[34] Carmody, C. (2018): Slowing productivity growth – a developed economy comparison. Treasury Australian Government

[35] OECD: Compendium of Productivity Indicators 2018. Productivity levels in the total economy

[36] FT (December 2018): UK productivity gap narrows with new measure

[37] ONS (2015): What is the productivity puzzle?

[38] CEP(2011): Growth and productivity: UK economic performance since 1997

[39] Corry, D. et al. CEP (2011): UK Economic performance since 1997. Growth, productivity, and jobs

[40] Haldane A (2017): Productivity Puzzles: Speech by Andy Haldane, Chief Economist, Bank of England, London July 2017

[41] Centre for Cities (2018): The wrong tail. Why Britain's 'long tail' is not the cause of its productivity problems

[42] European Central Bank (2016): The Slowdown in US Labour Productivity Growth — Stylised Facts and Economic Implications

[43] Schneider, P. (March 2018). "The UK's productivity puzzle is in the top tail of the distribution", Bank of England blog

[44] ONS (2018): Multi-factor productivity estimates: Experimental estimates to Quarter 2 (Apr to June) 2018

- **Misallocation of resources,** where inefficient firms are surviving longer, resulting in a lack of movement of labour (retention) to its most productive use, or misallocation of investment.[45,46]
- **Recession,** permanent damage to the corporate sector which resulted in productivity output per hour 10% to 15% lower than it was before the crash, and continued lower demand.[47]
- **Structural shifts in the economy,** from manufacturing to an economy based overwhelmingly on services (which also raises how productivity is measured, and growth in 'manu-services').[48]
- **Measurement problems**, for example, technological advances and the increasing 'value' of intangibles do not show up fully in conventional measures of productivity.[49]
- **Other factors,** for example, monetary policy, austerity, oil reserves, Brexit (risks to the openness of trade); smaller markets limiting specialisation, and restricted skills supply.[50,51]

These issues aside, the Manchester Independent Economic Review, for example, argued that city region differences in productivity growth and per capita incomes correspond to small, near-zero differences in the satisfaction of residents. [52] For example, differences in standards of living are almost equal due to the offsetting higher costs of living, housing, and other amenities in high per capita income regions. In many fast growing major cities, diseconomies also affect the quality of life such as congestion, and air quality. If the potential differences in quality of life or wellbeing are small, in terms of their links to higher per capita incomes and productivity, then, **should policy be concerned with raising productivity?**

**The simple answer is yes**. In a city region with growing employment and a growing economy, job opportunities at the margins are going to be better, career choices more plentiful and diverse, and things are going to feel better. The other key reason is that, in the long-term, rising productivity and employment in more successful economies is important in terms of the provision of public services, including services for residents who are not working. So, even modest improvements in technology can potentially make firms more successful, should help to raise wages and tax revenues, and create further jobs.[53]

## 2.4 What are the (main) sources of productivity growth?

Having outlined productivity challenge, the following section sets out current thinking on the main factors associated with productivity growth (and prosperity) in UK and then within city-regions.

### *2.4.1 Growth at the national level*

Economic geographers have long sought to understand the processes that give rise to productivity growth, as well as the reasons why patterns of uneven geographical performance often persist for considerable periods of time. Whist there is significant debate about the main drivers of local growth - and researchers have contested different types of growth models[54] - most of the current literature on productivity and city-region development highlights that the main differences in growth paths between them is attributed (in part at least) to differences in their economic structures and specialisms, and the extent to which cities have suffered from deindustrialisation and the success with which they have managed to rebuild their economies around knowledge intensive services.[55]

Standard models of economic growth presume an economy must rely on its own resources, i.e. a city region's working age population and the degree to which this is educated, trained, and employed, alongside the capital accumulated through saving for investment in property, technology, and so on. They do not assume inward or outward movements of the factors of production, labour and capital. In the absence of factor movements, differences in growth rates can

[45] Martin, B. Rowthorn, R. (2012): Is the British economy supply constrained? A renewed critique of productivity pessimism. CBRUC.

[46] OECD (2017): Zombie firms and weak productivity

[47] ONS (2012): The productivity conundrum, explanations and preliminary analysis

[48] The contention is that many parts of the service sector have limited potential for higher productivity growth (e.g. hospitality, care)

[49] Haskel, J. Westlake, S. (2018): Capitalism without Capital - The Rise of the Intangible Economy

[50] BoE (August 2016): Inflation Report

[51] Schneider, P. (March 2018). "The UK's productivity puzzle is in the top tail of the distribution", Bank of England blog

[52] Manchester Independent Economic Review (2009): Reviewers' Report

[53] HM Treasury (2015): Fixing the foundations: Creating a more prosperous nation

[54] For example, McCann (2016): The UK Regional-National Economic Problem: Geography, globalisation and governance (Regions and Cities); and Erturk, I. at al (2012) Accounting for national success and failure: Rethinking the UK case

[55] Cited in Martin et al (2018): The city dimension of the productivity growth puzzle

arise from differences in birth and death rates, differences in resident employment rates, differences in rates of technical progress and the application of skills, and entrepreneurship.

Whilst most of the literature on growth models is dominated by differences in technical progress (TFP), access to skills and labour mobility are still seen as significant factors in explaining growth differentials.[56] Success – in terms of purely economic growth – means providing sufficiently attractive wages and accessible employment prospects, as well as sufficient return on capital to draw in labour and capital from other areas.

In the absence of factor mobility, growth in productivity translates directly into differences in per capita income, more efficient production and capital accumulation, and potentially (but not always) into higher wages.[57] However, if there are large differences in TFP, and simply large differences in labour productivity, then that would lead to sustained movements of capital and labour from less productive city-regions and into more productive areas, assuming that the jobs are accessible.

Differences in productivity can therefore mean the difference between a city region that is rapidly gaining jobs and population, and one that is steadily losing them. In short, city-regional growth is more sensitive to differences in productivity performance.

When factor mobility[58] is high then policy impacts can be more than marginal, potentially transformative, in terms of growth rates, but also in terms of jobs, wages, and quality of life. However, when factor mobility is low, the differences between policies that raise productivity a few percentage points above trend will only have marginal impact.

The two arguments centre on the case for concentrating growth, and connections to it. The main contention with this approach is that uneven geographical development may create higher rates of national growth through the exploitation of various increasing returns that the spatial agglomeration of economic activity allegedly confers.

However, the marked unevenness in aggregate productivity levels, (as this and other related research shows)[59] cannot be explained by appealing purely to inherent differences in physical geography alone. Instead, it must be that, over time, the workings of the economic system have amplified and reinforced initial differences to generate historically persistent patterns of spatial disparity. For this to happen there must be self-reinforcing benefits from the spatial concentration of activity. As the next sections will show, local growth cannot rely on the concentration of activity alone, and has implications for the prosperity of places across Greater Manchester.

### *2.4.2 Growth at the local level*

At the national and local level, the literature stresses the importance of factor endowments, such as enterprise, skills, investment, innovation, competition and trade; and the importance of economic 'externalities' or 'spill-overs' which arise due to the connections and concentrations of industry and their workforce, and the presence of a range of assets, such as universities, schools and colleges, hospitals, parks and green infrastructure, town centres, public and social economy. All these are important in creating a series of benefits which give places a range of benefits to the local economy.

Further, an industry or 'cluster' of related industries generates spill-overs that reinforce that industry's local advantage, or in some cases spill-overs to other industries that are encouraged to locate in a region, or close to major transport locations. However, the literature also stresses how these factors are combined – within places – to produce social and economic outcomes, and stress the importance of sharing, matching, and learning, explained below.

First is the ability for a large range of firms (across many different 'sectors') to **share** or have access to specialised suppliers of intermediate inputs. For example, an e-fashion retailer close to sources of digital expertise, fashion designers, fabric samples, supply chain managers, and consumers. In short, input-output linkages occur because savings on transaction costs means firms benefit from locating close to their suppliers and customers.

Second, the concentration (and connectivity) of places allows for deeper labour markets in which the chances of good **matches** between skills that workers can offer and employers want is

[56] Corry, D. et al CEP (2011) UK Economic Performance Since 1997. Growth, Productivity, and Jobs

[57] A quick correlation of productivity and wages in this work showed that 60-65% of growth in productivity is linked to higher wages

[58] The ability to move factors of production - labour, capital or land - out of one production process into another, factor mobility is typically higher in a more service led economy

[59] Martin, R. et al (2018): The city dimension of the productivity growth puzzle: the role of structural change and within-sector slowdown

increased. Skilled workers benefit from better job matches and job security through access to a variety of employers, who in turn benefit from access to diverse a range of employees. Larger sources of jobs also allow for a finer division of labour and incentives for workers to invest in skills.

Third, external economic benefits arise from the **exchange of knowledge**. This exchange can be between individuals and firms in a close or well-connected proximity, and the added value of face-to-face contact and communication can help generate new ideas, referred to as 'knowledge spill-overs'.[60] Equally, proximity helps build trust between businesses and local sources of finance, and depends heavily on relationships between enterprises, investors, and knowledge institutions.[61]

**Physical proximity** can help with the diffusion of knowledge and skills. For example, young, unskilled workers may become skilled from the face-to-face interactions with older, more skilled workers that tend to be found in large cities. As a result of the diffusion of skills and the concentration of old skilled workers, living in large, high-skill cities when young, can be viewed as investment in skills and career progression.[62]

**Market access and trade** are also important. In terms of local and city-region markets, as well as connections to other major international markets linking suppliers and collaborators. This also exposes companies to competitive forces which exert pressure on firms to raise productivity. These factors can condition the possibilities of self-reinforcing growth in which being a large market in itself attracts other firms and investment, and attracts jobs leading to further market growth.[63]

Overall, '**sharing, matching, and learning**' are central pillars to economic models that help describe why certain places grow faster than others – and need to be recognised in the context to any thinking about addressing productivity. These factors come together in towns and cities (and the links between them). These places are increasingly seen as drivers of national productivity growth by acting both as places which maximise local knowledge spill-overs while also providing conduits to global networks of knowledge, trade, ideas, money and people.[64]

International literature outside the UK shows that the potential 'dividend' for productivity growth from increasing density (by 10%) include higher wages (+4%), patenting (+12.5%), preservation of open spaces (+23%), use of non-car modes (+7%), and energy consumption (+11% improvement).[65] However, this approach to growth also has inherent costs. Most obvious is increasing congestion and pressure on land prices as firms compete for scarce resources.

It is the trade-off between these costs and benefits, and how public policy responds to these, that determines which areas are rich and which are poor; which grow fast and which grow slowly. The same studies suggest that rising density is also associated with higher rents (+21%), higher inter-quartile wage gaps (+3.5%), raised mortality risk (+9%), and lower a subjective wellbeing (+0.5%).

At the same time, it is also common to find in the literature that a single reliance on agglomeration and clustering alone will not guarantee more prosperous and equal growth across different places. Most of the UK evidence to date suggests that city regions outside London do not, in aggregate terms, show a significant 'productivity premium' that matches their size.[66] One comprehensive study of the UK's regional growth challenges found that only seven of the UK's 35 largest cities had worker productivity levels that are significantly higher than the EU average.[67]

That is not to say that there are no benefits from density. As a rule of thumb, doubling the size of a city such as GM would only yield an increase in productivity of up to 4%. If GVA per employment stood at over £47,000 in GM in 2016, this would equate to an increase of just under £1,900 per worker. A doubling in size would halve the gap with the UK average.[68] That is not to say that 'density' is unimportant, but **the location of individuals per se cannot be the only source of increasing returns and, higher levels of productivity**.[69] As this study will show, the observed differences in terms of labour productivity among British regions are **more strongly correlated with endowments of certain inputs in each region, as well as job density**. In particular the

[60] Bishop, A. et al. (2018): Economic complexity and the emergence of new ideas

[61] Osma, N. van Oort, F. (2012): Agglomeration Economies, Inventors and Entrepreneurs as Engines of European Regional Productivity

[62] Storper, M, and Venables, A.J. (2003) Buzz: Face-To-Face Contact and the Urban Economy, LSE

[63] Ottaviano, G (2012): Agglomeration, trade and selection, Centre for Economic Performance, LSE

[64] McCann, P., and Acs, Z.J. (2011) Globalisation: Countries, Cities and Multinationals", 2011, Regional Studies

[65] Ahlfeldt G. Pietrostefani E. (2017): The economic effects of density: A synthesis/ SERC Discussion Paper 210

[66] Graham D.J. and Van Dender K. (2011): Estimating the agglomeration benefits of transport investments: Some tests for stability

[67] McCann, P. (2016) The UK Regional–National Economic Problem: Geography, Globalisation and Governance

[68] Rice P. Venables A. (2004): Spatial determinants of productivity, analysis for the regions of Great Britain

[69] Rice, P., Venables, A.J. and Patacchini, E. (2006). Spatial determinants of productivity: analysis for the regions of Great Britain

analysis looks at GM's relative underperformance in productivity growth in the light of skills, high-value employment, business start-up and scale-up, and industry-mix (amongst others) to see what explains GM's level of productivity.

### *2.4.3 Productivity, health and employment rates*

There is a growing awareness that economic development must go beyond GVA and core economic statistics to get a fuller understanding of how society is doing. This includes a focus on people, on how life is lived, wellbeing, happiness, and the prosperity of people and places.[70]

Measures of prosperity typically include a balanced set of indicators which include: income, jobs, housing, health, access to services, environment, education, safety, civic engagement, governance, community, and life satisfaction.[71] Examples of this research and analysis include the '**Good Growth Index for Cities'** which tracks the main factors driving social and economic performance.[72] The results suggest that most cities across the UK have improved their aggregate score, recovering from the decline associated with the 2008/09 recession triggered. The main drivers of this improvement in the UK and GM have been increases in new business start-ups, improvements to employment and skills, and incomes. However, the study also suggests that in the most successful places housing affordability and commuting times have deteriorated.

Studies of workplace wellness make the commercial case for investing in workforce health and productivity. The benefits associated with **Workplace Wellness Initiatives** include reduced sickness absence, rising employee satisfaction, reduced staff turnover; and improved levels of productivity. Analysis of literature and case studies of firm level interventions suggests Benefit Cost Ratios (BCRs) for: programmes targeting medical costs alone of 2.3; programmes targeting absenteeism of between 2.5 and 10; and programmes targeting absenteeism and presenteeism of 1.8 to 8.8.[73]

Recent research by the Northern Powerhouse demonstrates **the impact of tackling health inequalities** across the North of England.[74] It finds that up to **30% of the productivity gap with the UK average could be reduced by raising participation in the workforce through addressing ill health.** The research finds that working people experiencing a spell of ill health in the North of England are 39% more likely to lose their job compared to their counterparts in the rest of England; and decreasing rates of ill health by 1.2% and decreasing mortality rates by 0.7% would reduce the gap in productivity between the North and the rest of England by 10%.[75]

The research also suggests that **reducing morbidity leads to better economic outcomes in terms of higher employment rates, lower rates of economic inactivity, higher GVA per-head, and higher median weekly pay**. The report identifies that these relationships are consistently stronger in the North than compared in the rest of England, indicating there are potential higher economic returns to improving population health in the North. It also shows that ill-health leads to higher unemployment in the North compared to the rest of England, but reduced working hours in the rest of England compared to the North. This suggests that people in the North are more likely to drop out of the labour force when ill, and people in the rest of England reduce working hours.

These findings are important in the context of the fact that 47.2% of GM's adult population (aged 16+) with health conditions or illnesses lasting more than 12 months were in employment as of September 2018, compared to 60.1% for the total adult population – a gap of 12.9 percentage points. Based on average GVA per employee of £44,100, this gap equates to a potential loss to the economy of £4.1bn per annum. There are also significant productivity losses related to people in work who have health problems, both around 'presenteeism' (under-performance associated with ill-health) and sickness absence.

Whilst the former is challenging to quantify, the cost of losses to GM employers associated with sickness absence is estimated to be £0.6bn.[76] Headline Census data on the proportion of residents with a limiting long-term illness shows that three areas in GM were amongst the top 20% of all local authority areas in the country: Rochdale, Tameside and Wigan.

[70] Coyle, D. (2014): GDP: A Brief but Affectionate History

[71] OECD and ONS Index of Wellbeing, and others

[72] PwC / DEMOS Good Growth Index 2018 https://www.pwc.co.uk/industries/government-public-sector/good-growth.html

[73] Cited in PwC (2008): Building the case for wellness

[74] Bambra, Munford, Brown et al (2018) Health for Wealth: Building a Healthier Northern Powerhouse for UK Productivity

[75] North of England defined as the North West, North East and Yorkshire and Humberside (NUTS1) statistical regions

[76] GMCA (2018): Unpublished calculation

As figures 1 to 3 show these were amongst the areas within GM with the lowest levels of GVA per head and *more* acute health issues (for the domains chosen)[77,78]

*Figure 1: Prosperity (GVA per head of resident population) and correlation with residents with a limiting long-term illness, GM and all local authorities in England & Wales*
*(Source: Census 2011)*

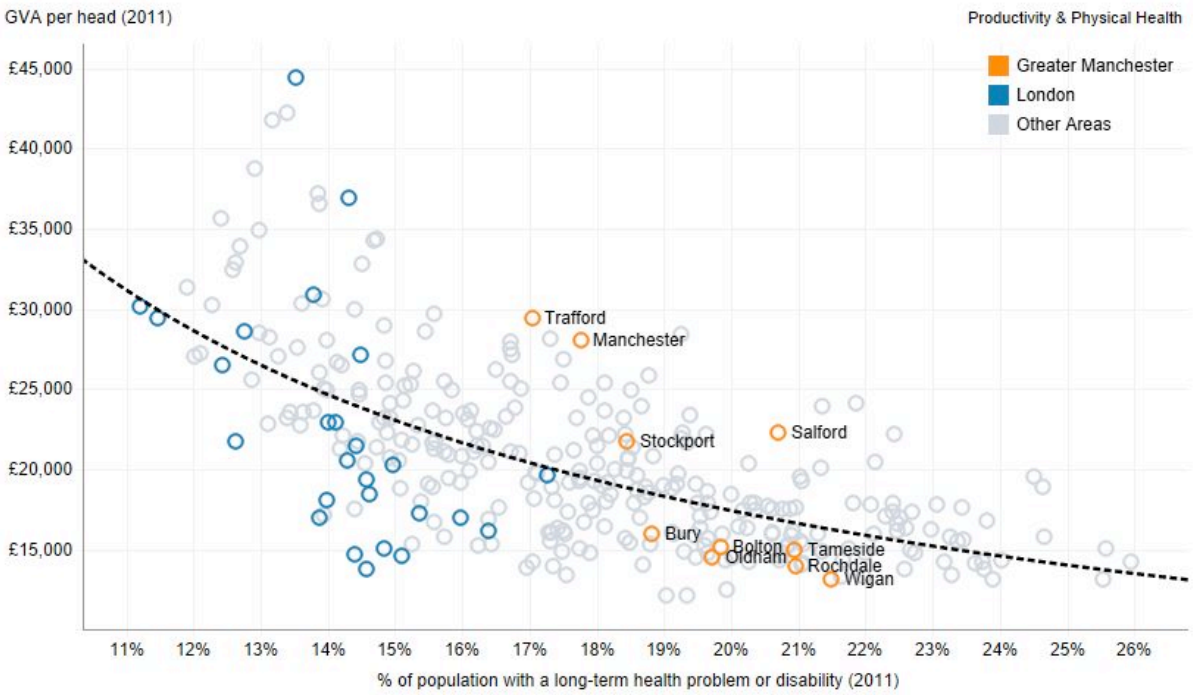
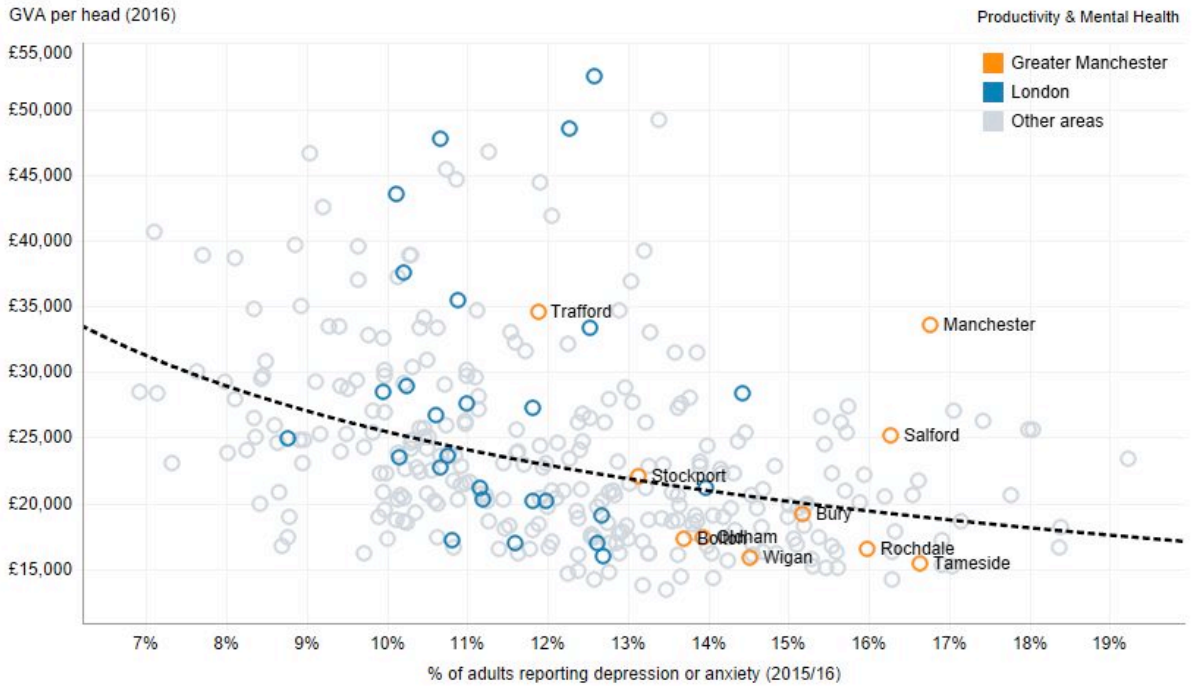


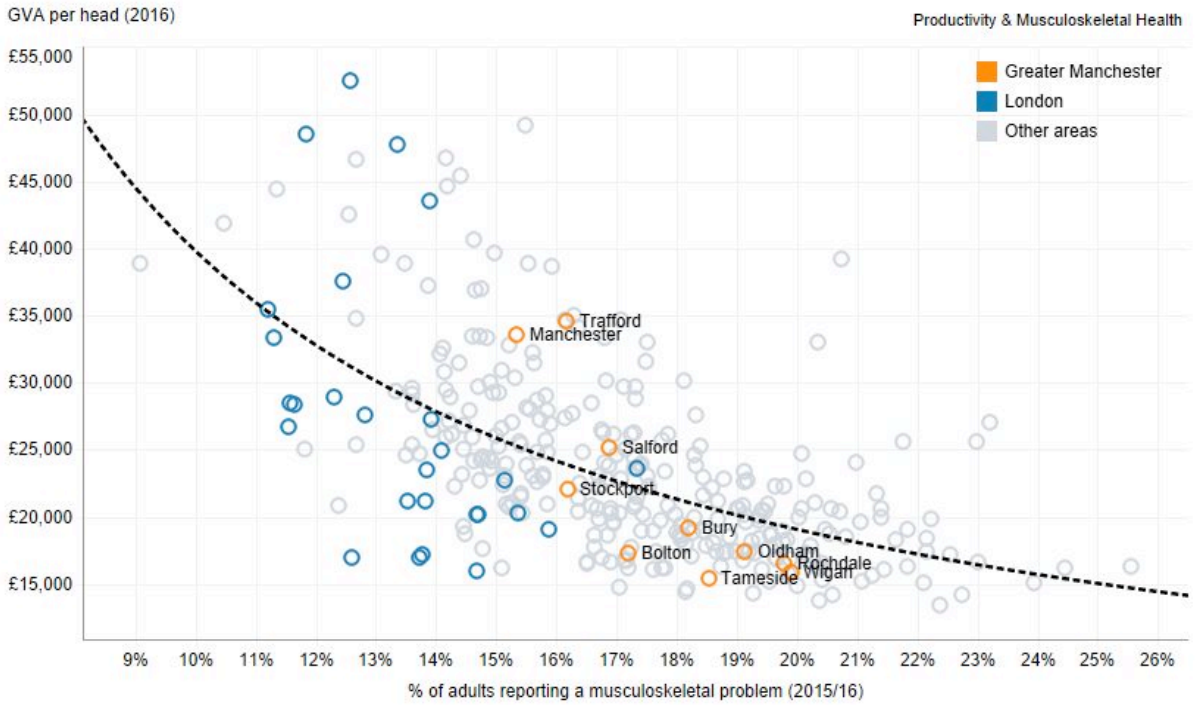

*Figure 2: Prosperity (GVA per head of resident population) and correlation with residents with mental health issues – depression and anxiety, GM and all local authorities in England & Wales*
*(Source: Public Health England Fingertips)*




[77] GMCA (2019): Calculation by GMCA research team (unpublished)

[78] Gross Value Added per Head of resident population used because data on limiting-long-term illnesses is also resident based.

*Figure 3: Prosperity (GVA per head of resident population) and residents with musculoskeletal health issues, GM and all local authorities in England & Wales*
*(Source: Public Health England Fingertips)*




Low economic participation rates reduce the available workforce, and can reinforce deprivation and social inequality. Of GM's £10bn potential output gap (of GM matched the UK average for economic activity and average productivity by sector), up to a quarter is accounted for by lower participation - Manchester, Oldham, Rochdale, Salford and Bolton contribute just over 90% of the gap. Adjusting for inactive students and early retirees, if GM were to match the UK average employment rate, an additional 72,000 residents would be in work.[79]

There are strong geographical concentrations of worklessness within GM (and across the wider North of England). Concentrations are especially high around the regional centre and town centres across GM, in particular within Bolton, Oldham and Rochdale, as well as in peripheral social housing locations. Analysis of Census data shows that, overall, 39 wards in GM accounted for 70% of the employment rate gap between the GM and UK average. It is too complex to show the specific economic activity rates of different resident groups in these individual localities, however GM wards with higher worklessness are significantly more likely to include residents that:

- have poor skill levels and lower prior educational attainment;
- have a long-term illness and disability;
- have lower levels of fluency in English;
- are lone parents;
- are from certain ethnic minority communities; and
- are young (aged 16 to 24 years old) or older residents (over 50 years old).

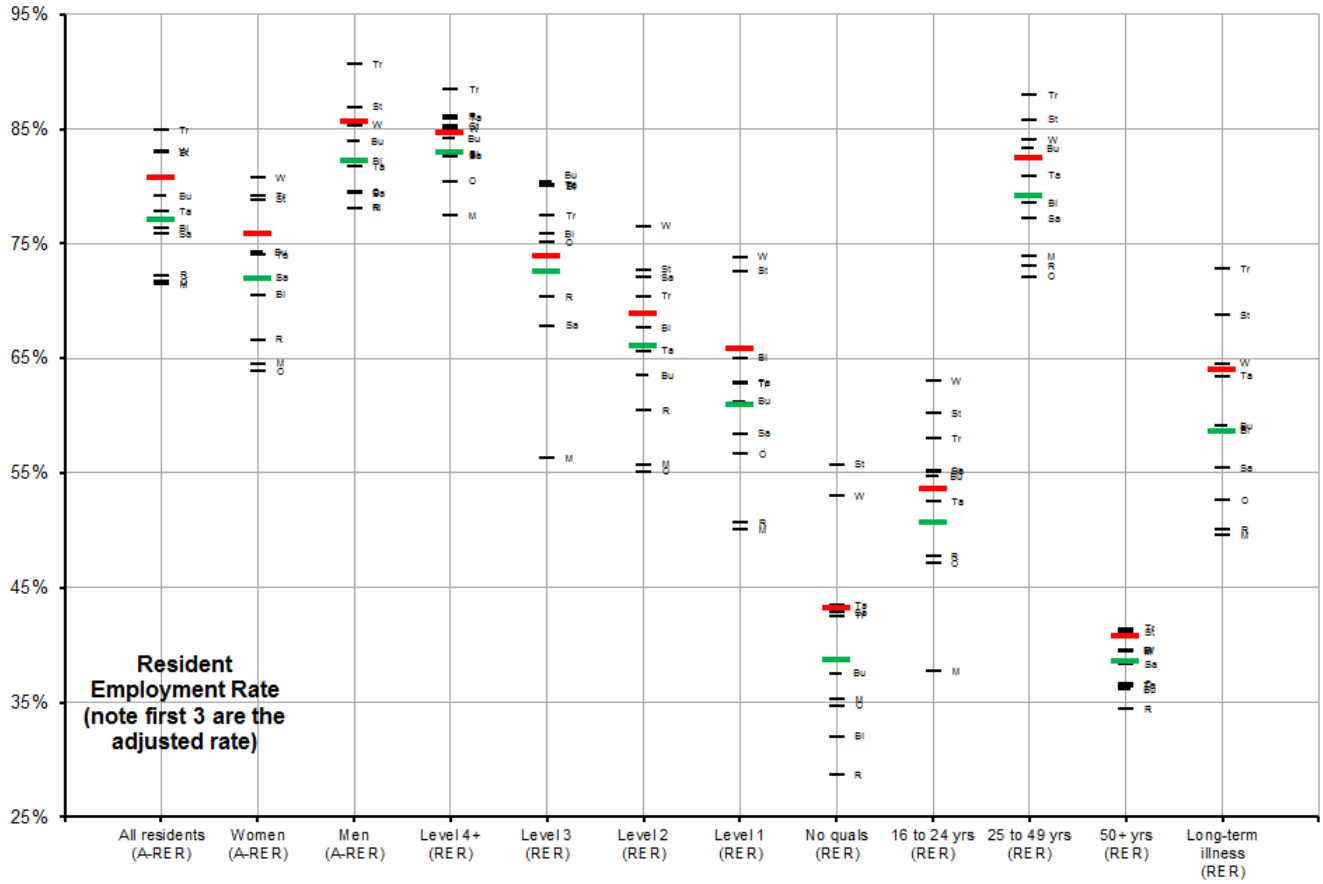
Of these factors, the proportion of residents with no formal qualifications is the key factor determining low rates of employment. Extending the analysis above shows that the resident employment rate in GM raises from 43% for those with no qualifications to 61% for residents with a formal (level 1) qualification, 69% with a Level 2 and to 74% for those with a Level 3 or above qualification.

Figure 4 shows that, across all sub-groups/resident characteristics analysed, GM (green bars) underperforms the national average for each (red bars). It also shows that resident employment rates are lower in areas with low prior educational attainment, and that employment rates improve significantly with formal qualifications. The gaps between the GM and UK averages are largest for those with: no qualifications, level 1 qualification, and those with limiting long-term illnesses. If all districts matched the UK average employment rate for those r**esidents with no qualifications or long-term illness**, then the overall employment rate gap with the national average would fall by at

[79] GMCA (2017): Productivity in Greater Manchester and deep dives

least half. Equally, raising the proportion of residents with formal qualifications and addressing barriers to employment will be critical in supporting inclusive growth and raising productivity.

*Figure 4: Employment rates and resident characteristics. Summary of factors linked with lower levels of employment by area, GM (Source: ONS, Annual Population Survey 2016 and Census 2011)* [80] *Note: Green bar = GM average; and red bar = UK average, GM districts as abbreviations*




### *2.4.4 Productivity and low pay (see accompanying Prosperity Review report)*

The OECD highlights that "*there is no guarantee that the benefits of higher levels of growth, or higher levels of productivity in certain sectors, when they materialise, will be broadly shared across the population as a whole*". On the contrary, there is a risk of a cycle setting in, where individuals with fewer skills and poorer access to opportunities often confined to operate in low productivity, precarious jobs". The relatively job-rich recovery following the 2007/8 recession prevented many thousands of households from the shock of unemployment, but nationally it translated into weaker productivity growth and five consecutive years of falling real wages.[81,82]

Research estimates that 23% of people in GM were employed in low paid work (earning less than two thirds of national median income, or a 'low-pay' threshold), higher than the UK average (21%); and 24% in GM earned less than the living wage (in 2015).[83] Research has also shown that low wage, typically lower productivity, work accounts for almost a quarter of total GVA in the UK and two-thirds of all low-paid employment. Aggregate productivity in these 'low-pay' parts of the UK economy is 30% below the same sectors in Germany, France, Netherlands, 20% below the US.[84] These issues are covered in detail in the Low Productivity & Low Pay study, however, it is important to note that the UK productivity challenge has **both** a supply and a demand side.[85]

[80] Analysis includes 'Adjusted Resident Employment Rate (ARER) which takes into account (removes) economically inactive due to students and early retirement). Due to method and survey sample sizes it is not possible to use A-RER for all analysis

[81] Resolution Foundation (2017): Living Standards 2017: the past, present and possible future of UK incomes

[82] JRF (2016): Monitoring poverty and social exclusion 2016

[83] New Economy (2016) Low Pay and Productivity in Greater Manchester

[84] Forth, J. and Rincon-Aznar, A (2018) Productivity in the UK's Low-Wage Industries. Joseph Rowntree Foundation

[85] Froud, J and Williams, K et al. (2018): Foundational Economy: the infrastructure of everyday life, Manchester University Press

# 3. Productivity performance

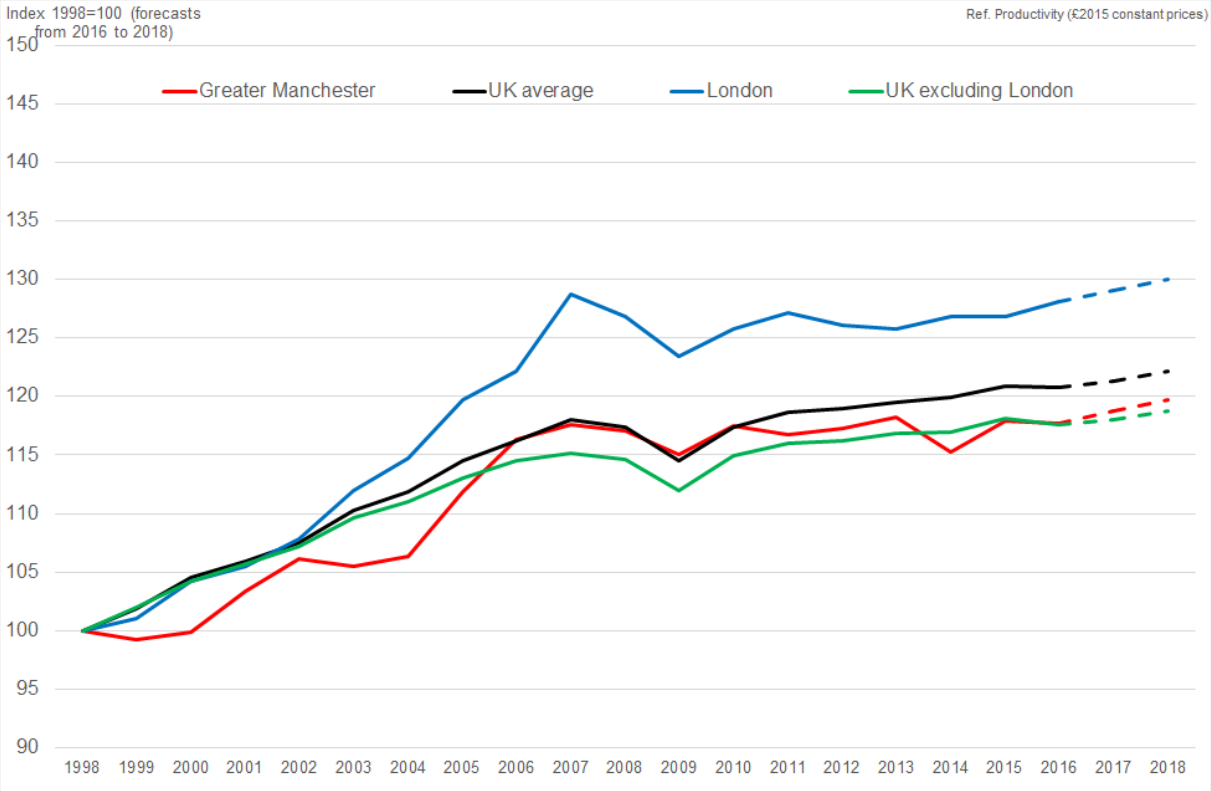
## 3.1 What is Greater Manchester's historical productivity performance?

### *3.1.1 Performance pre- and post- recession*

GM's experience of growth over the last 30 years is impressive by the standards of city regions outside the South East. Higher productivity sectors and businesses, at the cutting-edge of innovation, have played an important role in driving growth and creating well-paid jobs. Despite this, the evidence is more certain that GM's average aggregate productivity levels do not match the scale or density of the city region, and this has not improved 10 years on from the MIER.[86]

Figure 5 below shows the relative performance of GM compared to the UK average, the UK average excluding London, and London alone. Prior to the recession in 2008/09, GM had a strong growth story - in particular from 2004 onwards, which coincided with the start of a number of large projects, including for example Spinningfields, Metrolink extensions, Motorway improvements, development of MediaCityUK, and growth along the Oxford Road Corridor).

*Figure 5:* ***Productivity*** *(GVA per employment) performance GM vs national benchmarks. Index 1998=100 , GM vs UK, and GM vs UK excluding London 1998 to 2016, and forecast 2016 to 2018 (Greater Manchester Forecasting Model time-series, Oxford Economics, 2018)*




### *3.1.2 How does GM's performance compare to the national 'average'*

Figure 6 shows that, in the ten year run up to the recession real GVA grew by 2.6% per annum 1998 to 2008 in GM, ahead of the UK (less London) average of 2.4% per annum; and similar to the UK 2.7%. Over the same period, real-productivity grew by 1.6% per annum, the same as the UK (1.6%), but ahead of the UK excluding London(1.4% per annum); and GM's population also grew strongly, representing one of the largest travel to work areas outside London.[87] Given the scale of GM's economy (and the main findings of MIER[88]) the city-region's economy was reported as one of a few places outside London, with the potential to grow faster (in terms of jobs, GVA, and population) and therefore narrow the gap in performance with London and UK averages.

Despite this strong pre-recession performance in GM's economy, GVA growth after the recession slowed significantly, falling to 1.5% per annum (2010-2016), with a drop below the UK average

[86] MIER (2009): Manchester Independent Economic Review www.manchester-review.co.uk the UK's large cities see limited benefits to productivity from size, especially when London is removed from such analysis

[87] 2017/18 figures forecast based on the latest Greater Manchester Forecasting Model

[88] Ibid Manchester Independent Economic Review

from 2014/15 onwards - bringing the average lower than the UK's 2.1%. Productivity growth fell to just under 0.1% per annum in GM compared to 0.5% per annum in the UK from 2010 to 2016. London's overall GVA growth rate (over 3%) in the same period was higher than all other parts of the UK; and the fact that different cities across the UK experienced different degrees of growth & slowdown, suggests that the factors involved vary between cities (explored in section 4).

It is clear that the recession has had a significant impact on GM's economy, and was hit harder than many other comparator city-regions (shown in the figures below, illustrating 'before' and 'after' growth rates for GM and other city-region benchmarks). However, more recent data for the region - Purchasing Managers' Index surveys - show that the North West of England (the lowest area covered), has performed strongly in the last two-yeas 2016 to 2018, in particular Manufacturing which has consistently out-performed many other regions across the UK.[89] This has also been mirrored by record employment rates shown by the latest ONS regional jobs data, standing at 78.3% of the working age population in the period August 2018 to October 2018, and the gap with the national average narrowing to less than 1% throughout 2018.[90]

*Figure 6: Key statistics. GM vs national benchmarks (GM vs UK, and GM vs UK excluding London) 1998-2008, 2010-2016 (Source: GMFM, 2018, and ONS ASHE, ONS LFS).*

| **Workplace productivity (GVA per FTE)** | **1998** | **2008** | **2010** | **2016** |
|---|---|---|---|---|
| GM % of UK | 92.2% | 92.0% | 92.4% | 89.9% |
| GM % of UK excluding London | 98.0% | 100.1% | 100.2% | 98.1% |
| GM (%CAGR 1998-2008 and 2010-2016)[91] | - | 1.6% | - | <0.1% |
| *UK (%CAGR 1998-2008 and 2010-2016)* | | 1.6% | | 0.5% |
| *UK exc London (%CAGR 1998-2008, 2010-2016)* | - | 1.4% | - | 0.4% |
| **Workplace real-GVA (as a proportion of national benchmarks)** | | | | |
| GM % of UK | 3.8% | 3.8% | 3.8% | 3.7% |
| GM % of UK excluding London | 4.8% | 4.9% | 4.9% | 4.8% |
| GM (%CAGR 1998-2008 and 2010-2016) | - | 2.6% | - | 1.5% |
| *UK (%CAGR 1998-2008 and 2010-2016)* | - | 2.7% | - | 2.1% |
| *UK exc London (%CAGR 1998-2008, 2010-2016)* | - | 2.4% | - | 1.7% |
| **Workplace employment (as a proportion of national benchmarks)** | | | | |
| GM % of UK | 4.1% | 4.1% | 4.1% | 4.1% |
| GM % of UK excluding London | 4.8% | 4.9% | 4.9% | 4.9% |
| GM (%CAGR 1998-2008 and 2010-2016) | - | 1.0% | - | 1.4% |
| *UK (%CAGR 1998-2008 and 2010-2016)* | - | 1.1% | - | 1.6% |
| *UK exc London (%CAGR 1998-2008, 2010-2016)* | - | 1.0% | - | 1.3% |
| **GM resident real-earnings** | - | | - | |
| GM % of UK | 92.0% | 91.5% | 90.8% | 90.7% |
| GM % of UK excluding London | 96.0% | 95.9% | 95.1% | 94.7% |
| GM (%CAGR 1998-2008 and 2010-2016) | - | 1.8% | - | -0.8% |
| *UK (%CAGR 1998-2008 and 2010-2016)* | - | 1.9% | - | -0.8% |
| *UK exc London (%CAGR 1998-2008, 2010-2016)* | - | 1.8% | - | -0.7% |
| **GM resident employment rate** | | | | |
| GM (% of working age population) | 65.6% | 68.5% | 67.0% | 70.5% |
| UK (% of working age population) | 69.1% | 72.1% | 70.1%% | 73.8% |
| GM (%CAGR 1998-2008 and 2010-2016) | - | 1.3% | - | 1.4% |
| *UK (%CAGR 1998-2008 and 2010-2016)* | - | 1.4% | - | 1.5% |
| *UK exc London (%CAGR 1998-2008, 2010-2016)* | - | 1.3% | - | 1.2% |
| **GM total population** | | | | |
| GM % of UK | 4.3% | 4.2% | 4.2% | 4.2% |
| GM % of UK excluding London | 4.9% | 4.9% | 4.9% | 4.9% |
| GM (%CAGR 1998-2008 and 2010-2016) | - | 0.4% | - | 0.7% |
| *UK (%CAGR 1998-2008 and 2010-2016)* | - | 0.6% | - | 0.8% |
| *UK exc London (%CAGR 1998-2008, 2010-2016)* | - | 0.5% | - | 0.7% |

As well as relative growth rates it is instructive comparing how GM's absolute performance compares to the UK average, and the UK average excluding London. Figure 6 also looks at these variables in the period up to the recession and post-recession. Whilst GM's strong performance was not replicated post-recession, the same is true for the UK average excluding London.

[89] IHS Markit / NatWest UK Regional PMI (January 2016 to December 2018)

[90] ONS regional labour force survey 1992 to 2018

[91] CAGR: Compound Annual Growth Rate

It is clear that, London's performance compared to the rest of the UK (whilst weaker post-recession) continues to drive the main productivity differences, in aggregate at the national level. This still remains the case when data on real-estate is removed from GM and the UK's performance.[92,93]

*Figure 7: **GVA** performance GM vs national benchmarks. Index 1998=100. (GM vs UK, GM vs UK excluding London) 1998 to 2018, forecasts from 2016 to 2018*
*(Source: Greater Manchester Forecasting Model, 2018)*

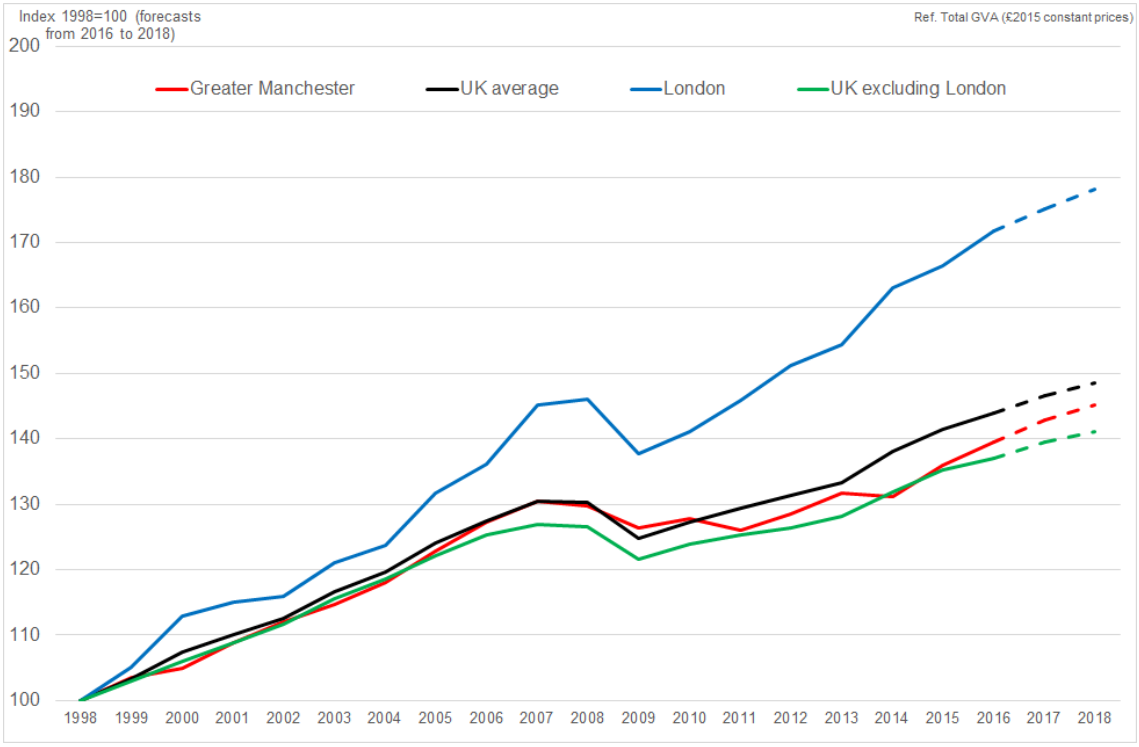
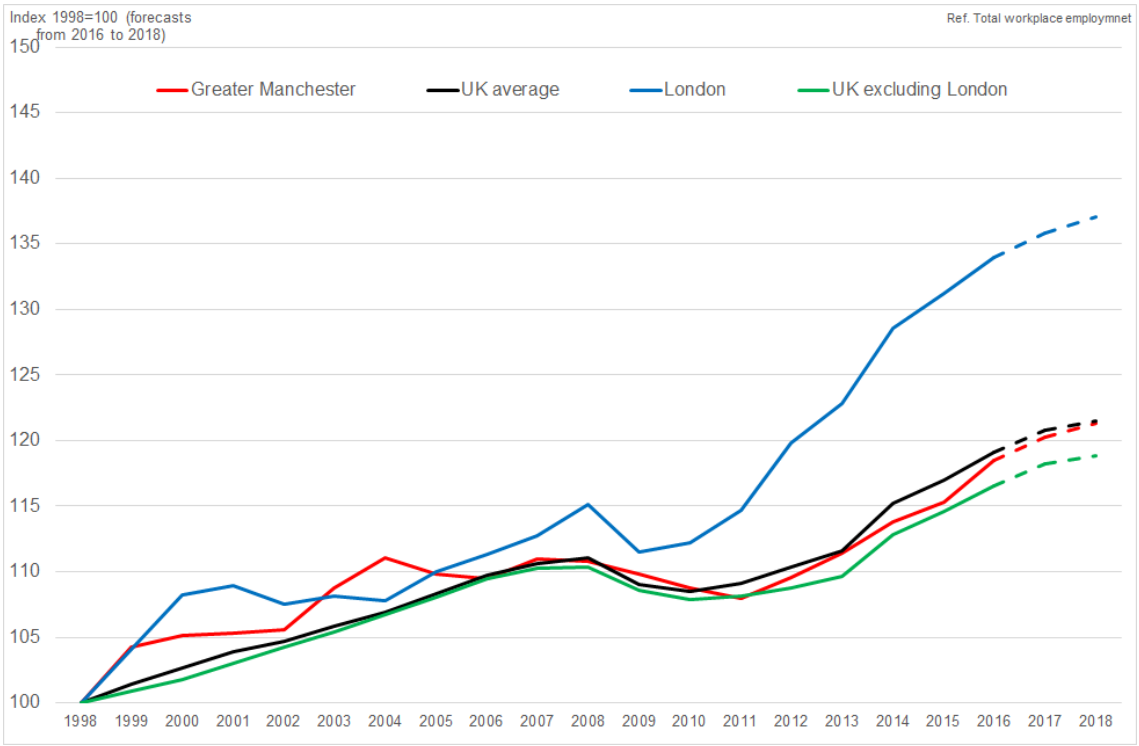


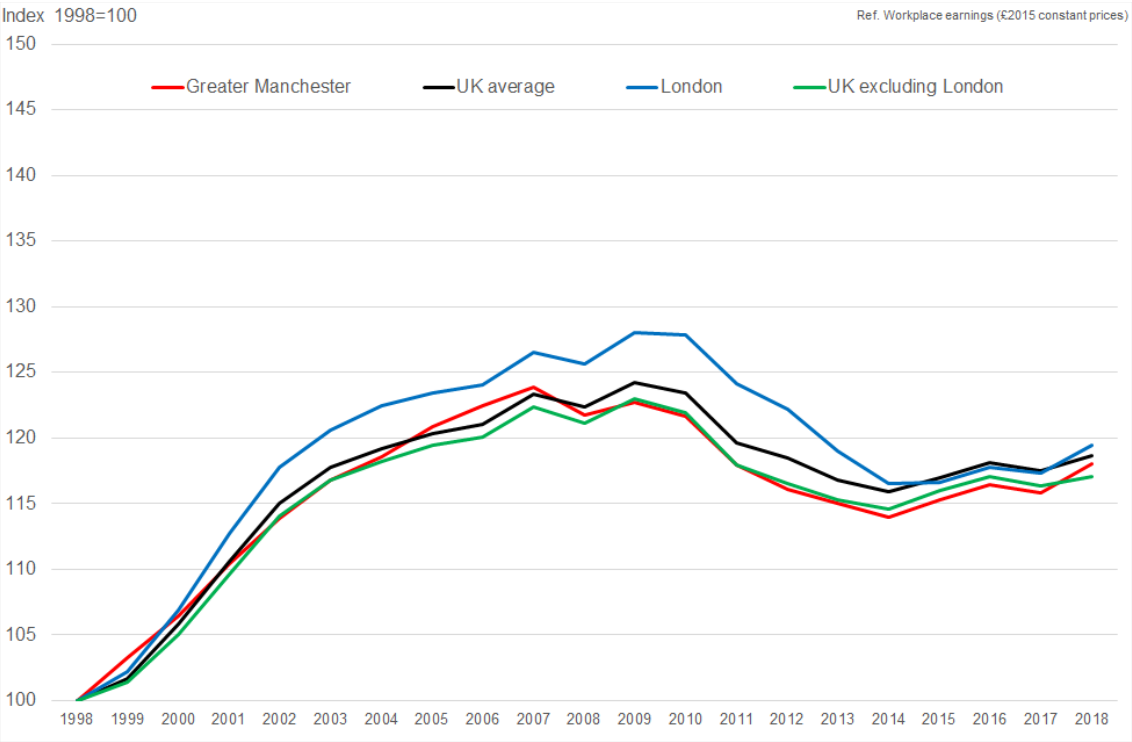

*Figure 8: **Employment** (workplace) performance GM vs national benchmarks. Index 1998=100. (GM vs UK, GM vs UK excluding London) 1998 to 2018, forecasts from 2016 to 2018*
*(Source: Greater Manchester Forecasting Model, 2018)*




[92] Note: Not all GVA components are equally relevant when assessing labour productivity, as some elements of GVA are not directly related to the input of labour. In particular, imputed rental incomes and parts of real-estate are excluded from the total GVA for UK and GM to obtain a measure of output more closely related to the measurable labour input

[93] ONS (2018): Regional and sub-regional productivity in the UK: February 2018. Experimental statistics for sub-regions of the UK

*Figure 9: **Earnings** (workplace) performance GM vs national benchmarks. Index 1998=100. (GM vs UK, GM vs UK excluding London) 1998 to 2018, actuals up to 2018*
*(Source: Greater Manchester Forecasting Model, 2018)*




## 3.2 How does Greater Manchester compare to other benchmarks?

### *3.2.1 City-region comparators*

GM is 10% less productive than the national average, but there are two clear phases in GM's recent economic history: the pre-recession period up to 2007/Q2-2008, when many northern city regions outpaced national productivity growth; and the post-recession period when growth across the board has been slower, with fewer places seeing productivity growth.[94] Further, whilst city regions across the UK saw strong employment growth (GM saw 117,000 net new jobs created post-recession between 2010 and 2016, compared with 130,000 between 1998 and 2008), almost all city regions outside London have seen slow GVA and productivity growth. [95]

This combination of slow productivity growth but increasing numbers of jobs infers that many of the jobs that have been created in GM (and other city-regions shown above) during the last decade are in lower value businesses and employment, and that they have not raised GVA sufficiently. It could also suggest "hollowing out" of the labour market where medium paid jobs are being lost or de-skilled by automation, a factor covered later in the report.[96] GM's relatively low productivity has a mix of causes, but economic analysis – shown later– helps to identify how the industrial structure and the other characteristics of regions affect their output. Industrial structure can help or hinder the growth of a particular place – if these industries are growing nationally (or globally), and they are highly concentrated in a particular area, then this area will tend to fare well- and vice-versa.

In terms of both national and international comparators, Figure 11 shows that the city regions with the highest productivity levels outside of London in the UK is Bristol. Following these, a group of city-regions in the Midlands and North of England – Birmingham, Greater Manchester, and Leeds – emerge as having higher productivity. In terms of international comparators, GM's productivity falls behind other leading European city regions such as Barcelona), Munich, and Helsinki-Uusimaa.

[94] ONS (2018): Sub-regional Productivity: Labour Productivity (GVA per employment

[95] Greater Manchester Forecasting Model. Note: Net is all gains/losses, and includes total employees plus the self-employed

[96] As suggested in Rubery, et al (2017) in the Human Development Report for Greater Manchester

*Figure 10: **Productivity growth** (nominal-GVA per Employment), pre-recession (2004 to 2007) and post-recession (2013 to 2016), size of circle equals size of economy (Source: ONS, 2018)*

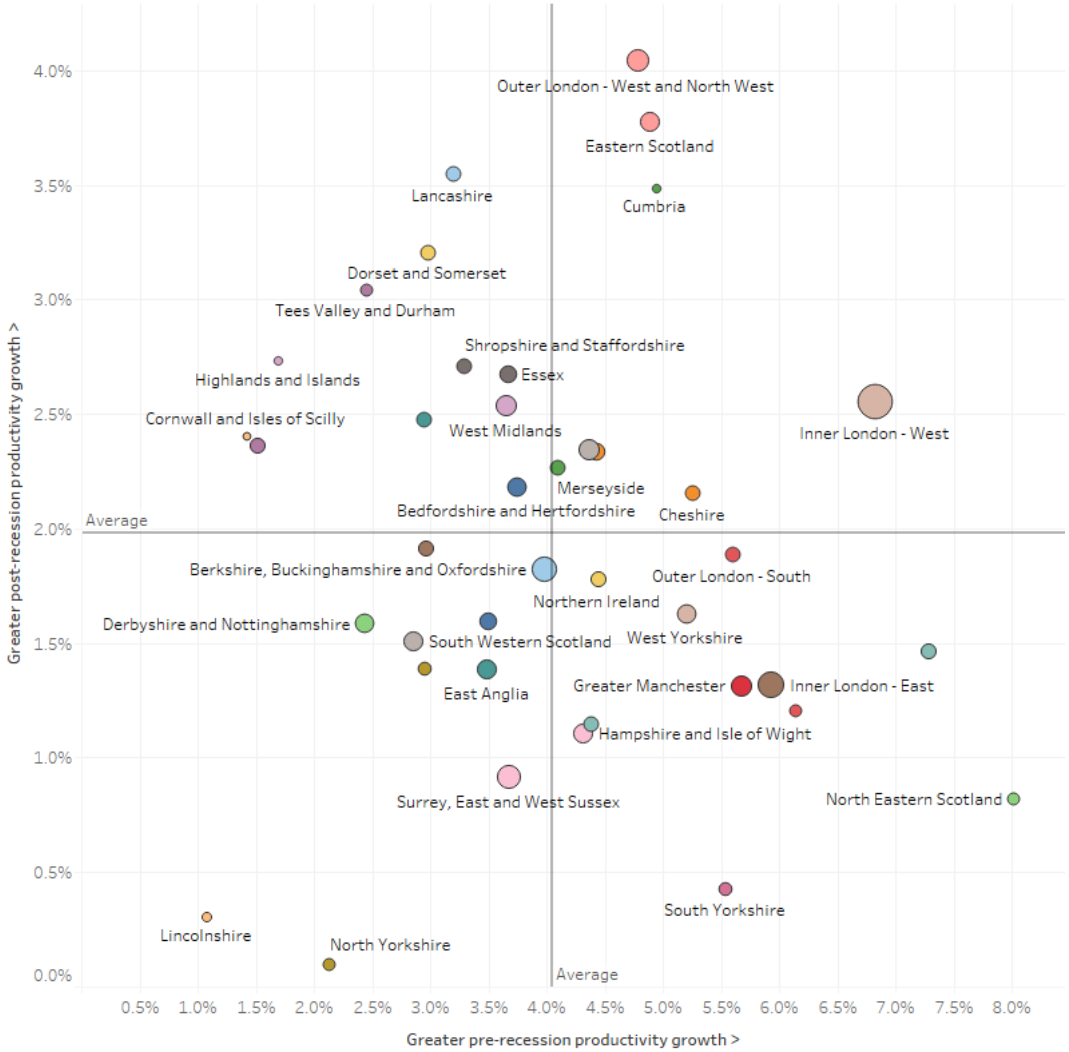
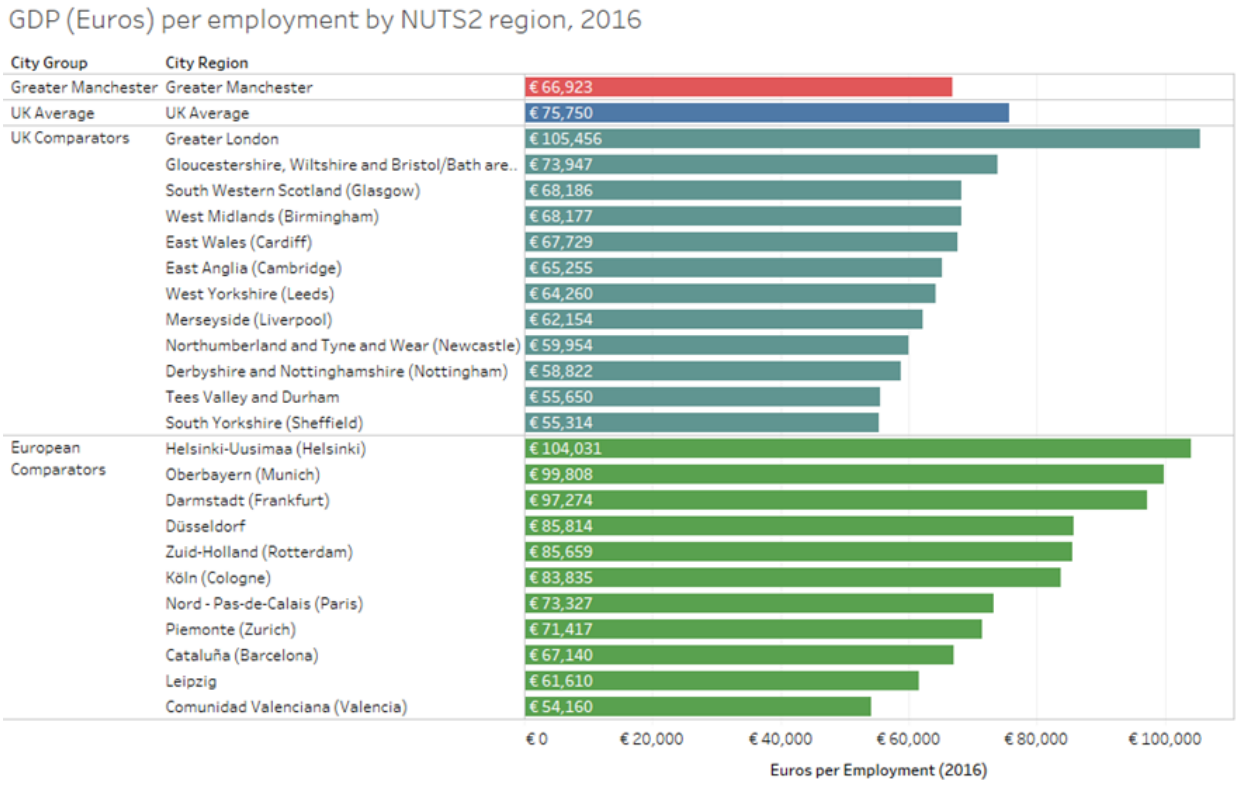



*Figure 11: Benchmarks of GVA per Employment (Euros in Purchasing Power Parity) comparing GM with other NUTS2 UK and European city regions, (Source: Eurostat, 2018)*

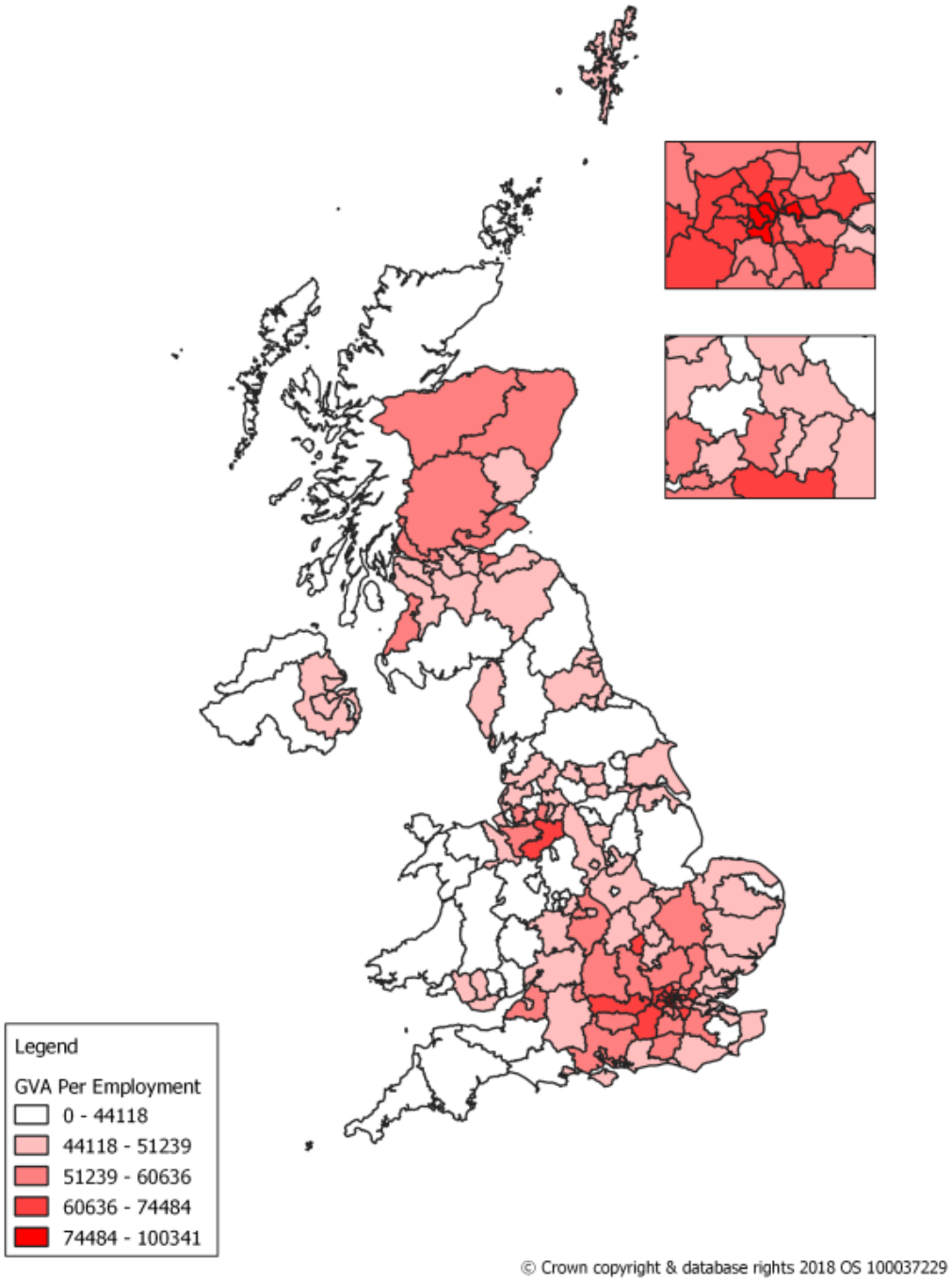


### *3.2.2 Spatial performance*

Figure 12 shows the spatial variation on productivity across the UK. The fact that different cities across the UK have different levels of productivity suggests that the causes or factors involved in relative performance vary between cities. However, the productivity puzzle is as complex at the city-region level as it is at the national scale.

There are as wider differences in productivity growth within city-regions than between the city-regions of the UK. For example real-GVA per employment growth from 1998 to 2008 was strongest in Manchester (2.0%), Tameside (1.9%), and Trafford (1.8%), but the data suggests that areas like Manchester saw almost static productivity growth (and GVA growth of 3%) from 2010 to 2016, suggesting growth was driven by higher employment levels. The data also show that when London is removed from the national average, the gap with GM narrows to 98%, and in Salford and Trafford productivity levels are above the UK average excluding London.[97]

*Figure 12: Gross Value Added per employment. Absolute levels, 2016, UK NUTS3 areas [London (upper) and Greater Manchester (lower) in the boxes] (Source: ONS, 2016)*




[97] Source: Greater Manchester Forecasting Model (GMFM-2018), 2016 latest actuals for GVA and employment

*Figure 13: Compound annual growth rate - percentage change in real-GVA per Employment in GM, and districts, 1998-2008, 2010-2016*
*(Source: Greater Manchester Forecasting Model, GMFM-2018)*

| | GVA CAGR % per annum | | GVA per employment CAGR % per annum | | Level in 2016 vs UK average | |
|---|---|---|---|---|---|---|
| Real-GVA | 1998 to 2008 | 2010 to 2016 | 1998 to 2008 | 2010 to 2016 | UK average=100% | UK excluding London=100% |
| Bolton | 2.0% | 1.0% | 1.6% | 0.0% | 79.6% | 86.9% |
| Bury | 2.1% | 1.9% | 1.5% | 0.4% | 89.6% | 97.8% |
| Manchester | 3.7% | 3.0% | 2.0% | -0.1% | 90.1% | 98.3% |
| Oldham | 1.5% | 2.1% | 1.3% | 0.4% | 87.3% | 95.3% |
| Rochdale | 1.7% | 1.3% | 1.1% | 1.2% | 87.2% | 95.2% |
| Salford | 3.1% | 1.7% | 1.4% | 1.4% | 96.2% | 105.0% |
| Stockport | 2.7% | -1.2% | 1.2% | -1.4% | 89.6% | 97.8% |
| Tameside | 2.1% | -1.4% | 1.9% | -1.0% | 89.7% | 97.9% |
| Trafford | 2.8% | 1.8% | 1.8% | -0.6% | 99.4% | 108.5% |
| Wigan | 2.0% | 1.2% | 1.1% | 0.8% | 84.2% | 91.9% |
| **GM** | **2.6%** | **1.5%** | **1.6%** | **<0.1%** | **89.9%** | **98.1%** |
| London | 3.9% | 3.3% | 2.4% | 0.3% | 142.1% | - |
| UK | 2.7% | 2.1% | 1.6% | 0.5% | 100% | - |
| UK excluding London | 2.4% | 1.7% | 1.4% | 0.4% | - | 100% |

## 3.3 What is Greater Manchester's performance across the 'Five Foundations'?

Given the variations in productivity performance shown earlier, it is useful to understand GM's performance in terms of the Government's 'productivity foundations'. The main headlines, presented at GM level (as this is the level at which more detailed data is available across each foundation), include the following (place, infrastructure, people, ideas, business environment): [98]

### *3.3.1 Place and Infrastructure*

The past decade has seen strong growth in GM's economy and population, reflecting GM's growing attractiveness as a place to live, work and do business. This is backed-up by surveys of wellbeing. However, as described above, GM's performance is held back by historically low levels of productivity growth, (as well as the 10 percentage point gap with the UK average); and a small number of locations make a disproportionate contribution to overall growth in jobs and GVA.

GM has developed its infrastructure asset base significantly over the past two-decades. This includes extensive light and heavy rail across the city-region, access to the West Coast mainline, and city-to-city connections via its main stations. GM is the global gateway to the North: Manchester Airport is the UK's largest regional airport providing connections to over 200 destinations worldwide and handling 28 million passengers;[99] and Port Salford provides water links to the rest of the world via shipping connections along the Manchester Ship Canal, carrying 7.5m tonnes of bulk cargo per annum, to the regional Post-Panamax facility at the Port of Liverpool.[100]

Digital infrastructure is an increasing priority. GM's full-fibre to the premises coverage (at 4%) is in line with other UK city regions but low by international standards (60% in Spain and Portugal). Ultrafast coverage which is copper based has more limited bandwidth (100Mbs) with under 50% coverage in some parts of GM; [101] GM has secured £23.8 million Local Full Fibre Networks Funding from Government to connect public sector premises in GM with full fibre. This 450km network is expected to drive wider commercial full fibre investment and 25% coverage within three years.

This infrastructure will support the continued growth of GM as one of the largest digital clusters in the UK with almost 8,000 digital businesses employing just under 80,000 people (in Creative and

[98] HMG (2018): Industrial Strategy. Building a Britain fit for the future

[99] Manchester Airport Group (2018): Manchester Airport annual passenger statistics

[100] Transport for the North (2017): Northern Freight & Logistics Report – Technical Appendices; and UK Port Freight Statistics 2017

[101] GMCA (December 2016): GM Digital Infrastructure Update. 'Current connectivity coverage in Greater Manchester'

Digital industries). Research suggests that achieving the Government's Full Fibre Network Challenge (25% full fibre coverage) will add £6.5bn to the GM economy over 15 years. [102] GM is also working with other partners across the North West to develop the £20m Made Smarter pilot to increase the uptake of technology in manufacturing, supporting the fourth industrial revolution. [103]

The role of 'Green Infrastructure' to GM's economy and social wellbeing is also increasingly recognised. Recent research by the Environment Agency suggests that the 'nine major benefits' from natural capital in GM have a combined value of nearly £1 billion per year (£930m). The study suggests that about half of the asset value identified is due to the benefit of natural environment for health and wellbeing, particularly the avoided health problems and associated healthcare costs. Alongside the health, recreation and welfare benefits from green infrastructure, woodland in GM is estimated to sequester 38,000 tonnes of CO2e per year valued at £2.4m per year. [104]

Despite these strengths, significant challenges remain, in particular on climate change risk, road congestion, and air quality. Road congestion is amongst the most severe in the UK. International research shows that, along with London, Manchester, Birmingham, Luton and Edinburgh made up the UK's five most major congested cities. Drivers in Manchester spent 39 hours in congestion during peak hours, and 10% of their total drive time (peak and non-peak) in gridlock. This in turn cost each driver £1,403, and the city £345 million. Motorists in Birmingham spent over 9% of their total drive time in congestion last year, costing the city £632 million.[105]

### *3.3.2 People and ideas*

GM is home to the largest labour market outside South East England: There are 2.8 million residents, and six million people live within an hour's travel time to the city region. The total population grew 7% (181,000) from 2009 to 2016, driven by high population growth in Manchester (15%), Salford (13%) and Trafford (10%).[106] The past decade has seen strong employment growth and sharp falls in unemployment, however levels of worklessness remain high in parts of GM.

With 1.3 million working age residents in employment (73%), 420,000 (24%) are economically inactive and 63,000 (5%) are unemployed. Since the recession the rate of employment growth has averaged 1.3% per annum in GM, compared to 0.9% per annum between 2004 and 2007; and the proportion of economically inactive has fallen by 1.4% per annum, as more people have entered the labour market.[107] Analysis of broad occupations in GM shows that the main growth areas have been in professional and associate professional jobs, however as Figure 15 shows, there has also been a significant rise in GM in the proportion of caring, leisure, and service occupations; and a falling proportion of skilled trade, and plant and machine operative occupations.

Figure 16 shows that the 'qualification profile' of the resident working age population in GM continues to improve, and that the proportion of working age residents with a Level 4 qualification or above grew from 25% in 2007 to 35% in 2017 - equal to an additional 200,000 working age residents compared with a decade earlier.[108] Whilst some of the growing graduate labour supply will help to address skills replacement demand due to retirements, local employer surveys suggest that 41% of employed graduates in GM work in non-graduate roles.[109] Previous UK analysis has highlighted that skills and their full use contribute up to a third of the UK's productivity gap.[110]

[102] Regeneris (2017): Impact assessment of the Government's Full Fibre Network Challenge

[103] Made Smarter Review (2017): Independent Review exploring how UK manufacturing can maximise benefits from increasing adoption of digital technology through a strong industry and government partnership

[104] EFTEC (2018): Natural Capital Account for Greater Manchester. Due to measurement challenges these figures exclude the potential savings on social care; and excludes the benefits from enhanced workforce productivity where health problems are avoided

[105] INRIX (2017): Global Traffic Scorecard

[106] Figures rounded-up to nearest whole percent

[107] ONS (2018): Annual Population Survey July 2017 to June 2018

[108] Graduate level qualifications, foundation degrees, higher apprenticeships and vocational qualifications

[109] HMG (2017): Employer Skills Survey. (Previously UKCES national Employer Skills Survey

[110] Leitch S. (2006): Leitch Review of Skills: Prosperity for all in the global economy - world class skills

The Greater Manchester and Cheshire East Science and Innovation Audit identified that GM has globally competitive research strengths and emerging industrial opportunities in health innovation and advanced materials. It also has fast growth opportunities in relation to digital, energy, and industrial biotechnology. GM's four universities are home to almost 100,000 students, with approximately 20,000 first-degree graduates (STEM and non-STEM) per year.[111] Despite its research assets and potential, GM could improve commercialising research into products - patent applications (per million inhabitants from 2008 to 2012), show that GM (37) falls below other UK core cities such as Bristol (168), Sheffield (105), and also London (95).[112]

*Figure 14: Number of residents aged 16 to 64 years in employment, unemployed and inactive Greater Manchester, 2004/05 to 2017/18 (Source: ONS Annual Population Survey)*

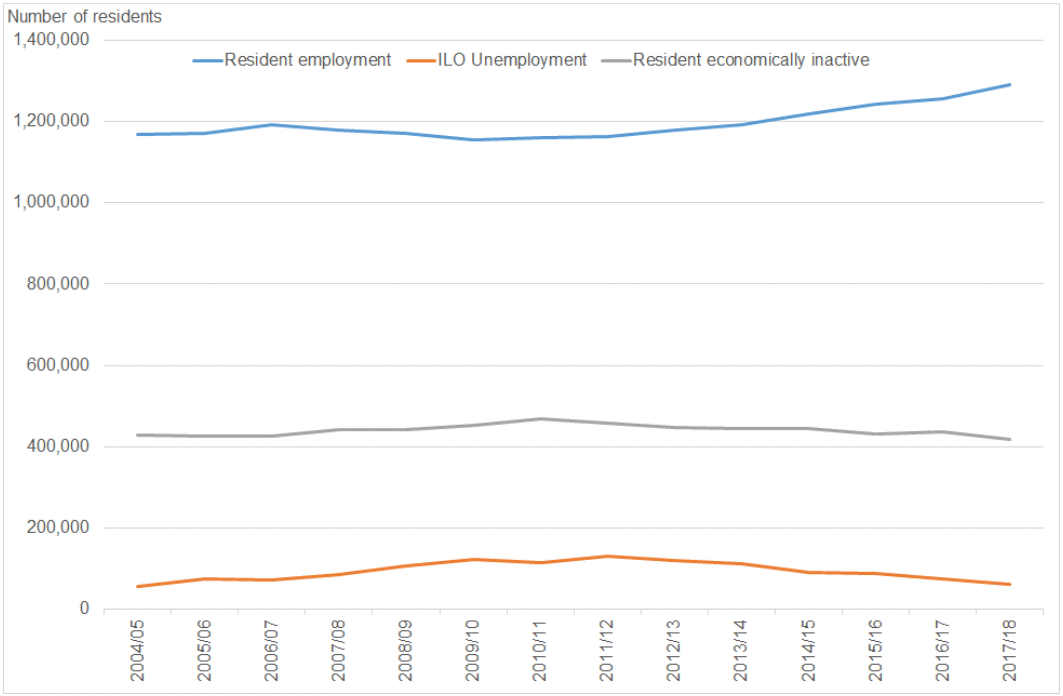
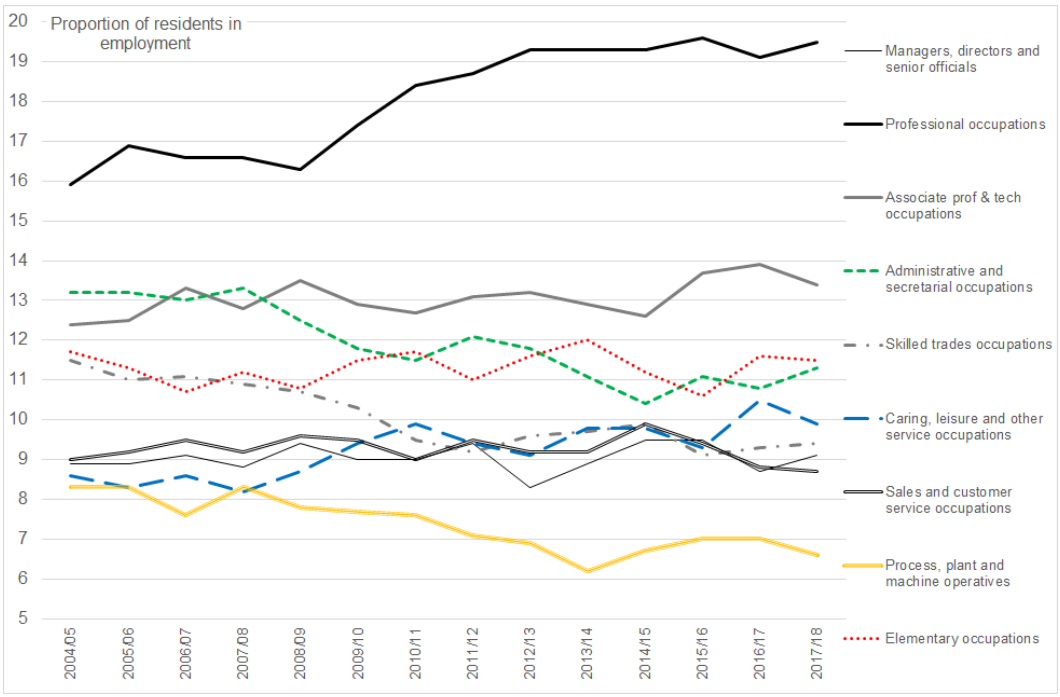



*Figure 15: Proportion of residents aged 16 to 64 years in employment by main occupation Greater Manchester, 2004/05 to 2017/18 (Source: ONS Annual Population Survey)*




[111] Higher Education Statistics Agency (2018): Undergraduate and Postgraduate learners, and qualifiers in 2017

[112] Eurostat (2018): Patent numbers per resident

*Figure 16: Change in the working age resident qualification profile, Greater Manchester, 2007 to 2017 (Source: ONS Annual Population Survey)*

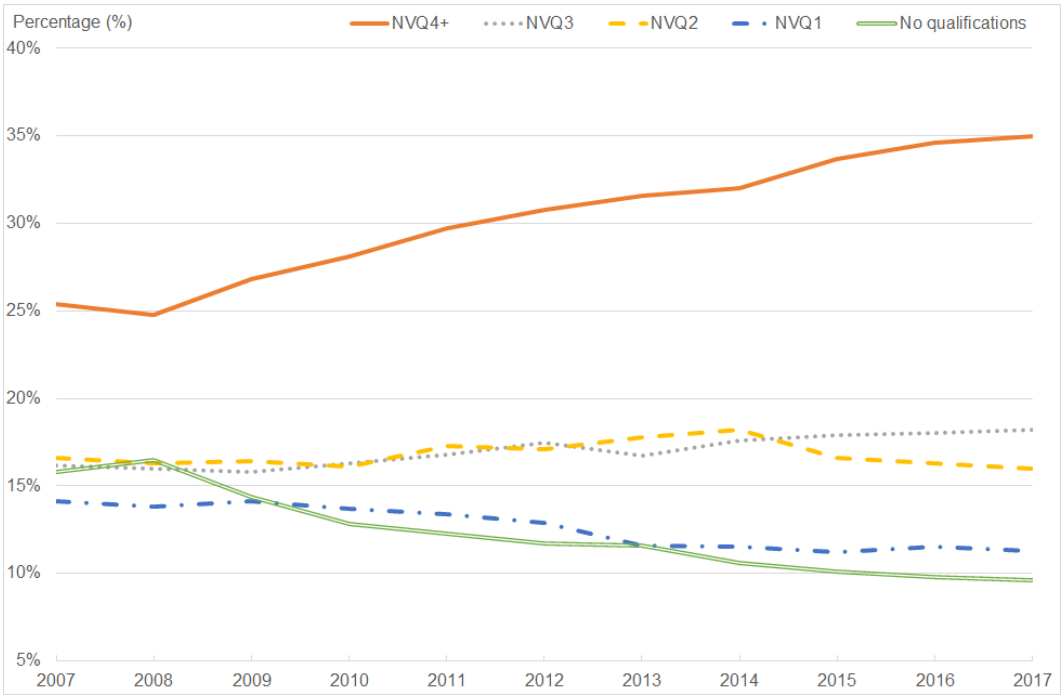
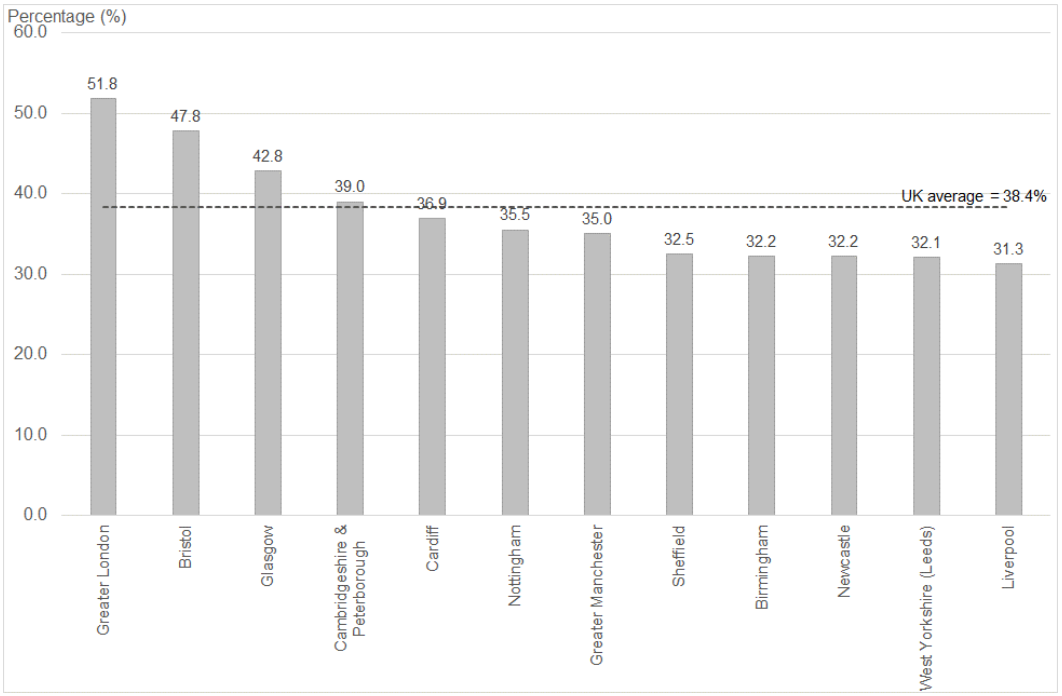



*Figure 17: Proportion of residents aged 16 to 64 years qualified to NVQ level 4 and above Greater Manchester and comparator city-regions, 2017 (Source: ONS Annual Population Survey)*




### *3.3.4 Business Environment*

The strength of GM's business base is its diversity. Analysis using the Krugman Specialisation Index (a measure of diversity in industry, jobs and output) shows that GM has become the most diverse city-region economy in the UK.[113] This brings resilience to economic shocks and for employers to pursue multiple growth opportunities. The Review's baseline highlights strengths in Advanced Manufacturing, Digital & Creative Industries, Business, Financial and Professional Services; and emerging strengths in Health Innovation, Low-Carbon Goods & Services. The following provides more details on the main trends across the business environment. The focus is on the period since the recession, but where possible includes data up to 2008/09.

[113] GMCA analysis using ONS time series

- **Enterprise.** Recent research highlights the importance of growing enterprise, in particular SMEs contribution to raising productivity.[114] There were a total of 124,000 local business units recorded in GM in 2017. Of these, 84% are micro-sized (employing 0-9 people), 13% small (employing 10-49 people), (3%) medium-sized (employing 50-249 people), 570 (less than 1%) are large (250+ employees). This breakdown has remained fairly stable since 2010, with a slight shift from SME businesses (19% of total businesses in 2010) - towards micro-size business (80% in 2010). Historic dataset show that the number of micro-sized firms was 83% in 2006/07, SMEs (17%), and large (0.8%).[115] GM has a strong voluntary, community and social enterprise sector, with almost 16,000 organisations, 28,600 full-time equivalent employees, contributing £900 million per annum to GM's economy. A significant proportion of these work in the areas of health, community development, education and training, sport and leisure services.[116]
- **Business start-ups.** Rates have improved sharply since the recession (growing by 29% in 2016 compared with 15% in 2015, and a UK average of 8% in 2016 - making it the best performing city region outside London. Despite strong growth since the recession business density levels (51 enterprises per 1,000 residents) still lags the national average (62 per 1,000), and London 80 per 1,000). Whilst these figures are higher than a decade ago in GM (43 in 2006/07), they suggest there is more to do in GM to help businesses survive and grow.[117]
- **Growth and scale-ups**. There are approximately 32,000 'high productivity firms' [118] accounting for 35% of all businesses in GM.[119] Further analysis shows that there were 1,500 scale-ups (firms with growth in turnover and/or employment greater than 20%).[120] These firms employed 142,000 with a total production value of £19.2 billion in GM in 2017. The ratio of scale ups per 100,000 residents is similar to the UK average (85), and scale-ups are found across all sectors in GM, but particularly within: Retail (15%), Business Services (14%), Health (12%), Manufacturing (10%), Professional, Scientific, and Technical Services (10%).However, at £135,000 average turnover per employee, scale-ups in GM are much lower value on average than London (£606,500), and the national average excluding London (£159,000).[121]
- **International trade.** The total value of GM goods exported in 2017 was £6.7 billion, a 5% increase from 2016 (rising by 16% between 2015 and 2016). This places GM 19th out of 40 UK NUTS2 regions in terms of total export value. However, the value of GM's export value per head of population is £2,380 per resident is lower than the UK average £4,972; behind comparators: Birmingham (£6,141), Bristol (£4,639), and Leeds (£2,582).[122] The latest GM Business Survey (2017) estimates that 16% of firms in GM trade internationally – (i.e. export and or import; and 14% export; an estimated 10,000 exporters).[123] The proportion of respondents that trade internationally over recent years had increased from 20% in 2012 to 24% in 2016, falling back in 2017. The majority (87%) of businesses involved in international trade have links with the EU, 47% have links with North America, and 45% with non-EU European states. The survey also indicates that the majority of SMEs focus on domestic markets.[124]
- **Foreign Direct Investment (FDI) and foreign owned firms.** The UK continues to outperform other nations within Europe for FDI, however its lead is dropping. Within the UK, London continues to dominate as a destination for foreign investment (2.2 times more than the North of England). However, outside of London, GM continues to lead by a strong margin among UK cities with 45 FDI projects in 2017, 55% more than the next highest city (Edinburgh, 29).[125] GM also has a strong representation of Foreign Owned Firms (FoFs). Analysis of Companies House data, suggests that between 3000 and 5000 are foreign-owned worth a total of £37 to £44 billion, employing between 172,000 to 194,000 depending on definition and data source.[126] Of these, firms were more likely than the GM average to be foreign owned id they are in Health Innovation (13% of firms in this sub-sector in GM), Logistics (41%), Retail & Wholesale (14%).

[114] IPPR North (2019): SMEs and Productivity in the Northern Powerhouse (February 2019)
[115] ONS, Business Demography
[116] GMCVO, 2017, Greater Manchester State of the Voluntary, Community and Social Enterprise Sector
[117] ONS, (2016): Business Demography for 2016, enterprise units
[118] High productivity is defined as productivity per employment that is higher than the GM average for all sectors in GMFM-2018
[119] GMCA analysis of BvD FAME and Companies House data 2017/18 (or latest accounts).
[120] Scale-ups are defined as firms with annualised growth in turnover or employment greater than 20% per annum, over a 3 year period
[121] It is important to note that turnover data can be 'spiky' within any one year, and that coverage is often incomplete (e.g. micro firms)
[122] HMRS (2018) Data on the value of exports for Greater Manchester in 2015 to 2017
[123] Number of exporters taken from HMRC (NUTS2) statistics https://www.uktradeinfo.com/Statistics/RTS/Pages/Analysis.aspx
[124] Greater Manchester Business Surveys from 2011/12, 2012/13, 2014/15, 2015/16, and latest is 2017
[125] EY (2018): UK Attractiveness Surveys 2018
[126] GMCA analysis of BvD FAME, Duedil firm data 2017/18; and ONS Annual Business Survey covering Foreign Owned Firms in GM

- **Innovation, Research and Development.** Total expenditure on R&D in GM has grown over time in value terms (from £0.55bn in 2012 to £0.68bn in 2016). However, as a percentage of the city region's total GDP, it has changed little; consistently at around 0.9% since 2012. The UK average is higher, at 1.68% of GDP in 2016, and it has remained relatively flat since 2012. As a share of total economic output, GM is one of the least R&D intensive regions in the UK, placed in the bottom third of the regions league table on this measure. In 2016 in GM, business enterprise sector and Higher Education sector accounted for the majority of R&D spend (at 48% each) and Government accounted for around 3%. The share of business investment in R&D as proportion of total investment is much lower in GM (48%) than in UK on average (67%), as is the share of Government investment (3% in GM compared to 7% in UK).[127]
- **Labour force skills.** Whilst GM has seen significant improvements in the skills profile of its resident workforce, including an additional 200,000 residents with at least a Level 4 qualification since 2007, the number of graduate entry-level jobs within the economy only increased by 64,000. Data on graduate retention rates have also remained broadly similar from 2003/4 to 2016/17, with 40-50% of graduates remaining in GM after graduation; and almost a third of these were also residents of GM before attending a local university.[128,129,130]
- **Recruitment difficulties.** Employers reporting at least one hard-to-fill vacancy rose across England from 5% in 2012 to 8% in 2017, while in GM it increased from 4% to 9%.[131] The figures reflect, among other things, the improving economic climate since the recession and a tighter labour market, with unemployment at record lows in the UK and GM in the last decade.[132] Local survey shows that most of the hard-to-fill vacancies reported in the Health and Social Care (nearly a third of employers had hard-to-fill vacancies), and in Business Services, Education, Hospitality & Tourism, and Manufacturing, where a fifth had hard-to-fill vacancies.[133]
- **Skills shortages.** Despite rising numbers of skills shortage vacancies in GM, from 4,000 in 2012 to 8,000 in 2017, when these are calculated as a proportion of all vacancies, then the results have remained broadly consistent over time. More specific skills shortages were reported in Construction and Engineering (skilled trades were 27% of employers skills shortage vacancies in 2017; and associate professional (16%) and professional occupations (14%), similar to national averages. Aside from these risks, employer surveys over the course of the last decade suggest that firms in GM have been – broadly – able to satisfy their skill needs.[134]
- **Workforce efficiency.** The share of employers reporting skills gaps has also remained relatively stable since 2011 both in GM and nationally at around 15%, while the density of skills gaps has also remained stable around 5%.[135] This suggests that GM employers as a whole appear to be reasonably satisfied with proficiency of their staff. However, more specific skills gaps were reported (in the survey) in specific occupations in GM, mostly relating to administrative and clerical staff, sales and customer service staff, and elementary occupations. These are jobs which have higher turnover levels, and skills difficulties relate to new staff.[136]
- **Employment in Knowledge Intensive Businesses (KIBs).** KIBs have been shown to be amongst the most important factors associated with areas having higher levels of productivity.[137] Figure 18 shows that London, Bristol and Cambridge standout on this measure. However, GM does contain a higher concentration of jobs in KIBs than any of the other comparator city regions; and if population size is considered, GM also has access to a larger highly-skilled population than the other provincial city regions. However, Figure 18 also suggests that there is no sign that growth in highly skilled employment has reached a critical 'take-off point' in GM beyond which the creation of skilled jobs and supply of workers enters a virtuous circle.[138]

[127] Eurostat (2012 to 2016 provisional estimates

[128] HESA (2018) The proportion of graduates from GM institutions that who remain in GM at least six months after graduation

[129] Ball, C. (2015) Loyals, Stayers, and Returners: Graduate Migration Patterns

[130] Swinney, P. and William, M. (2018) The Great British Brain Drain: where graduates more to and why. Centre for Cities.

[131] HMG (2011 to 2017): Employer Skills Survey. Hard-to-fill vacancies can be due to many risks including pay, conditions, and skills

[132] ONS (2008 to 2018): Annual Population Survey

[133] Greater Manchester Business Surveys, from 2012 to 2017

[134] Employer Skills Survey for England, and GM Business Surveys

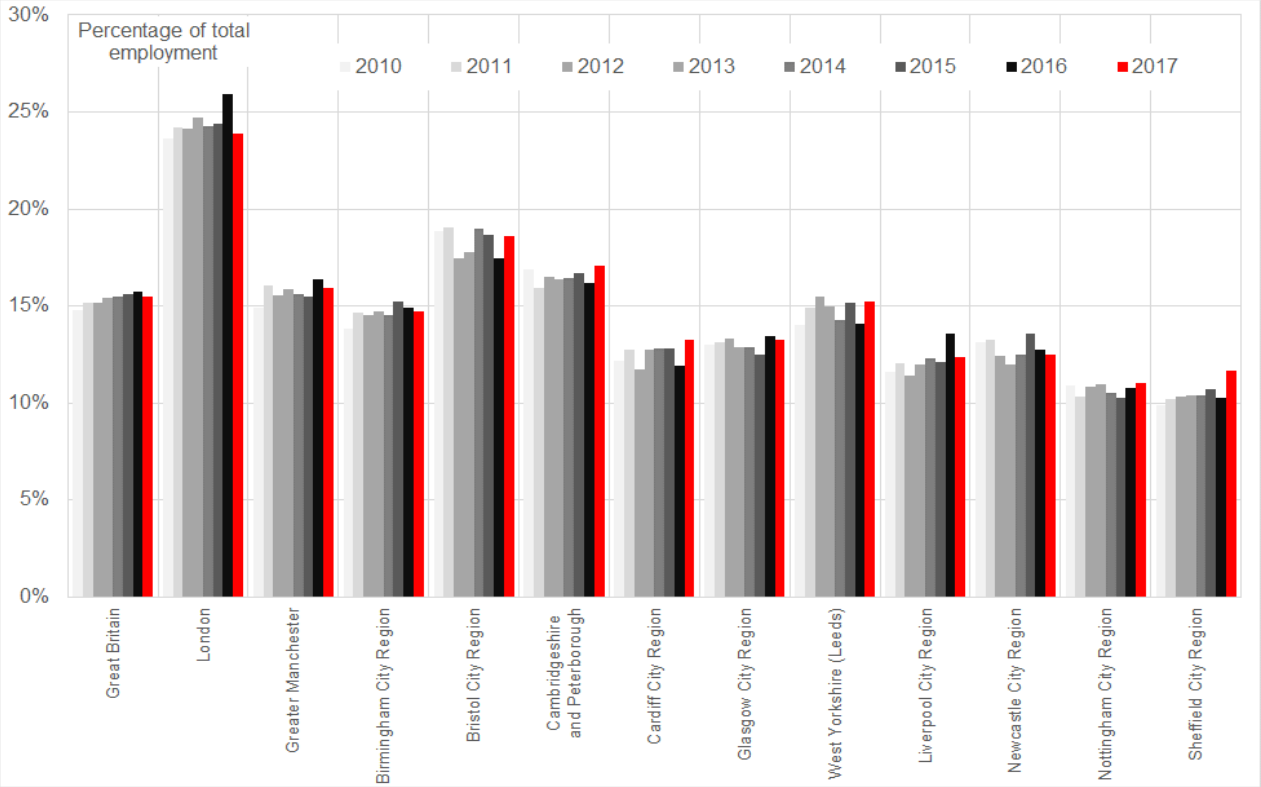
[135] Ibid

[136] Ibid

[137] E.g. Ideopolis (2008): How can cities thrive in the changing economy; J-Figueiredo R., et al (2017): Knowledge Intensive Businesses

[138] The analysis excludes Education, Health, Public Administration sectors, due to the challenges of disaggregating SIC codes

*Figure 18: Time-series of Knowledge Intensive Businesses (KIBS) – excluding Health and Social Care and Education, 2010 to 2017 (Source: ONS)*




## 3.4 How does productivity vary (on average) by sector?

### *3.4.1 Aggregate level analysis by broad sector*

Since the 1990s GM has experienced a structural shift in employment away from manufacturing, which generally comprises higher value sectors, to services, where aggregate productivity tends to be lower; and a shift towards professional, associate professional and technical occupations, and falling levels of plant machine operatives and administrative jobs. This shift continues to play a significant role in the changing structure of GM's economy. When this evidence is combined with GM's productivity performance relative to other places, in particular London it suggests (rather than being conclusive) that even the 'higher skilled' occupations in GM are potentially more likely to be focussed on lower value activities than their equivalents in cities like London.

Previous analysis (updated in this Audit) shows that GM is not overly reliant on a single large sector or major employer for jobs and growth.[139] According to the Krugman Specialisation Index, GM is the most diverse city-region in the UK in terms of businesses and jobs. However, analysis of sector data does suggest higher employment concentrations of work (and some specialisms) within the broadly defined sectors of Financial and Professional Services, parts of Manufacturing (including Materials), Health Innovation, and Digital Industries. However, despite these specialisms there is still a gap in average productivity between most of these sectors and their UK equivalents, shown in Figure 19. The figure's bars show the absolute levels of real-GVA per employment, whereas the figure's green circles show productivity levels relative to the UK average.[140]

The top five highest productivity sectors in GM in absolute terms are Financial and Professional Services, Utilities, Advanced Manufacturing, and Digital Industries. The lowest productivity sectors are Employment Services, Hospitality and Tourism, Business Services, Retail, Health and Social Care. However, relative to the UK average, the productivity gap is 'widest' in Food and Drink Manufacturing (70% of the UK average), Professional Services (71%), Creative Industries (80%), Retail (83%), Financial Services (83%), and Logistics (85%).[141]

[139] GMCA: Sector Deep Dives and Productivity in Greater Manchester, 2016 and 2017

[140] Note: Sector names in capital letters are composites of sub-sectors, where data is also given

[141] Greater Manchester Forecasting Model, GMFM-2018 (figures for latest actuals in the model for 2016)

*Figure 19: GVA per employment by sector in GM 2016 (Source: Greater Manchester Forecasting Model 2018, Oxford Economics. Capitalised sectors are composite of other sub-sectors)*

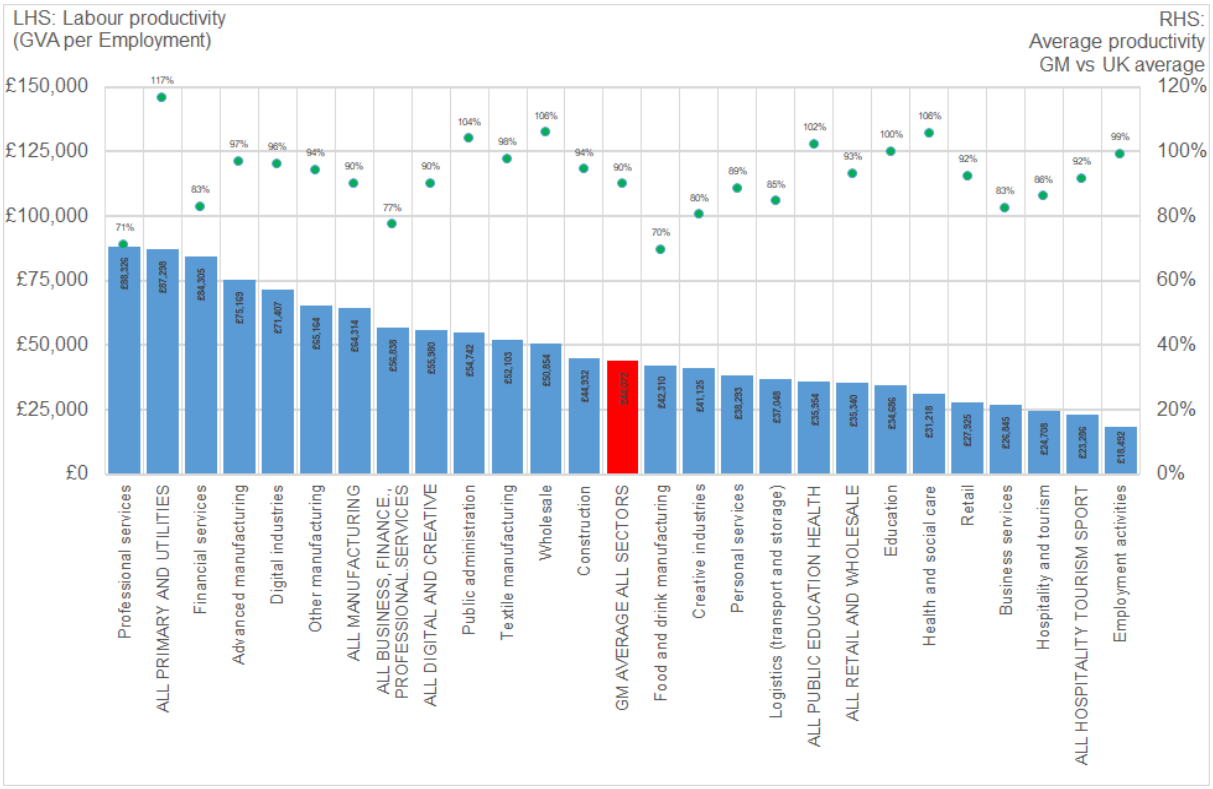



Figure 20 shows that, despite the current gaps in sector performance, there has been significant (average aggregate) productivity improvement during the last 20 years in GM within Manufacturing, Digital and Creative Industries, and Business, Financial and Professional Services. However, Figure 20 also shows that productivity in sectors such as Health and Social Care (typically low productivity and low pay sectors), as well as in Professional Services, have fallen over the same period. Further, studies suggest that the UK could eliminate a third of its 'productivity gap' with Belgium, France, Germany, and Netherlands by raising the productivity in these sectors.[142]

Particularly striking is the evidence on the falling productivity seen within Professional Services at the UK and particularly GM level; and the rising productivity seen in Employment Services (which includes work in a range of activities, from management recruitments through to security services). Equally interesting is the fall in Logistics productivity suggesting a potential rise in smaller last mile deliveries which have lower levels of average productivity.[143]

*Figure 20: Percentage change in GVA per Employment by broad industry sector, 1996 to 2016 (Source: Greater Manchester Forecasting Model, Oxford Economics)*

| Sector (and sub-sector) | UK % change 1996-2016 | GM % change 1996-2016 |
|---|---|---|
| Manufacturing | **66%** | **87%** |
| Construction | 8% | 1% |
| Wholesale and Retail | **39%** | **37%** |
| Hospitality, Tourism and Sport | **-1%** | **-8%** |
| Logistics | 11% | -5% |
| Digital and Creative Industries | **63%** | **75%** |
| Business, Financial & Professional Services, sub-sectors: | **18%** | **19%** |
| - Business services | 34% | 34% |
| - Employment activities | 218% | 335% |
| - Financial services | 50% | 54% |
| - Professional services | -10% | -17% |
| Education | -22% | -28% |
| Health & social care | 30% | 38% |
| Public administration | 15% | 44% |

[142] IPPR (2016): Boosting Britain's Low-Wage Sectors: A Strategy for productivity, innovation and growth; and House of Commons

[143] Based on Greater Manchester Forecasting Model data (GMFM-2018), 1996 to 2016

## 3.5 How does productivity vary by local authority level?

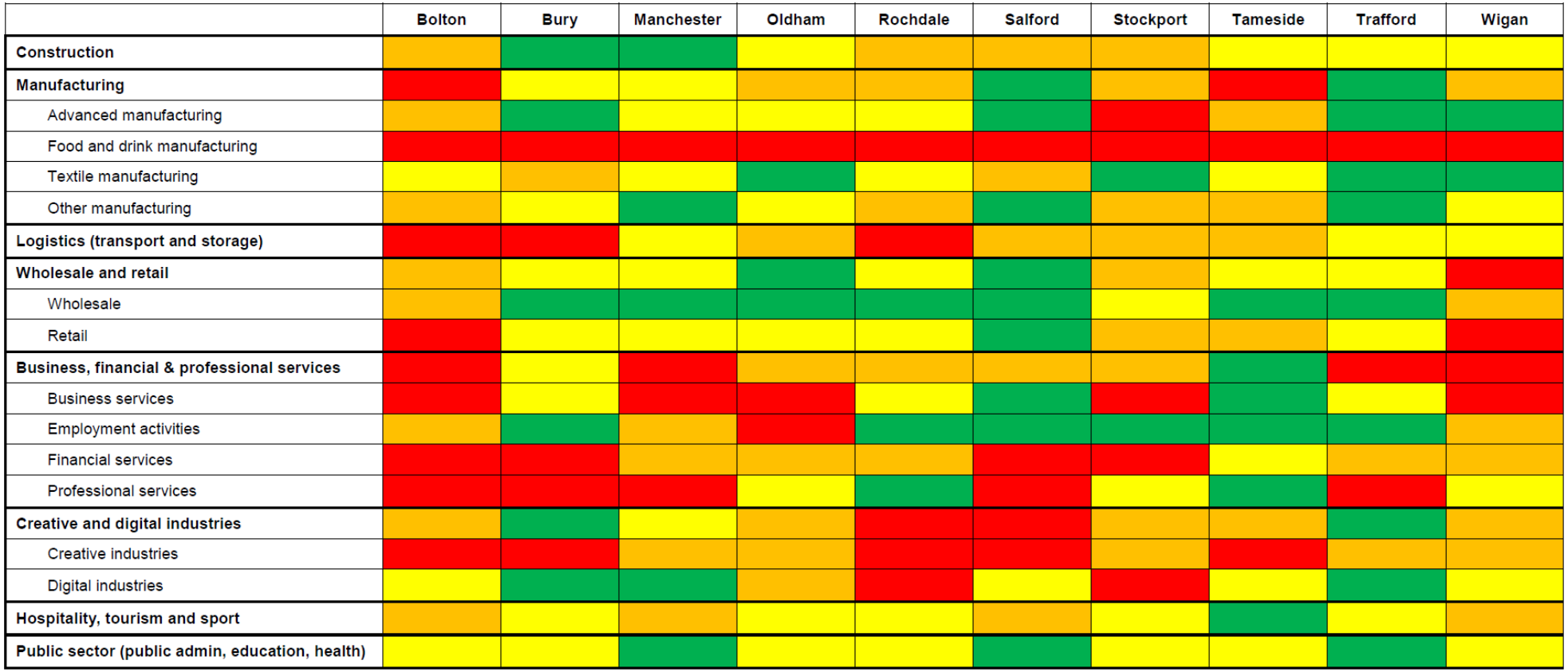
Figure 21 uses GMFM data on GVA and employment at the Local Authority level to calculate productivity for each sector (and where possible sub-sector) and to compare this with the UK average. The colours in the table relate to the following: **Green:** 100% - or above the UK average; **Yellow:** 90 to 99%; **Orange:** 80 to 89%; and **Red:** under 80% of the UK average. Overall, the analysis highlights that higher productivity activities tend to be located within Bury, Manchester Salford, Trafford, with some sector specific variations which include the following:

- Despite the importance of Business, Finance, and Professional Services to the regional and local economy, and its relatively high GVA per employment within the GM context, average levels of productivity are under 90% of the UK average in most districts; and 4 of the 10 districts have productivity levels that are **below 80% of** the UK average for Professional Services.
- Productivity in Digital Industries is highest in Manchester, Bury, and Trafford where these areas have productivity at or above the UK average. Whereas. Bolton, Salford, Tameside and Wigan are all 80 to 90% of the UK average.
- Manufacturing and its sub-sectors (apart from Food Manufacturing) performs relative well across most districts, apart from Bolton and Tameside.
- Logistics has under 80% of the UK average productivity in 3 of the 10 districts, and 80 to 90% the UK average in a further four districts, reflecting the previous findings suggesting a relatively lower (and falling) average aggregate productivity in the sector.

These findings reflect those of other studies in GM, which show that the main areas of growth in both business and employment, have been within the 'regional centre' (broad definition) which includes a large proportion of those areas identified above. Employment growth from 2010 to 2015 was strongest in the Regional Centre, which saw a 10% increase in jobs (22,500 jobs) compared to just over 5% increase across the rest of GM (50,500 jobs).[144]

[144] GMCA (2017): Understanding the dynamics of the 'Regional Centre' and the implications for the rest of GM

*Figure 21: Rank of absolute highest productivity by subsector in GM, 2016 (Source: Greater Manchester Forecasting Model, GMFM-2018)*[145]



| | Bolton | Bury | Manchester | Oldham | Rochdale | Salford | Stockport | Tameside | Trafford | Wigan |
|---|---|---|---|---|---|---|---|---|---|---|
| **Construction** | | | | | | | | | | |
| **Manufacturing** | | | | | | | | | | |
| Advanced manufacturing | | | | | | | | | | |
| Food and drink manufacturing | | | | | | | | | | |
| Textile manufacturing | | | | | | | | | | |
| Other manufacturing | | | | | | | | | | |
| **Logistics (transport and storage)** | | | | | | | | | | |
| **Wholesale and retail** | | | | | | | | | | |
| Wholesale | | | | | | | | | | |
| Retail | | | | | | | | | | |
| **Business, financial & professional services** | | | | | | | | | | |
| Business services | | | | | | | | | | |
| Employment activities | | | | | | | | | | |
| Financial services | | | | | | | | | | |
| Professional services | | | | | | | | | | |
| **Creative and digital industries** | | | | | | | | | | |
| Creative industries | | | | | | | | | | |
| Digital industries | | | | | | | | | | |
| **Hospitality, tourism and sport** | | | | | | | | | | |
| **Public sector (public admin, education, health)** | | | | | | | | | | |

**Key:**

**Green:** 100% - or above the UK average;

**Yellow:** 90 to 99.9%;

**Orange:** 80 to 89.9%;

**Red:** under 80% of the UK average

[145] Sectors same as those chosen for GMCA Sector Deep Dives analysis and definitions included in the Annex

# 4. Determinants of productivity

## 4.1 What factors explain Greater Manchester's aggregate productivity performance?

### *4.1.1 Approach and scope*

As noted in section 1, the literature suggests that density of economic activity can be a source of enhanced productivity gains, due to the effect of externalities leading to increasing returns.[146] However, a growing amount of literature highlights that the mere location of individuals and firms within a specific space cannot be the only source of aggregated increasing returns. The literature highlights that UK cities are undersized and are not of sufficient scale to benefit from agglomeration;[147] and suggests a more important role for endowments of places.[148,149]

This section of the report provides a comparative econometric analysis, in order to assess the relative importance of urban density and other key factor or foundational assets (controlling for endogeneity).[150] As the analysis will show density is still important in terms of a positive influence in productivity, but its impacts are dramatically reduced when other variables (e.g. intangible human capital / high skilled work, patenting, entrepreneurial culture/start-ups, etc.) are introduced to the modelling analysis.

The modelling helps understand the extent to which the density of firms and skills help explain GM's level of productivity, alongside which mix of 'variables' / 'factors' / 'determinants' of productivity are more likely to be associated with variations in city regional productivity. Analysing these patterns helps to shed light on local growth dynamics, it helps reflect on potential priorities for addressing the 'productivity puzzle', and provides some indication of which 'improvements' to specific determinants could have a more significant impact in GM.

The data are taken in 'snap-shot' for a period of time, and the modelling covers GM and comparators;[151] and the method includes the following steps:

**Step 1.** Comparison of the factor endowments between GM and the national average.

**Step 2.** Investigation of correlations between each individual factor and labour productivity.

**Step 3.** Cross-sectional regression modelling to test the relative importance of each factor.

### *4.1.2 Step 1: Factor endowments*

The picture that emerges from the previous two sections of the report, and from comparisons between GM and other city regions (based upon the proportion of the workforce employed in knowledge industries, and the proportion with higher level skills) is that the trend for success across these measures is repeated when the focus shifts to relative levels of performance. Figure 22 shows the full range of test variables against the UK average (indexed at 100%) derived from a review of literature evidence (here and in section 3), availability of time-series at the city-region level, and the match to the main 'foundations' of productivity.[152] The main variables used include:

- **Labour productivity**, GVA per employment (filled job).
- **Skills and human capital,** focussing on the following indicators: [153]
  - Proportion (%) of highly educated workers in each city-region;

[146] For example: Artis, M. et al (2009): Assessing Agglomeration Economies in a Spatial Framework

[147] Overman, H. and Rice, P. (2008) Resurgent cities and regional economic performance. SERC policy papers

[148] Swinney, P. & Breach, A. (2017) The Role of Place in the UK's Productivity Problem, London: Centre for Cities

[149] McCann, P. (2018), Productivity perspectives synthesis. An evidence review

[150] That is the risk of "two-way causation" problems between productivity and agglomeration - are cities highly productive because they are big and dense, or are cities big because they are highly productive?

[151] The data typically covers two to three years, and covers all GB NUTS2 (standard statistical) areas

[152] Note – there are limited time-series of trade data for GM, and there are limited indicators on city-region innovation, the analysis uses proxy indicators as the closest (but imperfect) measures

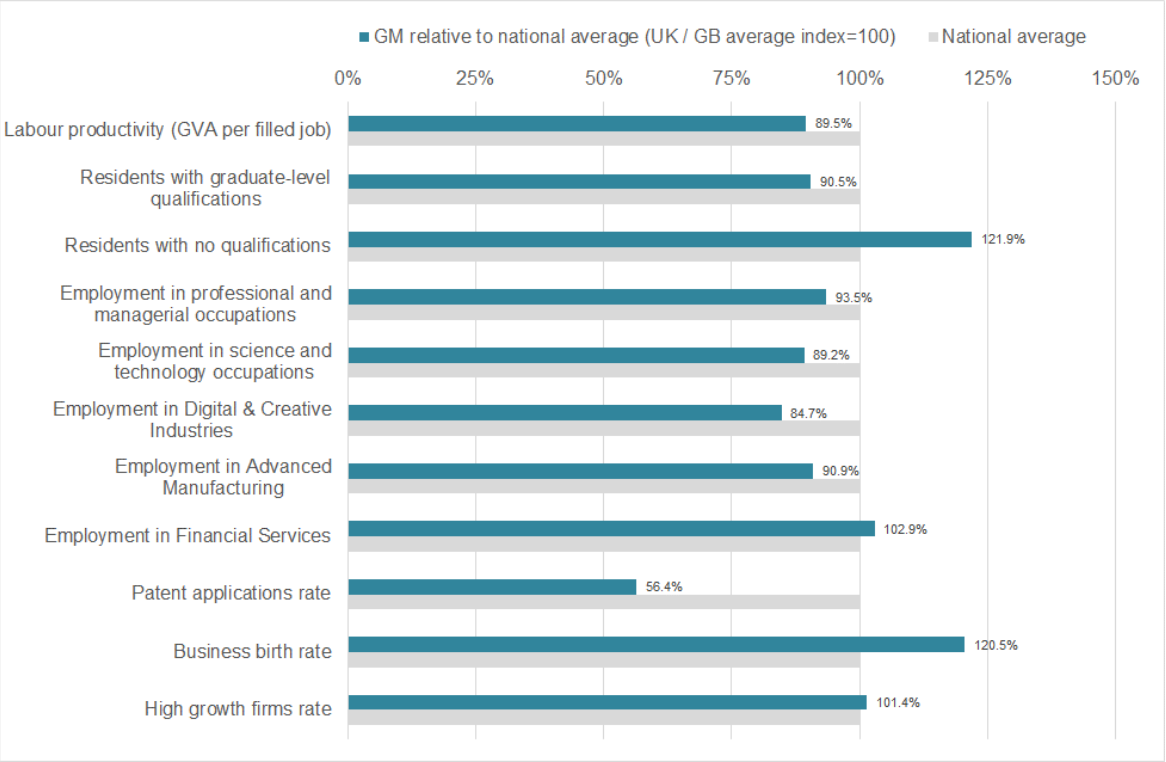
[153] Supporting literature includes: CEP (2006) : Measuring and explaining management practices across firms and countries; UKCES (2008): Skills Utilisation Literature Review; UKCES (2015): High performance working: segmentation of smaller firms; and ERC (2016): Human resource practices and firm growth: an explanatory analysis using the ONS business structure database

- Total number of economically active individuals without qualifications; and
- Proportion (%) of the workforce employed in managerial and professional roles.

- **Investment / access to finance,** the analysis uses the proxy of the proportion of the local economy/employment in financial intermediation.[154]
- **Innovation / R&D,** the analysis uses the proportion employed in science and technology intensive jobs, and the number of patents per 10,000 population as a proxy for innovation.[155]
- **Enterprise / Knowledge Intensive Business**, the analysis includes the business birth rate, as well as the proportion employed in Advanced Manufacturing, Digital & Creative Industries.[156]
- **Density,** the analysis looks at the number of jobs per hectare of land.[157,158]
- **Krugman Specialisation Index** to understand the importance of scale and diversity of economic activity.[159]

As outlined earlier, despite recent strong performance in business start-up, and relative shares of higher value employment compared to some other city-regions, review of these factors shows that GM has a gap in most of the 'high-level factors' associated with higher levels of productivity. The gap appears widest (with the national average) for: the patent applications rate; the proportion of employment in knowledge based - Digital and Creative Industries; and the proportion of employment in Science and Technology-related occupations. The factors which are closer to the national average are the business birth rate; employment in financial services (including financial intermediation and auxiliary services) and the proportion of residents with no qualifications.

*Figure 22: Factor endowments in GM compared to the national average, UK=100% (Source: ONS 2015-2016, and Eurostat 2008-2012 patenting data)*




[154] Enterprise Research Centre (2016): Exploring the success and barriers to SME access to finance

[155] Enterprise Research Centre (2018): Exploring the links between design investment, innovation, and productivity

[156] Supporting literature includes: Coutu, S. LSE (2014): The scale-up report on UK economic growth; HM Treasury and DTI (2001): Productivity and Enterprise: A World Class Competition Regime; and

[157] Arzaghi, M. and Henderson J.V. (2006): Networking off Madison Avenue; and Graham, D. (2007): Agglomeration Economies and Transport Investment, Journal of Transport Economics and Policy; and Swinney, P. Centre for Cities (2014): Core Strength:

[158] OECD (2014): Regional Outlook. City productivity premiums according to city size

[159] Supporting literature includes: Palan, N. (2010) Measurement of specialisation, the choice of indices. FIW Working Paper; European Central Bank (2016): What's so special about specialization in the euro area; and Hausmann, R., et al (2014): The Atlas of Economic Complexity: Mapping paths to prosperity

### *4.1.3 Step 2: Bilateral correlations*

The second step, is to consider in more detail how each of these variables correlate to levels of labour productivity in GM and comparator city regions. Data are sourced from ONS and NOMIS, with shares of employment covering: Digital & Creative Industries, Financial Services, and Advanced Manufacturing; and patents data are from Eurostat. The analysis uses ONS real productivity data (real GVA per employment) for GM and other city-region benchmarks (NUTS2). The data is transformed into a series of two or three year averages to take into account any abrupt changes in the data from year to year.[160] The majority of tests show a positive correlation between productivity and the following:[161]

- Human capital variables – share of population (aged 16-64) with NVQ4 plus qualifications;
- share of population who are working in managerial and professional occupations;
- share of employment in Digital and Creative Industries jobs;
- share of Science and Technology-related occupations in each area;
- share of employment in Financial Services;
- number of high growth firms (per 10,000 jobs); and
- number of new enterprise start-ups (per 1,000 jobs).

The explanatory variables that do not have a positive correlation with labour productivity are the 'share of low qualifications', and 'share of advanced manufacturing', where there is a negative correlation.[162] The results show a relationship between density and productivity, shown in Figure 23, as employment densities rise, then so does productivity. This correlation is indicated by the rising slope of the red-line which bisects the dots representing particular NUTS2 comparators / city regions.[163] The line can be interpreted as an indicator of whether areas do better or worse than might be expected in terms of productivity and their scale / density of employment. The places that lie above the line perform 'better', whilst those lying below perform worse.

The analysis in Figure 24 starts to suggest that that variations in human capital is a more powerful explanatory factor in GM (and other city-regions) than those based on strengths with respect to, for example, employment in advanced manufacturing, entrepreneurship/business start-up, the generation of patents, and employment within high tech services.

In terms of the other factors, there is moderate correlation between productivity and specialisation (Krugman Specialisation Index), suggesting that higher productivity in more specialised areas and lower productivity in more diversified areas.[164] However, this correlation turns slightly negative when London is removed from the analysis, suggesting that high levels of specialisation in London skews the results for this test. Further, when London is removed from the analysis (detailed in Annex 4), a positive relationship appears between productivity and Advanced Manufacturing (although relatively weak), along with stronger correlations for Science and Technology roles, and patenting activity which suggests there are concentrations of science and technology assets outside London (including GM) which are likely to be driving productivity in those areas.

Comparing the analysis with the results of similar analysis in MIER shows that density has become less of a driver of productivity in city-regions, and that the proportion of Level 4+ (graduate) qualifications variable appears somewhat less significant than the importance of Managerial, Professional, and Science and Technology jobs. This suggests that qualifications on their own are not enough and it is more important to support people into higher value work.[165]

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[160] The approach is similar to that used by Artis et al. University of Manchester in the MIER (2009) Labour Market study. Productivity and density are calculated as 2 year averages over 2015 and 2016 and the other explanatory variables as 3 year averages 2012-2014. The results with smoothed estimates were similar to those using nominal productivity as the dependent variable.

[161] The analysis also included just Digital Industries employment, excluding Creative Industries (see annex for definitions)

[162] These correlations become positive when London is removed from the modelling

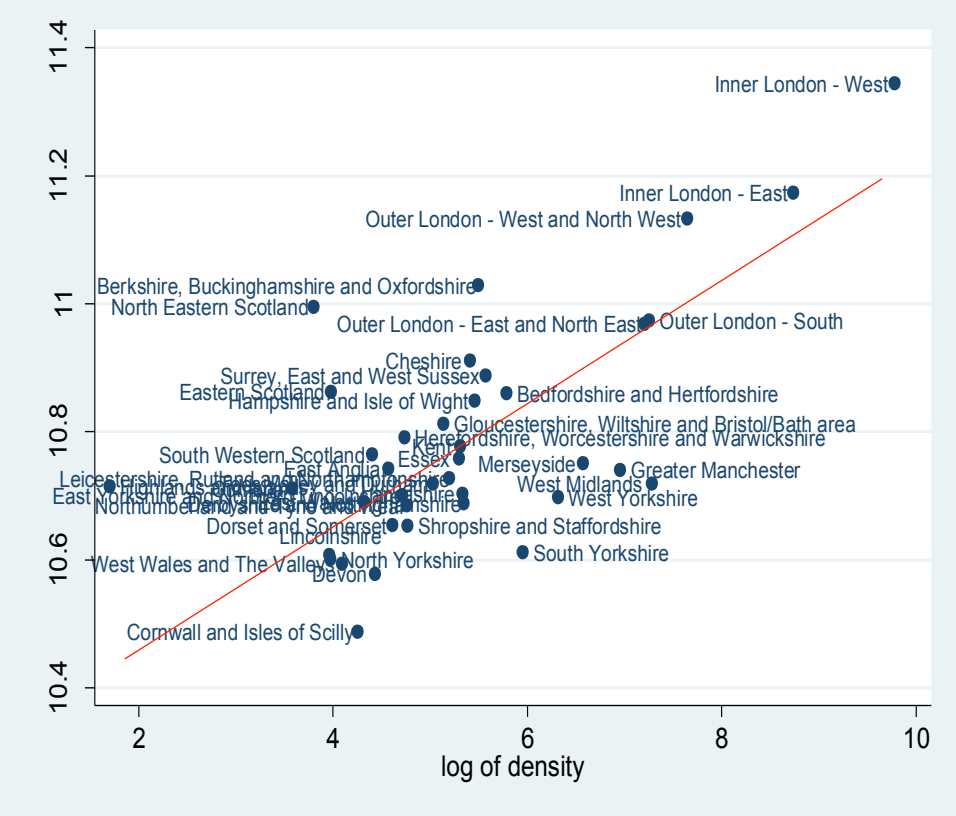
[163] See https://ec.europa.eu/eurostat/web/nuts/background

[164] Note: From the earlier Specialisation Index analysis, Greater Manchester was the least specialised city-region (most diverse) in the UK

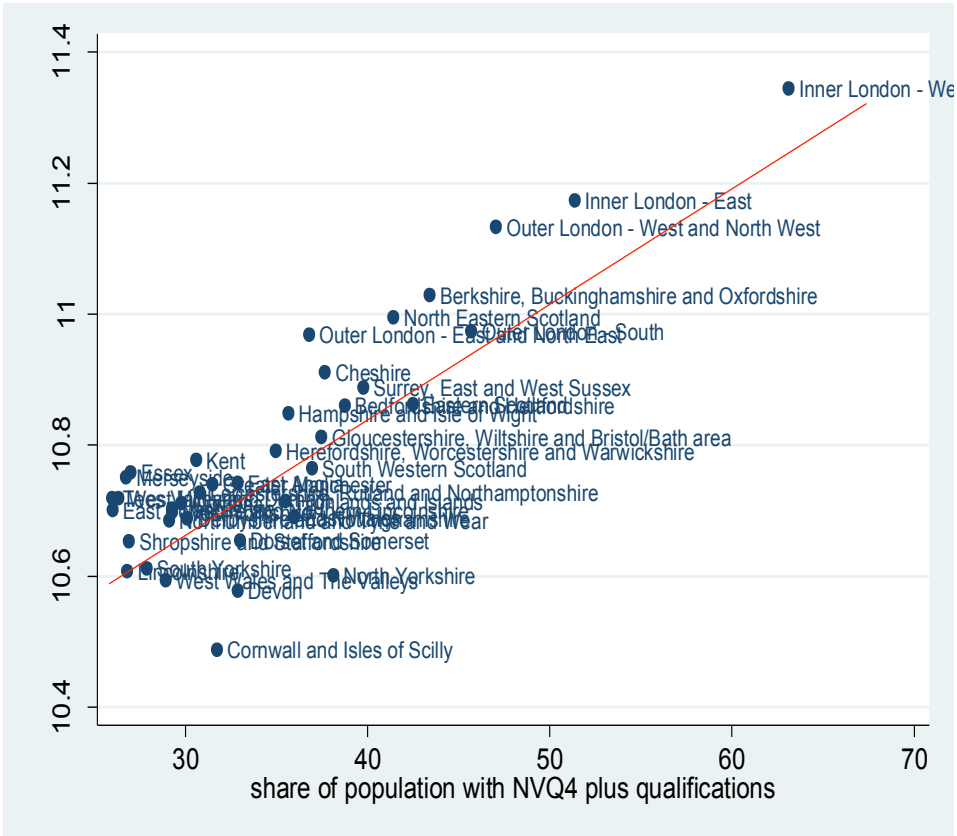
[165] Artis et. Al. (2009): Manchester Independent Economic Review, Productivity and agglomeration economies in the city-region

*Figure 23: Correlation of labour productivity and density (upper), level 4+ qualifications lower)*[166]

**Urban density (jobs per km2)**



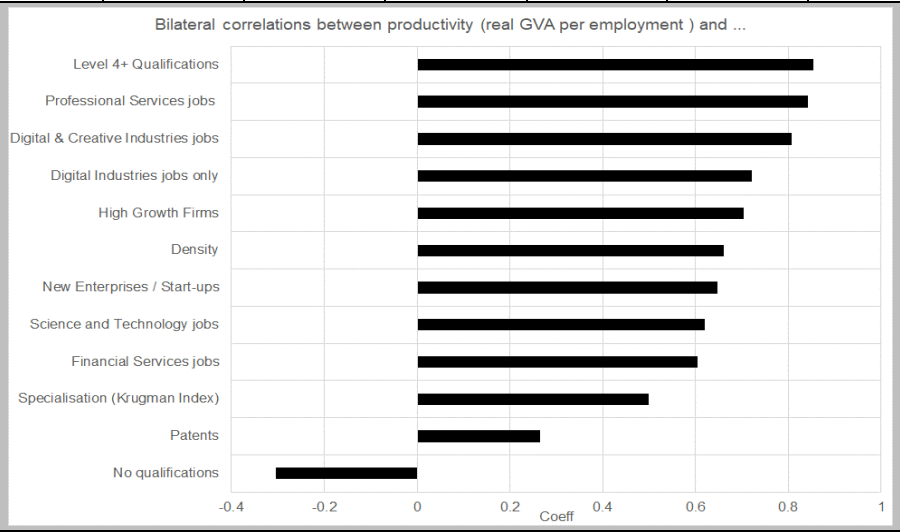

**Level 4 and above qualifications**




[166] ONS (2015/16) for productivity and density, and average 2012/14 for Level 4+ qualifications, for all NUTS 2 city-regions

*Figure 24: Correlation of smoothed variables in cross-section regressions, 39 NUTS 2 areas (Source: Analysis using ONS and Eurostat)*[167] *- Numbers closest to 1 show the highest bilateral correlations – green indicate the higher correlations. Chart is from column one.*

| Variable | Real-Productivity | Density | Level 4+ Qualifications | No qualifications | Prof Services jobs | Science and Tech jobs | Digital Industries jobs only | Digital & Creative jobs | Advanced Manuf. jobs | Financial Services jobs | Krugman Index | New Enterprise Start-ups | Patent rate |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Real-Productivity** | | | | | | | | | | | | | |
| **Density** | **0.6613** | | | | | | | | | | | | |
| **Level 4+ Qualifications** | **0.8535** | 0.4854 | | | | | | | | | | | |
| **No qualifications** | -0.305 | 0.1105 | -0.5294 | | | | | | | | | | |
| **Professional Services occupations** | **0.8412** | 0.5926 | 0.8977 | -0.5156 | | | | | | | | | |
| **Science and Technology jobs** | **0.6195** | 0.1379 | 0.5404 | -0.4864 | 0.5989 | | | | | | | | |
| **Digital Industries jobs only** | **0.7211** | 0.5831 | 0.6439 | -0.3148 | 0.7720 | 0.6021 | | | | | | | |
| **Digital & Creative Industries jobs** | **0.8065** | 0.7350 | 0.7773 | -0.2949 | 0.8513 | 0.4258 | 0.9045 | | | | | | |
| **Advanced Manuf. jobs** | -0.273 | -0.460 | -0.3760 | 0.0766 | -0.3167 | 0.3051 | -0.294 | -0.4874 | | | | | |
| **Financial Services jobs** | **0.6036** | 0.6358 | 0.6487 | -0.0533 | 0.6622 | 0.1443 | 0.5244 | 0.7347 | -0.4008 | | | | |
| **Krugman Index** | **0.4980** | 0.2372 | 0.5417 | -0.1652 | 0.3764 | 0.0629 | 0.1109 | 0.3386 | -0.1527 | 0.2712 | | | |
| **New Enterprises / Start-ups** | **0.6475** | 0.6310 | 0.4796 | -0.2102 | 0.5066 | 0.2931 | 0.4485 | 0.5791 | -0.5259 | 0.2490 | 0.2211 | | |
| **Patents** | 0.2642 | -0.111 | 0.1939 | -0.3772 | 0.3220 | 0.7581 | 0.4527 | 0.2240 | 0.4382 | -0.00 | -0.2003 | -0.0643 | |
| **High Growth Firms** | **0.7041** | 0.5770 | 0.6632 | -0.3425 | 0.7173 | 0.3926 | 0.5121 | 0.6823 | -0.2040 | 0.4978 | 0.4810 | 0.4939 | 0.1906 |




[167] Dependent variable is the average of real productivity in 2015 and 2016; density is the average of 2015 and 2016; other variables are 3 year averages over 2012-2014, patents 2008-2012 average

### *4.1.4 Step 3 regression analysis*

The final step of analysis is to understand which factors, and combinations of factors are statistically significant in fostering higher levels of (labour) productivity in GM and a selection of city-region benchmarks, with a particular reference to density and the variables outlined above. The approach builds a series of cross-sectional regression models to assess the potential impact of agglomeration economies amongst all NUTS2 sub-regions and uses a set of controls to check the robustness of the relationships identified. The contributions were assessed under the following:

**Step 1:** Contributions of variables according to Ordinary Least Squares (OLS) estimations of specification - to help start estimating the initial model.[168]

**Step 2:** Two-Stage Least Squares with instrumental variables.[169]

**Step 3:** Two-Stage Least Squares, with Generalised Method of Moments (GMM) weight matrix.[170]

The main finding, unsurprisingly, is that there is a strong positive relationship between **productivity and the human capital variables**. In particular, the share of higher-level qualifications in the population (Level 4 and above), and the share of higher level managers and professional occupations. This holds with the results of academic literature.[171] The other main findings include:

- The **density** variable is generally positive and significant. A doubling of workforce density, (holding other coefficients fixed) brings about gains in productivity of between **2% to just under 4%** (in line with literature, and in one model run an 'optimistic' impact of up to 6%).[172]
- The coefficient on the variable for share of population with **no qualifications** is significant. Halving the proportion of residents with no qualifications, would increase productivity by **just under 2%** (again with all other coefficients fixed).
- Doubling the proportion **of science & technology jobs** could increase productivity by **just under 5%.**
- Increasing the **share of high growth** firms in a city-region could increase productivity by **3%**.[173]

The results suggest that agglomeration economies are significant in determining productivity, although the estimates of their size is somewhat reduced when the intangible asset endowments which characterize the knowledge-based economy are introduced, (knowledge, human capital, and entrepreneurial culture - are included in the estimations). Specifically, the majority of the variables representing intangible assets are significant and with the expected sign, and the results are consistent when treating for "two-way causation" problems between productivity and density.[174]

The overarching finding is that – whilst continued investments in, for example, local/regional transport system improvements might boost labour productivity,[175] the accumulation of certain kinds of intangible endowments in a given region is extremely important, in particular as the regression modelling confirms, the availability and utilisation of skills, in line with the literature.[176]

[168] Several sources of endogeneity could arise from these first estimates. It could be the case that the concentration of employees leads to better economic outcomes or, on the contrary, that better economic outcomes attract more workers to live in a given region due to higher wages. If the latter occurs, estimation by OLS will yield inconsistent estimates. To deal with this problem, the estimations are conducted using Two-Stage Least Squares (2SLS)

[169] Using land area and log of (1801) population as first stage instruments on density as in Rice, P., Venables, A.J. and Patacchini, E. (2006): Spatial determinants of productivity: analysis for the regions of Great Britain, Regional Science and Urban Economics 36(6)

[170] Generalized Method of Moments (GMM) is a generic method for estimating parameters in statistical models

[171] Findings from research in Ciccone, A. (2002): Agglomeration effects in Europe; Rice et al (2006): Spatial determinants of productivity: Analysis for the regions of Great Britain; and Artis, M.J., Miguelez E. and Moreno, R. (2012): Agglomeration economies and regional intangible assets: an empirical investigation, Journal of Economic Geography 12: 1167-1189

[172] For example: De La Roca and Puga (2011): Learning by working in big cities, CEPR Discussion Paper No. 9243; Abel, J. et al. (2011): Productivity and the Density of Human Capital, Federal Reserve Bank of New York Staff Reports, no. 440; and OECD (2014): Regional Outlook. City productivity premiums according to city size

[173] In each case, the uplifts achieved for each variable, but holding others fixed

[174] As noted previously in Artis, M. et al. (MIER 2009): Productivity and agglomeration economies in the Manchester City Region

[175] Northern Powerhouse Partnership (2017): Northern Powerhouse Partnership: First Report; and MIER (2009)

[176] OECD (2017): Getting Skills Right. Boosting skills would drive UK growth and productivity; and Bloom, N. et al. (2016): International data on measuring management practices. American Economic Review

*Figure 25: Cross-section linear regressions (GMM), 39 NUTS 2 areas, excluding Northern Ireland (ONS and Eurostat)*[177,178] *Green highlights some of the stronger associations*

| Model run >> | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
|---|---|---|---|---|---|---|---|
| **Constant** | 10.30 (0.11)* | 9.91 (0.05)* | 9.96 (0.07)* | 9.87 (0.04)* | 10.1 (0.07)* | 10.00 (0.05)* | 9.94 (0.06)* |
| **Density** | **0.060** (0.02)* | 0.022 (0.01)* | 0.029 (0.01)* | 0.037 (0.01)* | 0.026 (0.01)* | 0.026 (0.01)* | 0.039 (0.01)* |
| **Level 4+ Qualifications** | | | 0.01 (0.00)* | | 0.005 (0.00)* | | 0.008 (0.00)* |
| **No qualifications** | **-0.019** (0.01)* | | | | | | |
| **Professional Services occupations** | | 0.016 (0.00)* | | 0.013 (0.00)* | | 0.011 (0.00)* | |
| **Science & Tech. jobs** | **0.04** (0.02)* | | | | 0.047 (0.02)* | 0.048 (0.01)* | |
| **Digital Industries jobs** | | | | | | 0.005 (0.00) | 0.005 (0.01) |
| **Digital & Creative jobs** | | | | 0.002 (0.00) | | | |
| **Adv. Manufacturing jobs** | | 0.012 (0.01)* | 0.011 (0.01)* | | | | |
| **Financial Services jobs** | | | | | 0.01 (0.01) | | |
| **Krugman Spec. Index** | | 0.002 (0.00) | 0.003 (0.00)* | 0.004 (0.00)* | | 0.003 (0.00)* | 0.004 (0.00)* |
| **New Enterprises/Start-ups** | | 0.012 (0.00)* | 0.012 (0.00)* | 0.011 (0.00)* | | 0.003 (0.00) | 0.014 (0.00)* |
| **Patents** | 0.002 (0.00) | 0.003 (0.00)* | 0.003 (0.00)* | 0.004 (0.00)* | 0.001 (0.00) | | 0.004 (0.00)* |
| **High Growth Firms** | **0.027** (0.01)* | | | | 0.033 (0.01)* | | |

## 4.2 What combinations of factors are most important to raise productivity?

Figures 26 to 29 compare the cross-section results in more detail, focussing on a narrow but illustrative set of city-regions including GM. **The analysis re-enforces the finding that the proportion of higher-skill workers and proportion of science and technology jobs are amongst the most important factors correlated with higher levels of productivity in all city-regions**. These factors are particularly important in Bristol which may help explain its higher aggregate levels of productivity over that of other city regions, but are also **the most important factors for raising productivity in GM.** The results reinforce the evidence that suggests that GM's performance, in terms of human capital and higher value jobs, has some way to go if it is to at least raise high value outputs and start to reach a critical mass that could start to close the skills and prosperity gap with both the national average and London. Unsurprisingly, the agglomeration coefficient in the modelling exercise is much stronger when London is included in the regression.[179]

The analysis finds positive and significant explanatory variables in all city-regions for human capital (higher-level qualifications), the share of workers with Professional and Managerial occupations, Advanced Manufacturing and of Science and Technology workers along with the share of high growth firms. Taking the evidence in the round, the latter appears (along with enterprise start-ups) to be more important for GM. In fact, all areas appear to do well in terms of new-enterprise, in particular when higher-level qualifications are included in the analysis (graduate start-ups).

However, as Figure 26 shows, the other stand out finding is that GM performs less well is in terms of patenting and productivity performance. It is also important to note that the density variable changes when other factors are included in the linear regression models. The emphasis therefore, is on what combination of factors tell us most about the relationship between labour productivity and the variables used. When London is excluded from the analysis there is a stronger role for Science and Technology, Advanced Manufacturing and Financial Services workers along with stronger coefficients for new start-ups and patents.

[177] NUTS1 regional dummies applied in all analysis models

[178] Data for these figures is for 2014 to 2016, apart from patenting 2008 to 2012

[179] Regression results excluding London are shown in Annex 4

*Figure 26: Cross-section regression model for selected city-regions - Model variant 7: Including share of Advanced Manufacturing employment, and patenting (Source: ONS and Eurostat)*[180]

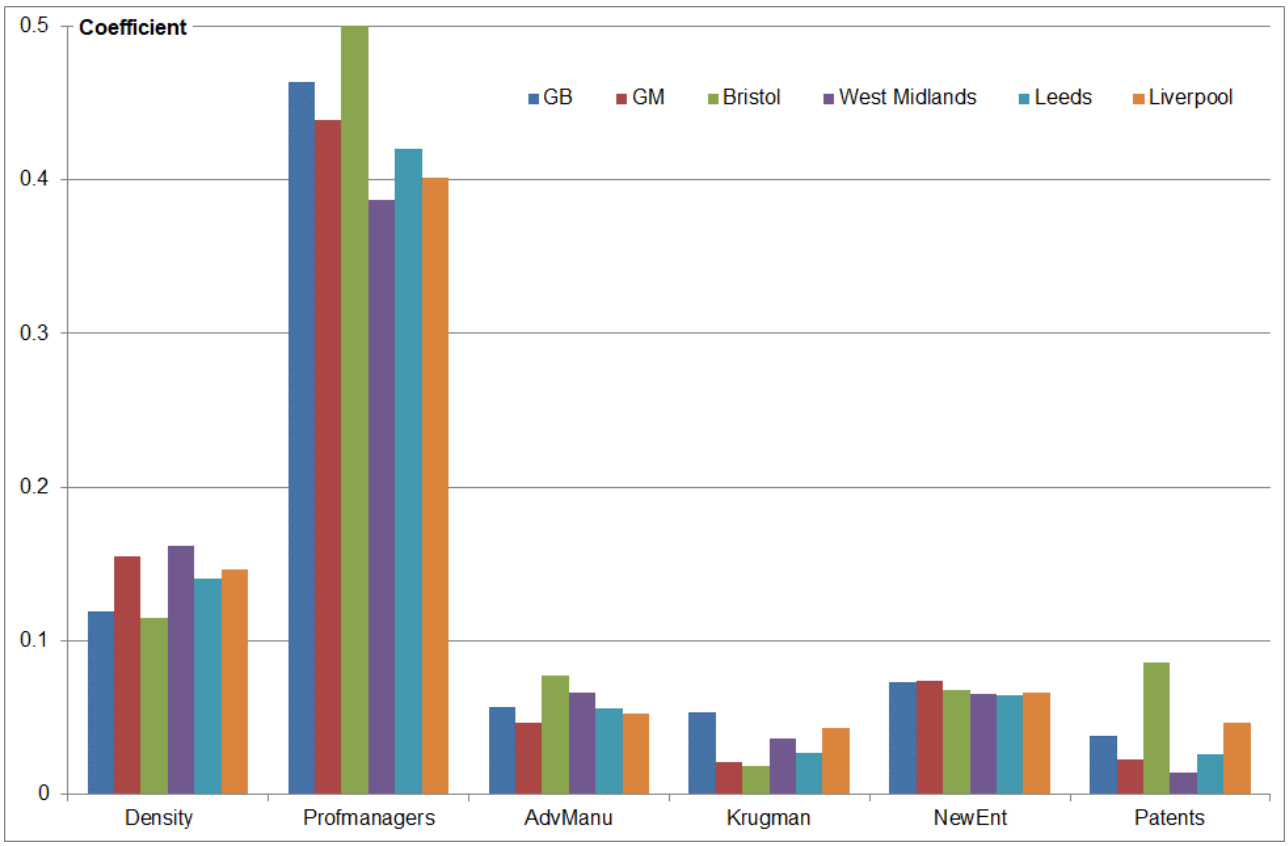
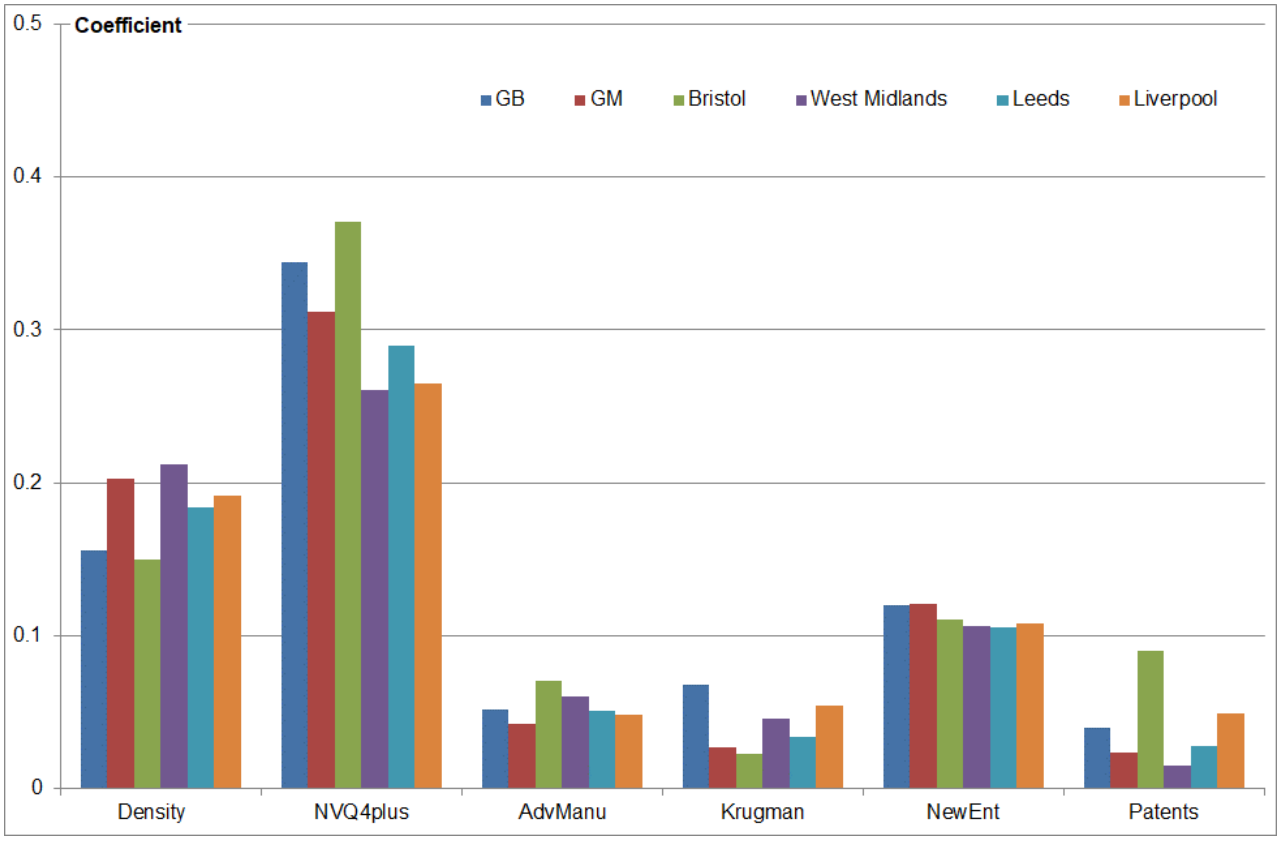



*Figure 27: Cross-section regression model for selected city-regions – Model variant 8: Share of Level 4 and above qualifications, and patenting (Source: ONS and Eurostat)*




[180] Note: Data for these figures is for 2014 to 2016, apart from patenting 2012 to 2014

*Figure 28: Cross-section regression model for selected city-regions – Model variant 11: Share of Digital Industries, and Science and Technology employment (Source: ONS and Eurostat)* [181]

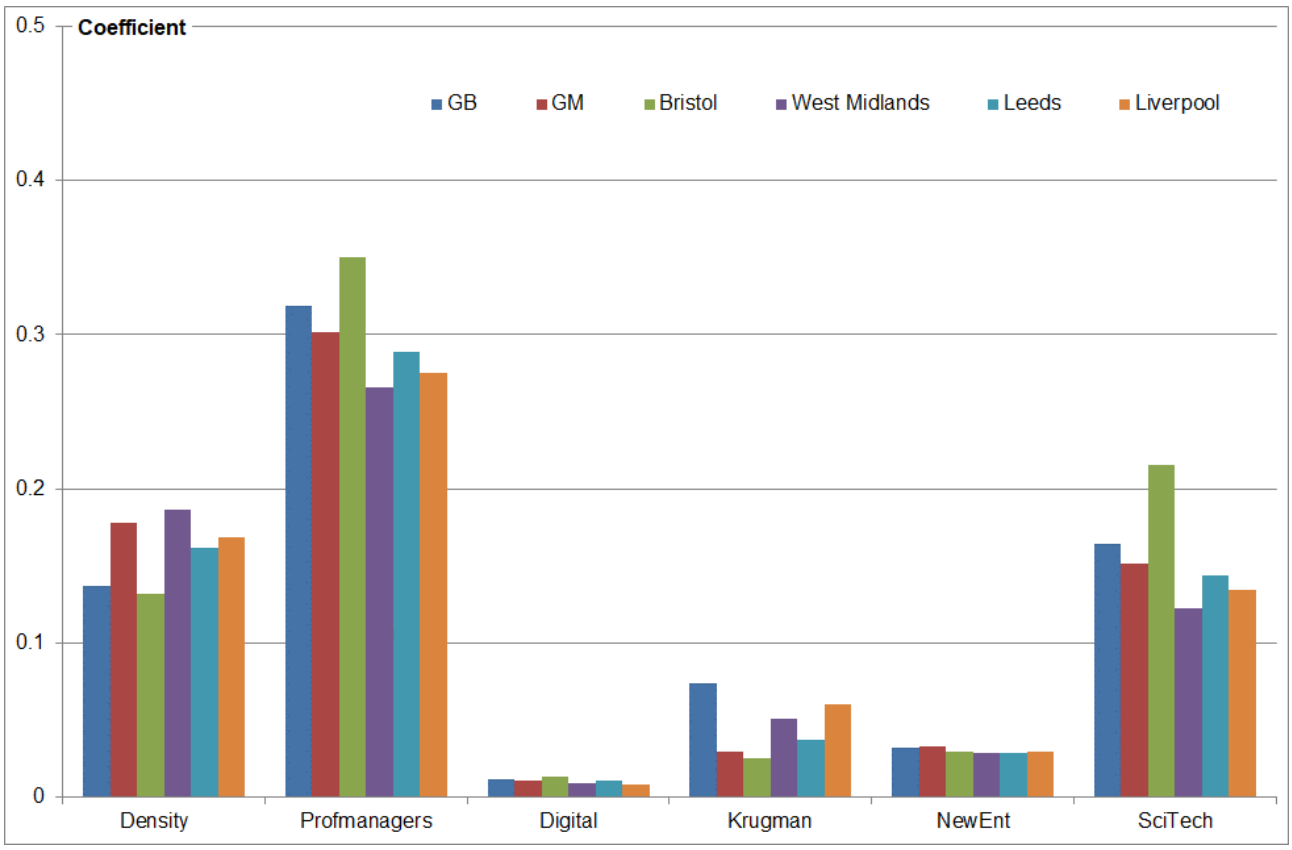
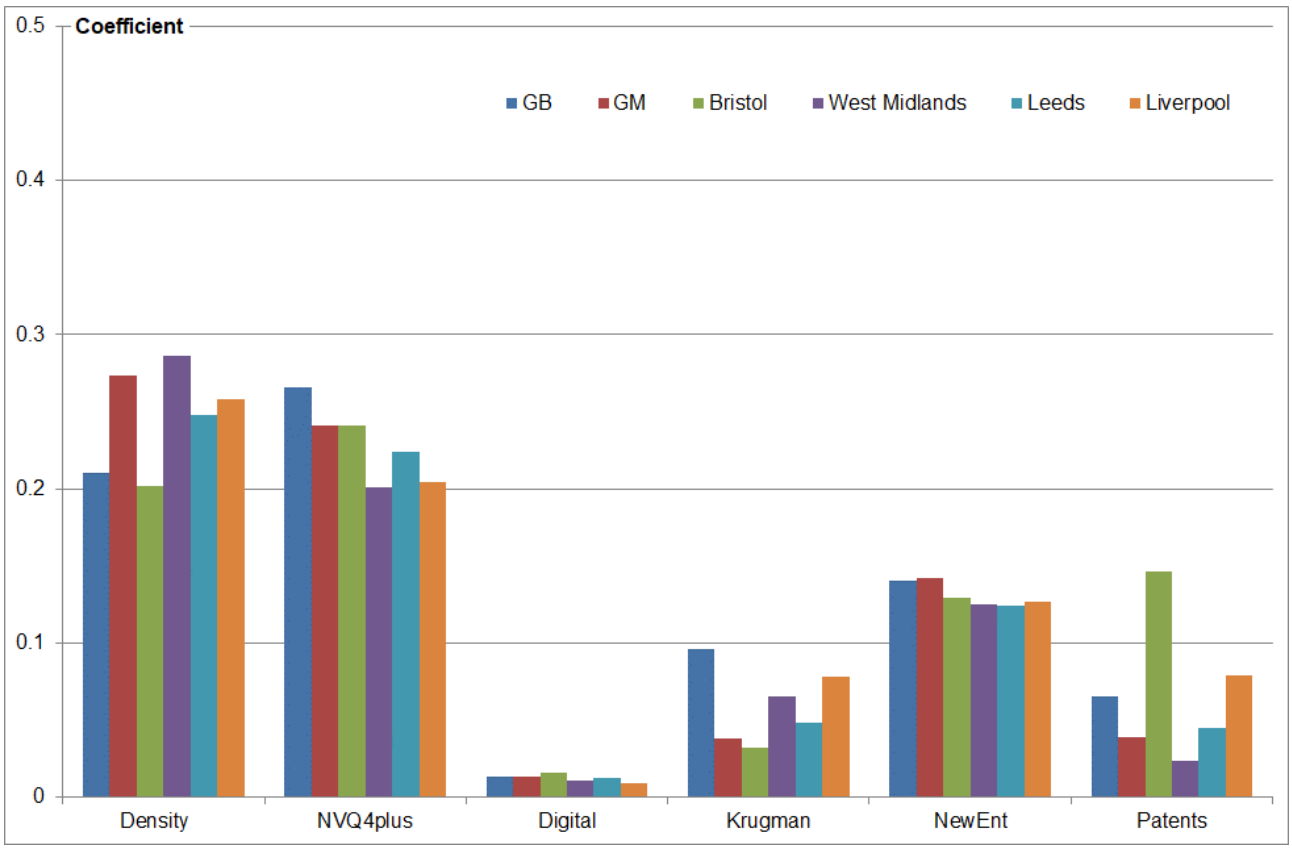



*Figure 29: Cross-section regression model for selected city-regions – Model variant 12: Share of Digital Industries, and patenting (Source: ONS and Eurostat)*




[181] Note: Data for these figures is for 2014 to 2016, apart from patenting 2012 to 2014

# 5. Which factors explain firm-level productivity?

The following section uses plant-level data from ONS to show the relative importance of industry-mix to aggregate productivity levels compared to the productivity of individual firms (by a range of variables relating to size, sector, exporting, ownership and so on). It also looks at the distribution of productivity across firms in GM as a whole,[182] and then investigates the characteristics of the top 20% of GM's most productive firms;[183] and how this group differs from the overall business population. The analysis accompanies additional analysis of low productivity in the accompanying report Low Productivity & Low Pay in GM which also draws on recent work by ONS.[184]

## 5.1 Is industry-mix or firm productivity more important?

### *5.1.1 Approach and scope*

Differences in average labour productivity between city-regions can reflect differences in both firm characteristics and industry composition of an area. The following analysis uses a **decomposition** technique to investigate these sources of productivity and how they relate to differences in aggregate productivity between the benchmark city-regions. The analysis breaks down (changes to) labour productivity in each city-region into three indices, as follows:

1. **The Firm Productivity Index**, which shows the average level of productivity in a city-region (relative to the national average) assuming the industry composition in that region is the same as for the economy as a whole; this is designed to demonstrate the effect of the firm level productivities on the city-region's estimated average productivity.
2. **The Industry Composition Index**, which shows the average level of productivity in a region relative to national average - assuming the productivity of each industry in that city-region equals nationwide average productivity for that industry. This index is designed to demonstrate the effect of the industry composition on the city-region's average productivity.

   A higher value of the Firm Productivity Index in a given region shows that productivity of the firms (hence industries in general) in that city-region are higher than firms in equivalent industries elsewhere. A higher value of Industry Composition Index implies that the more productive industries, on average nationally, have larger industry shares in that city-region.
3. **The residual - covariance term,** provides a link between industry shares and industry productivity in an area. As an example, if an area has a high share of industry employment relative to Great Britain in the industries to which the nation has significant productivity advantages (for example Financial Services in London, Oil and Gas in Aberdeen, and Metals/Automotive in South Wales), then it would likely have a large positive residual.[185]

### *5.1.2 Headline findings*

Labour productivity[186] differs considerably both between and also within different industries. However, as Figure 30 shows, **productivity differences within industries appears to play a more prominent role than the industry structure/mix** in explaining overall spatial differences in productivity. This holds both nationally and in particular for GM. When industry mix is adjusted to match national averages, so areas look the same as the national profiles of sectors, the areas with the biggest 'gains' in performance are in places which are over-reliant on lower value sectors, or equally they have 'over-reliance' on single industries which help explain their performance.

When productivity within all sectors is adjusted to match the national average, the city regions with the biggest 'gains' in performance are Sheffield, Newcastle, Cardiff, West Yorkshire, GM, and Birmingham. The same adjustment sees a fall in London, Bristol, Glasgow, and Liverpool (implying the possibility of high-value clusters in these areas, e.g. Financial Services in London).

[182] Excluding parts of financial services, and public sector

[183] Other literature referring to the top 20%, top 10% and 5% as 'Frontier Firms'

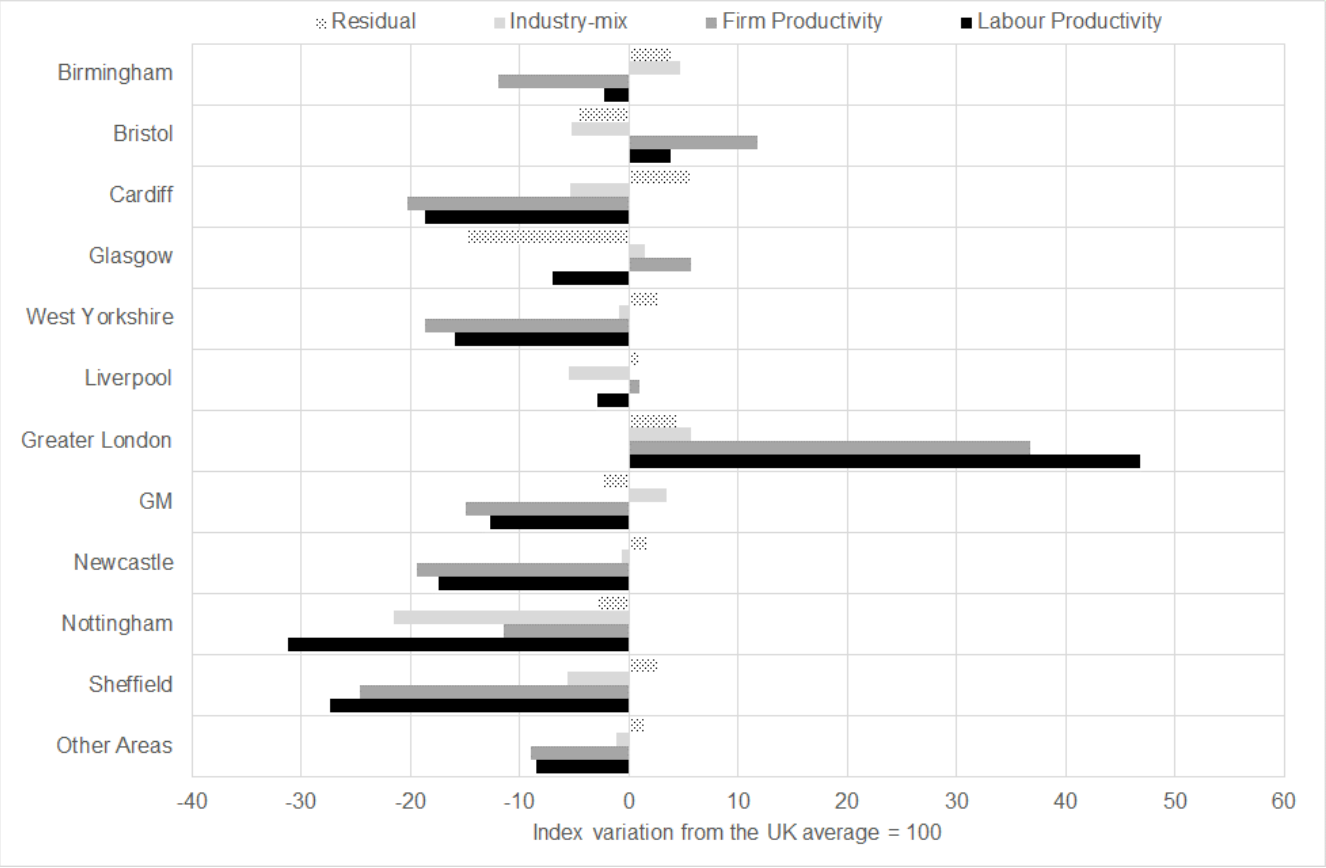
[184] ONS (2018): Understanding firms in the bottom 10% of the labour productivity distribution in Great Britain: 2003 to 2015

[185] ONS (2018): Examining regional gross value added growth in the UK 1998 to 2016

[186] Labour productivity in nominal terms, without of adjustments for different regional prices in inputs.

Finally, the areas with the largest unexplained variance (the residual) from this analysis are Cardiff, London (and less so Birmingham and Sheffield). This suggests that other factors offer a productivity advantage, for example, London's productivity advantage over other areas is not just about having more firms in say Financial Services. It also means that London firms display a significantly higher level of productivity on average compared to equivalent industries elsewhere.

*Figure 30: Firm productivity and industry mix effects on aggregate average productivity, Greater Manchester and city-region comparators, 2016 (Source: ONS)*




## 5.2 What are the characteristics of higher productivity businesses?

Research by ONS shows that, in the period since the recession, there has been a marginal increase in the share of firms with higher levels of productivity, and that there has been a modest rate of increase in the share of people working in more productive firms since the recovery. Further, while the gap in the level of productivity has closed between micro-firms (1 to 9 employees) and SMEs/Large firms, this has not resulted in growth in UK aggregate productivity.[187]

Research on the 'long-tail' and the productivity distribution of firms has been recently undertaken by the Centre for Cities and Bank of England.[188,189] This work shows that the distributions at the lower sections of the productivity 'tails' have grown faster in the post-crisis period than they did before it; and that there is little difference between different parts of the UK in the tails of 'lower-productivity' sectors such as retail, hospitality, health and social care. The findings of these studies reiterate the importance of developing 'good employment' in the 'routine economy'. However, they also highlights that the biggest improvements to productivity can be achieved by focussing on the lagging productivity of cities outside of London and the local business environment that will help grow existing exporters (volume and value or traders), and attract new ones to a city-region.

The following section builds on these studies, drawing on detailed firm data at city-region level, for GM and comparator city-regions. As with the preceding national research, the analyses make use of 'Kernel Densities'. These plot the distribution of productivity of individual firms (based on ONS survey) across an area. By looking at how the distribution curves skew (to the left indicating lower

[187] ONS and Economic Statistics Centre of Excellence (2018): Below the Aggregate: A sectoral account of the UK productivity puzzle

[188] Centre for Cities (2018): The wrong tail. Why Britain's 'long tail' is not the cause of its productivity problems

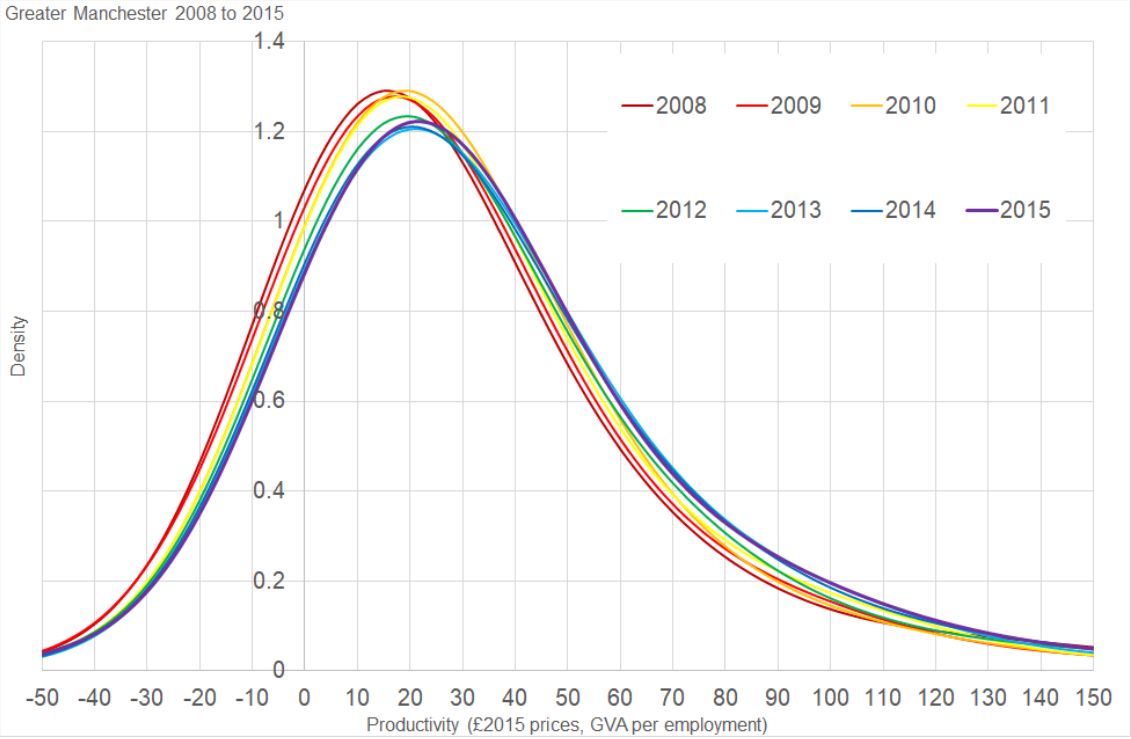
[189] Schneider, P. (2018): The UK's productivity puzzle is in the top tail of the distribution. First published in the Bank of England Blog

productivity, and to the right, higher productivity) it is possible to start to understand how productivity varies within sectors in GM, and how future enterprise policy could be developed. **It is also important to note that the data include firms that report negative productivity, when businesses spend more than they earn.**

### *5.2.1 Distribution analysis - approach and scope*

Figure 31 shows the overall distribution of firms by their productivity.[190] The shape of the distribution indicates a concentration of firms with annual GVA per employment within the £5,000 to £20,000 range, and a gradually falling share of firms with higher levels of productivity as the distribution moves to the right. It shows, that over time there is a noticeable rightward shift in the share of GM firms with negative GVA per employment, indicating the likely impact of unproductive firms ceasing to trade and/or of an improvement in productivity. [191] It can be also be observed there have been some (modest) gains at the upper end of the productivity distribution in GM.

*Figure 31: Distribution of firm-level productivity **GVA per employment over time**, Greater Manchester, 2008 to 2015 (Source: ONS Annual Business Survey, Non-financial economy)*

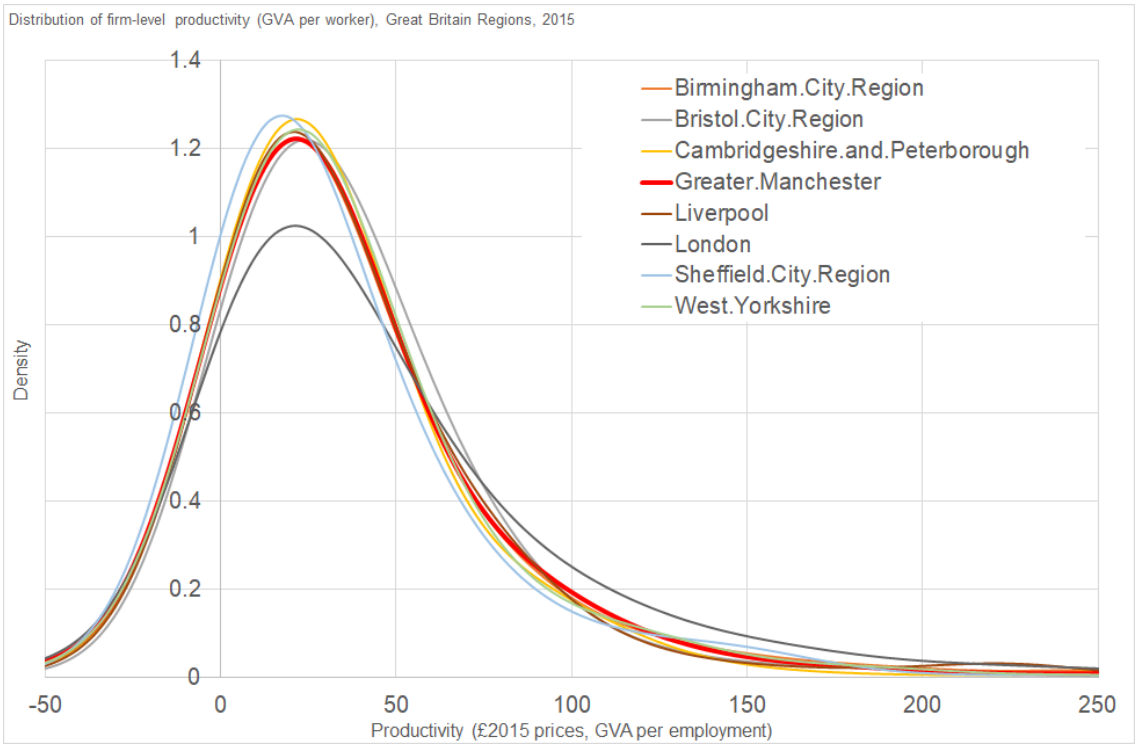



Comparison of city-region performance in Figure 32, also shows that there is little difference in the overall shapes of the productivity distribution curves, with London having a distinctly shorter tail of lower-productivity firms, and a longer tail of higher productivity firms. GM has a slightly shorter tail of low productivity firms than other city-regions, however Bristol stands out with a higher proportion of firms in the £50 to 100k per employee bracket.

[190] All prices are deflated to 2015 constant prices

[191] Firms can have negative levels of productivity in specific periods when they report larger values of purchases than their total turnover

*Figure 32: Distribution of firm-level GVA per employment, **Greater Manchester and comparator city-regions**, 2010 to 2015 (Source: ONS Annual Business Survey, Non-financial economy)*




Note: chart truncated above £250k+ to aid visualisation of the difference between city-regions

### *5.2.2 Productivity by firm-size and age*

Analysis of GM firm data in Figure 33 shows that there is no clear relationship between productivity and firm size or age (since registration), with arguably a small peak in higher productivity in small firms (10 to 49 employees) in the £100,000 to £150,000 per employee bracket. Further analysis of data against age suggests that firms over 20 years of age in GM typically fall into one of two categories, either micro-size or large (over 250 employees) suggesting that there are a significant proportion of older small firms that have not scaled-up.

These findings run counter to national evidence which shows that larger firms are, on average in the UK, more productive than smaller firms, and this holds across most sectors.[192] While our analysis has so far not been able to confirm that directly, it does suggest that larger firms in GM appear less likely than smaller firms to be in the top 20% or bottom 20% most productive categories; and micro-size and small firms are more likely to be found at either of these extremes.[193]

Whilst micro-size firms make up 84% of GM's economy, the findings suggest that policy should not (in most cases) target businesses based solely on size, and should consider supporting firms to scale up, i.e. those with the capacity, capability, and confidence to grow. Further, several studies show that scale-ups have an important role to play in local economies.[194] Scale-ups generate more productive jobs than the average and are more likely to be associated with work experience, apprenticeships, graduate jobs, and non-executive directorships. They are also more likely to have international trade connections, and have a more diverse workforce, and higher proportions of women in boardroom role and in executive management teams.[195,196]

[192] ONS (2018): Regional firm-level productivity analysis for the non-financial business economy

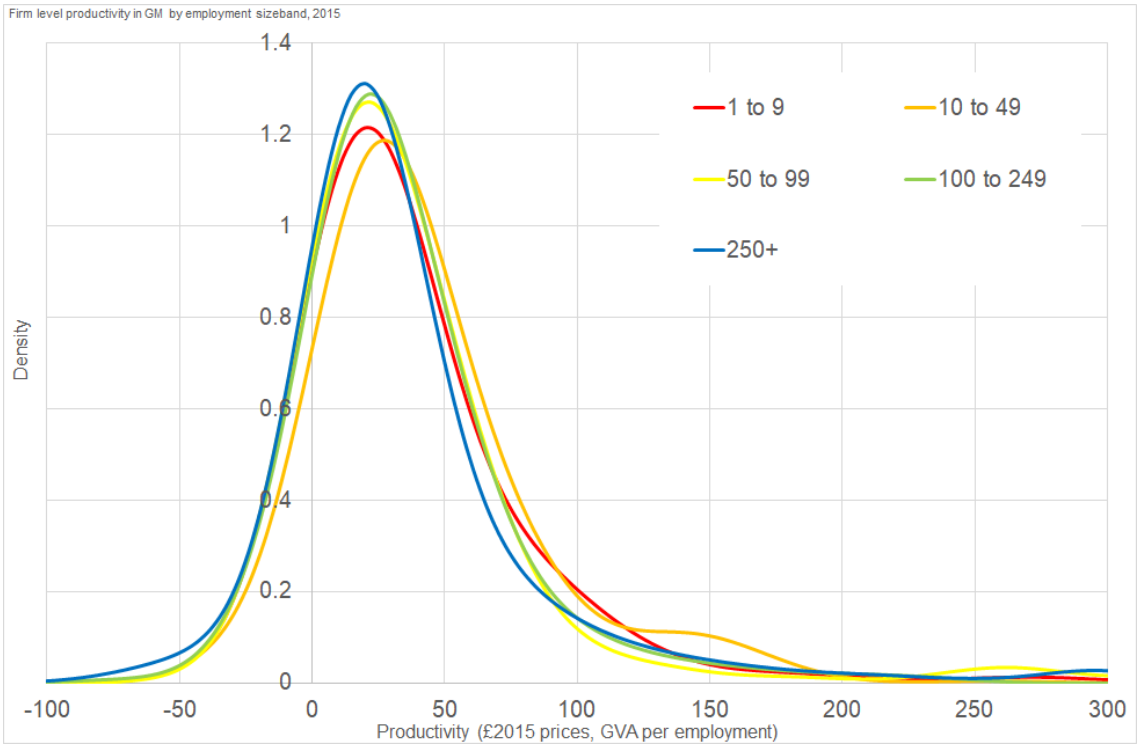
[193] NESTA (2016): Riley R. and Rosazza Bondibene C. - Sources of labour productivity growth at sector level in Britain, after 2007

[194] For example: The ScaleUp Institute (2014): The Scale-Up Report on UK Economic Growth

[195] FTSE (2018): Hampton-Alexander Review of FTSE Women Leaders

[196] Pipeline (2018): Women Count - The role, value and number of female executives in the FTSE 350

*Figure 33: Distribution of firm-level GVA per employment by **firm size**, Greater Manchester, 2010 to 2015, and by **size**: 0-9, 11-249, 250+ employees (Source: ONS Annual Business Survey)*




Note: chart truncated to aid visualisation of main trends

### *5.2.3 Productivity by industry sector*

Much of the previous analysis explored the relationship between sector, industry mix and productivity. The main finding suggested that productivity of firms is much more important in most city-regions for explaining differences in aggregate productivity, rather than industry mix – with the exceptions of specialist clusters, such as Financial Services in London, and Oil and Gas in Aberdeen.

This is not to say industry mix is entirely unimportant. Studies have shown that there is, for example, significant variation across different sectors in allocative efficiency within both manufacturing and services; and studies have suggested that a quarter of the variation across sectors in (log) labour productivity between 1998 and 2013 in the UK arises due to variation in allocative efficiency.[197] However, this is not the same as trying to ensure a particular mix of industries within a locality. This will be determined by which types of firms determine a particular location has a range of benefits that outweigh the costs for their business.

The firm level data shows that there are highly productive and very low productive firms in all industry sectors in GM. However, there is a clear trend in the likelihood of firms falling in the top or bottom 20% of the productivity distribution based on a very broad industrial classification. Firms in Business and Professional Services, Digital and Creative Industries, Construction, and Health Innovation, and Manufacturing are more likely to fall in the group of **most** productive local firms.

Whereas, firms in Hospitality, Tourism, and Sport; Retail and Wholesale; Health and Social Care are more likely to fall in the group of **least** productive firms/organisations. In the latter, firms in the sector are both less likely than average to fall among the most productive firms in the local economy, and more likely to fall among the least productive. This is an important finding, as these three broad sectors accounted for 37% of jobs, and 26% of GVA, in GM's economy in 2016.[198]

As Figures 34 to 42 show, the main difference in productivity (longer tails of lower productive firms) exist across GM's core competencies, in particular in Digital & Creative Industries and Advanced

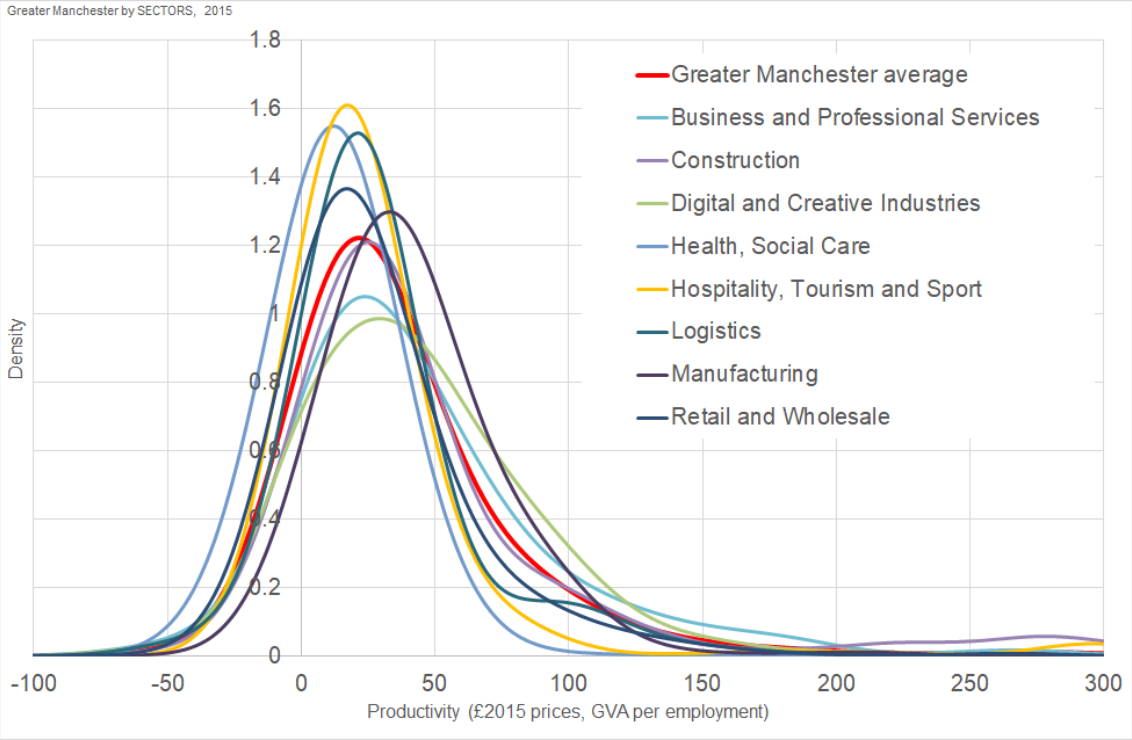
[197] ONS (2018): Regional firm-level productivity analysis for the non-financial business economy

[198] Greater Manchester Forecasting Model (2018) Oxford Economics

Manufacturing; and the remaining charts highlight that there is little difference in the long-tails (and higher productivity firms) in the 'routine' economy, similar to national findings by ONS.[199]

**These findings (and related research)[200] suggest that policy should not be overly concerned with the mix of industries within a city region, and that it is better to focus on the main drivers of productivity within a city region. However, as discussed in the conclusions, there may be a case to raise performance where GM has sets of core competencies and key assets.**

*Figure 34: Distribution of firm-level GVA per employment across **broad industry sectors**, (Source: ONS Annual Business Survey, Non-financial economy)*




Note: chart truncated above £300k+ to aid visualisation of the difference between sectors

Firm level data allows for a more detailed, finer grained assessment of productivity (comparing GM to the national average) down to 2 and 3 digit SIC classification. Whilst the main results are included in the Review's work on Global Competitiveness,[201] the headline findings using firm level data summarised below.

The analysis suggests that GM has comparative advantages in the following: Scientific Research & Development, Health Innovation (which includes pharmaceutical manufacturing), sport, construction (site preparation and demolition), waste management, e-commerce, and parts of manufacturing, notably - paper, print and packaging, technical coatings (ceramics, insulators), electrical products/components (semi-conductors), advanced textiles and materials, and television and radio broadcasting.[202]

Separate analysis of location quotients - which show employment concentrations rather than comparative productivity advantages - suggest that GM has higher concentrations of employment compared to the national average in: Insurance Services, Telecommunications, Aviation, Computer Consultancy and Software, Legal Services, Accountancy, Shared Services, Call Centres, Residential Care, and Manufacturing of Bulk Chemicals.[203]

[199] ONS (July 2017): Understanding firms in the bottom 10% of the labour productivity distribution in Great Britain: "the laggards"

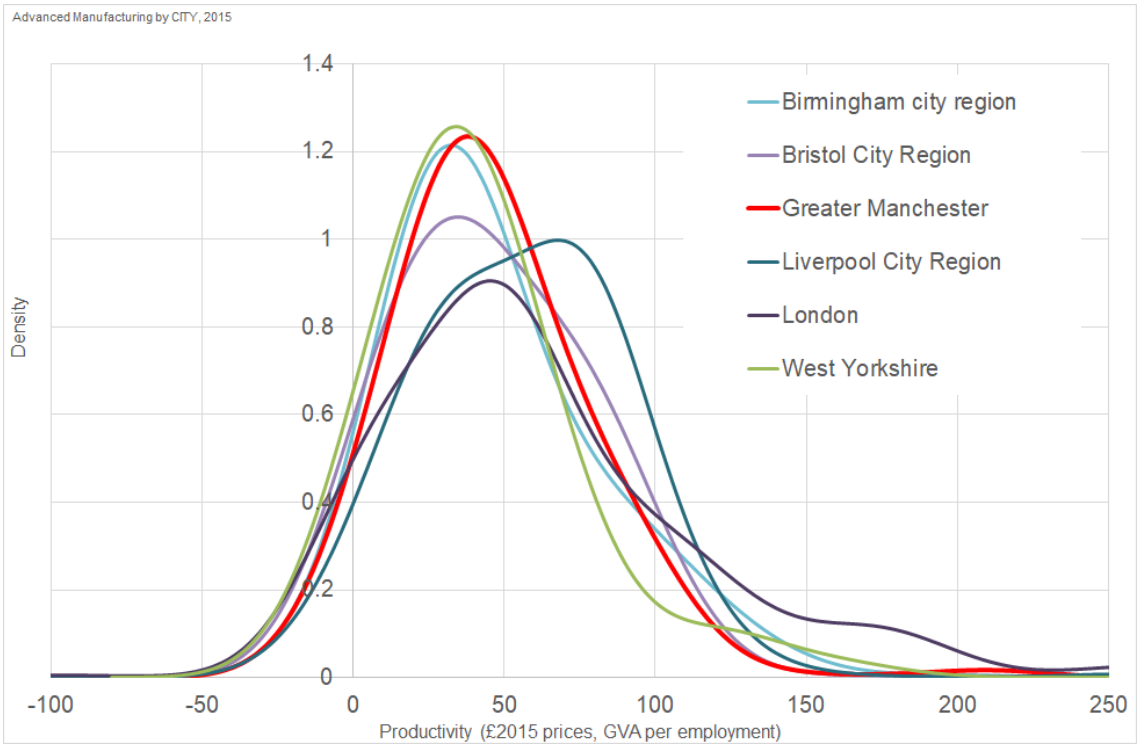
[200] Martin, R. et al (2018): The city dimension of the productivity growth puzzle: the role of structural change and within-sector slowdown. *"These findings point to the need for further research on the causes of this slowdown in 'within-sector 'productivity growth and why those causes appear to differ from city to city."*

[201] The Greater Manchester Independent Prosperity Review (2019): global competitiveness and Innovation ecosystems

[202] ONS Annual Business Survey, data for Greater Manchester

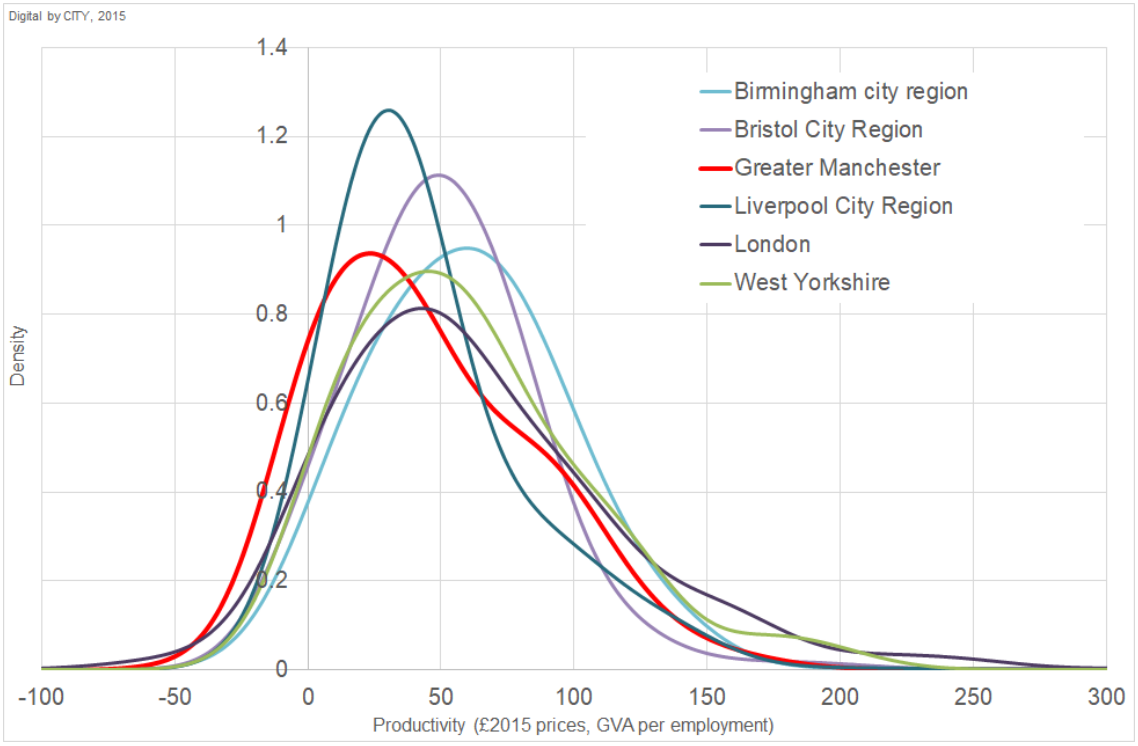
[203] ONS (2016): Business Register Employment Survey

*Figure 35: Distribution of firm-level GVA per employment across **Advanced Manufacturing**, (Source: ONS Annual Business Survey, Non-financial economy)*



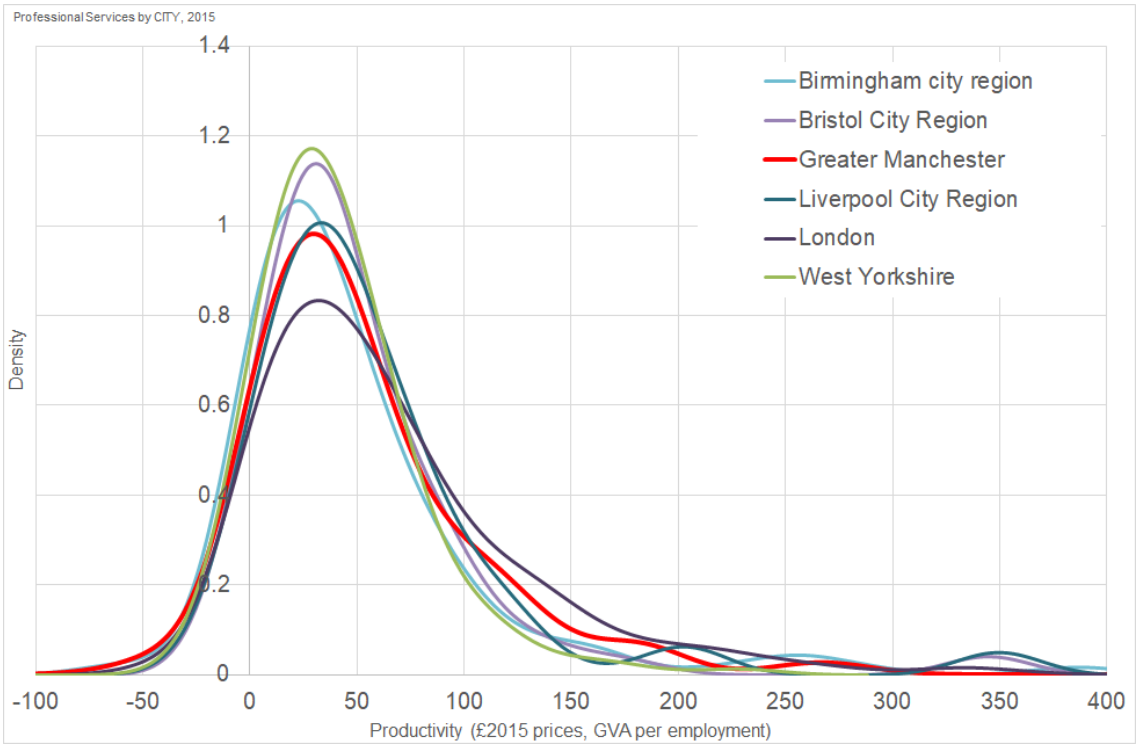

Note: chart truncated above £250k+

*Figure 36: Distribution of firm-level GVA per employment across **Digital and Creative Industries**, (Source: ONS Annual Business Survey, Non-financial economy)*



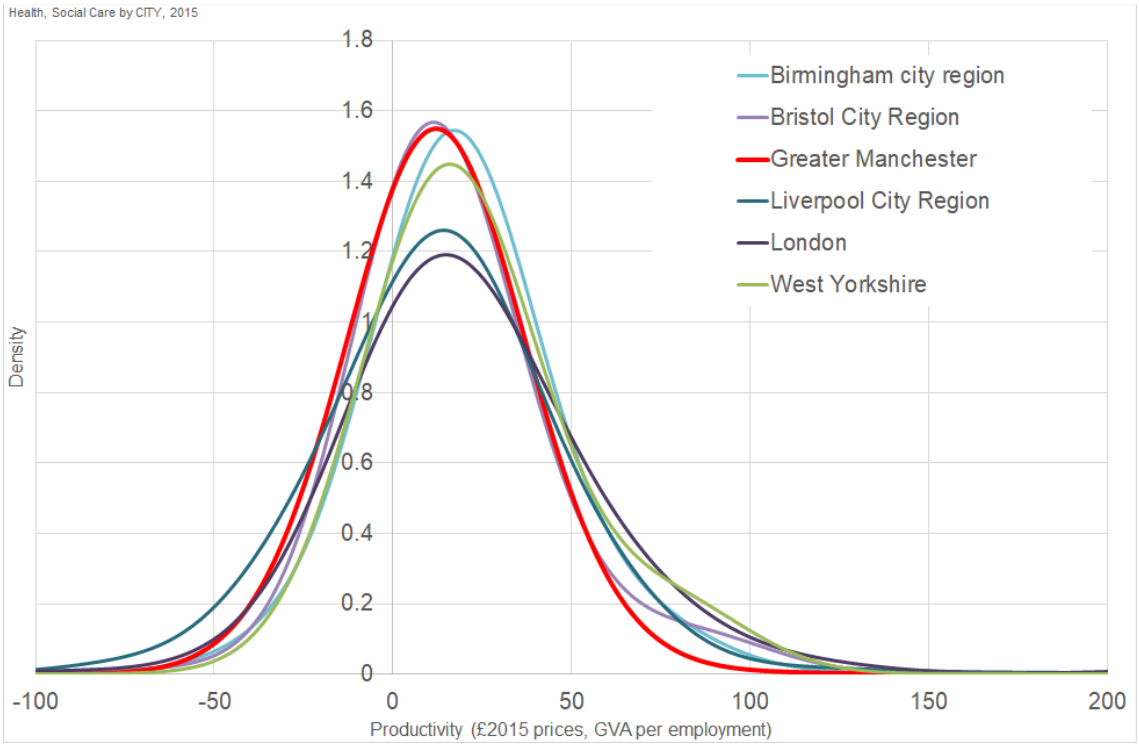

Note: chart truncated above £300k+

*Figure 37: Distribution of firm-level GVA per employment across **Professional Services**, (Source: ONS Annual Business Survey, Non-financial economy)*



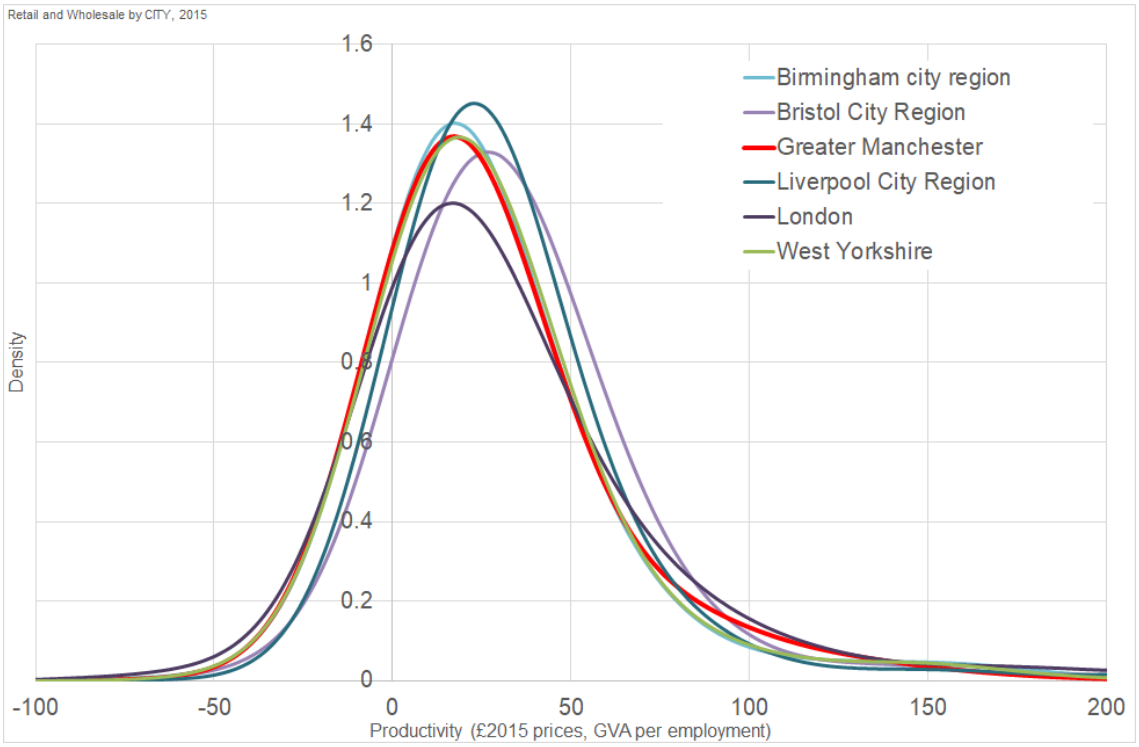

Note: chart truncated above £400k+

*Figure 38: Distribution of firm-level GVA per employment across **Health and Social Care**, (Source: ONS Annual Business Survey, Non-financial economy)*



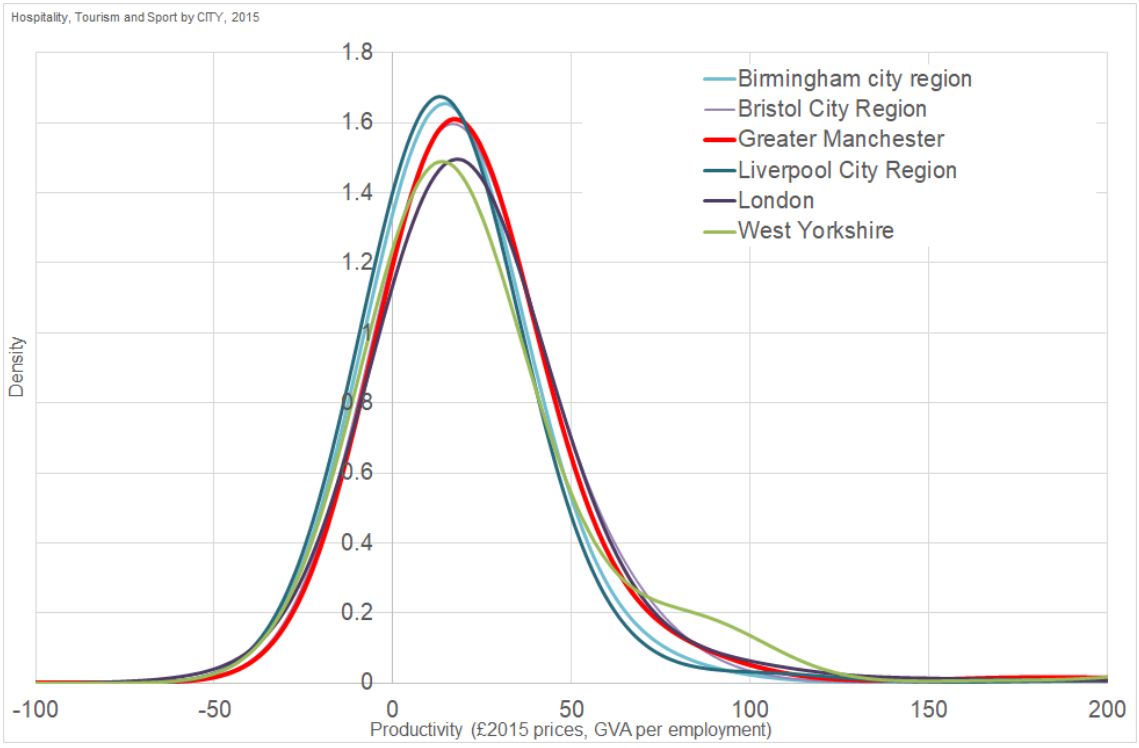

Note: chart truncated above £200k+

*Figure 39: Distribution of firm-level GVA per employment across **Wholesale and Retail**, (Source: ONS Annual Business Survey, Non-financial economy)*



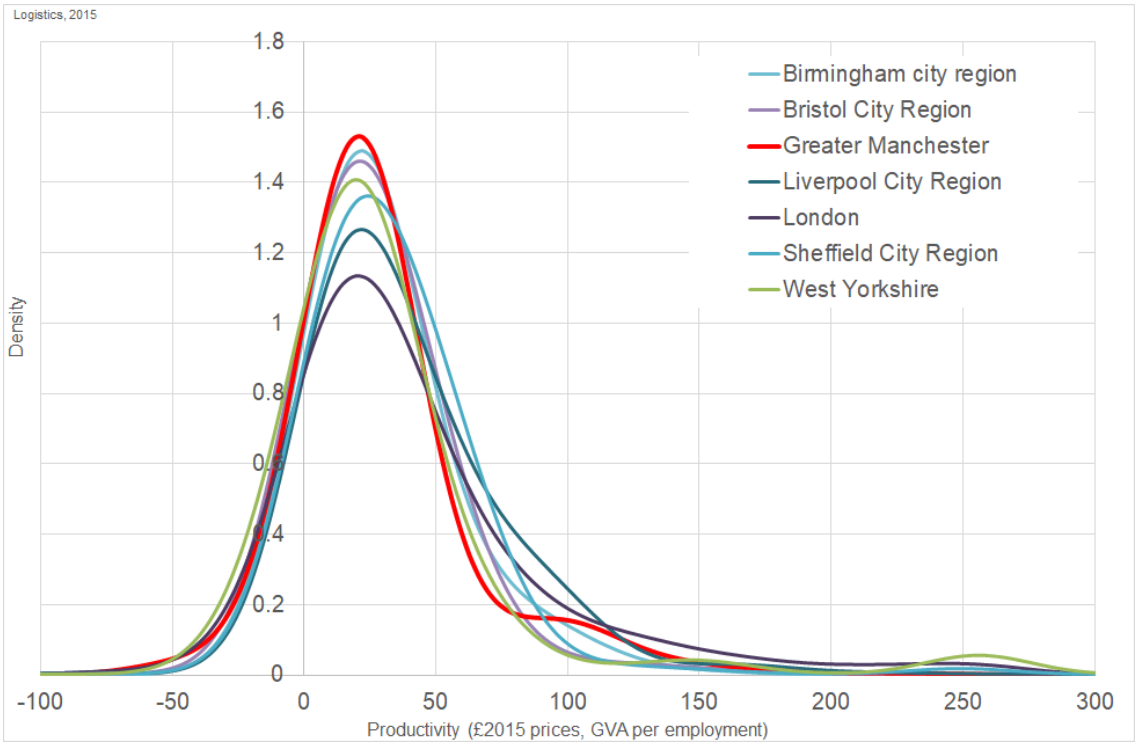

Note: chart truncated above £200k+

*Figure 40: Distribution of firm-level GVA per employment across **Hospitality, Tourism, and Sport** (Source: ONS Annual Business Survey, Non-financial economy)*



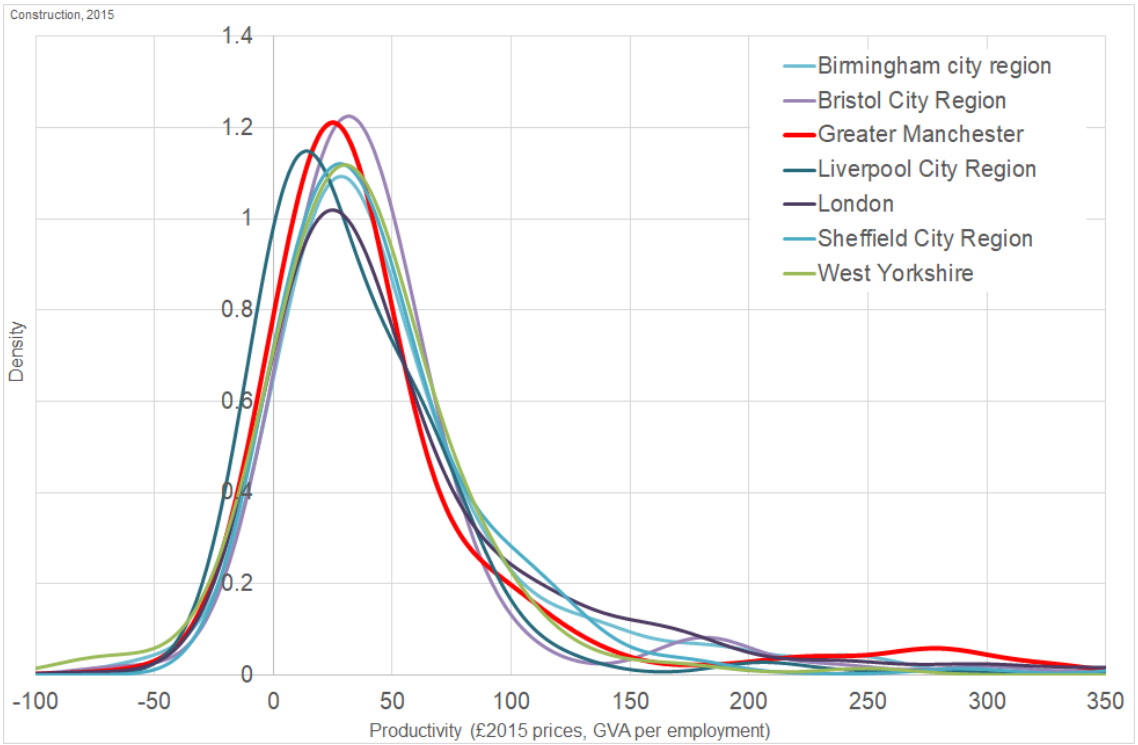

Note: chart truncated above £200k+, full chart includes major sports clubs

*Figure 41: Distribution of firm-level GVA per employment across **Logistics**, (Source: ONS Annual Business Survey, Non-financial economy)*




Note: chart truncated above £300k+

*Figure 42: Distribution of firm-level GVA per employment across **Construction**, (Source: ONS Annual Business Survey, Non-financial economy)*




Note: chart truncated above £350k+

### *5.2.4 Productivity and exporting*

A variety of studies show that businesses that are more likely to sell beyond their local markets – such as Automotive and Aerospace Engineering, traded Financial Services, Digital Industries – tend to be more productive than those that focus more on local markets, such as Retail, Hospitality and Tourism, Food and Drink, and so on.[204] In terms of the links to productivity puzzle, research has suggested that the UK's trade performance has been poor in the period after the recession (up to 2016) in a way which is consistent with a larger permanent fall in productivity.[205,206]

At the national level, a dataset from ONS and HMRC – linking firm-level data with administrative data – suggests that UK firms that report goods exports and/or imports were around 20% more productive than businesses which do not trade after controlling for their size, industry, and ownership; and more productive businesses export to, and import from, more destinations than less productive traders.[207]

Further, the 'premia' associated with trading with non-EU markets are considerably larger than those associated with EU trade, suggesting that lower productivity firms find it easier to access EU than non-EU markets; and that more productive firms are better at addressing trade barriers. The same ONS data suggests that direct trading behaviour is very unequally distributed, with the largest traders responsible for the bulk of trade. Of total UK exports, 35% to 40% were reported by the 50 largest exporting enterprise groups between 2008 and 2016.[208]

As highlighted earlier, GM's performance in terms of propensity to export and the value of exports is improving, but is still lower than would be expected given the size of the economy. Consecutive business surveys in GM show that exporters were more likely to be large firms and SMEs, and more likely (than non-exporting firms) to report growth in turnover and jobs. The latter was particularly strong, with exporters significantly more likely than non-exporters to report growth and to expect future employment growth in excess of 50% of current staff.[209]

Figure 43 shows **that GM's exporters are more likely to have much higher productivity than non-exporters**, and this applies across all business age groups, and across all sizes of firm. GM appears to be in line with the average across comparator city-regions in the share of high- and low-productive exporters. However there is evidence to suggest that this trend varies by industry, for instance, internationally-trading manufacturing firms in GM appear less likely to be low productive than other sectors. Overall, exporting firms in GM do not seem to be particularly more or less likely than those elsewhere to fall into the 20% least productive in the local economy.

**These findings suggest that growing the propensity of firms to export, and raising the value of exports will be an important contribution to raising aggregate productivity in GM.**

[204] Wagner J. (2005): Exports and productivity: A survey of the evidence from firm level data

[205] Giles, C. (2011): Britain needs to buy more from Bognor, not Barcelona

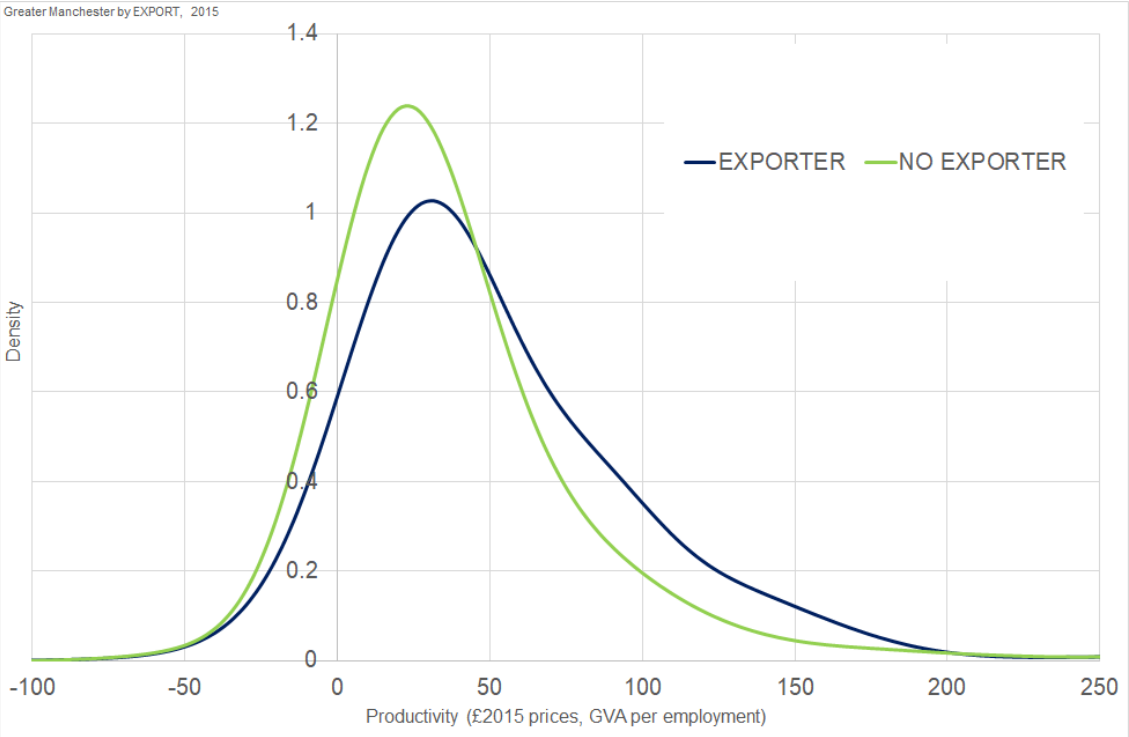
[206] ONS (2018): The 2008 recession, 10 years on

[207] ONS (2018): UK Trade in goods and productivity: new findings using 2016 micro-data (published July 2018)

[208] Ibid

[209] Greater Manchester Business Survey 2012 to 2017

*Figure 43: Distribution of firm-level GVA per employment **exporting vs non-exporting**, Greater Manchester, 2015 (Source: ONS Annual Business Survey)*




### *5.2.5 Productivity and foreign ownership*

Analysis of Companies House data shows that there are approximately 9,000 foreign owned firms in GM, just under 10% of all businesses.[210] Further, 28% of these foreign-owned firms reported overseas turnover (last 3 years of accounts) which is a proxy for export trade. [211] Previous studies show that investment by these firms in the city-region does not crowd out, or displace, investment by UK firms. Inward foreign investment in GM is associated with increased investment by domestic firms which supply the 'new' inward investor.[212] This investment also uses skilled labour to augment output in GM - rather than substituting for labour – implying that rising overseas and domestic investment creates additional jobs. Less encouraging is the finding that inward investment taken as a whole does not have a positive effect on the productivity of domestic firms operating in the same sector, however there is an impact on productivity in supply chains.

More recent analysis by the ONS shows that – controlling for size, industry, and location – foreign owned firms that have located through FDI are more productive than non-FDI firms.[213] The median productivity of these firms in the UK is £59,000 per employee, compared to £28,000 in non-FDI firms; and the average productivity of FDI firms (£172,000) is around three times that of the non-FDI firms. The study also finds that FDI firms are more likely to be large, 9% having 250 or more employees, compared with under 1% of non-FDI firms.

These 'productivity-premia' are more pronounced in Utilities, Professional, and Scientific and Technical industries. As shown in Figure 44 below, foreign-owned firms in GM are on, average, more likely to have higher productivity than non-foreign owned firms, and this applies across all sizes of firm. Similar to other comparators, just under a third (30%) of foreign owned firms in GM are in the top 20% most productive firms locally. However, the data also shows that they are more likely than the national average to be found in the bottom 20% least productive firms across all GM.

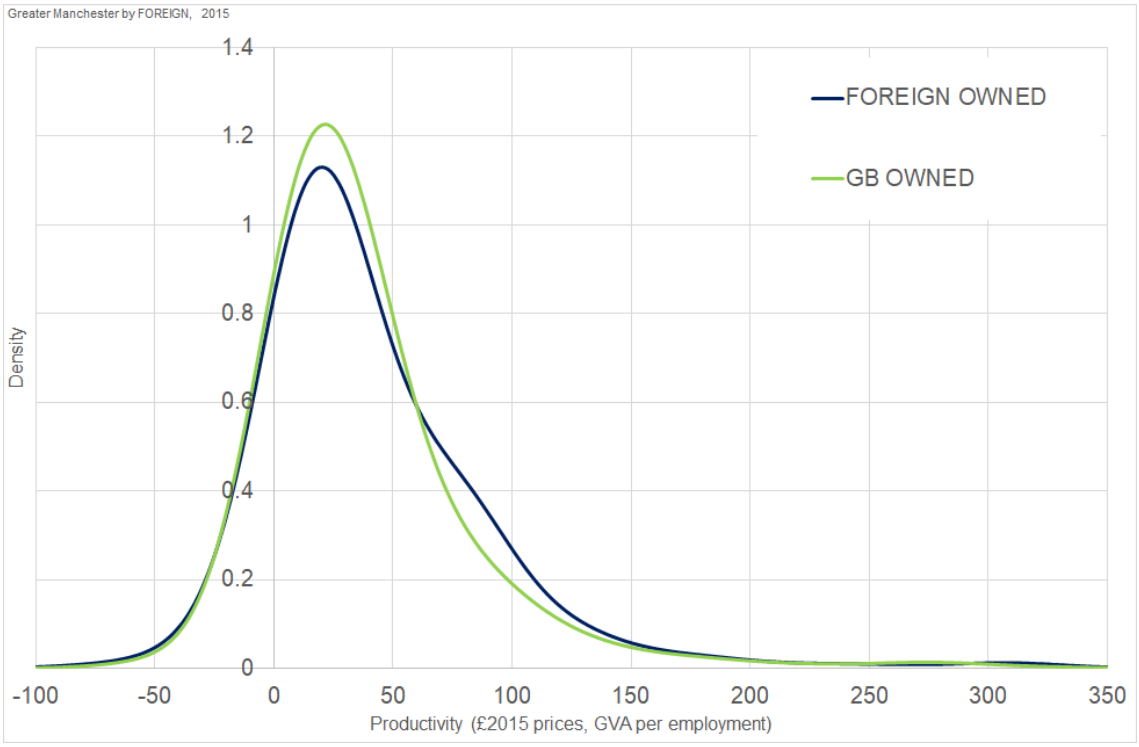
[210] Firms with a registered trading office addresses in GM and with a minimum of 1 employee, where foreign (non-UK) shareholders own together between 51% and 100% of the company's shares. Note: The number of foreign owned firms falls significantly (to 1%) when looking at larger firms with more than one employee

[211] Firms with a registered office or primary trading address in GM which have recorded any known amount of overseas turnover in their last 3 years of available accounts (proxy for exporting)

[212] MIER (2009): Growing Inward and Indigenous Investment

[213] ONS (2018): Foreign direct investment and labour productivity, a micro-data perspective, 2012 to 2015 (published October 2017)

*Figure 44: Distribution of firm-level GVA per employment in **foreign-owned vs non-foreign** owned firms, Greater Manchester, 2015 (Source: ONS Annual Business Survey)*




Research also suggests a link between foreign ownership and the importance of having a higher prevalence of structured management practices amongst this type of firm (and a higher prevalence in large firms and SMEs) compared to domestic (and family owned) firms.[214,215,216,217] The latest research also points to the use of new business models aligned with the latest process and supply chain technologies.[218]

Taken in the round, these findings suggest that **focussing on attracting foreign owned firms will have dividends for GM's economy. Equally, it will be important to encourage the development of supply chains which link overseas investors with domestic firms within GM's economy after investment.**

### *4.2.6 Other factors affecting productivity and 'gaps' in data*

Recent ONS firm-level analysis using a linked e-commerce and Annual Business Survey datasets suggested that there is a productivity premium associated with businesses' use of technologies for e-commerce or business organisation activities, and these vary across industries.[219] The Audit has attempted to use similar data on businesses' expenditure on IT and telecoms as a proxy for adoption of digital technologies, to examine its relationship with firm-level productivity. The analysis found that there is some relationship between IT investment and firm-level productivity, however this was only statistically significant in two of the eight years of survey data analysed. Further analysis also looked at the relationship between investments in patents, licenses, trademarks and similar rights and firm-level productivity. Again, the relationship between these factors proved inconclusive, as it was statistically significant in some of the survey years, but not others. Finally, the Audit analysis attempted to look at the relationship between R&D and firm-level productivity, however this was limited by the ONS survey design, as the only survey question relevant to R&D asked businesses whether they were planning to carry out any in-house R&D on a regular basis in the next two years, whilst gave a positive response from almost all respondents.

[214] ONS and Economic Statistics Centre of Excellence (2018): Below the Aggregate: A sectoral account of the UK productivity puzzle
[215] NESTA (2016): Sources of labour productivity growth at sector level in Britain, after 2007: a firm level analysis
[216] Huxtable-Thomas L and Hannon P (2017) The Role of Entrepreneurial Leadership in City Region Economies
[217] IFB Research Foundation and Oxford Economics (2017) The State of the Nation: The UK Family Business Sector
[218] Velu, C. (2018): Solving the productivity paradox. Cited in Manufacturing Leadership Journal
[219] ONS (2018): Information and communication technology intensity and productivity

# 6. Conclusions and issues for consideration

## 6.1 What are the main implications of the analysis findings?

### *6.1.1 The scale of the 'productivity gap'*

Many of the factors that will determine productivity performance are outside the influence of economic policy – both national and local. There must be recognition of these risks when reading the conclusions and implications emerging from this work. The UK's exit from the European Union, potential rising 'trade protectionism', the continued growth in India and China, rising oil and energy prices, risks from climate change, unforeseen technological advances will all be more important than the macro-economic position of the UK. These risks, amongst many, will continue to have an impact on GM's long-term economic performance.

The overarching conclusion, is that productivity growth has been worse after the recession than expected by economists and policymakers. The reasons for this have been hotly debated, as outlined in the literature review, as have the potential range of solutions. Regardless of the specific influence of political choices, the responses to the slowdown of growth depend on whether policymakers regard this as driven by supply side weaknesses or demand side challenges.

If slow growth is driven by a weaker supply side, due to low productivity, then attempts to stimulate demand through monetary policy, or quantitative easing, will likely be ineffective - the likely outcome would be rising inflation and additional costs to firms and residents. However, if slow growth is a demand phenomenon, and any perceived 'output-gap' with a counterfactual is greater than zero, then there should be a role for policy to help growth.

The underlying assumption behind this is because there was strong productivity performance leading up to the 2007/8 recession in GM (and other city-regions); and evidence presented in this report suggests that the underperformance was more likely to relate to investment in the endowments which drive more productive economies (rather than, for example, access to finance and so on). Equally important, the evidence suggests that success will not be driven by raising density alone. Density/agglomeration is part of the mix, however there is no single silver-bullet to raise overall performance. A combination of foundational 'factors' – in particular human capital – will need to be addressed to drive a more successful economy.

### *6.1.2 Some high level principles*

Before turning to specific findings and implications, the next section sets out some broad principles for improving productivity which help to set the context for presenting more specific implications.

The most important lesson from this report is to try and get the policy environment right in terms of the 'human capital' infrastructure. That is, investing in people and places to improve performance, alongside stimulating and managing the benefits and costs of growth/agglomeration, and ensuring that residents and businesses across all GM can benefit from these positive externalities - in particular those working in low wage / lower productivity industries.[220] This risk is covered extensively in the Review's Low Productivity and Low Pay study. The Audit also highlights that sustaining city-regions as centres of growth and productivity improvements (even when they face the risks of congestion, pollution, and inequalities) is still an important consideration.

A final challenge is the need to manage the balance of responses that improve the labour market, and those that improve firm productivity. The two are not mutually exclusive. At the firm level, boosts to productivity will (generally) increase sales and potentially jobs growth – but policies that improve productivity at the macro level may not necessarily translate into more jobs – though if wages rise, this may draw more (typically higher skilled) people into the local workforce. In a similar way, it is wrong to believe that productivity will fall if more 'less skilled' workers are drawn into the workforce. If potential outputs are improved by expanding the effective labour force (and 'good quality' jobs[221]) - there is no reason to expect the overall efficiency of GM's economy to fall.

[220] Harding, A. et al (2010): Agglomeration and Governance, Greater Manchester in a European Perspective

[221] Jacobs, M. et al. (2018): Industrial Strategy. Steering structural change in the UK economy IPPR Commission on Economic Justice

## 6.2 Broad issues for consideration in improving productivity

The Audit, and previous studies such as the Greater Manchester Industry Sector Deep Dives, come to the same conclusion about the importance of investing in a 'core infrastructure' that provides a flexible and supportive foundation for market-driven growth, and improves the raising of the demand side and supply side of the economy in parallel. Above all else, this work stresses the importance of the following:

Inter-related factors for developing **aggregate productivity and enterprise:**

- **Addressing 'effective' density.** GM has yet to show the full productivity gains which reflect the size of the city region. This suggests the need to continue to improve transport networks and accessibility across the city-region and with neighbouring regions, encouraging development around key public transport hubs and city- and town-centres, and developing new sites in accessible locations which have strong demand.
- **Helping businesses to scale-up.** The evidence suggests that increasing the rate of high value start-ups and supporting small firms to scale up – in particular those showing the opportunity, ability and desire to grow - could help raise overall productivity.
- **Raising the value of work.** Compared to London and Greater South East, the evidence suggests that GM businesses are less productive than their equivalents in these areas. This raises the importance of encouraging firms to improve their positions in national supply chains, to ensure that more high value activity is relocated into GM. It also highlights the importance of attracting high-value firms to GM and facilitating trade linkages.

Inter-related factors for raising the value of, and deployment of, **human capital:**

- **Lifelong investment in education and skills.** The long-term success in building a productive, high-value, high-skill economy will depend on the quality of pre-schooling, primary and secondary education, and continued 'lifetime' investment in the skills of GM's workforce.
- **A healthy and prosperous workforce.** Research has highlighted the importance of investing in a healthy workforce - in terms of raising in-work productivity levels - but also the importance of helping all residents to access work, in terms of wellbeing and prosperity.
- **Raising the quality of jobs in 'foundational economy'.** Promoting the use of high-performing business practices, in particular the importance of investing in people and ensuring good pay and conditions within high employment, low productivity sectors such as Hospitality, Tourism and Sport; Retail; and Health and Social Care.
- **Raising employers' demand for skills.** Working with employers to adopt higher skill and higher wage business models, and demonstrating the potential returns to investment in people; and helping to promote careers and development opportunities to attract and retain talent.
- **Investing in leadership and management skills.** In particular, promoting learning from high performing foreign owned firms in GM, demonstrating the returns to investment in skills; and sharing best practice in the discovery and adoption of leading innovations.[222]

Inter-related factors for **trade and investment**:

- **Exporting and supply chains.** Working with firms to change their positions in national supply chains or organisational structures, to ensure that more high value activity occurs in GM; and raising the ability of firms to trade outside the city-region and potentially export.
- **Attracting high value foreign and domestic inward investment**, but with a greater emphasis on attracting high performing / higher value-added operations, and high wage jobs to GM; and ensuring that these firms are 'plugged-in' to local supply chains after relocation.
- **Capitalising on GM's key assets and their competitive advantage.** Whilst policy for a solely sectors/clusters approach is relatively weak - firms tend to benefit more from being in a dense and diverse city region with a large labour market than through proximity to firms in the same sector - it will still be important to promote GM's unique assets and strengths, in particular concentrations of university and research and development specialisms.

**The remainder of the report develops these in more detail and turns to more specific findings from the Audit and their implications.**

[222] Konings, J. and Vanormelingen, S. (2010): The Impact of Training on Productivity and Wages

## 6.3 More specific issues for consideration in improving productivity

### *6.3.1 The role of density and agglomeration*

Research has shown that there is a correlation between metropolitan areas/city-regions/regional centres across Europe which are characterised by more intense concentrations of employment and Gross Value Added and those that have experienced highest net wealth creation.[223] The core areas that contain the regional centre / central city area have experienced economic growth rates, during the decade that preceded the global downturn, that were high by European standards and stood out within their national contexts.

On density, the evidence highlighted in this report (and others) provides no absolute conclusions on whether positive or negative externalities of city size dominate, other than that GM, along with other city-regions, tends to have higher levels of aggregate productivity compared to smaller and less dense city-regions. The evidence is more certain that GM's productivity levels do not match the scale or density of the city-region. As others have described, it is not that London is too large, it is that the UK's 'second cities' are under-sized compared to other international comparators.[224,225,226] This raises the important role of transport in connecting people and work, and firms to their suppliers. Investment in transport can improve 'effective density' – that is, the number of people and businesses within a certain travel time, and therefore feeding into improved productivity.[227,228]

Analysis of productivity over time is revealing. Whilst productivity has risen in all city regions, there has been a persistent ten percentage point gap between GM and the national average over the course of the last decade, and the slower productivity growth in GM since the recession shows that the gap with the UK average widened by 1-2 percentage points since 2008/09.[229] This comes alongside strong employment growth and more flexible working;[230] and is a period which has included several attempts to address regional imbalances. However, these disparities are recognised to have proved resistant to policymakers' attempts to address them.[231,232]

GM's performance in the run-up to the recession (2008/09) was particularly strong. Even when accounting for changes to rental / property values, GM's labour productivity was growing faster than the UK average. By 2008, GM was equal to the UK average productivity excluding London. However, post-recession (2010 to 2016) the gap grew back to 2 percentage points with the UK (excluding London), and back to over 10% with the UK average. In addition, data on GVA and employment shows that GM has added jobs at a similar rate to the UK average – GM is about 4.1% of total employment in the UK, however GVA as a proportion of the UK average fell from 3.8% in 2008 to 3.7% in 2016.[233] A small difference, but possibly due to lower productivity work.

The evidence shows that productivity of firms varies across GM. Whilst high and low productivity firms exist across GM, higher levels of productivity are more likely to be found in the regional centre vs other parts of the city-region.[234] As with previous evidence, this suggests that working with the grain of, rather than against, market forces has had more success than failure.[235]

However, this approach is no guarantee that all places, people, and communities will benefit from growth.[236] A decade on from the publication of the Manchester Independent Economic Review[237] the growth statistics (GVA, employment and productivity) still bear out that whilst there has been growth across GM, this has been far from even. A focus upon improving local fundamentals of a

[223] ESPON (2013): Harding, A. et al. The case for agglomeration economies in Europe

[224] BBC Davis, E. and Overman H. (2014): The case for making Hebden Bridge the UK's second city

[225] ESPON (2013) on the role of second tier cities in growth

[226] Besis, M. (2016): Competing with the continent; How UK cities compare with their European counterparts. Centre for Cities

[227] For example, Deng, T (2013): The impacts of transport infrastructure on productivity and economic growth; DfT TAG Unit A2.4 Appraisal of productivity impacts; and Docherty, I. and Waite, D (2018): Infrastructure. Productivity insights network evidence review

[228] Volterra Partners (2014): Investing in city-region transport

[229] ONS Regional Statistics (2016); and Greater Manchester Forecasting Model, GMFM-2018

[230] Covered in more detail in the Review – Low productivity and low pay study

[231] "Eight decades of productivity assessment" in McCann, P. (2018): Productivity Perspectives Synthesis

[232] Heseltine, M. (2012): No stone unturned: In pursuit of growth

[233] Greater Manchester Forecasting Model, GMFM2018. Data for GM, UK, and London

[234] GMCA (2017): Regional Centre Study

[235] Manchester Independent Economic Review (2009): Reviewers' Report

[236] Inclusive Growth Commission (2018): Making our economy work for everyone. The RSA

[237] Manchester Independent Economic Review (MIER). www.manchester-review.org.uk

productive economy (improving labour force skills, business capacity, innovation), alongside improvements to infrastructure that improve 'effective density' could improve performance.[238,239]

### *6.3.2 Productivity, sectors and clusters*

The literature has always been wary of 'picking winners.' As highlighted by the Nobel prize winning economist Paul Krugman on regional policies in the UK: *"External economies are hard to identify, even after the fact, and are harder still to predict. Selective policies can be shaped by wishful thinking at best, and undue influence at worst."* Investments in human capital, supply chains and the ecosystem for investment - that criss-crosses sectors and area boundaries - are a more sensible choice for policy.[240]

Despite this challenge, most governments around the world have an element of 'industrial policy' or 'de-facto' industrial policies which include an emphasis on exporting, FDI, and place marketing. This raises key questions of what would a more pro-active industrial growth strategy look like, and in turn, what GM has in terms of comparative advantages to capitalise on growth opportunities.

These are detailed in other reports in the Review, however the evidence is clear from this Audit, that policy should not be overly concerned with the sectoral composition or industrial-mix of the local economy.[241] What the evidence does suggest in GM (and others[242]) is that the persistence of 'frontier' firms (and 'frontier' city-regions) in terms of productivity growth seems to be greater than for 'frontier or superstar' sectors, with dominant research-driven and market leading firms tending to be persistently, and even increasingly, anchored in these dominant city regions.

Indeed, the sectoral composition is an outcome of a large number of decisions taken by both firms and workers about where they want to locate and what they want to produce. These choices are driven by factors that are hard, if not impossible, to predict. Sometimes policy makers will need to make decisions about investments with large fixed costs that are likely to favour particular types of activities. However, as the literature highlights,[243] these should build upon local public, social, university, and private sector assets; where there is strong evidence of a critical mass of specialism, such as Advanced Materials and Textiles,[244] and Health Innovation in GM.[245]

In terms of potential areas of comparative advantage, this Audit provides evidence to suggest that GM has higher concentrations of employment and urban assets that relate to Advanced Manufacturing; Health Innovation, Digital Industries, and parts of Financial and Professional Services: Legal, Accounting, and Insurance. Equally there is evidence of comparatively higher productivity in Scientific Research in Natural Sciences and Engineering, Construction (in particular site preparation), Sports Clubs, Waste Management, and also E-Commerce.

### *6.3.4 Firm level analysis*

One of the most striking set of findings of the firm level productivity analysis, is the importance of increasing the propensity for (and value of) international trade, and targeting foreign investment. Whilst there are lower productive firms that trade internationally, including foreign owned firms, these factors, combined with the prevalence of a highly skilled labour force, are strongly associated with higher performing city-regions. These points are self-evident. Businesses have to be more competitive and productive if they are competing well beyond their local markets.

The wider global linkages suggest that firms are making connections to other firms that provide them with some element of competitive advantage or higher value added inputs, and also help the company to absorb further new ideas, innovations, business models, and supply chain practices.

The implications of these findings are that it is the share of 'frontier-firms' in the top 10% to 20% most productive in the country which drives productivity performance. The evidence also suggests that rather than pursuing a 'transformation' in the 'long-tail' of unproductive businesses, the largest additionality for policy should be found in growing and attracting frontier firms, and encouraging beneficial spill-overs to other parts of the economy. That is not to say that raising the productivity in

[238] UKCES and SQW (2011): Rebalancing the economy sectorally and spatially: An evidence review

[239] Martin, R. and Gardiner, B. (2018): Reviving the 'Northern Powerhouse' and spatially rebalancing the British Economy

[240] Coyle, D et al. (2005): New Wealth for Old Nations. Chapter Two: Paul Krugman, Second Winds for Industrial Regions?

[241] Ibid, MIER

[242] MGI (2018): Superstars: The Dynamics of Firm, Sectors Cities Leading the Global Economy

[243] Manchester Independent Economic Review (MIER 2009); and What Works Centre for Local Economic Growth

[244] Lord David Alliance Project (2015): The Alliance Report. Repatriation of UK textiles manufacture

[245] For example, Regional Growth Fund (Round 4 and 6) National Textiles Growth Programme (TGP) 2012 to 2014

high-employment - 'foundational' economy is not important, as raising productivity and the quality of work and wages, will be beneficial for a large proportion of workers across GM.[246]

However, the fact that there is little difference in the size and shape of productivity tails of 'lower productive sectors' between different places strongly suggests that the differences in the rate of productivity growth, and the gap in productive performance with leading city-regions, is more likely to be due to the location decisions (and performance) of the 'frontier firms'.[247]

In short, the costs and benefits of what a location is able to offer in terms of access to land, labour and capital, and suppliers, is critical. The evidence suggests that frontier firms, typically higher productive firms, are willing to pay a premium to have access to these benefits, which is typified by higher rents found in parts of more successful city-regions.

The critical issue, and implication from these findings, is that the lower productivity of many cities outside London (and South East) is a result of the lower density of frontier firms and exporters they have been able to attract or grow within their economies, rather than the underperformance of foundational economy businesses. A similar argument holds of management practices. The productivity distribution analysis shows that foreign-owned companies are more productive than domestic companies, with one likely reason for this being that management practices are stronger amongst foreign companies.[248]

One area where the rationale for policy intervention is often clearer than many others is workforce skills.[249] This study shows that city-region differences in higher-value employment and the utilisation of skills are potentially the most important factors driving differences in local economic performance. As previous studies in GM have shown, skills and educational attainment are important in determining entry to employment, career progression, as well as lifetime earnings.[250]

A final comment on productivity, sectors and clusters, is the importance of using firm level data. Whilst aggregate sector data provides a good summary understanding of economic performance, the analysis presented in the Audit reinforces the need for more detailed granular data that highlights which firms typically have lower and higher productivity. In the case of the Audit, the main characteristics associated with higher performing firms are those that trade internationally and/or are foreign-owned. A factor common to both would be the size of the market firms can access. Better access to larger markets also increases innovation and investment. Analysis of these factors seem more important than simple focus on firm size, age, or broad sector.[251]

### *6.3.3 Human capital, talent attraction and workforce development*

General academic literature and this study show that skills are a large part of the explanation for the productivity gap between the Southeast and the rest of the country.[252] GM does well in terms of skills compared to other cities in the North, but not compared to London and Bristol; and the productivity of its skilled workers is lower than that of skilled workers in these two comparators. However, transformational actions to address skills and raise productivity performance remain a challenge for the city-region.

Given the evidence on productivity and sectors, policy decisions on skills would appear to be an important area where the case for policy changes to focus on specific sectors continues to be not that compelling. There may be cases for specific labour shortages, however – as highlighted in this study and several employer skills surveys - the causes of these are complex and wide ranging, from general resident attitudes and preconceptions of working conditions in certain industries, to the ability to draw upon latent skills in the workforce which, through re-training, could be re-employed in different types of work. This clearly brings several other challenges, including residents' ability to pay to retrain, and the competing wage costs between different industries.

[246] Jacobs, M. et al. (2018): Industrial Strategy. Steering structural change in the UK economy IPPR Commission on Economic Justice

[247] Schneider, P. (2018): The UK's Productivity Puzzle is in the Top Tail of the Distribution. Bank of England, Bank Underground

[248] Haldane A (2017): Productivity Puzzles: Speech by Andy Haldane, Chief Economist, Bank of England, London July 2017

[249] Valero A and Roland I (2015) Productivity and Business Policies; and City and Guilds (2015): Sense & Instability: three decades of skills and employment policy

[250] Greater Manchester Skills Assessments from 2007 to 2017; Holden, J. (2010): Three's Company: How employers, individuals and Government shape skills supply and demand

[251] A practical approach to identifying businesses with growth potential includes scale/capacity, capability, and appetite for growth.

[252] Abreu, M. (2018) Skills and productivity. Productivity Insights Network (PIN) Evidence Review

These challenges aside, the evidence suggests that employers in GM have been able to satisfy their skills requirements without too much difficulty even during the last five to ten years, similar to the MIER findings on the decade prior to the 2007/8 recession.[253] That is, at least against their existing business plans according to several consecutive employer skills surveys. Some of the 'supply-side' response (colleges, training providers) may reflect the tailoring of training provision towards particular skills as a result of current demand from employers.

Several employer skills surveys suggest that existing mechanisms are adequate to meet skills needs - without adding any further emphasis on any particular sectors of the economy.[254] However, it is important to note that such surveys typically miss risks such as 'latent skills' challenges which arise from parts of the economy which may be 'locked-in' to a 'low skills equilibrium' and arise due to a lack of recognition of workforce problems (and opportunities).

The evidence shows that – despite rising levels of graduates in GM's labour market – there has not been a matching rise in aggregate productivity. As demand for skills is a derived demand – no matter how responsive the training system becomes, firms need to demand training based on business need. Unless firms' HR practices change, there won't be an increase in the demand for skills, and the productivity, employment and social inclusion boost that policy hopes for.

Research in GM also indicates that there are occupational areas of 'over- and under-supply' of skills. The latest data on graduate skills, and graduate level employment suggests a prevalence of underemployment in GM, and that this position has (despite growing numbers of higher skilled knowledge intensive jobs) remained the same since 2008/09.[255] Equally, GM continues to lose a substantial portion of its high skilled and mobile young workers to the diversified environment of London and the Southeast after graduation. 20% of all graduates leave GM and move to London. The fact that the proportion leaving GM has remained stable at 50-60% during the last twenty years, despite the rising number of jobs, implies that career prospects are better elsewhere.[256]

These findings highlight that there is a role for policy continuing to promote greater utilisation of skills amongst employers, reflecting the findings of other policy and research papers.[257],[258] Policy should have a greater focus on generating demand for skills and ensuring that firms are using the skills of their workforce efficiently. Promotion of high performance working practices is critical, as are incentives for firms to move up the value chain and create local economic benefit; and the continued investment in leadership skills at all levels of work.

The UK does not fare well in terms of international comparative surveys of management quality, in which UK firms appear to have a larger share of poorly managed firms than many other countries; and also lower level of advanced capital investment and skills-training.[259] Initial results of recent research on UK management practices are broadly in line with expectations, in that structured management practices are more evident in larger firms, foreign firms, services, non-family-owned firms than in small firms, domestic, manufacturing, and family-owned firms.[260] Further, recent research across the FTSE350 shows the importance of firms developing a more diverse workforce, including, for example, higher proportions of women in executive management roles.[261] Finally, as outlined earlier, research shows the importance of places supporting a healthy, productive and highly skilled workforce - up to 30% of the productivity gap with the UK average could be reduced by raising participation in the workforce through addressing ill health.[262]

[253] MIER (2009): Understanding Labour Markets, Skills and Talent. University of Manchester; and similar levels of skills difficulties reported in the Learning and Skills Council (2001): Greater Manchester Employer Skills Survey

[254] (National) Employers Skills Survey, and Greater Manchester Business Survey

[255] Swinney P and Williams M, The Great British Brain Drain: where graduates move and why. Centre for Cities. Manchester analysis

[256] Higher Education Statistics Agency, National survey of graduate qualifiers

[257] OECD/ILO (2017) Better Use of Skills in the Workplace: Why it matters for productivity and local jobs, OECD Publishing,

[258] Rincon-Aznar, A. et al. (2015): UK Skills and Productivity in an International Context, BIS Research Paper Number 262,

[259] Bloom, N., and Van Reenen, J., (2006): Measuring and Explaining Management Practices Across Firms and Countries, NBER Working Paper 12216; and Bloom, N., and Van Reenen, J., (2010): Why Do Management Practices Differ across Firms and Countries? Journal of Economic Perspectives

[260] ONS (2018): Management Practices and Productivity in British Production and Services Industries. Management Survey: 2016

[261] Pipeline (2018): Women Count - The role, value and number of female executives in the FTSE 350

[262] Research by the Northern Powerhouse demonstrates the impact of tackling health inequalities across the North of England. It finds that up to 30% of the productivity gap with the UK average could be reduced by raising participation in the workforce through addressing ill health. Bambra, Munford, Brown et al (2018) Health for Wealth: Building a Healthier Northern Powerhouse for UK Productivity.

### *6.3.5 Innovation and the role of universities*

One final point that this study highlights is the importance of knowledge intensive businesses and jobs and the links between human capital and innovation; and the fact that a disproportionally large number of UK SMEs are slow adopters of new technologies, compared to other countries. [263,264] Increasing the number of firms trading outside the region will also help connect GM to the best sources of innovation – nationally and globally. Productivity enhancing innovations are more likely to cascade through a dense network of firms connected by supply chains.

These findings should be set into the context of research on the productivity gap between the top performing 10% of firms and the bottom-performing 10% of companies in the UK, which is higher than in our competitor countries. Since 2001 these gaps have increased by 2-3 times more in the UK than amongst competitor countries. Here, Haldane argues that these observations suggest that knowledge-diffusion and absorption processes within the UK economy are both limited and increasingly stalling.[265] This is further supported by the fact that not only is the global ranking of the UK's performance in terms of knowledge-diffusion much lower than its innovation ranking, but its knowledge-diffusion ranking has deteriorated sharply in recent years.

It is also important to mention the role of critical urban assets, within both public and social sectors (including the social-economy, community and voluntary sectors), without which the economy would also not reach its full potential, as well as the impact of universities, and education and training providers in the city-region. These are detailed in other reports in the Prosperity Review, as well as in the Science and Innovation Audit (SIA) for Greater Manchester.[266]

Furthermore, the SIA highlights major challenges to growing innovation in GM, which include:

- A need for new strategic investments to capitalise on the key intersections between sectoral and research specialisms and future growth opportunities;[267]
- maintaining investment in key science assets, enhancing collaboration both within research organisations and between universities and industry;[268]
- attracting and nurturing talent; and growing the skills that foster innovation, in particular through management and leadership cultures and practices;[269]
- developing business support, to ensure that businesses gain access to diverse finance support at the right scale to help businesses at all stages to invest in innovation; and
- addressing the challenge in measuring investment in innovation.[270]

Whist business surveys typically capture the value of inputs to products and processes, much less is known about the outcomes from investment. The SIA highlights that more work needed to understand R&D strengths within the private sector and how they work collaboratively with smaller firms. Each of these mirror the findings of the Audit of Productivity, along with the challenge of increasing commercialisation of ideas, and businesses' propensity to invest in R&D. Set in the context of UK's per capita levels of technology and R&D spend, along with workforce development spending, which are all low by OECD standards, the challenge is even more acute.[271,272]

Finally, when it comes to the links between universities and business, there should be a role for strengthening the outstanding capabilities in basic research, idea generation and invention, as typified by Graphene City, as well as growing 'incentives' for the application of university research results. Here, incentives for increased R&D spending by firms and larger outlays for the purpose by Government should be a priority. The links to the Challenges identified in the Government's Industrial Strategy and the respective opportunities for growth are key.[273]

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[263] Haldane, A. (2018); The UK's Productivity Problem: Hub No Spokes. Academy of Social Sciences Annual Lecture, London, 28 June

[264] Haldane, A. (2018) Ideas and Institutions: A Growth Story. Speech Given at The Guild Society, University of Oxford, 23 May

[265] Ibid

[266] BEIS (2016): Greater Manchester and Cheshire East Science and Innovation Audit

[267] BEIS (2017): Industrial Clusters in England

[268] Ankrah, Samuel & Al-Tabbaa, Omar. (2016). Universities—industry collaboration: A systematic review

[269] ONS (2018): Management practices and productivity in British production and services industries - initial results from the Management and Expectations Survey: 2016

[270] NESTA (2007): Hidden Innovation - How innovation happens in six 'low innovation' sectors

[271] Wren-Lewis, S. (2017): Disentangling the UK Productivity Problem

[272] MGI (2018): Solving the UK's Productivity Puzzle in a Digital Age

[273] HMG (2018): Industrial Strategy Grand Challenges
https://www.gov.uk/government/publications/industrial-strategy-the-grand-challenges/industrial-strategy-the-grand-challenges

# Annex 1: Data definitions

This study uses a series of standard definitions which are set out below, including key sector definitions and geographic comparators used throughout the Review. The main analysis in this report focusses upon labour productivity due to the availability of data (aggregate and firm level data) at the city region level. Reference is also made to Total Factor Productivity (TFP), i.e. how efficiently and intensely inputs are utilised in production, and wider measures of prosperity and economic outcomes, social inclusion and quality of life - covered in separate Review studies.

### *Gross Value Added and Labour Productivity*

The report uses definitions by the Office for National Statistics for Gross Value Added (GVA) and labour productivity:

- *Labour productivity* is defined in this work as the ability to produce outputs, such as goods or services, taking into consideration the amount of inputs, such as raw materials, capital and labour, used to produce them: [274]

$$\text{Labour Productivity}_{it} = \frac{VA_{it}}{L_{it}}$$ where:

  - **VA is value added,** is a measure of the increase in the value of the economy due to the production of goods and services. It is workplace based and relates to the total income and the profit generated in the production of goods and services – that is, the total value of all goods and services produced, less goods and services used up or transformed in the production process.
  - **L is employment,** is the total number of full time equivalent jobs filled within the firms' workplaces.

### *Gross Value Added per Head (Prosperity measure)*

GVA per head of population is a useful way of comparing regions of different size and is an important indicator for both domestic and European policy purposes. Total GVA estimates in millions of pounds sterling (£ million) are divided by the total resident population of a region (including the economically inactive) to give GVA per head.

The GVA per head measure includes people not in the workforce (including children, pensioners and others not economically active) in the calculation, and can also be heavily biased by commuting flows. This is because if an area has a large number of in-commuters, the output these commuters produce is captured in the estimate of GVA, but the commuters are not captured in the estimate of residential population. In this situation, a GVA per head measure would be artificially high if used as a proxy for economic performance or welfare of a region. For this reason most of this work focusses on GVA per employment, but for completeness GVA per head is also included in part of our analysis – in particular, international comparator work.[275]

### *Caveats*

Small areas, such as local authorities, can be subject to very large distortions due to survey sample sizes and weighting, and this should be borne in mind when interpreting the statistics as an indicator of relative economic prosperity. As an example, the City of London has a very small resident population but has a very high GVA generated by workers commuting into the area. At the other end of the scale, areas such as Blaenau Gwent are affected by large numbers of people commuting out of the area to work elsewhere. GVA per head is not a measure of firm/aggregate industry sector productivity.

[274] ONS (2018) Productivity Handbook

[275] The relationship between the two measures is explored in detail by Wosnitza and Walker 2008.

### *Geography*

GVA data are collated in aggregate to give a national benchmark (typically UK unless otherwise stated). The basic city-region definition that we use (unless otherwise stated,) are the international Nomenclature of Units for Territorial Statistics (NUTS) classifications. For example, Greater Manchester (NUTS level 2), and other similar areas such as Bristol (represented as Gloucestershire, Wiltshire and North Somerset), Birmingham (represented as West Midlands), Leeds (West Yorkshire); and London (NUTS1 region, and sub-regions within London NUTS2).

The guidance for NUTS2 geographies suggests, amongst other factors, that they should follow a population range between 800,000 and 3 million people. The majority (including all UK NUTS2 areas) do so. Furthermore, these larger units allow the most detailed analysis of productivity without compromising which other determinants of productivity can be included in the analysis.

### *Data sources and units of analysis*

Aggregate productivity data for Greater Manchester and key sectors are taken from the Greater Manchester Forecasting Model (which includes data on the UK, North West, and GM). GVA per head data is sourced from the ONS providing data for all comparator areas. Eurostat is used for both UK and international comparators. There are four levels at which it is possible to analyse the data: the holding company, enterprise, reporting unit and individual/local plant levels. The firm level productivity analysis is completed at the level of the local unit, which is the main sampling unit in the national ONS Annual Business Survey. The main sector classifications are based upon the UK Standard Industrial Classification 2007.

### *Firm-level analysis*

It is important to note that the analysis looks at individual plant level data – via survey, which is referred to throughout as 'firm-level analysis'. Firm level analysis makes use of comparatively new data sources from the ONS Secure Research Service. The ONS Annual Business Survey provides data on the value of their output minus their inputs, and employment. It is important to note that firm level data is survey based (using weightings to scale the survey results to each city region economy) and excludes data on financial services, and public sector and healthcare. The analysis also draws upon ONS Business Demography data, as well as the ONS Business Register Employment Survey (BRES), and 'nominal' data on regional and sub-regional Gross Value Added (GVA), i.e. unadjusted for price inflation.

### *Time series and prices*

All data are sourced in the report and labelled either as a single reference year, or where required, several years to compensate for the 'lumpiness/variation' in smaller areas data. Headline data on productivity in GM and the city region's key sectors are in 'real' or 'constant' prices using deflators to remove the effects of inflation, and expressed in 2015 prices. International comparators of GVA per employment, and data on GVA per head of population are expressed in 'nominal' terms which are uncorrected for price changes, due to how the data are collected and published.

# Annex 2: Geographic definitions

The Local Industrial Strategy research programme uses the following geographical comparators across all its evidence base. This common approach enables all elements of the work to provide comparable benchmarks.

The list of Local Authorities indicates the most accurate possible definition of those benchmarks, to be used where the data allows. The NUTS2 definitions listed are the closest NUTS2 definitions that map to these Local Authority definitions. In some cases these may be larger than the LA definition, in others they are smaller. For Greater Manchester the NUTS2 and LA definitions map exactly.

For datasets where more accurate data is not available (for example, international datasets), the main unit of comparison are all NUTS2 areas. This enables comparison to other international cities, as well as being close to many of the LEP areas across the UK.

The evidence does not use all LEP areas lists due to both overlap and potential to change following the recent Government consultation.

The city regions *starred are the main benchmarks. Where appropriate, the evidence base aims to include all other comparators if possible.

## *Birmingham

| NAME | Local Authority Definition | NUTS 2 |
|---|---|---|
| **Birmingham City Region** | Birmingham | West Midlands |
| | Coventry | |
| | Dudley | |
| | Sandwell | |
| | Solihull | |
| | Walsall | |
| | Wolverhampton | |
| | Warwick District Council | |
| | Stratford-on-Avon District Council | |
| | Rugby Borough Council | |
| | Hinckley & Bosworth Borough Council | |
| | Nuneaton & Bedworth Council | |
| | North Warwickshire Borough Council | |
| | Cannock Chase | |
| | Lichfield | |
| | Tamworth | |
| | East Staffordshire | |
| | Redditch | |
| | Bromsgrove | |
| | Wyre Forest | |

# *Bristol

| NAME | Local Authority Definition | NUTS 2 |
|---|---|---|
| **Bristol City Region** | Bath and North East Somerset | Gloucestershire, Wiltshire and Bristol/Bath area |
| | City of Bristol | |
| | North Somerset | |
| | South Gloucestershire | |

# *Cambridgeshire and Peterborough

| NAME | Local Authority Definition | *NUTS 3* |
|---|---|---|
| **Cambridgeshire and Peterborough** | City of Cambridge | *UKH11, UKH12* |
| | South Cambridgeshire | |
| | Huntingdonshire | |
| | Fenland | |
| | East Cambridgeshire | |
| | City of Peterborough | |

# Cardiff

| NAME | Local Authority Definition | NUTS 2 |
|---|---|---|
| **Cardiff City Region** | Cardiff | East Wales |
| | Vale of Glamorgan | |
| | Bridgend | |
| | Rhondda Cynon Taf | |
| | Caerphilly | |
| | Merthyr Tydfil | |
| | Blaenau Gwent | |
| | Torfaen | |
| | Monmouthshire | |
| | Newport | |

# Glasgow

| NAME | Local Authority Definition | NUTS 2 |
|---|---|---|
| **Glasgow City Region** | Glasgow | South Western Scotland |
| | East Dunbartonshire | |
| | East Renfrewshire | |
| | Inverclyde | |
| | North Lanarkshire | |
| | Renfrewshire | |
| | South Lanarkshire | |
| | West Dunbartonshire | |

# *Leeds - West Yorkshire

| NAME | Local Authority Definition | NUTS 2 |
|---|---|---|
| **West Yorkshire (Leeds)** | Bradford | West Yorkshire |
| | Leeds | |
| | Calderdale | |
| | Kirklees | |
| | Wakefield | |

# *North Yorkshire

| NAME | Local Authority Definition | NUTS 2 |
|---|---|---|
| **North Yorkshire** | York | North Yorkshire |
| | Craven | |
| | Hambleton | |
| | Harrogate | |
| | Richmondshire | |
| | Ryedale | |
| | Scarborough | |
| | Selby | |

# *Liverpool

| NAME | Local Authority Definition | NUTS 2 |
|---|---|---|
| **Liverpool City Region** | Halton | Merseyside |
| | Knowsley | |
| | Liverpool | |
| | Sefton | |
| | St. Helens | |
| | Wirral | |

# *Greater London

| NAME | Local Authority Definition | NUTS 2 |
|---|---|---|
| **London** | Barking and Dagenham | Greater London UK13, UKi4, UKI5, UKI6, UKi7 |
| | Barnet | |
| | Bexley | |
| | Brent | |
| | Bromley | |
| | Camden | |
| | Croydon | |
| | Ealing | |
| | Enfield | |
| | Greenwich | |
| | Hackney | |
| | Hammersmith and Fulham | |
| | Haringey | |
| | Harrow | |
| | Havering | |
| | Hillingdon | |
| | Hounslow | |
| | Islington | |
| | Kensington and Chelsea | |
| | Kingston upon Thames | |
| | Lambeth | |
| | Lewisham | |
| | Merton | |
| | Newham | |
| | Redbridge | |
| | Richmond upon Thames | |
| | Southwark | |
| | Sutton | |
| | Tower Hamlets | |
| | Waltham Forest | |
| | Wandsworth | |
| | Westminster | |
| | City of London | |

# *Greater Manchester

| NAME | Local Authority Definition | NUTS 2 |
|---|---|---|
| **Greater Manchester** | Bolton | Greater Manchester |
| | Bury | |
| | Manchester | |
| | Oldham | |
| | Rochdale | |
| | Salford | |
| | Stockport | |
| | Tameside | |
| | Trafford | |
| | Wigan | |

# *Newcastle

| NAME | Local Authority Definition | NUTS 2 |
|---|---|---|
| **Newcastle City Region** | County Durham | Northumberland and Tyne and Wear |
| | Gateshead | |
| | Newcastle upon Tyne | |
| | North Tyneside | |
| | Northumberland | |
| | South Tyneside | |
| | Sunderland | |

# *Nottingham

| NAME | Local Authority Definition | NUTS 2 |
|---|---|---|
| **Nottingham City Region** | Broxtowe | Derbyshire and Nottinghamshire |
| | Gedling | |
| | Rushcliffe | |
| | Nottingham | |

# *Sheffield

| NAME | Local Authority Definition | NUTS 2 |
|---|---|---|
| **Sheffield City Region** | Barnsley | South Yorkshire |
| | Bassetlaw | |
| | Bolsover | |
| | Chesterfield | |
| | Derbyshire Dales | |
| | Doncaster | |
| | North East Derbyshire | |
| | Rotherham | |
| | Sheffield | |

# Tees Valley (with Durham)

| NAME | Local Authority Definition | NUTS 2 |
|---|---|---|
| **Tees Valley** | Hartlepool and Stockton-on-tees | Tees Valley and Durham |
| | South Teeside | |
| | Darlington | |
| | Durham | |

# EUROPEAN COMPARATORS

| NAME | Local Authority Definition | NUTS 2 |
|---|---|---|
| **Valencia** | Valencian Community | ES52 |
| **Barcelona** | Cataluña | ES51 |
| **Cologne** | Köln | DEA23 |
| **Düsseldorf** | Düsseldorf | DEA11 |
| **Frankfurt** | Darmstadt | DE71 |
| **Helsinki** | Helsinki-Uusimaa | FI1B |
| **Leipzig** | Leipzig | DED31 |
| **Lille** | Nord - Pas-de-Calais | FR3 |
| **München** | Oberbayern | DE21 |
| **Rotterdam** | Zuid-Holland (South Holland) | NL33 |
| **Torino** | Piemonte | ITC1 |

# Annex 3: Sector definitions

# Manufacturing

| SIC Code(s) | Description |
|---|---|
| **All Manufacturing: The composite total of all four subsectors defined below.** | |
| **Advanced Manufacturing** | |
| **20** | Manufacture of chemicals and chemical products |
| **21** | Manufacture of basic pharmaceutical products and pharmaceutical preparations |
| **26** | Manufacture of computer, electronic and optical products |
| **27** | Manufacture of electrical equipment (electronics) |
| **28** | Manufacture of machinery and equipment not elsewhere classified (automotive) |
| **29** | Manufacture of motor vehicles, trailers and semi-trailers (automotive) |
| **30** | Manufacture of other transport equipment (aerospace etc.) |
| **33** | Repair and installation of machinery and equipment |
| **325** | Manufacture of medical and dental instruments and supplies |
| **7112** | Engineering activities and related technical consultancy |
| **Food and Drink Manufacturing** | |
| **10** | Manufacture of food products |
| **11** | Manufacture of beverages |
| **12** | Manufacture of tobacco products |
| **Textiles Manufacturing** | |
| **13** | Manufacture of textiles |
| **14** | Manufacture of wearing apparel |
| **15** | Manufacture of leather and related products |
| **Other manufacturing** | |
| **16** | Manufacture of wood and of products of wood except furniture |
| **17** | Manufacture of paper and paper products |
| **19** | Manufacture of coke and refined petroleum products |
| **22** | Manufacture of rubber and plastic products |
| **23** | Manufacture of other non-metallic mineral products |
| **24** | Manufacture of basic metals |
| **25** | Manufacture of fabricated metal products, except machinery and equipment |
| **31** | Manufacture of furniture |
| **321** | Manufacture of jewellery, bijouterie and related articles |
| **322** | Manufacture of musical instruments |
| **323** | Manufacture of sports goods |
| **324** | Manufacture of games and toys |
| **329** | Other manufacturing |

# Construction

| SIC Code(s) | Description |
|---|---|
| **41** | Building Construction: Development of building projects; Construction of residential and non-residential buildings |
| **42** | Civil Engineering: Construction of roads and railways; Construction of utility projects; Construction of other civil engineering |
| **43** | Specialised Construction: Demolition and site preparation; Electrical, plumbing and other construction installation activities; Building completion and finishing; Other specialised construction activities. |

# Retail and Wholesale

| SIC Code(s) | Description |
|---|---|
| **45** | Wholesale and retail trade and repair of motor vehicles and motorcycles |
| **46** | Wholesale trade, except of motor vehicles and motorcycles |
| **47** | Retail trade, except of motor vehicles and motorcycles |

# Logistics

| SIC Code(s) | Description |
|---|---|
| **49** | **Land transport and transport via pipelines** |
| **50** | Water transport |
| **51** | Air transport |
| **52** | Warehousing and support activities for transportation |
| **53** | Postal and courier activities |

# Hospitality, Tourism and Sport

| SIC Code(s) | |
|---|---|
| **55** | Accommodation |
| **56** | Food and beverage service activities |
| **79** | Travel agency, tour operator and other reservation service and related activities |
| **91** | Libraries, archives, museums and other cultural activities |
| **92** | Gambling and betting activities |
| **93** | Sports activities and amusement and recreation activities |

# Business, Financial and Professional Services

| SIC Code(s) | Description |
|---|---|
| **All Business, Finance and Professional Services** - Composite total of all the SIC codes listed below | |
| **Business Services** | |
| **77** | Rental and leasing activities |
| **80** | Security and investigation activities |
| **81** | Services to buildings and landscape activities |
| **82** | Office administrative, office support and other business support activities |
| **94** | Activities of membership organisations |
| **99** | Activities of extraterritorial organisations and bodies |
| **Employment Services** | |
| **78** | Employment activities |
| **Financial Services** | |
| **64** | Financial service activities, except insurance and pension funding |
| **65** | Insurance, reinsurance and pension funding, except compulsory social security |
| **66** | Activities auxiliary to financial services and insurance activities |
| **Professional Services** | |
| **68** | Real estate activities |
| **69** | Legal and accounting activities |
| **70** | Activities of head offices; management consultancy activities |
| **743** | Translation and interpretation activities |

# Digital and Creative Industries

| SIC Code(s) | Description |
|---|---|
| **Creative Industries** | |
| **18** | Printing and reproduction of recorded media |
| **58** | Publishing activities |
| **59** | Motion picture, video and television programme production, sound recording and music publishing activities |
| **60** | Programming and broadcasting activities |
| **73** | Advertising and market research |
| **90** | Creative, arts and entertainment activities |
| **7111** | Architectural activities |
| **741** | Specialised design activities |
| **742** | Photographic activities |
| **Digital** | |
| **61** | Telecommunications |
| **62** | Computer programming, consultancy and related activities |
| **63** | Information service activities |

# Education

| SIC Code(s) | Description |
|---|---|
| **85** | Education |

# Health and Social Care

| SIC Code(s) | Description |
|---|---|
| **Health and Social Care** | |
| **86** | Human health activities |
| **87** | Residential care activities |
| **88** | Social work activities without accommodation |

# Health Innovation / Lifesciences

| 2110 | Manufacture of basic pharmaceutical products |
|---|---|
| **2120** | Manufacture of pharmaceutical preparations |
| **3250** | Manufacture of medical and dental instruments and supplies |
| **7211** | Research and experimental development on biotechnology |
| **7219** | Other research and experimental development on natural sciences and engineering |

# Annex 4: Determinants of productivity model details

The following tables of results exclude the 5 London NUTS 2 regions from the analysis to compare the results outside of the Capital.

*Figure A1: Cross-section linear regressions (GMM), 34 NUTS 2 areas, excluding London (ONS and Eurostat)*[276],[277] *Green highlights some of the stronger associations*

| Model run >> | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
|---|---|---|---|---|---|---|---|
| **Constant** | 10.20 (0.13)* | 9.97 (0.06)* | 10.03 (0.07)* | 9.88 (0.05)* | 10.35 (0.12)* | 10.11 (0.06)* | 9.96 (0.07)* |
| **Density** | **-0.021** (0.03) | 0.014 (0.01)* | 0.014 (0.01)* | 0.035 (0.01)* | 0.003 (0.01) | 0.015 (0.01)* | 0.036 (0.01)* |
| **Level 4+ Qualifications** | | | 0.006 (0.00)* | | -0.002 (0.00) | | 0.004 (0.00) |
| **No qualifications** | **0.021** (0.02) | | | | | | |
| **Professional Services jobs** | | 0.01 (0.00)* | | 0.011 (0.00)* | | 0.0008 (0.00) | |
| **Science & Tech. jobs** | **0.12** (0.03)* | | | | 0.089 (0.01)* | 0.082 (0.01)* | |
| **Digital Industries jobs** | | | | | | 0.007 (0.01) | 0.01 (0.01) |
| **Digital & Creative jobs** | | | | 0.00005 (0.01) | | | |
| **Adv. Manufacturing jobs** | | 0.019 (0.00)* | 0.019 (0.01)* | | | | |
| **Financial Services jobs** | | | | | 0.015 (0.01)* | | |
| **Krugman Spec. Index** | | -0.0003 (0.00) | -0.0005 (0.00) | 0.0027 (0.00)* | | 0.0001 (0.00) | 0.003 (0.00)* |
| **New Enterprises/Start-ups** | | 0.022 (0.01)* | 0.027 (0.01)* | 0.017 (0.01)* | | 0.02 (0.01)* | 0.024 (0.01)* |
| **Patents** | -0.0002 (0.00) | 0.003 (0.00)* | 0.004 (0.00)* | 0.005 (0.00)* | 0.00096 (0.00) | | 0.006 (0.00)* |
| **High Growth Firms** | **0.001** (0.02) | | | | 0.012 (0.02) | | |

[276] NUTS 1 regional dummies applied in all analysis models

[277] Data for these figures is for 2014 to 2016, apart from patenting 2008 to 2012

*Figure A2: Correlation of smoothed variables in cross-section regressions, 35 NUTS 2 areas (Excluding London)*

| Variable | Real-Productivity | Density | Level 4+ Qualifications | No qualifications | Prof Services jobs | Science and Tech jobs | Digital Industries jobs only | Digital & Creative jobs | Advanced Manuf. jobs | Financial Services jobs | Krugman Index | New Enterprise Start-ups | Patents |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Real-Productivity** | 1.0000 | | | | | | | | | | | | |
| **Density** | 0.1713 | 1.0000 | | | | | | | | | | | |
| **Level 4+ Qualifications** | 0.6449 | -0.2499 | 1.0000 | | | | | | | | | | |
| **No qualifications** | -0.2564 | 0.4192 | -0.6184 | 1.0000 | | | | | | | | | |
| **Professional Services jobs** | 0.6909 | 0.1394 | 0.7668 | -0.5456 | 1.0000 | | | | | | | | |
| **Science and Technology jobs** | 0.8642 | 0.0599 | 0.7479 | -0.4820 | 0.7959 | 1.0000 | | | | | | | |
| **Digital Industries jobs only** | 0.6433 | 0.3793 | 0.5020 | -0.2962 | 0.7304 | 0.6549 | | | | | | | |
| **Digital & Creative Industries jobs** | 0.5769 | 0.4021 | 0.4849 | -0.3276 | 0.7443 | 0.5958 | 0.9695 | 1.0000 | | | | | |
| **Advanced Manuf. jobs** | 0.3953 | -0.0115 | 0.1455 | -0.0579 | 0.1539 | 0.5250 | -0.0135 | -0.0988 | 1.0000 | | | | |
| **Financial Services jobs** | 0.3061 | 0.4320 | 0.3307 | -0.0051 | 0.4229 | 0.2341 | 0.3134 | 0.3500 | -0.1614 | 1.0000 | | | |
| **Krugman Index** | -0.0472 | -0.5346 | 0.0119 | -0.0584 | -0.2617 | 0.0165 | -0.3499 | -0.4251 | 0.3537 | -0.6561 | 1.0000 | | |
| **New Enterprises / Start-ups** | 0.4544 | 0.3685 | 0.1183 | -0.2403 | 0.4995 | 0.3386 | 0.3944 | 0.4716 | -0.0980 | 0.1058 | -0.2829 | 1.0000 | |
| **Patents** | 0.7037 | 0.0688 | 0.5766 | -0.4619 | 0.6899 | 0.8457 | 0.6455 | 0.6197 | 0.3954 | 0.1638 | -0.1319 | 0.3250 | 1.0000 |
| **High Growth Firms** | 0.4127 | 0.1581 | 0.2793 | -0.3097 | 0.4311 | 0.5093 | 0.2892 | 0.3512 | 0.3023 | -0.0494 | -0.0146 | 0.5506 | 0.4492 |

# Glossary

| | |
|---|---|
| BAME | Black, Asian and minority ethnic |
| BEIS | Department for Business, Energy and Industrial Strategy |
| BP-ICAM | BP International Centre for Advanced Materials |
| Brexit | The withdrawal of the United Kingdom from the European Union |
| COPD | Chronic Obstructive Pulmonary Disease |
| ESA | Employment Support Allowance |
| EU | European Union |
| Early Years | The early years foundation stage (EYFS) sets standards for the learning, development and care of your child from birth to 5 years old. |
| EY | Ernst and Young |
| FAME business database | Financial Analysis Made Easy – financial information database of 7 million companies in the UK and Republic of Ireland |
| FDI | Foreign Direct Investment |
| GDP | Gross Domestic Product |
| GEIC | Graphene Engineering and Innovation Centre |
| GLD | Good level of development – seen as an indicator of school readiness |
| GM | Greater Manchester |
| GMCA | Greater Manchester Combined Authority |
| GMCVO | Greater Manchester Centre for Voluntary Organisation |
| GM Districts | The ten local authority districts which make-up Greater Manchester: Bolton, Bury, Manchester, Oldham, Rochdale, Salford, Stockport, Tameside, Trafford, Wigan |
| GMS | Greater Manchester Strategy |
| GMSF / GM Spatial Framework | Greater Manchester Spatial Framework |
| GVA | Gross Value Added |
| H&SC | Health & Social care |
| HEI | Higher Education Institution |
| HMRC | Her Majesty's Revenue and Customs |
| HQ | Head Quarters |
| IMD | Index of Multiple Deprivation |
| IoT | Internet of Things |
| LEP | Local Enterprise Partnership |
| LGBT | Lesbian, gay, bisexual, and transgender |
| LIS | Greater Manchester Local Industrial Strategy |
| MIDAS | Manchester Investment Development Agency Service |
| MIER | The Manchester Independent Economic Review (MIER) consisted of a Commission of prominent economists and business leaders, supported by a Policy Advisory Group and Secretariat, with responsibility for commissioning high-quality evidence-based research to inform decision-makers in Manchester. The MIER reports were published in 2009. |
| MSB | Mid-Sized Business |
| NHS | National Health Service |
| NIA | National Infrastructure Assessment |
| NUTS | Nomenclature of Territorial Units for Statistics (NUTS) is a geocode standard by Eurostat for referencing the sub-divisions of the UK and Northern Ireland for statistical purposes |
| OECD | Organisation for Economic Co-operation and Development |
| ONS | Office for National Statistics |
| R&D | Research and Development |
| Regional Centre | Broadly covers Manchester City Centre, inner Salford and Trafford Wharfside. Technical definition includes the Regional Centre planning policy definition used within the Draft Greater Manchester Spatial Framework published October 2016 and the Manchester City Centre definition developed by Manchester City Council. |
| SAF Model | Strategic Assessment Framework Model |
| SIA | Greater Manchester and Cheshire East Science and Innovation Audit |
| SME | Small & Medium-sized Enterprises |
| STEM | Science, Technology, Engineering and Mathematics |
| TfGM | Transport for Greater Manchester |
| UK | United Kingdom |