OXFORD ECONOMICS

THE CISCO UK PRODUCTIVITY INDEX

EXAMINING LOCAL PERFORMANCE DISPARITIES WITHIN THE UK

FINAL REPORT

DECEMBER 2018

Oxford Economics

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December 2018

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FOREWORD



Tony Danker
Chief executive,
Be the Business

Amid all the uncertainty created by the UK's scheduled exit from the European Union, every day that passes leaves us looking a little less competitive. As a nation, our productivity—the amount produced per worker, per hour—has not noticeably improved for around a decade. Compared to similar economies like the United States, Germany, or France, we are around a third less productive.

Increasing our output per worker is essential if we are to continue raising employee pay and, ultimately, living standards in the UK. This makes productivity the defining issue of our economy. It is the only way we will be "match-fit" for life outside the EU.

The Cisco UK Productivity Index is an invaluable addition to the body of thinking around this country's productivity. It takes absolutely the right approach by controlling for industry sectors, and in so doing shows that our lacklustre productivity is broad-based, with firms all over the country performing a little more weakly than they should be. This report also confirms what we know will lead these companies to become more productive: the businesses that export, and invest in new equipment and technology, are the firms with the highest levels of performance.

When we think about how to close the productivity gap, we need to remember who it is that is doing the closing: the UK's five million businesses. Only when we engage with productivity at the level of each individual business will we be able to give firms, and the people who work with them, a stake in our collective success. That's why Be the Business is building a movement of companies, from industry leaders such as Cisco to small manufacturers and hospitality firms. Its success will be built on leading firms sharing the business practices that work for them with ambitious companies that want to improve. Productivity can't be a concept left to economists—it's about instilling a competitive edge in every business in this country, and making sure that improving business productivity is at the heart of all Local Industrial Strategies.

There is a significant prize on offer. This report amply demonstrates that it is both big, and within our grasp: improving the productivity of underperforming local areas to where they should be, based on their industrial makeup, could add £140 billion to the UK economy each year.

The Cisco UK Productivity Index provides a valuable metric for charting progress in different parts of our economy. It gives policymakers, local government and industry a means of tracking our progress. Given the UK's scheduled exit from the EU, it has never been more important to kick our competitive instincts into gear, and empower our entire business community to become productivity leaders. I look forward to future editions of the Index, and to seeing firms all around the country rising to the productivity challenge.

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EXECUTIVE SUMMARY

Britain is in the grip of a long-term productivity slump. While most major economies have seen productivity growth slow since the financial crisis, the UK's experience has been particularly poor. On average, each UK worker produces around a third less per hour than French, German, and American workers.

An important aspect of this story is the disparities in productivity between different UK locations—even within the same region. To bring new understanding of this issue, we have created the Cisco UK Productivity Index, which offers unique insights by being both more geographically granular, and more up to date, than other published productivity statistics.

A key feature of the Index is that it controls for the aspect of productivity performance that is explainable by each local area's industrial mix (the "industry effect"). In so doing, it can shed more light on *other* explanatory factors that may be unique to each area—from levels of investment in technology to the quality of road, rail, and air connections. Collectively, we term this the "area effect". In some cases, these factors may be easier for policymakers to influence than the industrial mix of a particular region, with local-level strategies that aren't dependent on national policy.

The Index reveals a wide divergence in productivity levels across the UK, even when differences in industrial composition are taken into account. Large *intra*-regional variations are also highlighted, particularly in the Index's stronger-performing areas. This underlines that regional geographies are only part of the explanation for the UK's productivity disparities.

London boroughs dominate the top of the Index, with 15 of the 20 strongest-performing areas located in Greater London. The three local areas at the top of the Index (the London boroughs of Wandsworth and Camden, plus Slough in Berkshire) are all over 50 percent more productive than their industrial makeup alone would imply. Outside London and the South East, the North West is the strongest-performing English region on the Index, while in Scotland, we see clusters of strength in the north east, centred on the oil city of Aberdeen, and in Edinburgh and East Lothian. At the other end of the Index, eight of the 20 weakest-performing areas are found in Wales, with productivity in each between 20 and 30 percent below their industrial benchmark.

A result that illustrates the extent of the UK's productivity challenge concerns the 10 "Core Cities", which all score below their benchmark on the Cisco Index.[1] When each of these cities is defined by a single local authority district, rather than a wider urban area, they account for around nine percent of UK economic activity and one in 10 jobs, so their productivity performance is important to both local and national economic development.

114 (29%)

Number of local areas that outperform their industrial benchmark, according to the Index. The top three (Wandsworth, Camden, and Slough) are all over 50 percent more productive than their benchmark.

In all, the Index assesses 391 local areas.

[1] The 10 Core Cities are Birmingham, Bristol, Leeds, Liverpool, Manchester, Newcastle, Nottingham, Sheffield, Glasgow, and Cardiff.

The regional disparities highlighted by the Index suggest there is a huge opportunity for the UK to increase its economic performance by raising the productivity of underperforming local areas. If all these areas were able to achieve their benchmark productivity level in 2018, we calculate that their contribution to the UK's annual GDP would be an extra £140 billion, adding 7.5 percent to the size of the UK economy this year. Raising the Index scores of the 10 Core Cities alone would add around £18 billion in 2018, equivalent to one percent of national GDP.

£140 billion

Additional contribution to UK GDP in 2018 if all 'underperforming' local areas raised their Index scores to the industrial benchmark (100).

This equates to adding 7.5 percent to the size of the UK economy this year.

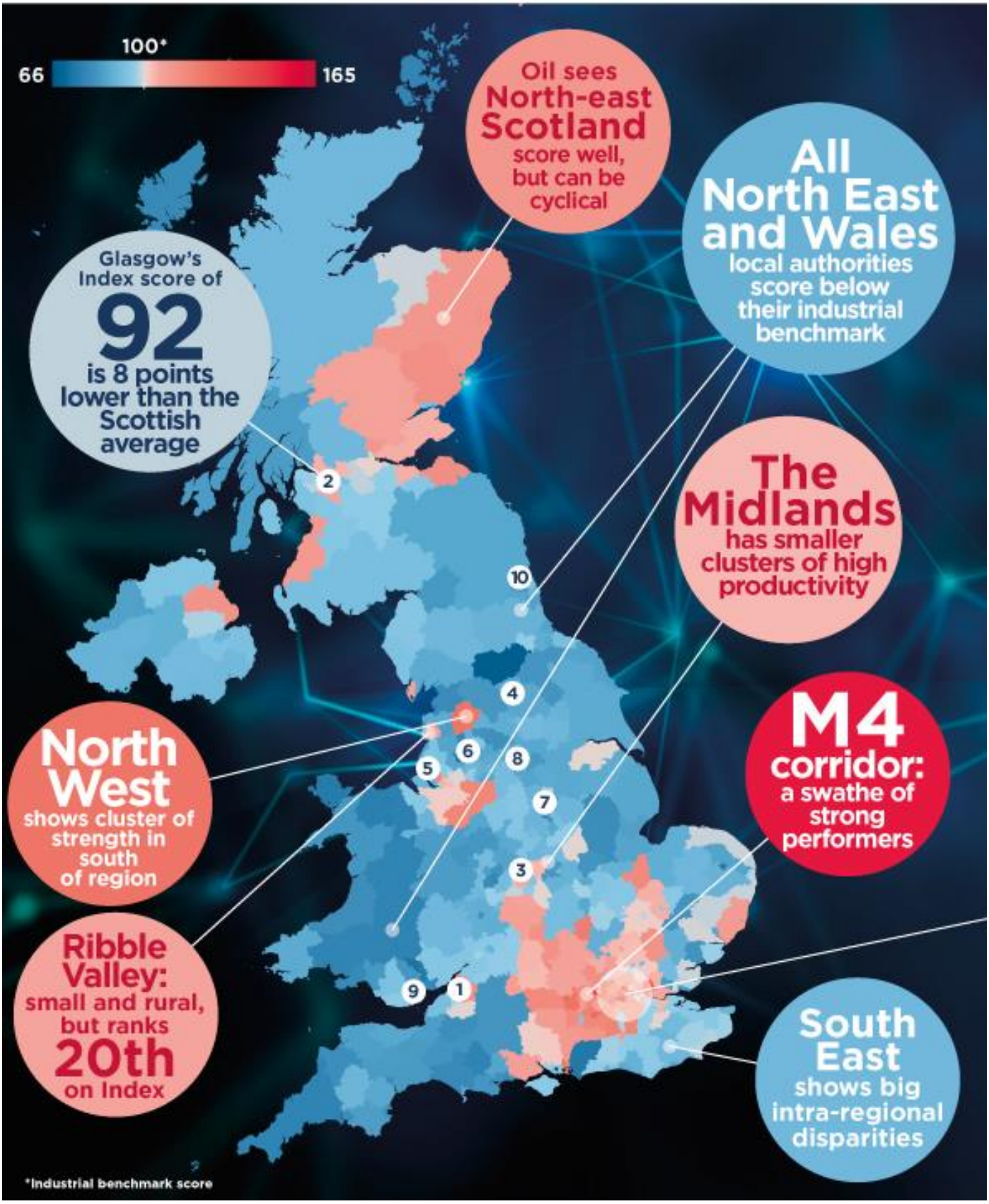
This report goes on to analyse which factors might be most closely linked with increasing the productivity performance of different local areas. For example, our analysis shows that productivity scores on the Index are correlated both with higher levels of investment in technology by firms, and with the number of digital technology occupations in a local area's workforce—particularly at senior level.

This is part of a suite of factors that the Index suggests business, government, and other interested parties could focus on to raise productivity levels. For example, we see that workforce skill levels are closely linked to productivity performance at a local level, highlighting the importance of investment in education to degree level and beyond, and also in apprenticeship and lifelong learning programmes. Business innovation is also key: local areas with a high proportion of firms with "beneficial characteristics" (for example, firms that are smaller and younger; foreign-owned; engaging in R&D; and/or internationally competitive) are likely to show above-benchmark performance on the Cisco UK Productivity Index.

These factors are underpinned by infrastructure. Analysis of the Index shows that productivity performance is linked not only to dense concentrations of economic activity, but also to ease of access to these areas. Transport is a key factor in this regard, particularly for many of the UK's large urban areas outside London.

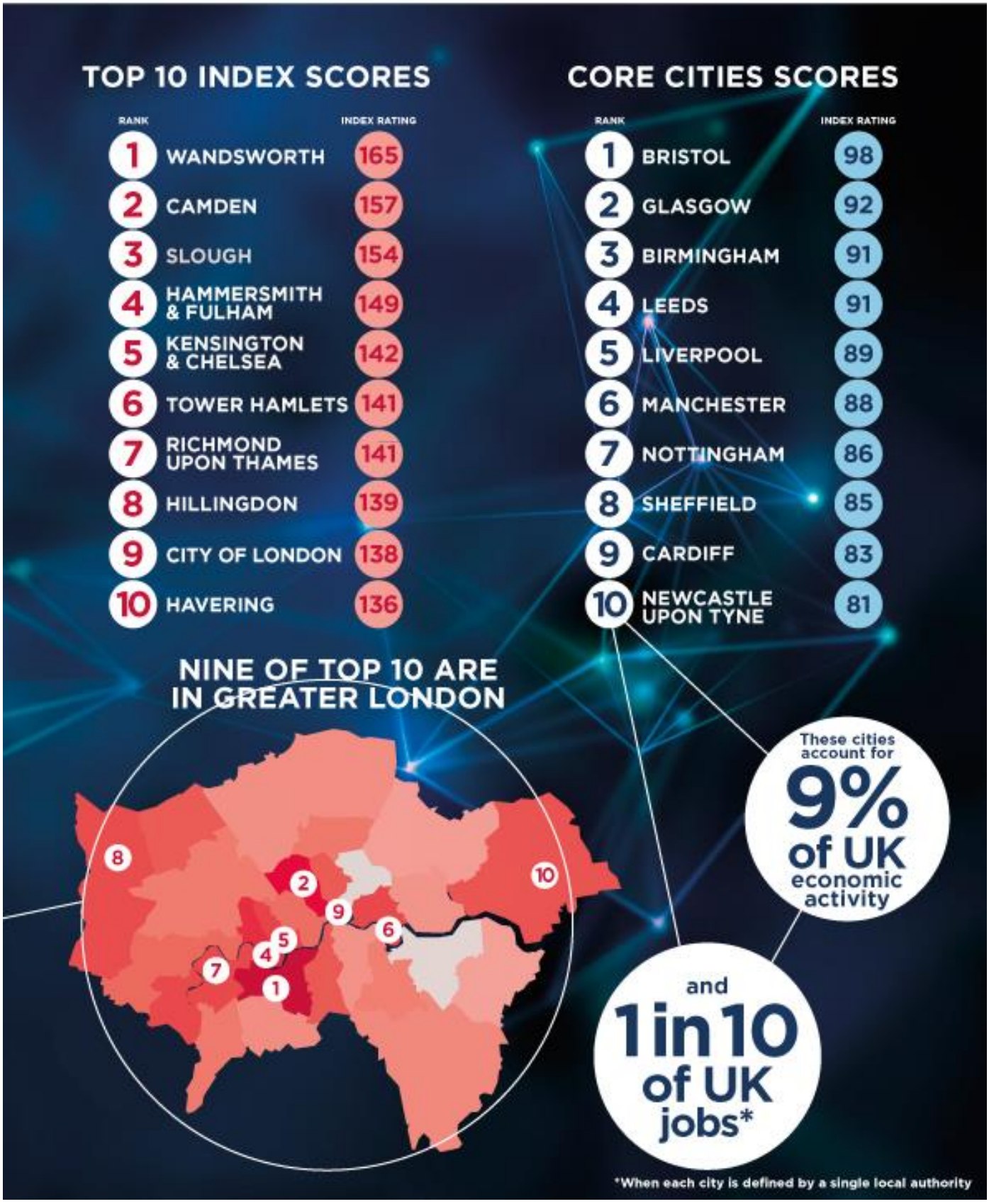
Above all, this report underlines that productivity performance is anything but uniform across the UK. Tackling underperformance at a local level demands greater understanding, and discussion, of the many underlying characteristics that differentiate productivity levels in different parts of the country. The Cisco UK Productivity Index seeks to help this process by shedding new light on these issues.

2018 CISCO PRODUCTIVITY INDEX



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1. INTRODUCTION

Productivity is a key determinant of the pay and living standards of UK residents. In the long run, increasing productivity levels is the way nations become richer, businesses grow more profitable, living standards improve, and governments can spend more on public services and welfare benefits. It is also the benchmark used by many to compare the UK's economic performance with our international peers.

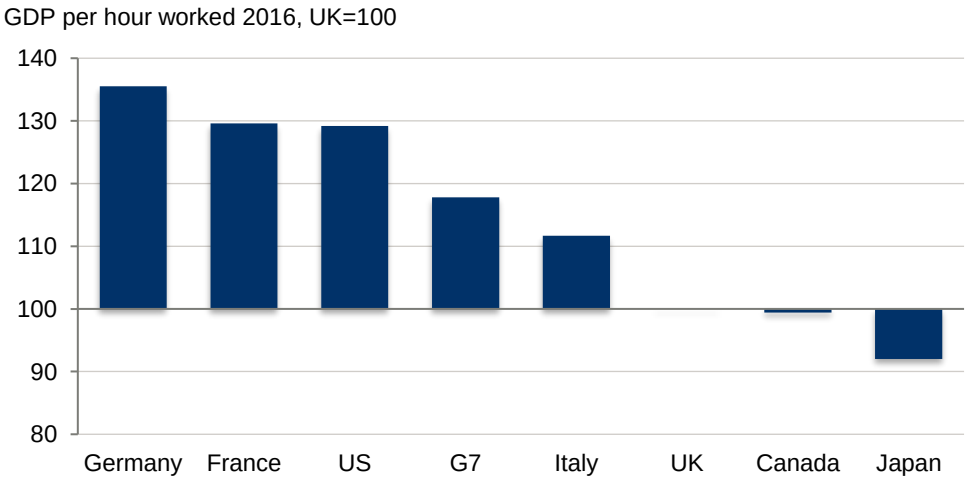
Across the whole economy, productivity refers to the amount of GDP (total value of goods and services) that are produced in a period of time, divided by all the hours worked over the same period. When productivity increases, workers' wages can rise without risk of an inflationary spiral.

Many other factors can also affect productivity levels over the long term—from a nation's quality of infrastructure and education, to firms' willingness to innovate, and employees' acceptance of more flexible working patterns. This means everyone has an important role to play, from the shopfloor to the boardroom to the policy office. But influencing long-term growth is not easy, and demands greater understanding of the issues at stake—not just at a national level, but within regions, where productivity levels can vary widely.

1.1 THE UK'S PRODUCTIVITY PROBLEM

Productivity has been one of the black spots of the UK economy since the onset of the financial crisis. Even today, more than a decade on, output per hour worked is, on average, barely any higher than at the end of 2008. The UK's productivity levels are lower than for many of its international peers: for example, each UK worker produces around a third less per hour than French, German, and American workers, on average (Fig. 1).

Fig. 1. International comparison of labour productivity, 2016

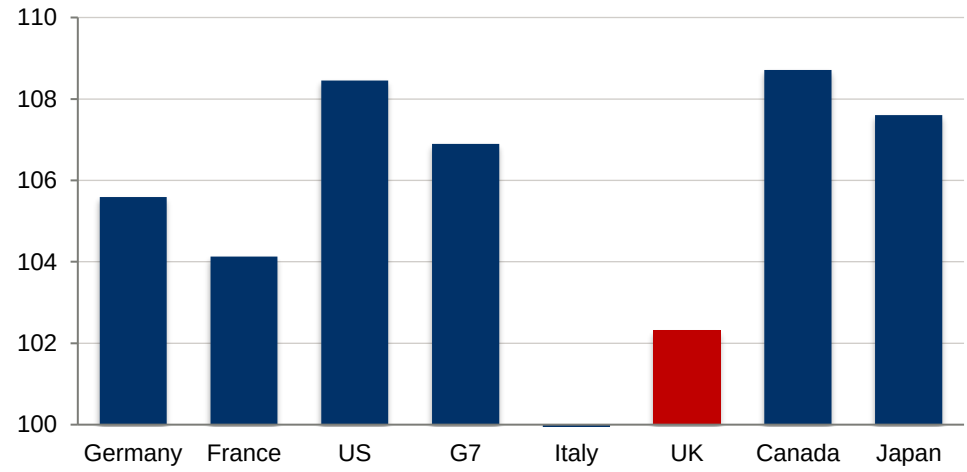


Source: ONS

Not only is productivity in the UK low, it has also barely grown over the past decade. While all major economies have seen their productivity growth slow since the financial crisis, the UK's experience has been particularly poor. From 1995 to 2007, the UK experienced the joint-fastest rise in output per hour among the G7 countries, level with the US. Since then, however, it has experienced expansion levels significantly weaker than the G7 as a whole, and only above Italy among those countries (Fig. 2).

Fig. 2. International comparison of labour productivity growth, 2008-2016

GDP per hour worked 2016, 2008=100



Source: ONS

The UK's dismal performance since the financial crisis, both in absolute terms and relative to its peers, is one of the most pressing challenges facing businesses and policymakers alike. A key element of this issue, yet one which is debated less often, is the *regional aspect* of the UK's productivity problem. The productivity performance of local areas varies widely around the UK, and national aggregates mask these differences.

While the UK's most-productive local areas rank alongside some of the world's best-performing locations, around 70 percent have productivity levels below the UK average. The extent of this disparity in performance is particularly noticeable in the UK when compared with our European neighbours.

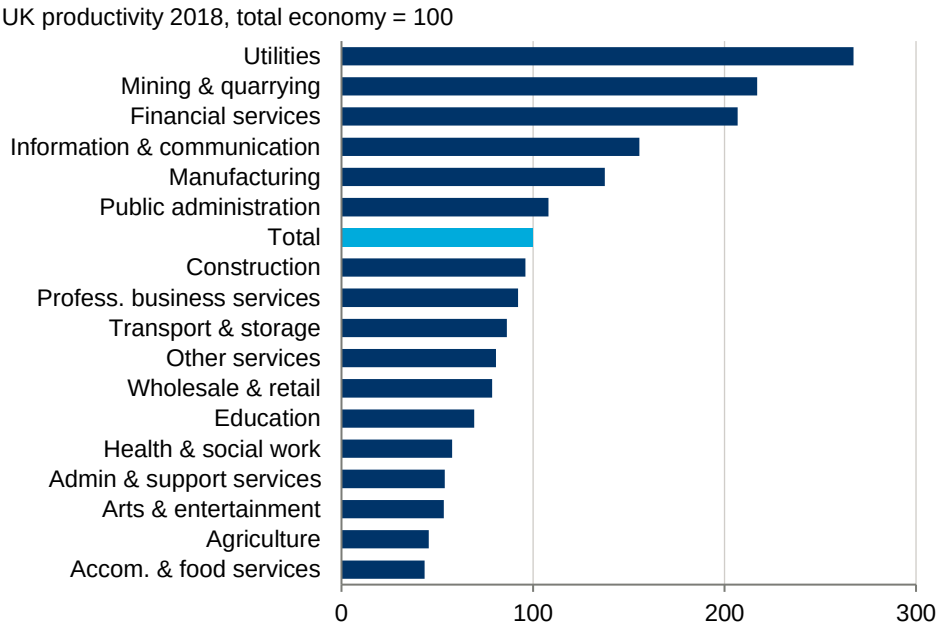
Productivity performance impacts on a local area's competitiveness, its ability to attract and retain investment and talent, and, ultimately, to achieve economic growth. Productivity differentials are therefore among the factors that underpin local disparities in growth and prosperity. Of course, local areas often wrestle with their own unique issues, so it should be noted that a "one-size-fits-all" policy response is not always appropriate.

1.2 WHAT'S DRIVING REGIONAL PRODUCTIVITY GAPS?

One explanation for the widespread variation in productivity performance in the UK is that productivity varies considerably by industry. The industrial composition of each local area also varies widely, of course, so this has a bearing on how productive each area is.

For example, output per worker in financial services is about twice the UK economy average, and this sector is heavily concentrated in a relatively small number of areas. Information & communication, and manufacturing are also relatively productive sectors. By contrast, a range of service activities across both the private and public sectors have productivity levels at around half the UK average (Fig. 3).

Fig. 3. UK productivity performance by industrial sector, 2018



Source: Oxford Economics

But is the UK's divergent productivity performance solely due to the location of different types of industries, or are location-specific factors also playing a role? In order to shed light on this question, we created the Cisco Productivity Index, which allows us to measure how productive each local area is when its industrial makeup is controlled for (see explainer panel, overleaf).

This means we can distinguish how much of a local area's productivity performance is down to its industrial mix ("the industry effect"), and how much is due to other factors that may be unique to that locality ("the area effect"). By stripping out the industry effect from our analysis, the Index can shed more light on why some parts of the UK perform better than others. For example, do certain parts of London still perform well even after we control for their high exposure to the productive financial services and digital sectors? And if so, can we understand why?

In the next chapter, we summarise the headline findings of the Cisco UK Productivity Index, and discuss any notable geographical clusters of strong and weak performance. In Chapter 3, we consider what factors might explain the regional disparities the Index has thrown up, focusing on four broad pillars of potential influence: technology; people; business structure and innovation; and geography and infrastructure. In Chapter 4, we draw together our initial conclusions from creating the Index, and from our analysis of correlations with potential explanatory factors.

WHAT IS THE CISCO PRODUCTIVITY INDEX, AND HOW DOES IT WORK?

The 2018 Cisco UK Productivity Index draws on Oxford Economics' proprietary databases, which incorporate data published by the Office for National Statistics (ONS). This new Index provides unique insights by being both more geographically granular, and more up to date, than raw ONS productivity statistics.

The Index measures every UK local area's productivity against its "industrial benchmark", which is the level of productivity a local area would theoretically achieve if each of its industries exactly matched the UK productivity average for that sector (without considering any other factors).[2]

The Index therefore identifies the "area effect"—the element (positive or negative) of each local area's productivity performance that is down to factors *other* than the composition of its industries. In turn, this allows us to explore possible correlations between regional variations in the Index, and other potential influencing factors—from technology capital, to road, rail and air connections. In the longer term, these factors may be easier for policymakers to influence than the industrial mix of a particular region.

An Index score of 100 signifies that a local area's productivity is exactly in line with its industrial benchmark. A score above 100 indicates that area's level of productivity is above the industry average, while local areas with a score below 100 are those where productivity falls short.

The main inputs to the Index are OE's estimates of local areas' "gross value added" (GVA), and employment. GVA—a measure of the value of goods and services produced—is the headline indicator for economic output in each local area. Employment covers all UK-based employees, plus the self-employed and Her Majesty's Forces. Both GVA and employment are measured on a workplace basis.

The most recent ONS estimates for local area GVA and employment are for 2016. However, these data have been brought forward to 2018, the reference year for the Cisco UK Productivity Index, using OE's proprietary suite of forecasting models, which draw on more up-to-date national and regional economic data where available. This ensures that the Index provides the most accurate possible assessment of the UK's current productivity performance across all of its local areas.

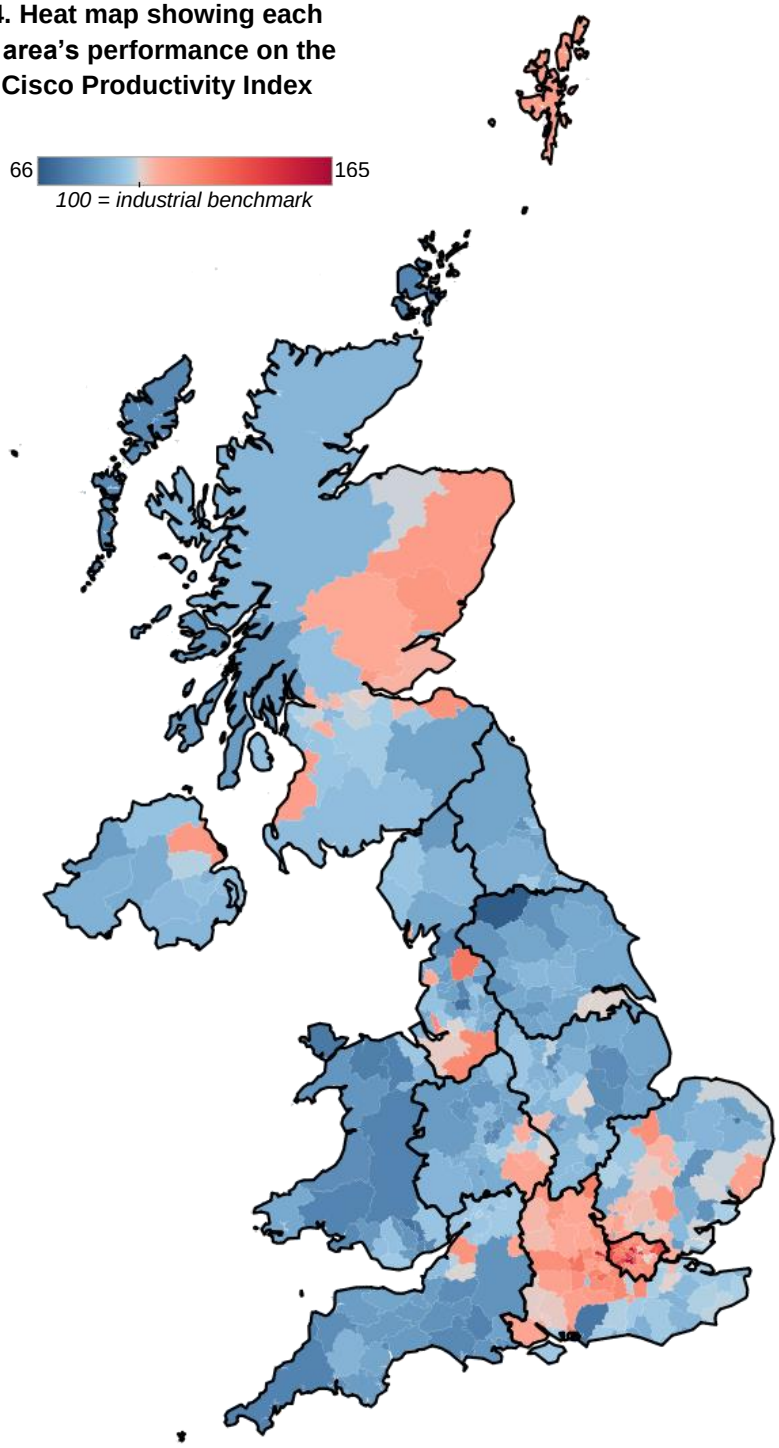
Note: The Cisco UK Productivity Index comprises 391 mutually-exclusive local areas across the UK. These are defined by the boundaries of local government jurisdiction, the structure of which varies by location. In Northern Ireland, Scotland, Wales, and parts of England, where a single organisation is responsible for all local government functions, we include these unitary authorities (known as local government districts in Northern Ireland). Where two-tiered systems exist—such as district or city councils, or boroughs, that sit within counties or combined authorities—only the lower-tier authorities are considered. For simplicity and consistency, we refer to all of the above as "local areas" in this report.

[2] This analysis disaggregates the economy into 18 industries: Agriculture, forestry & fishing; Mining & quarrying; Manufacturing; Utilities; Construction; Wholesale & retail trade; Transport & storage; Accommodation & food services; Information & communication; Financial & insurance activities; Real estate activities; Professional, scientific & technical activities; Administrative & support service activities; Public administration & defence; Education; Human health & social work; Arts, entertainment & recreation; Other services.
National level productivity is defined as mainland UK.

2. THE CISCO UK PRODUCTIVITY INDEX: HEADLINE FINDINGS

The 2018 Cisco Productivity Index demonstrates that there is a large divergence in productivity levels across the UK, even when the different mix of industries found in each local area is controlled for. In Fig. 4, red-shaded local areas (which score above 100 on the Index) are performing better than their industrial mix would imply, while blue-shaded local areas (scoring below 100) are performing "below par" relative to national industry averages.

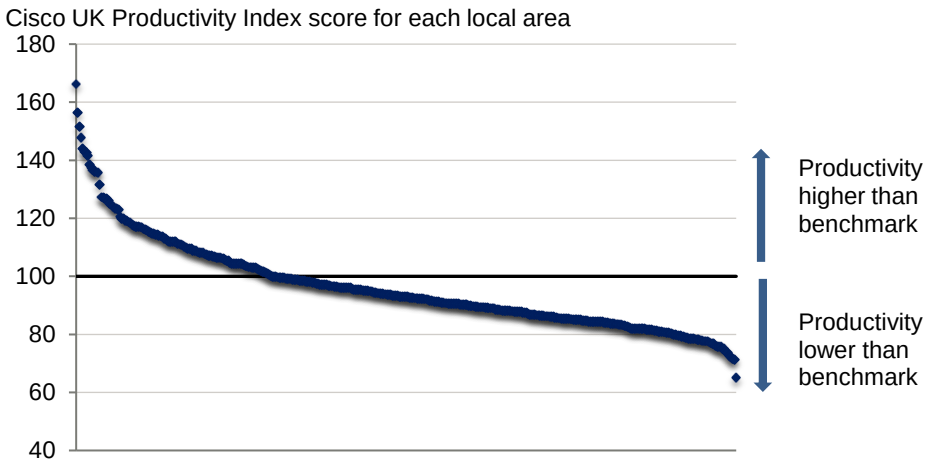
Fig. 4. Heat map showing each local area's performance on the 2018 Cisco Productivity Index



The three local areas at the very top of the Index (the London boroughs of Wandsworth and Camden, plus Slough in Berkshire) are all over 50 percent more productive than their industrial makeup alone implies. Indeed, their *actual* productivity levels would place them near the top of a Europe-wide league table, ahead of cities such as Amsterdam, Copenhagen, and Frankfurt.

However, we find that the majority of the UK's local areas perform below their industrial benchmark (ie. they score below 100 on the Cisco Productivity Index). Those areas at the very bottom of the Index are more than 25 percent less productive than their industrial makeup alone would imply.

Fig. 5. Spread of UK local area scores on the 2018 Cisco Productivity Index



Source: Oxford Economics

2.1 THE INDEX'S TOP PERFORMERS

London boroughs dominate the top of the Cisco Productivity Index—indeed, 15 of the 20 strongest-performing areas are in the capital (and nine of the top 10). Leading the way is Wandsworth, where productivity is 65 percent higher than its industrial benchmark. Key features of the borough are its large and highly productive business services sector, ongoing significant real estate development in Nine Elms, and the growth of the local tech scene. The latter has been boosted by high-tech giant Apple's announcement that it will be relocating its UK headquarters to Battersea Power Station, in the north east of the borough.[3]

Close on Wandsworth's heals is Camden, another Inner London borough famous for its burgeoning reputation as one of London's leading digital centres (Facebook and Google are amongst those investing in the Kings Cross Development, for example). Productivity levels in Camden are significantly higher than the national average across all sectors, helping to secure the borough's strong standing in the Cisco Index.

[3] Please note that while some company-level data in this report has come from the ONS Secure Research Service, this does not include any information about specific companies mentioned in this report.

The top five is completed by Slough, Hammersmith & Fulham, and Kensington & Chelsea. Productivity levels in each of these areas are between 40 and 55 percent above benchmark. Interestingly, one of the common characteristics of this leading group of five is that they all have a relatively small financial services sector. By contrast, the UK's two major financial centres—the City of London, and Tower Hamlets (home to Canary Wharf)—make the top 10 but not the top five, despite being the UK's most-productive areas in actual terms by some margin. This shows that high exposure to financial services activity can explain part, but by no means all, of an area's strong productivity performance.

Fig. 6. Top 20 local areas (boroughs) in the Cisco UK Productivity Index

Rank	Local area	Index		Rank	Local area	Index
1	Wandsworth	165		11	Barking & Dagenham	136
2	Camden	157		12	Lambeth	134
3	Slough	154		13	Islington	134
4	Hammersmith & Fulham	149		14	Harrow	134
5	Kensington & Chelsea	142		15	Hounslow	128
6	Tower Hamlets	141		16	Reading	127
7	Richmond upon Thames	141		17	Woking	127
8	Hillingdon	139		18	Westminster	126
9	City of London	138		19	Wokingham	125
10	Havering	136		20	Ribble Valley	125

Source: Oxford Economics

The highest-ranking local area outside London is Slough. More than a quarter of this Berkshire town's economic activity is directly accounted for by the information & communication sector, compared to seven percent nationally. But when its industrial mix is controlled for, we find that Slough's productivity is more than 50 per cent higher than its benchmark—and this strength is seen across a broad range of sectors. Joining Slough in the top 20 are three fellow South East local areas: Reading (16th), Woking (17th), and Wokingham (19th).

Outside of the south of England, Ribble Valley squeezes into the top 20. This local area stands out from the other top performers both due to its scale (Ribble Valley is one of the smallest and most rural of UK local areas), and its economic structure—it has a relatively high reliance on manufacturing, mainly due to the presence of BAE Systems. Neither of these characteristics is generally shared by other strong performers.

2.2 CLUSTERS OF STRONG PERFORMANCE

Some clear clusters emerge when we look across the country. The most obvious is the number of highly-ranked locations in London, particularly in the west and centre of the capital. But we see other clusters too: the top-20 performers of Slough, Reading, and Wokingham are among a swathe of strong performances along the M4 corridor. This merges with an arc of high-ranking locations between Oxford and Cambridge, encompassing the likes of Milton Keynes, Stevenage and St Albans.

Outside London and the South East, the North West is the strongest performing English region on the Cisco UK Productivity Index. The region's strength is predominantly based on a cluster of strong performance in the south of the region, including Cheshire and Knowsley, thanks to a particularly strong productivity performance by manufacturing firms in that area. Smaller clusters of strong performance are also found in the Midlands, including around Warwick and Stratford-upon-Avon, where productivity is above both the national average and the industrial benchmark.

The final notable cluster of strength is in the north east of Scotland, centred on Aberdeen. This area is relatively unique in a UK context, given its dependence on the oil sector. And while this means economic performance can be very cyclical, it also boosts productivity in both an absolute and relative sense—productivity in Aberdeen and Aberdeenshire is around 25 percent higher than their industrial compositions would suggest, according to our Index. But the Scotland story is not just about oil. Productivity levels are also relatively high in Edinburgh and East Lothian, compared to their benchmark.

2.3 THE WEAKEST PERFORMERS

Just as one region (London) dominates the top of the Index, we see a similar pattern at the bottom of the rankings. Eight of the 20 weakest-performing areas are found in Wales, with productivity in each between 20 and 30 percent lower than their benchmark. However, the local area at the foot of the rankings is Richmondshire, in the Yorkshire & Humber region. Richmondshire is a rural economy that has a high exposure to agriculture and tourism, and which also includes the large army base at Catterick. It therefore has a structure unlike most other local areas.

Fig. 7. Bottom 20 local areas in the Cisco UK Productivity Index

Rank	Local area	Index		Rank	Local area	Index
391	Richmondshire	66		381	Cornwall	77
390	Bolton	72		380	North Dorset	77
389	Blaenau Gwent	72		379	Carmarthenshire	77
388	Chichester	73		378	Orkney Islands	77
387	Anglesey	74		377	Blackburn with Darwen	77
386	Norwich	74		376	Sandwell	78
385	Torfaen	74		375	Blackpool	78
384	Conwy	75		374	Newport	78
383	Denbighshire	76		373	Eilean Siar	78
382	Powys	77		372	West Dorset	78

Source: Oxford Economics

Like Richmondshire, many of the local areas at the foot of the rankings are rural in nature, such as Cornwall and North Dorset. But there are exceptions to this rule—most notably Bolton, Sandwell, and Norwich, all of which are relatively urbanised. Bolton is the lowest-placed of these, with an Index score 28 percent below its benchmark. This is largely due to the Greater Manchester

town's lower-than-average productivity across the sectors which account for a relatively high share of local economic activity.

Chichester in West Sussex is another notable member of this low-ranking group. This relatively prosperous cathedral city sits within the strong-performing South East region, and therefore stands apart from many of its neighbours. Its role as a "county town" means it has a relatively high exposure to the public sector, and productivity in these activities is lower than the national average, dragging Chichester towards the bottom of the Index. Its actual productivity performance compares more favourably.

2.4 CORE CITIES

Another notable finding of the Cisco Index is that the productivity scores of all 10 "Core Cities" are below their industrial benchmark.[4] When each city is defined by a single local authority district (rather than a wider urban area), these 10 cities account for around nine percent of UK economic activity and one in 10 jobs, so their performance is very important for both local and national economic development. This result illustrates the extent of the UK's productivity challenge.

Fig. 8. Core Cities' rankings

Rank	Local area	Index
1	Bristol	98
2	Glasgow City	92
3	Birmingham	91
4	Leeds	91
5	Liverpool	89
6	Manchester	88
7	Nottingham	86
8	Sheffield	85
9	Cardiff	83
10	Newcastle upon Tyne	81

Source: Oxford Economics

While all Core Cities fail to achieve their benchmark level of productivity, the scale of these shortfalls varies considerably. Bristol, for example, has an Index score of 98, so the city is falling only modestly short of its benchmark. But there is a marked gap between Bristol and Glasgow, the second-ranked Core City on the Cisco Index.

Glasgow is among a group of five Core Cities (the others are Birmingham, Leeds, Liverpool and Manchester) where productivity is currently about 10 percent lower than their industrial makeup implies. Inevitably, there are factors unique to each city that explain this shortfall, but there is a general

[4] The Core Cities Group was established in 1995 as a self-selected, self-financing advocacy group of large regional cities outside Greater London. The eight original members were Birmingham, Bristol, Leeds, Liverpool, Manchester, Newcastle, Nottingham, and Sheffield. Glasgow and Cardiff joined the group in 2014.

tendency for these cities to have lower-than-average productivity across a broad range of private service industries.

Newcastle is the lowest-ranked Core City, with a score almost 20 percent lower than benchmark—principally due to its lower-than-average productivity in the public sector (which accounts for a relatively large proportion of the local economy), and its relatively small premium in high-productivity sectors such as information & communication and financial services.

Another striking feature of the Core Cities is that many underperform their wider region on the Index. This regional shortfall is most significant in Glasgow, whose Index score of 92 is eight points lower than the Scottish average of 100, despite it being the second highest-placed Core City in the rankings. Newcastle records a similar shortfall compared to the North East. Bristol again stands out from the other Core Cities on this comparison, with its Index score of 98 being substantially higher than the South West average of 88.

The relatively lacklustre performance of the Core Cities is mirrored in several other large urban areas. In the bottom quartile of the Index—populated by local areas whose productivity is at least 15 percent below benchmark—there are 18 areas which make a significant contribution to UK economic activity (defined as areas with at least 100,000 jobs). These range across much of the UK: in addition to some Core Cities, they include Bolton, Sandwell, Swansea, Exeter, Plymouth, Walsall, and Leicester.

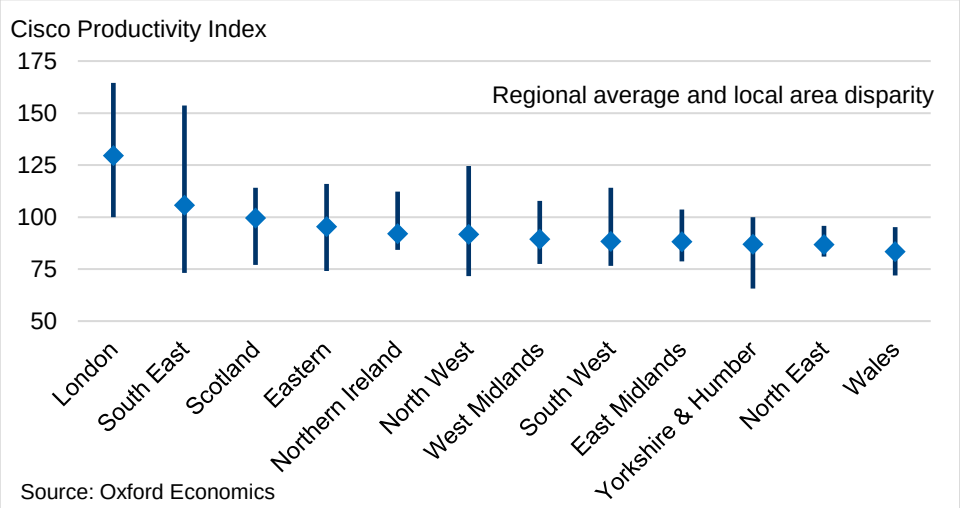
Furthermore, while Edinburgh has an Index score (104) which outperforms its industrial benchmark, the other two capitals of the UK's devolved nations, Belfast (90) and Cardiff (83), underperform this benchmark. But whereas Cardiff broadly matches the average score for Wales, Belfast underperforms its regional score, ranking eighth of the 11 local areas across Northern Ireland.

In general, however, urban areas score more highly on the Cisco Index than their rural counterparts.

2.5 INTRA-REGIONAL VARIATIONS

Another key finding from our research is that there are wide *intra*-regional variations in the Cisco UK Productivity Index (see Fig. 9, overleaf). This is evident across all regions, but most notable in Greater London and the South East, the two strongest-performing parts of the UK. Such local variation indicates that geography alone can only tell us part of the UK's productivity story.

Fig. 9. Intra-regional variations on the Cisco UK Productivity Index



We have already commented on the strength of places such as Wandsworth and Camden, where productivity is more than 50 percent higher than its benchmark. But the capital region is also home to boroughs such as Greenwich and Hackney, where productivity is only just in line with what their industrial makeup implies.

South Eastern local areas show a similar disparity. Several areas—mainly in Kent and coastal/rural Sussex—register scores on the Index that fall short of their benchmark, in stark contrast to the performance of local areas in the north and west of the region.

£140 billion

Additional contribution to UK GDP in 2018 if all 'underperforming' local areas raised their Index score to their industrial benchmark.

This equates to adding 7.5 percent to the size of the annual UK economy.

The narrowest intra-regional disparities are generally found in the parts of the UK that have the lowest scores on the Index, such as Wales and the North East of England. Indeed, all local areas in these two regions have Index scores under 100, signifying that productivity throughout both is always below the industrial benchmark.

2.6 QUANTIFYING THE UK'S 'PRODUCTIVITY OPPORTUNITY'

The regional productivity disparities highlighted by the Index suggest there is a big opportunity for the UK to increase its overall economic performance by focusing on raising the productivity of under-performing local areas.

Had every local area with an Index score of less than 100 (i.e. all those that fall short of their industrial benchmark) actually achieved their benchmark score in 2018, we calculate their combined contribution to UK GDP would have been £140 billion higher this year, adding around 7.5 percent to the annual UK economy. Raising the Index scores of the 10 Core Cities alone would have added around £18 billion in 2018, equivalent to one percent of national GDP.

In the next chapter, we explore some of the factors that may help to explain the disparities in local areas' productivity performances, once their industrial mix has been controlled for. These are issues that policymakers may wish to consider when addressing how to improve the UK's enduring productivity problem.

For the full 2018 Cisco UK Productivity Index list, see Appendix 1

3. EXPLAINING THE UK'S REGIONAL PRODUCTIVITY DIFFERENCES

Having created the Cisco UK Productivity Index to identify disparities in productivity that go beyond differences in the industrial makeup of different local areas, we now look at what other factors may go some way to explaining each local area's relatively high, or low, productivity performance.

To do this, we gathered a long-list of potential explanatory factors across four broad pillars of potential influence—technology; people; business structure and innovation; and geography and infrastructure—drawing on three different sets of sources. First, our assessment considered publicly available data such as official statistics published by the ONS, government departments, and other statutory authorities. Alongside this, we accessed microdata via the ONS Secure Research Service, to test factors where data are gathered (via ONS surveys and other confidential datasets) but not published. Finally, we estimated data to assess factors where public data either did not exist, or lacked sufficient coverage at local authority level.

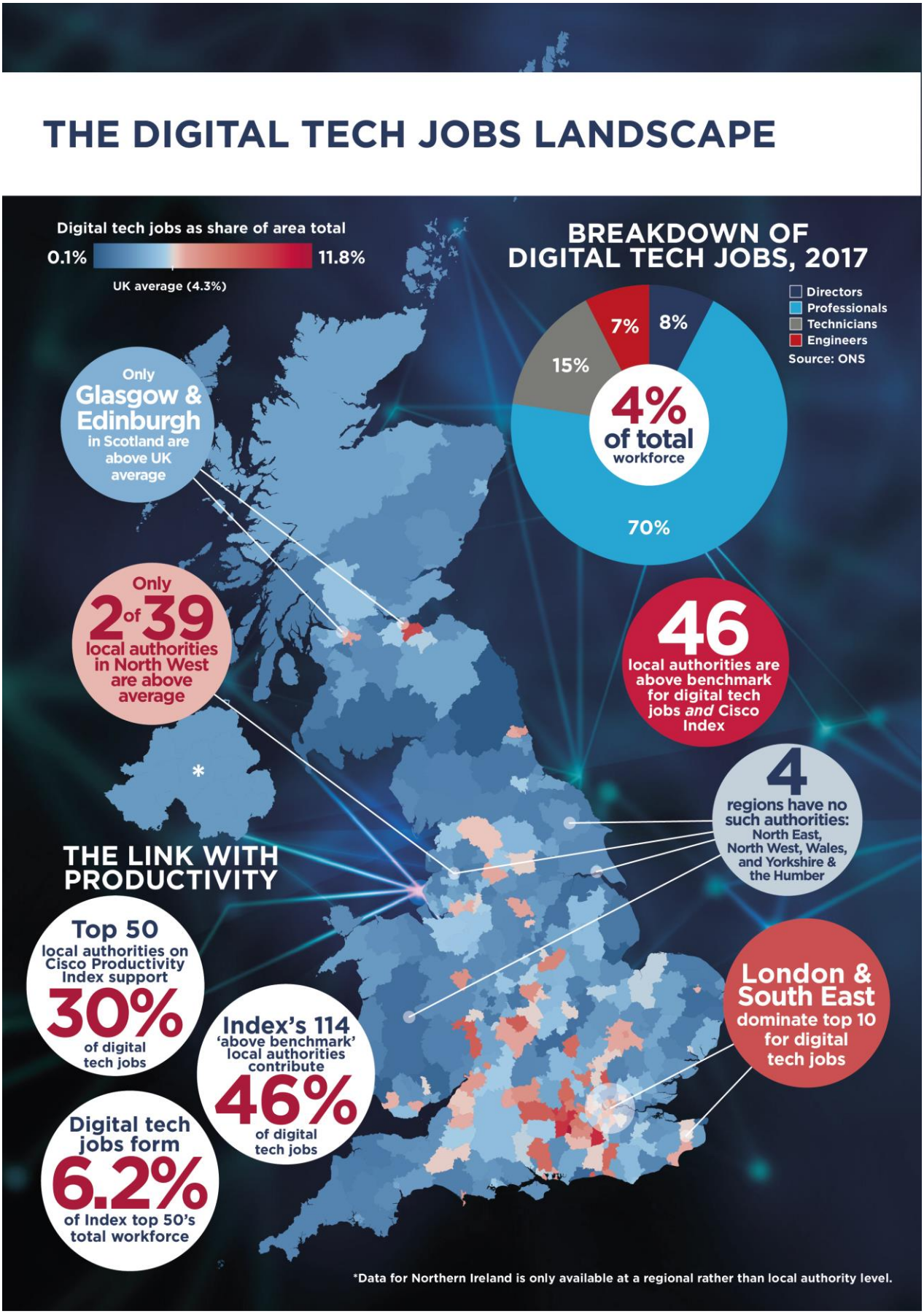
For each selected database, we then conducted a statistical analysis to consider both the strength of correlation with the Cisco UK Productivity Index scores, and the degree of variation underpinning this. In each case, we sought only to identify the *extent* of correlation; we did not seek to identify causality, in either direction. While the factors tested are not exhaustive, they cover a wide range of acknowledged influences on productivity performance.

Over the longer term, these factors may prove easier for policymakers to influence than the industrial mix of a particular region. The benefits of improving these factors are also self-reinforcing, as locations that do so may be better positioned to attract more highly-productive industries in the future.

Note: throughout this chapter, these relationships are visualised using scatter charts that plot each local area's performance in a particular category against its overall Index score. Each scatter chart shows a trendline which represents the line of best fit between each data point on the chart. The trendline represents both the form and strength of correlation, with the direction of the line indicating whether the relationship is positive or negative, and the gradient representing its strength. In each case, we present the trendline for the full sample of local areas where data is available, unless otherwise stated.

3.1 PILLAR 1: TECHNOLOGY

The availability and quality of technology, from area-wide infrastructure to a company's stock of computer hardware and software, is widely acknowledged to have an impact on the productivity of firms—as is the ability of workers to put this technology to most efficient use. In this section, we explore the strength of the correlations between a range of technology-related metrics and local areas' rankings on the Cisco UK Productivity Index.


THE DIGITAL TECH JOBS LANDSCAPE
Digital tech jobs as share of area total
0.1%
11.8%
UK average (4.3%)
BREAKDOWN OF DIGITAL TECH JOBS, 2017
Directors
Professionals
Technicians
Engineers
Source: ONS
8%
7%
15%
4% of total workforce
70%
Only Glasgow & Edinburgh in Scotland are above UK average
Only 2 of 39 local authorities in North West are above average
46 local authorities are above benchmark for digital tech jobs and Cisco Index
4 regions have no such authorities: North East, North West, Wales, and Yorkshire & the Humber
THE LINK WITH PRODUCTIVITY
Top 50 local authorities on Cisco Productivity Index support 30% of digital tech jobs
Index's 114 'above benchmark' local authorities contribute 46% of digital tech jobs
Digital tech jobs form 6.2% of Index top 50's total workforce
London & South East dominate top 10 for digital tech jobs
*Data for Northern Ireland is only available at a regional rather than local authority level.

3.1.1 Digital technology occupations

Throughout the UK, there were almost 1.5 million digital technology occupations in 2017, constituting over four percent of the country's total workforce.[5] These occupations were dominated by senior professionals, who formed 70 percent of all jobs (1.02 million), with the remainder divided between directors (eight percent), technicians (15 percent), and engineers (seven percent).

The share of digital technology occupations appears closely related to productivity, with the relationship particularly strong for the largest 100 local areas in absolute productivity terms (see Fig. 10, overleaf). Local areas in London and the South East dominate this occupations ranking, forming 34 of the top 50 local areas, and nine of the top 10.

The distribution of digital technology occupations is also heavily weighted towards well-performing areas on the Cisco Productivity Index. The 114 local areas that outperform their benchmark contribute 46 percent of technology jobs—some 662,500—despite constituting just over a third (35 percent) of overall employment. The difference is most notable among IT directors, with just under half (49 percent) of these jobs located in the 114 "outperforming" local areas.

When we focus on especially well-performing local areas, the concentration of digital technology occupations increases even more. The top 50 best-performing local areas support 30 percent of all tech jobs in the UK — a rate one-and-a-half times their employment share (20 percent) — including a third of all IT director positions. Digital technology occupations form 6.2 percent of the top 50's total workforce, over twice that of the 50 worst-performing local areas (3.2 percent).

Similarly, of the 25 local areas with the highest digital tech occupations share, 20 have an Index score of over 100, including 13 of the highest 14.
The South East is well represented in this group, with 14 of the 25 highest digital technology occupation shares, including all of the top three: Rushmoor (Hampshire), Mole Valley (Surrey), and Bracknell Forest (Berkshire).

[5] The definition for digital technology occupations is taken from the Tech Nation 2017 report: https://technation.io/wp-content/uploads/2018/04/Tech_City_2017_report_full_web.pdf

Fig. 10. Digital technology occupations as a proportion of total local area workforce[6]



Source: ONS, Oxford Economics

Further analysis also highlights the types of digital technology occupation that are most closely linked with productivity performance. For example, **the relationship is stronger when considering higher-value occupations such as IT directors and senior professionals**. But while the relationship between senior digital, technology professionals and productivity is wholly driven by local areas with an Index score of over 100, the reverse is true with IT directors: a stronger relationship is observed for local areas scoring under 100. This signifies that a closer link exists between local areas with a deficit of IT directors, and weaker performance on the Cisco Index. The Index is also positively associated with IT technicians, albeit to a lesser extent, while our analysis of occupations in the "skilled trades" classifications—typically IT engineers—demonstrates no such positive links.

A positive relationship between the Index and the share of digital technology occupations also exists when we control for the expected share of these occupations in each local area, based on its sector mix—but to a lesser degree. This implies that a high share of digital technology occupations is a factor in both the industrial *and* locational drivers of productivity.

3.1.2 Investment in technology

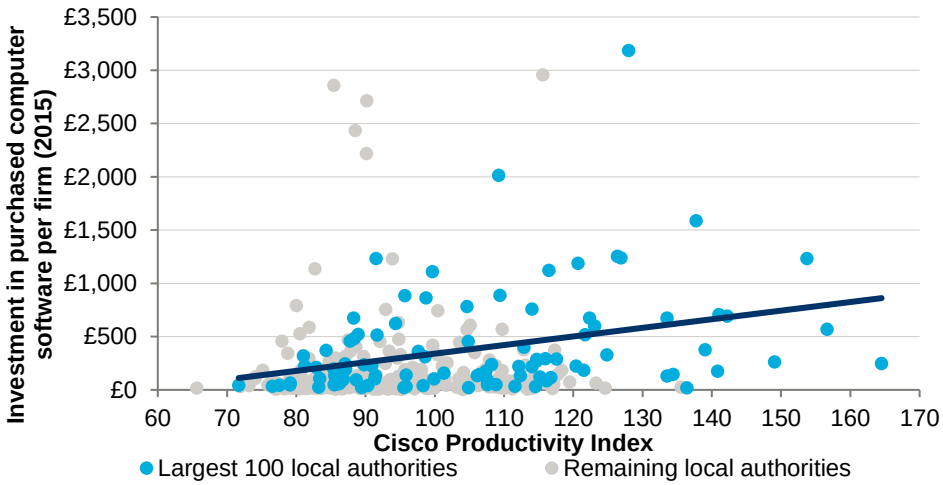
Our analysis of aggregated firm-level microdata suggests a **positive correlation between the extent of investment in technology capital**, and local areas' productivity performances relative to their benchmarks.[7] This correlation is particularly strong when we consider the 100 largest local areas by GVA, which together contribute nearly 60 percent of the UK's total economic output, and also arguably offer a more robust dataset (see Fig. 11, overleaf).

[6] Trendline shown for the largest 100 local areas only.

[7] Note that data on investment in technology at the local level suffers from small sample sizes and disclosure issues.

Of this group, Hounslow in west London (Cisco Index position: 15th) is the highest-ranking local area in terms of its annual private-sector investment in computer software, followed by Crawley in West Sussex, then City of London and its neighbouring borough of Westminster. Of course, average firm sizes may vary significantly across the UK, but when we control for this by estimating investment as a share of turnover, we continue to observe a positive relationship—albeit to a more-moderate degree.

Fig. 11. Average per-firm investment in computer software, plotted against Cisco Productivity Index scores[8]



Source: ONS, Oxford Economics

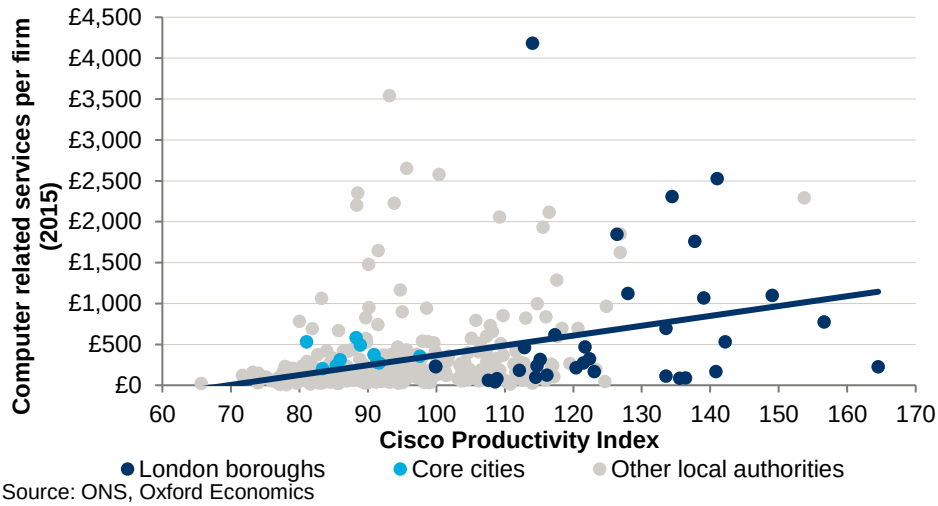
We have also analysed the **degree of correlation with investment in computer-related services** (ie. the "other purchases" that are required to enable technology investments to function, such as the repairs to and maintenance of office machinery and computers).

We find that this measure is also broadly positively correlated with performance on the Cisco Productivity Index (see Fig. 12, overleaf)—despite the fact that London boroughs, which typically perform very well on our Index, are less well-represented in this category. Just three of the top-14 local areas in this category are in London: Barnet, Tower Hamlets, and Lambeth. Copeland in Cumbria scores highest of all local areas (192nd on the Index), followed by Coventry (158th), and Eastleigh in Hampshire (113th). A majority of Scotland's local areas (59 percent) are located in the bottom 100 for this category.

To further explore the relationship between investment in technology and productivity performance requires more robust local data than is currently available for all local areas—for example, in the field of digital skills training, another factor that is likely to play an important role in improving productivity levels, in conjunction with increased levels of capital investment in technology.

[8] Trendline shown for the largest 100 local areas only.

Fig. 12. Average per-firm investment in computer-related services



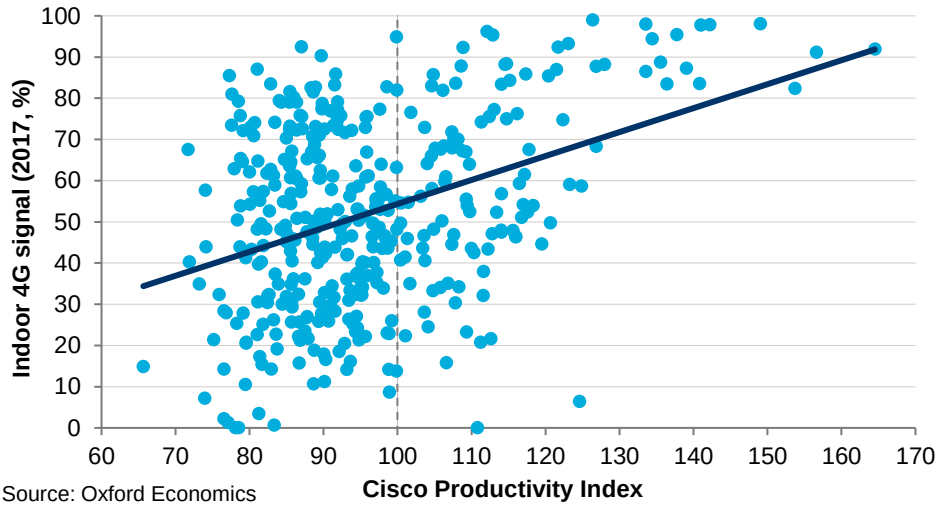
Source: ONS, Oxford Economics

3.1.3 Technology infrastructure

While investing in technology capital and skills has been seen to be correlated with productivity, the success of these investments is also likely to be influenced by the extent of digital connectivity. We find that the **Cisco Productivity Index is positively related to a range of measures of technology infrastructure**—of which the strongest statistical relationship is with indoor 4G signal for the main mobile providers (measured as a percentage of premises).

The correlation is stronger for the 114 local areas with an Index score of 100 or above. By contrast, there is almost no relationship for local areas with an index score below 100. This might suggest that good mobile signal can support better productivity performance, but only when other factors are in place that enable a local area's performance to be better than expected in the first place.

Fig. 13. Proportion of local area premises with indoor 4G signal



Source: Oxford Economics

Alongside this, we also considered fixed-point digital connectivity, in the form of superfast broadband availability. While we might expect this to be correlated with productivity, we find **no such positive relationship**. This could largely be the result of there being a particular focus on rolling out broadband in rural areas, which typically perform less well on the Index. But it may also mean that lots of other factors are offsetting or masking the positive role that superfast broadband is likely to play. Again, this is an area that would benefit from further study as new data becomes available.

3.2 PILLAR 2: PEOPLE

Our second "pillar of influence" considers possible correlations between the makeup of the UK's workforce in different parts of the country, and performance disparities on the Cisco UK Productivity Index.

3.2.1 Qualifications

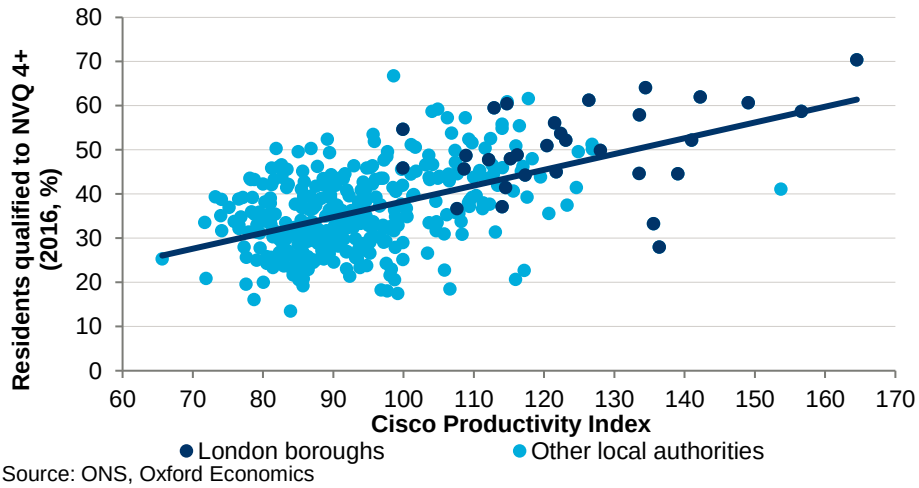
The qualifications profile of a resident population provides an indication of the skill level of the local workforce, which is likely to influence productivity. We find that **degree-level and above qualifications (NVQ level 4+) are indeed positively correlated with Cisco Index scores** (see Fig. 14).[9] As it does for the overall Index, London dominates by this qualifications measure, with the capital's boroughs making up seven of the 10 highest-performing local areas (Cambridge, Oxford, and Elmbridge in Surrey are the exceptions in this top 10).

There is a particularly strong correlation between NVQ4+ qualifications and the Index among larger local economies. The UK's 100 biggest local areas by economy size demonstrate a relationship four-times stronger than the

[9] This scatter chart compares a resident-based measure of qualifications to the Cisco UK Productivity Index, which is workplace based. Were workplace-based qualifications data available, we would expect an even stronger positive relationship with the Index to exist.

equivalent for the remaining 291 local areas, and represent 30 of the 50 highest-ranking local authorities by this qualifications measure.

Fig. 14. Share of local area residents qualified to NVQ level 4+



Source: ONS, Oxford Economics

As data on apprenticeships/vocational qualifications is not gathered on a consistent basis across the UK, we are unable to compare these qualification types to the Cisco Productivity Index. However, statistics released by the Education & Skills Funding Agency show that over three-quarters of employers who have hired apprentices indicate that productivity levels have improved as a result.[10] Similarly, evidence presented by the OECD indicates that promoting "upskilling" through lifelong learning, such as adult education programmes, can also help to improve productivity.[11]

3.2.2 Age profiles

We find that a **strong relationship also exists between age and performance on our Index**. Generally, a high proportion of residents of working age (16 to 64) is positively correlated with productivity performance—although the extent of this is not universal across all age bands within the working-age cohort. The relationship grows with each age band: while a high 21-to-24 year-old population is positively correlated with the Index score, the relationship with a high 25-to-34 population is stronger, likely reflecting the increasing earnings profiles of individuals in the labour market as they gain experience and expertise.

The strongest relationship is observed for the 35-to-44 cohort. While London boroughs feature heavily in the highest population shares of 35-to-44 year olds (22 of the top 30), we find the correlation with the Cisco Index to be strongest outside the capital, in the South East region. Of the highest-ranked local areas outside London by this age group, many are located within the capital's

[10] Key Facts About Apprenticeships (Education & Skills Funding Agency, February 2017): www.gov.uk/government/publications/key-facts-about-apprenticeships/key-facts-about-apprenticeships
[11] 'Boosting skills would drive UK growth and productivity' (OECD, November 19 2017); http://www.oecd.org/education/boosting-skills-would-drive-uk-growth-and-productivity.htm

commuter belt—including Slough, Watford, Woking, Milton Keynes, and St Albans.

However, a **"tipping point" appears to exist beyond this age**: the relationship with the Cisco Index for the 45-to-54 cohort is slightly negative, and from this age group upwards, an increasing share of the population is associated with a worse performance on the Index.

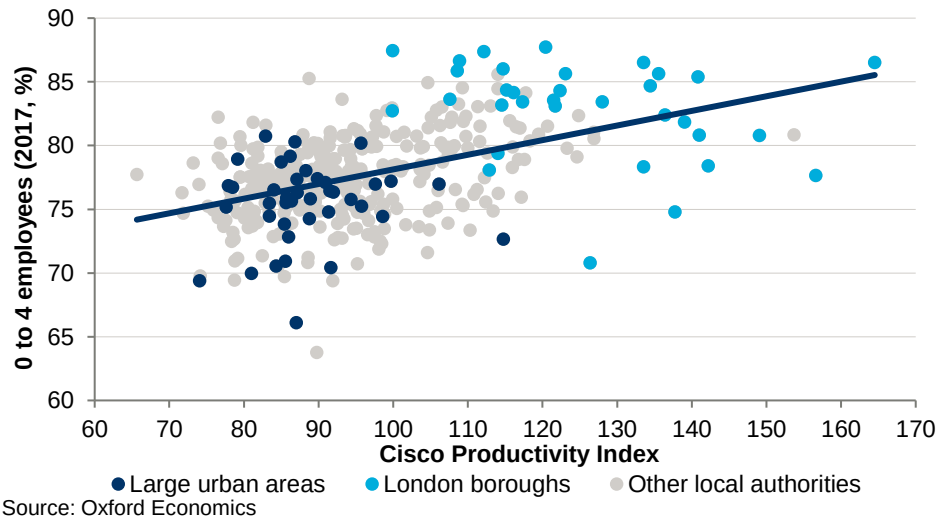
3.3 PILLAR 3: BUSINESS STRUCTURE AND INNOVATION

Our third pillar of influence considers possible correlations between the differing characteristics of UK businesses across the country, and performance disparities on the Cisco UK Productivity Index.

3.3.1 Firms' sizes, ages, and lifespans

Having a **greater share of smaller firms is positively correlated with performance on our Index**, with the relationship strengthening when an even-smaller employee size band is considered. Indeed, we find the relationship is strongest with the proportion of firms in each local area that employ up to four employees (see Fig. 15). By contrast, we find that **no positive relationship exists for small- and medium-size enterprises** (SMEs), which employ up to 250 people. This trend is also linked to businesses rather than sole operators, as no positive relationship is found between rates of self-employment and productivity performance.

Fig. 15. Businesses with 0 to 4 employees (%)



Source: Oxford Economics

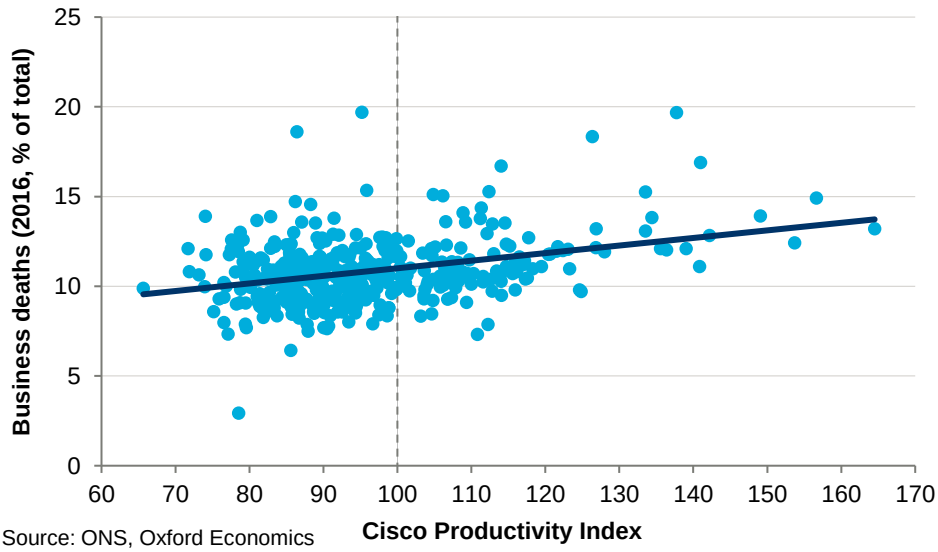
Generally, we observe a **link between firm age and productivity**, as defined by the Cisco Index. This may be because younger firms tend to be more nimble and open to new ideas, which can improve productivity, and it may also be linked to size, as younger firms tend to employ fewer workers than older firms. Analysis of the share of firms by age demonstrates a cut-off point of around

10 years; a **greater share of firms up to 10 years old** is a positive indicator of productivity performance on our Index.

We also find a relationship with "business churn"—with higher rankings by this measure suggesting a larger share of newly formed firms, as these areas' poorer-performing firms tend to shut down more quickly. However, there is an **even stronger relationship** with local areas' rates of "business deaths" alone. Large urban areas tend to have relatively high rates of business deaths, with only three of our grouping of 40 non-London urban areas—Glasgow, York, and Bath & North East Somerset—ranked in the bottom half of local areas by this measure.

The correlation with business deaths is almost entirely driven by local areas that experience better-than-benchmark productivity, scoring over 100 on the Cisco Index, while among the remaining local areas the relationship is minimal (see Fig. 16, overleaf). Furthermore, while higher rates of business births, deaths, and churn are all linked with productivity performance, we find no positive relationship exists with business survival rates.

Fig. 16. Annual business deaths as a proportion of local areas' total business stock



Source: ONS, Oxford Economics

3.3.2 Foreign ownership of firms

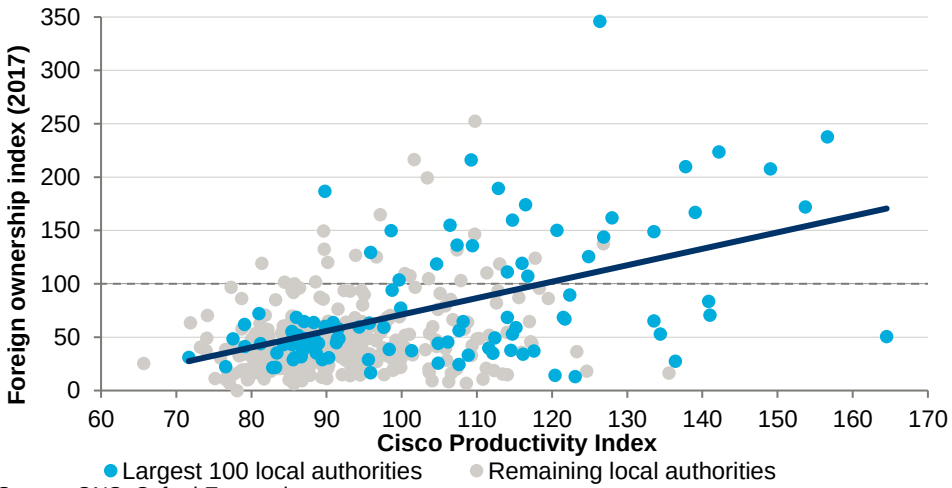
The proportion of foreign-owned firms in a local area is positively correlated with performance on the Cisco Index. Large urban areas tend to rank well by this measure: nine of the 10 Core Cities are ranked in the top half of local areas for foreign-owned firms (Liverpool is the exception, with a foreign-owned proportion of just 0.6 percent), while eight of the 16 highest levels of foreign ownership are found in Inner-London boroughs.

We can further explore this relationship by again controlling for the industrial profile of each local area. This ensures that higher scores for foreign ownership are not determined by the industry mix, as certain industries such as mining or

financial services are more likely to attract foreign ownership. As per the Cisco Productivity Index itself, scores over 100 indicate that a local area has a greater share of foreign-owned firms than is implied by its sector mix, and vice versa. When controlling in this way, we find an even-stronger relationship exists with the Cisco UK Productivity Index (see Fig. 17, overleaf). This may be connected with foreign-owned firms being both better positioned to benefit from best practice, and tending to be more innovative (see next section).

Only 50 local areas have a "larger-than-expected" concentration of foreign ownership, led by Westminster, with 3.5 times the concentration implied by its industrial makeup, followed by Bracknell Forest and Camden. By this measure, foreign ownership is smaller-than-expected for 38 of our grouping of 40 large urban areas outside London, with only Oxford and Cambridge bucking this trend.

Fig. 17. Index of foreign ownership, controlling for local areas' industrial makeup[12]



Source: ONS, Oxford Economics

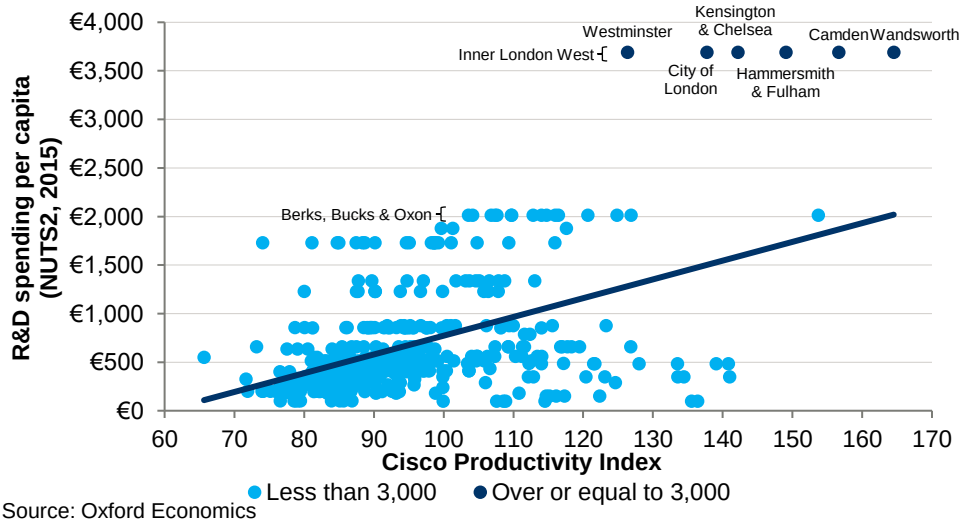
3.3.3 Innovation and exports

We find a strong relationship between spending on research & development (R&D) and performance on the Cisco Productivity Index. Data gathered by the EU provides an indication of spending per capita at the NUTS2 regional level.[13] The main outlier is in Inner London West, where R&D spending per capita is 83 percent higher than the next highest NUTS2 region: Berkshire, Buckinghamshire & Oxfordshire. Fig. 18 illustrates all NUTS2 regions broken up into their constituent local areas.

[12] Trendline shown for largest 100 local areas only.

[13] NUTS2 statistical regions refer to counties in England (many of them grouped), groups of districts in Greater London, groups of unitary authorities in Wales, groups of council areas in Scotland, and Northern Ireland.

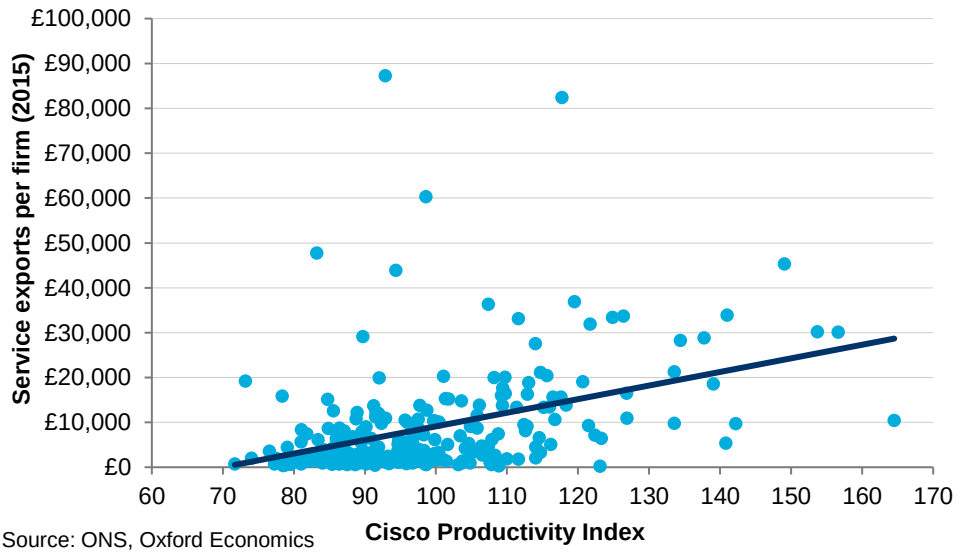
Fig. 18. R&D spending per capita at the NUTS2 regional level[14]



Source: Oxford Economics

The exporting of services is also linked to productivity performance—as illustrated in Fig. 19, which shows the positive relationship between local areas' average value of service exports (per firm), and their scores on the Cisco Index. Three-quarters of London boroughs are in the top 100 by this service exports measure, while the South East (56 percent) and Wales (50 percent) are similarly well represented. Firms that export services overseas compete in an international market and face greater competition, which encourages greater levels of innovation.

Fig. 19. Average value of exported services per firm (£)[15]



Source: ONS, Oxford Economics

[14] This chart presents NUTS2 data at a local authority level, for consistency.

[15] Excludes the outliers of Rushmoor (£231,700) and Hounslow (£128,200).

Note, however, that the precise form of exports is important. While the trade in services constitutes a majority of the value of UK exports, we find **no evidence of a positive relationship between the exporting of goods** (expressed in terms of the proportion of local area firms that export goods) and Cisco Index scores.[16]

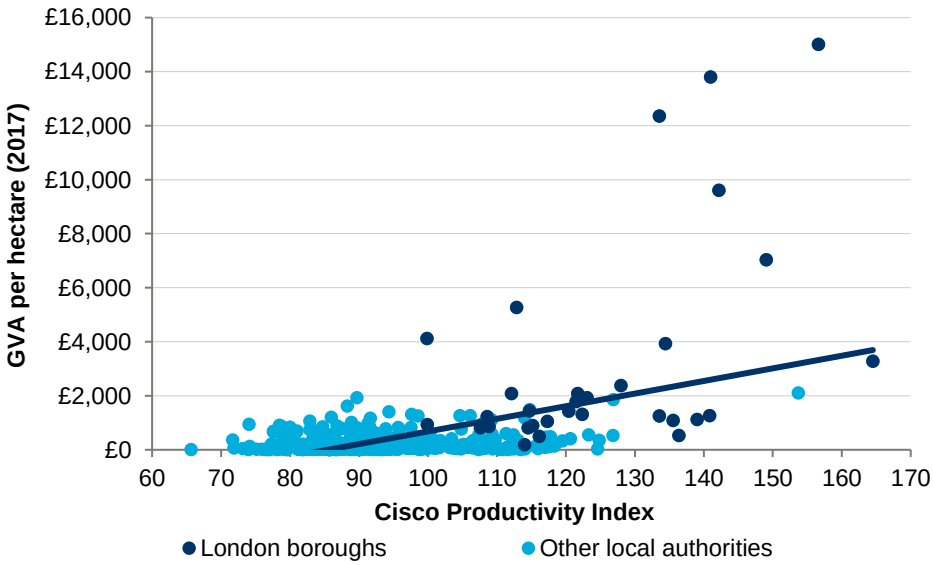
3.4 PILLAR 4: GEOGRAPHY AND TRANSPORT

Our fourth and final pillar of influence considers possible relationships between the differing characteristics of UK local areas, in terms of their structure, geography, and "connectivity" levels, and how they score in the Cisco UK Productivity Index.

3.4.1 Agglomeration

In economic terms, agglomeration refers to the benefits achieved when firms and people locate near one another. One way of measuring agglomeration is to assess the amount of GDP that is generated per hectare of land. Even after excluding two outliers—the City of London and Westminster[17]—London boroughs still comprise 17 of the 25 highest-ranked local areas, with Slough (13th), Watford (16th), and Reading (18th) the highest local areas outside the capital by this measure. But **a positive relationship also exists between agglomeration and the Cisco Index outside of London**.

Fig. 20. Annual density of economic output



Source: ONS, Oxford Economics

[16] Owing to survey design, we were only able to ascertain the proportion of firms that export goods, rather than the value of these goods, so this measure cannot be considered on a like-for-like basis against service exports.
[17] £172,700 and £27,900 per hectare respectively.

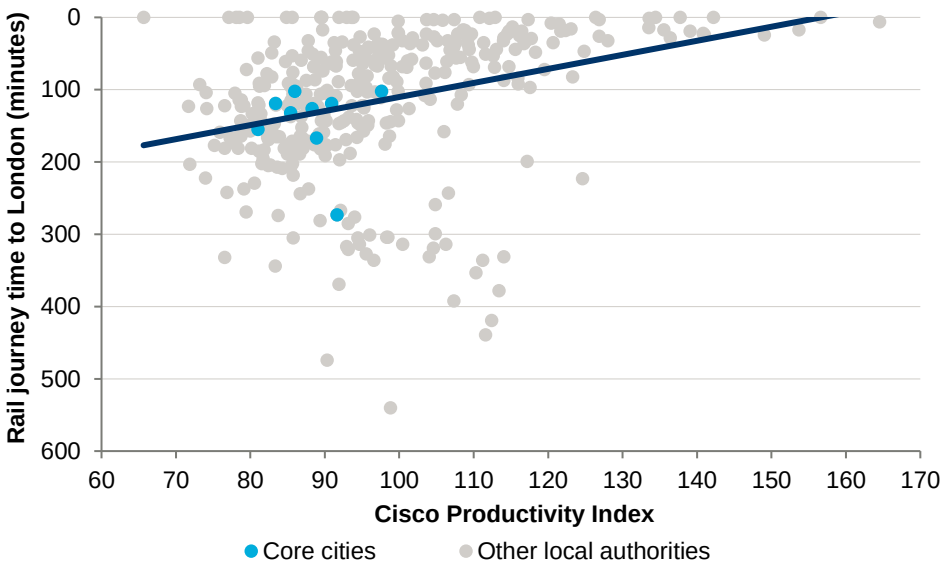
3.4.2 Geography and connectivity

Firms which operate in well-connected areas that benefit from good transport infrastructure can draw upon a wider pool of labour, generating obvious operational advantages. We capture this in various different measures of "connectivity"—and **find positive correlations with productivity performance in all cases**, as captured in the Cisco Index.

Rail access is a key measure of connectivity. Given London's position as the UK's centre of economic performance, we considered the journey time to any London terminal.[18] While we find a positive correlation with all local areas under this measure, the relationship becomes stronger when considering local areas in closer proximity to London.

The correlation is strongest for local areas located within a 90-minute journey time of London, which are therefore within its commuting catchment. From around two hours onwards, the relationship weakens. All of the Core Cities have a longer journey time than the local area average, and none of them are within 100 minutes of London (see Fig. 21, overleaf).

Fig. 21. Journey time from local area's principal rail station to a London terminal



Source: Office of Rail and Road, Oxford Economics

Whether moving people or goods, road transport far exceeds rail in terms of annual distances covered (in 2016, 80 percent of passenger kilometres were by car, van, or taxi, while the volume of freight moved by road was 10 times that moved by rail).[19] Our analysis again finds a **link between road connectivity and productivity, as measured by the Cisco Index**. But the

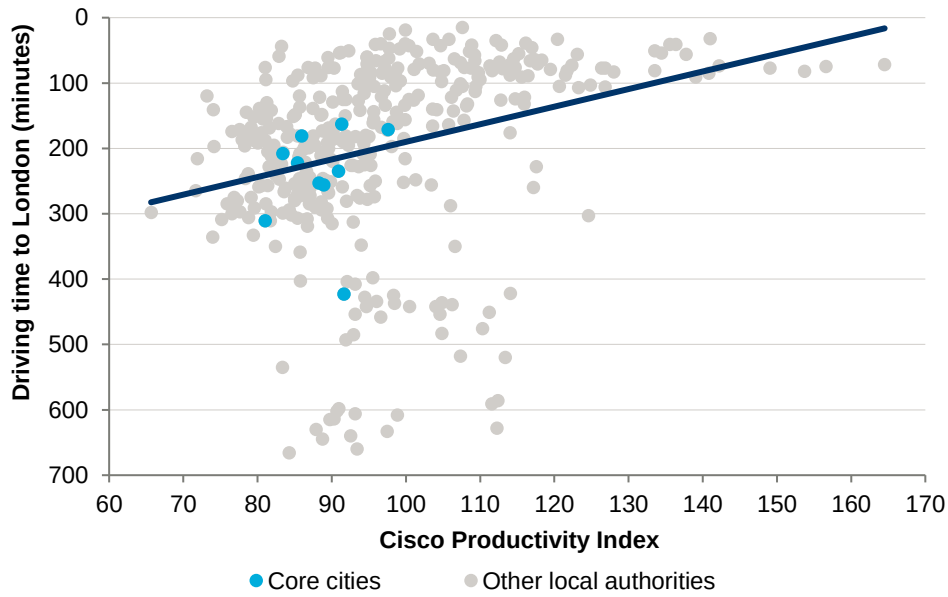
[18] During the morning rush hour; measured from each local area's most frequently used rail station.

[19] Transport Statistics Great Britain 2017 (Department for Transport, November 2017).

positive correlation between drive times[20] to five selected major cities[21] is largely driven by the 141 local areas for whom London is their closest major urban destination—underlining the importance of the UK capital in any measure of connectivity.

When considering the overall road journey times to London specifically, a similar relationship with the Cisco Index exists as for rail travel (see Fig. 22, overleaf).

Fig. 22. Drive time from each local area to London



Source: Oxford Economics

While rail and road links play a leading role in determining domestic connectivity differentials, **air travel is also strongly related to productivity performance**, our Index shows. A local area benefits from both its proximity to, and the size of, local airports.[22]

Combining these measures for each local area, and setting a distance threshold of 100km,[23] we formed a range of indices to test different measures of airport connectivity. We observe a stronger relationship exists when considering the **number of unique destinations directly accessed from each airport** than other measures such as number of flights or seat capacity (see Fig. 23, overleaf). Similarly, a measure of all destinations has a stronger

[20] Taken from the mid-point of each local area.

[21] Defined as Belfast, Birmingham, Glasgow, London and Manchester.

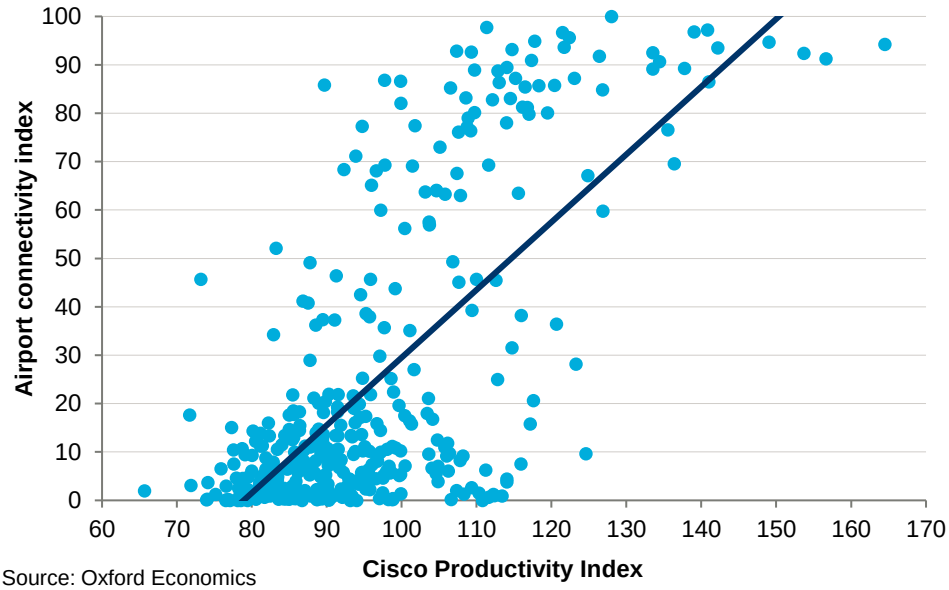
[22] Airports in Great Britain and the island of Ireland are considered separately.

[23] As per the Department for Transport's Journey Time Statistics for England, we estimated the distance between each local area and all commercial airports, forming an index that captures an aggregate combination of both the proximity to, and size of, airports within this threshold (as noted above, we tested various definitions of size). Local areas located closer to airport(s) score more highly, with those closer to larger airports scoring more highly still. Six local areas—Allerdale, Ceredigion, Copeland, Isles of Scilly, Pembrokeshire, and Powys—have no airports within this threshold, and are therefore scored zero on this index.

relationship than considering just international flights, or those to long-haul destinations.

Not surprisingly, Hounslow is the highest-scoring local area, owing to its proximity to Heathrow Airport. Similarly, 99 of the top-100 local areas by this measure are located in London, the South East, or East of England. Elsewhere, the poor performance of our chosen group of large urban areas is striking. Brighton (87th) and Oxford (89th) are the only local areas among this grouping of 40 non-London urban areas to rank in the top 100 for airport connectivity.

Fig. 23. Airport connectivity, by index of unique destinations



Source: Oxford Economics

4. INITIAL CONCLUSIONS

Productivity is a key determinant of living standards in the long run, and the UK has experienced persistent underperformance since the onset of the financial crisis**.** To shed new light on what factors are driving this weakness at a very local level, we created the Cisco UK Productivity Index.

The Index demonstrates some common geographic themes. London boroughs dominate the top of the new Cisco Index—with 15 of the 20 strongest-performing areas located in the capital—while the South East, East, and North West of England, plus the north east of Scotland, all demonstrate clusters of strong performance. At the other end of the scale, eight of the 20 weakest-performing areas are found in Wales. Another striking result is that the Index scores of all 10 Core Cities are below their industrial benchmark—just as their actual productivity levels are all below the UK average.

Large intra-regional variations are also observed in the Cisco Index, particularly in stronger-performing areas. This indicates that geography alone can only tell us part of the story. To explore the factors that are associated with relatively high, and low, productivity performance, we have considered a range of factors of potential influence across four broad pillars—technology; people; business structure and innovation; and geography and infrastructure.

Investment in technology is an important factor influencing the UK's local productivity levels. Productivity performance is correlated with a greater prevalence of both investment in technology by firms and digital technology occupations in the workforce, particularly IT directors and professionals. This is a particularly common characteristic of those local areas that perform best on the Cisco Index. Further data on the accumulation of capital and, in particular, technology stock at a firm level, alongside other enabling factors such as workforce digital skill levels, would be very useful in enabling a more in-depth investigation of this relationship.

However, there are a wide range of other factors that business, government, and other interested parties need to focus on—all of which will also help unlock technology's productivity potential. Workforce skill levels are closely linked to productivity performance at a local level, highlighting the importance of investment in education, training, and workforce "upskilling". Business structure is also key to encouraging innovation, which can in turn unlock higher levels of productivity. We note that areas with a high proportion of firms with "beneficial characteristics" (for example, smaller and younger; foreign-owned; engaging in R&D; and internationally competitive) are likely to show above-benchmark performance on the Cisco Index.

These factors are underpinned by infrastructure. The Index highlights that productivity performance is linked not only to dense concentrations of economic activity, but also to the quality of a local area's "connectivity"—physical as well as digital. Transport is a key factor in this regard, particularly for many cities outside the South East of England, where the weakness of

existing infrastructure may need to be overcome before their full potential can be unlocked.

This report underlines that productivity performance is anything but uniform across the UK. Tackling underperformance at a local level demands greater understanding of the underlying characteristics that differentiate local areas' productivity levels. While our modelling has identified some of the characteristics that are more strongly correlated with productivity, the next stage of research would be to quantify the relative strength of these correlations, and to determine the "direction of causality" for these influencing factors. In so doing, very different policy priorities could emerge for different local areas around the UK, depending on which factors are identified as the biggest drags on productivity for their particular set of industrial, geographical, business, and population circumstances.

The benefits of enhancing the productivity levels of underperforming areas are made clear—and quantifiable—through the Cisco Index. Were every "underperforming" local area on the Index able to match its industrial benchmark (ie. achieve a score of 100), we calculate this would add £140 billion to the UK's annual GDP in 2018—increasing the size of the national economy by around 7.5 percent. Perhaps more importantly, this productivity growth would be concentrated on those regions that are currently feeling the greatest pressures as a result of the UK's persistent productivity problem.

APPENDIX 1: THE CISCO UK PRODUCTIVITY INDEX IN FULL

Rank	Local area	Index		Rank	Local area	Index		Rank	Local area	Index
1	Wandsworth	164.5		34	Tandridge	117.0		67	Suffolk Coastal	109.3
2	Camden	156.6		35	Guildford	116.8		68	Epsom & Ewell	109.3
3	Slough	153.7		36	Windsor & Maidenhead	116.5		69	Crawley	109.2
4	Hammersmith & Fulham	149.1		37	Bromley	116.1		70	Redbridge	108.9
5	Kensington & Chelsea	142.2		38	West Berkshire	116.0		71	St Albans	108.8
6	Tower Hamlets	141.0		39	Fenland	115.9		72	Waltham Forest	108.6
7	Richmond upon Thames	140.8		40	Hart	115.6		73	New Forest	108.3
8	Hillingdon	139.0		41	Croydon	115.2		74	Swindon	108.2
9	City of London	137.7		42	Oxford	114.7		75	Stevenage	107.9
10	Havering	136.4		43	Merton	114.7		76	Stratford on Avon	107.8
11	Barking & Dagenham	135.5		44	Enfield	114.5		77	Aylesbury Vale	107.6
12	Lambeth	134.4		45	East Lothian	114.1		78	Bexley	107.6
13	Islington	133.5		46	Barnet	114.0		79	Wycombe	107.4
14	Harrow	133.5		47	South Gloucestershire	114.0		80	Runnymede	107.4
15	Hounslow	128.0		48	Chiltern	114.0		81	Perthshire & Kinross	107.3
16	Reading	126.9		49	Angus	113.4		82	South Oxfordshire	106.8
17	Woking	126.8		50	Three Rivers	113.0		83	Barrow in Furness	106.6
18	Westminster	126.4		51	Southwark	112.9		84	Hertsmere	106.5
19	Wokingham	124.8		52	Cherwell	112.8		85	Warwick	106.4
20	Ribble Valley	124.6		53	Uttlesford	112.6		86	East Renfrewshire	106.2
21	Havant	123.3		54	Aberdeen City	112.4		87	Southampton	106.1
22	Haringey	123.1		55	Mid & East Antrim	112.2		88	Fylde	106.0
23	Kingston upon Thames	122.4		56	Newham	112.1		89	Thurrock	105.8
24	Brent	121.7		57	Waverley	111.6		90	North Warwickshire	105.8
25	Ealing	121.5		58	Aberdeenshire	111.6		91	Dacorum	105.1
26	Milton Keynes	120.7		59	Spelthorne	111.3		92	Fife	104.9
27	Lewisham	120.4		60	Clackmannanshire	111.2		93	Edinburgh	104.8
28	Surrey Heath	119.5		61	Shetland Islands	110.8		94	East Cambridgeshire	104.8
29	Mole Valley	118.3		62	South Ayrshire	110.3		95	Brentwood	104.7
30	Elmbridge	117.8		63	East Hampshire	110.0		96	Luton	104.6
31	Cheshire East	117.6		64	Bracknell Forest	109.7		97	West Dunbartonshire	104.6
32	Sutton	117.3		65	South Bucks	109.7		98	West Oxfordshire	104.1
33	Knowsley	117.2		66	Basingstoke & Deane	109.4		99	East Dunbartonshire	104.0

Rank	Local area	Index	Rank	Local area	Index	Rank	Local area	Index
100	North Hertfordshire	103.7	139	Bristol	97.6	178	Portsmouth	94.3
101	Gravesham	103.6	140	Gloucester	97.5	179	Forest of Dean	94.3
102	Hinckley & Bosworth	103.6	141	Antrim & Newtownabbey	97.5	180	Monmouthshire	94.2
103	Vale of White Horse	103.6	142	Horsham	97.2	181	Allerdale	94.0
104	Halton	103.4	143	Kettering	97.2	182	Rushmoor	93.9
105	East Hertfordshire	103.1	144	Ashford	97.1	183	Rossendale	93.8
106	Welwyn Hatfield	101.8	145	Bedford	97.1	184	Nuneaton & Bedworth	93.8
107	Winchester	101.7	146	Dover	97.1	185	Staffordshire Moorlands	93.6
108	Epping Forest	101.5	147	Tendring	96.8	186	East Northamptonshire	93.6
109	Cheshire West & Chester	101.3	148	Fareham	96.7	187	Eastbourne	93.5
110	South Cambridgeshire	101.1	149	Bromsgrove	96.7	188	Causeway Coast & Glens	93.4
111	Test Valley	101.0	150	Sevenoaks	96.6	189	West Lancashire	93.4
112	Falkirk	100.5	151	Inverclyde	96.6	190	South Derbyshire	93.2
113	Eastleigh	100.4	152	West Lothian	96.0	191	North Ayrshire	93.2
114	Tonbridge & Malling	100.4	153	Mid Sussex	96.0	192	Copeland	93.1
115	Greenwich	99.9	154	Trafford	95.9	193	Lisburn & Castlereagh	93.1
116	North Lincolnshire	99.9	155	Medway	95.9	194	Stirling	92.9
117	Melton	99.9	156	Darlington	95.8	195	North Tyneside	92.9
118	Hackney	99.9	157	Arun	95.7	196	Rhondda Cynon Taff	92.8
119	Rugby	99.8	158	Coventry	95.7	197	Bridgend	92.6
120	Bath & North East Somerset	99.7	159	Cotswold	95.7	198	North Down & Ards	92.5
121	Warrington	99.7	160	Rushcliffe	95.6	199	Harlow	92.3
122	Babergh	99.2	161	South Lanarkshire	95.5	200	North Somerset	92.2
123	Castle Point	99.1	162	Wealden	95.3	201	Dumfries & Galloway	92.1
124	Maldon	98.9	163	Vale of Glamorgan	95.2	202	Redcar & Cleveland	92.0
125	Moray	98.8	164	St Helens	95.2	203	Gedling	91.9
126	North Norfolk	98.8	165	Isle of Wight	95.2	204	Dundee City	91.9
127	Solihull	98.7	166	Forest Heath	95.1	205	Gosport	91.9
128	Waveney	98.7	167	Tewkesbury	95.0	206	Oadby & Wigston	91.8
129	Mid Suffolk	98.6	168	Flintshire	94.8	207	Glasgow City	91.7
130	Cambridge	98.6	169	Swale	94.8	208	South Northamptonshire	91.5
131	Renfrewshire	98.5	170	Canterbury	94.8	209	Daventry	91.5
132	North Lanarkshire	98.3	171	Broxbourne	94.7	210	Derby	91.5
133	Great Yarmouth	98.3	172	Midlothian	94.7	211	Northampton	91.4
134	Bolsover	98.1	173	Huntingdonshire	94.6	212	High Peak	91.4
135	Shepway	98.0	174	Stroud	94.6	213	Birmingham	91.3
136	Dartford	97.8	175	Adur	94.5	214	Chelmsford	91.3
137	Reigate & Banstead	97.7	176	East Ayrshire	94.4	215	South Staffordshire	91.2
138	Rochford	97.7	177	Derbyshire Dales	94.4	216	Maidstone	91.1

Rank	Local area	Index		Rank	Local area	Index		Rank	Local area	Index
217	Armagh, Banbridge & Craigavon	90.9		256	Chesterfield	88.5		295	Middlesbrough	85.6
218	Leeds	90.9		257	Harborough	88.5		296	Sefton	85.6
219	Newry, Mourne & Down	90.7		258	Peterborough	88.4		297	Wigan	85.6
220	Charnwood	90.5		259	Manchester	88.3		298	Stoke on Trent	85.5
221	Highland	90.3		260	Mid Ulster	87.9		299	Newcastle under Lyme	85.5
222	Rother	90.3		261	Pendle	87.8		300	Stockport	85.4
223	Wyre Forest	90.2		262	Central Bedfordshire	87.8		301	Hastings	85.4
224	Redditch	90.2		263	Braintree	87.8		302	Sheffield	85.4
225	Weymouth & Portland	90.2		264	Malvern Hills	87.7		303	Gateshead	85.4
226	Herefordshire	90.1		265	Worthing	87.5		304	South Ribble	85.4
227	Breckland	90.1		266	Wychavon	87.5		305	Cannock Chase	85.4
228	Broxtowe	90.1		267	King's Lynn & West Norfolk	87.5		306	South Holland	85.1
229	Eden	90.0		268	Bradford	87.1		307	Rochdale	85.0
230	Selby	89.9		269	Stockton on Tees	87.1		308	Hartlepool	85.0
231	Salford	89.8		270	Kingston upon Hull	87.0		309	Broadland	85.0
232	Belfast	89.8		271	Wyre	87.0		310	Chorley	85.0
233	Newark & Sherwood	89.7		272	Rotherham	86.9		311	East Dorset	84.8
234	Watford	89.7		273	West Lindsey	86.8		312	Ipswich	84.7
235	North West Leicestershire	89.6		274	Brighton & Hove	86.8		313	Scarborough	84.6
236	Bury	89.6		275	South Lakeland	86.7		314	Lichfield	84.4
237	Amber Valley	89.6		276	Pembrokeshire	86.7		315	Sunderland	84.3
238	Thanet	89.5		277	Ryedale	86.6		316	Derry & Strabane	84.2
239	Tunbridge Wells	89.5		278	East Riding of Yorkshire	86.6		317	Wolverhampton	84.0
240	South Tyneside	89.4		279	North East Lincolnshire	86.4		318	Boston	83.9
241	Wirral	89.4		280	East Staffordshire	86.4		319	North Devon	83.7
242	Erewash	89.4		281	Oldham	86.4		320	South Hams	83.6
243	West Devon	89.4		282	Kirklees	86.3		321	Sedgemoor	83.5
244	Wrexham	89.2		283	Doncaster	86.2		322	Preston	83.4
245	Cheltenham	89.2		284	Bassetlaw	86.2		323	Cardiff	83.4
246	North East Derbyshire	89.1		285	Nottingham	86.0		324	Argyll & Bute	83.3
247	Tameside	88.9		286	Teignbridge	85.9		325	Shropshire	83.2
248	Liverpool	88.9		287	Harrogate	85.9		326	Basildon	83.2
249	York	88.8		288	Scottish Borders	85.8		327	Mid Devon	82.9
250	Fermanagh & Omagh	88.7		289	Northumberland	85.7		328	Southend on Sea	82.9
251	Tamworth	88.7		290	Wakefield	85.7		329	Leicester	82.9
252	South Norfolk	88.7		291	Corby	85.7		330	Taunton Deane	82.7
253	County Durham	88.6		292	East Lindsey	85.7		331	East Devon	82.6
254	Hyndburn	88.6		293	West Somerset	85.6		332	Neath Port Talbot	82.5
255	Lewes	88.5		294	Wellingborough	85.6		333	Carlisle	82.4

Rank	Local area	Index		Rank	Local area	Index		Rank	Local area	Index
334	Barnsley	82.3		354	Christchurch	80.3		373	Eilean Siar	78.1
335	Stafford	82.2		355	Calderdale	80.2		374	Newport	77.9
336	Blaby	81.9		356	Mansfield	80.0		375	Blackpool	77.6
337	Craven	81.8		357	Worcester	80.0		376	Sandwell	77.6
338	Caerphilly	81.8		358	Torridge	79.6		377	Blackburn with Darwen	77.3
339	Gwynedd	81.7		359	Mendip	79.5		378	Orkney Islands	77.1
340	Purbeck	81.6		360	South Kesteven	79.5		379	Carmarthenshire	76.9
341	Merthyr Tydfil	81.5		361	Ceredigion	79.4		380	North Dorset	76.6
342	Telford & Wrekin	81.4		362	North Kesteven	79.1		381	Cornwall	76.6
343	Hambleton	81.4		363	Plymouth	79.1		382	Powys	76.5
344	Rutland	81.2		364	Dudley	79.1		383	Denbighshire	75.9
345	Wiltshire	81.2		365	Lancaster	78.8		384	Conwy	75.2
346	St Edmundsbury	81.1		366	Lincoln	78.8		385	Torfaen	74.1
347	Burnley	81.1		367	Exeter	78.7		386	Norwich	74.0
348	South Somerset	81.0		368	Ashfield	78.7		387	Anglesey	74.0
349	Colchester	81.0		369	Isles of Scilly	78.5		388	Chichester	73.2
350	Newcastle upon Tyne	81.0		370	Bournemouth	78.5		389	Blaenau Gwent	71.9
351	Poole	80.7		371	Swansea	78.3		390	Bolton	71.7
352	Torbay	80.6		372	West Dorset	78.3		391	Richmondshire	65.7
353	Walsall	80.5								

Source: Oxford Economics



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