

# West of England Economic Connectivity

February 2019

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The purpose of this document is to provide strategic insights that will inform the priorities in the West of England Combined Authority's (WECA) Local Industrial Strategy. This aims to strengthen WECA's evidence base and help identify what makes the West of England (WoE) region genuinely distinctive. The analysis explores the economic connectivity between the WoE region, the rest of the UK, and beyond. A deeper understanding of these interconnections could identify opportunities to strengthen the WoE's role in driving growth in the wider UK economy.

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# Summary of ‘Business linkages’ analysis

Below, we set out a summary for each section of the economic connectivity analysis including: the purpose of the analysis; the key findings; and potential implications for consideration. Please see the main body of the report for more detail on the approach, analysis and conclusions.



## **Purpose of Business linkages analysis**

The UK Industrial Strategy sets out an ambition to “make better connections between high-performing businesses and their supply chains.” Our analysis aims to provide insight into the role that WoE businesses play in the wider supply chain. It explores how important sectors in the WoE could strengthen their supply chain linkages and drive productivity growth by collaborating with businesses across the rest of the UK.

## **Summary of key findings**

- **Sector analysis**
  - Based on employment and comparative advantage in the WoE, five prominent sectors have been identified: (i) Manufacture of other transport equipment; (ii) Information services; (iii) Architectural and engineering activities; (iv) Insurance services; and (v) Financial services.
  - Although manufacturing is prominent across the WoE boasting 8000 jobs, information services has seen the fastest growth in LQ (41.5%) since 2009.
  - Productivity in the WoE is £34.50 per hour which is driven by productivity within the Insurance services sector. However, the WoE has seen a relative decline in growth in this sector since 2009.
- **Agglomeration analysis**
  - Overall WoE is better connected to metropolitan areas such as Birmingham, London, Oxford, than Southern counterparts of Exeter and Southampton. This provides evidence as to where the greatest economic returns are for WoE businesses to collaborate.
  - Short-distance connectivity is extremely important for the region, as it supports strong levels of agglomeration. The analysis highlights the high value of these linkages, however it does not help explain the volume of collaboration occurring between the region and other areas of the UK and Europe.
  - Other economic hubs such as London, Manchester and Birmingham may be better connected than the WoE. However, this does not capture the unique sectoral composition of the area, which has above average levels of productivity and has a strong services economy.
- **Trade flows**
  - The WoE has a net trade position of a £894m surplus which is driven by the export of services (worth £2.5bn).
  - The WoE region has a trade deficit in terms of goods i.e. it imports more goods than it exports. This is quite typical of higher growth economic areas where households have higher disposable income and therefore demand for imported goods is higher.
  - In Bristol there is a lesser amount of goods exports (4.6%) and significant levels of exports from services (9.9%). This infers that the Bristol economy is predominantly based on services which is likely to present high levels of innovation and productivity.



## **Potential implications**

- The WoE has a broad set of sectoral specialisms, which positions the region well to deliver both sustainable and inclusive growth.
- The WoE region will benefit from greater economic returns by building stronger relationships with core cities areas and across the M4 corridor.
- The strong goods trade position in the WoE which is driven by EU exports (£2.85bn) may be at risk as a result of the EU Exit.



# Summary of 'Infrastructure connectivity' analysis



## **Purpose of Infrastructure connectivity analysis**

As the WoE develops a Local Industrial Strategy to achieve long-term sustainable growth, it will be critical to build strong infrastructure that connects the WoE to key economic corridors across the country. Greater connectivity with other regions could better connect people to more suitable jobs and enable stronger supply chain linkages for businesses. This could boost productivity and increase the WoE's role in driving growth in the wider economy.

## **Summary of key findings**

### • Severn Bridge toll removal

- Due to the varying assumptions and scope of the existing literature around the Severn Bridge toll removal, there seems to be inconclusive evidence around the impact on traffic flows and the wider economic impact of the proposed intervention.
- The DfT report models the proportionate change in traffic flows over the next 10 years and the impact of reducing the tolls rather than full removal of the toll, which makes it challenging to compare to traffic modelling analysis undertaken by the Welsh Government.
- There are also significant differences between the assumptions in the baseline data around traffic flow growth between 2018 and 2027/28; with the Welsh Government and DfT proposing 11.7% and 28% respectively, potentially due to difference in base years in the analysis.
- The Atkins reports builds upon the impact assumptions from the DfT and Welsh Government reports to build high and low growth scenarios. Overall, there is limited evidence that models the impact on the wider WoE economy as a result of the removal of the tolls; particularly as the Welsh Government 2012 report focuses on the economic benefits for South Wales.
- Surveys suggest that businesses think that the removal of the tolls may benefit their businesses; however this may not be a direct impact in terms of a reduction in their operating costs. In some industries (e.g. logistics and transport), increases in traffic flow may offset the benefit of reduced operational costs.

### • Digital connectivity

- Within the WoE region, the proportion of internet users is consistently above the national average, reaching 92.8% and 93% respectively for Bristol, and the group of Bath & NE Somerset, N Somerset, and S Gloucestershire.
- There is significant variability across local authorities in the availability of Ultrafast Broadband with 60% of premises in S. Gloucestershire having access to these broadband speeds compared to 1% of premises in N. Somerset. This picture is evolving rapidly, however, with ongoing programmes supporting more digital connectivity.
- Bristol has the strongest 4G connection within the WoE both inside (77.3% coverage) and outside (98.9% coverage) of buildings, however, other local

## **Potential implications**

- Given the projected increase in the population of WoE residents (see People section), current levels of migration inflow into the area and the expected rise in commuters from the Severn Bridge Toll removal, there may be additional value in improving transport connectivity both within the region and for connections to key economic corridors in the UK.
- Improving digital connectivity across the WoE will boost productivity and the capacity of local businesses, contributing to both the regional and national economies.



Infrastructure



# Summary of 'Movement of people' analysis



## **Purpose of Movement of people analysis**

In order to drive clean and inclusive growth, the WoE economy needs to prepare for rapidly changing social demographics and understand the potential impact on its workforce and infrastructure. This analysis reveals insight into how people travel for work and what sectors are in need of support to facilitate higher growth. It also explores the flow of people with other areas in the UK to identify areas of potential collaboration with Local Industrial Strategies developed elsewhere.

## **Summary of key findings**

- **Travel to work flows**
  - In the finance, insurance and information service sectors identified in the 'Business linkages' section, people tend to be commuting shorter distances on average, particularly in comparison to each sector nationally. In other sectors such as manufacturing, this trend is not as pronounced.
  - In finance and insurance, the proportion of people commuting under 10km in the WoE was 12% more than E&W and 11% lower for journeys over 10km.
  - The Travel to Work survey (2018) estimates that 44% of employees working in the WoE favour their car to commute versus other modes of transport.
- **Migration flows**
  - Historically, there has been an upwards trend in the inflow of short-term international migration into the WoE region, driven by people moving for jobs and study opportunities. However, since 2015 there has been a sharp decline in the net inflow of long-term international migration, driven mainly by Bristol.
  - Falling inflows in long-term international migration may be partially explained by a fall in the national inflows of migrants from abroad but the outflows from the WoE region are the fifth highest of all LEPs in the UK. This slowdown is also consistent with trends in internal migration from other UK regions.
  - The WoE experiences a significant inflow of young people aged 15-24, covering 40% of the total inflows of people. However, this has recently slowed down due to the recent outflows of young people from the WoE area.
  - The WoE attracts a net inflow of people from London and the South East whilst seeing a net outflow of migration to nearby areas such as Gloucestershire and South Wales.
- **Population projections and graduate retention**
  - The region is forecast to see above average growth in its working age population (10%) versus the South West (2.4%) and England (2.6%). However, a challenge still remains for the WoE regarding an aging population, with the 65+ population expected to grow by 37%.
  - Over 70% of students from the WoE stay in the region immediately after graduating and only one in ten leave for London. This compares favourably with other regions such as Enterprise M3 and Oxfordshire LEP.



**Movement  
of people**



## **Potential implications**

- Improving infrastructure within the WoE will better connect people to jobs opportunities both in and outside of the region; this could reduce congestion and the number of people who move out of the WoE for employment.
- The slowdown of net internal migration flows into the WoE may be partially explained by trends in the national economy but this may also be as a result of other wider issues around infrastructure and housing. Given the projected increase in WoE's population, there may be an opportunity to invest in improving infrastructure and incentivise commuters to use public transport more regularly.
- Given projected demographics, it may be important to consider the WoE's contribution to the 'ageing population' Grand Challenge in the Industrial Strategy.

# Summary of 'Flow of ideas' analysis



## Flow of ideas



### **Purpose of Flow of ideas analysis**

The WoE's Local Industrial Strategy should set out how it could help the UK to achieve its ambition of being "the world's most innovative economy." This analysis provides strategic insight into the whole innovation life cycle from seeding an idea; to testing and developing; and finally to scaling and commercialisation. It demonstrates the impact of collaboration between universities and businesses and how this could further drive productivity growth across the country.

### **Summary of key findings**

- **Academic Collaboration**
  - Universities in the WoE show a higher level of collaboration with other national institutions than their UK and European counterparts. The University of the West of England (UWE) produces over 30% of papers in collaboration with other national institutions, which is the highest of the Universities in the WoE. The Universities of Bath and Bristol both average over 50% of their papers with international institutions.
  - Universities in the WoE have a tendency to collaborate more with closer universities that are well connected to the WoE region.
  - The University of Bristol ranks seventh in the UK in the value of income from business activities. This suggests strong connections with local enterprise.
- **Fostering entrepreneurial activity within the business community**
  - WoE universities have a strong reputation for seeding and supporting spin-off businesses, particularly in connecting innovators with investment opportunities. University of Bath ranks 9th in the UK for the estimated turnover of its spin-off enterprises.
  - The ScaleUp Institute's 2018 ScaleUp review found that WoE businesses are also finding good connections to public investment, through the likes of Innovate UK grants. WoE consistently ranks in the top 5 LEP areas for value of Innovate UK grants secured, but has been recently overtaken by areas such as Coventry, Warwick and Oxfordshire.
  - Innovative businesses in the region are experiencing three main constraints, access to talent, support to penetrate international markets, and access to both physical and digital infrastructure.
- **Fostering entrepreneurial activity within the business community**
  - Businesses in the WoE have an R&D spend on par with the national average. However, the WoE files more patent applications than both UK and European benchmarks. This may be driven by a smaller number of highly active firms, such as Rolls-Royce, BAE systems and Airbus. These three firms have been in the top 20 of UK patent office applications for the last three years.
  - South West regional performance is low across a number of innovation metrics, including R&D tax credits and R&D spend.



### **Potential Implications**

- The WoE is starting from a position of strength. The Ideas landscape is well-connected throughout the WoE economy and spans more widely to other regions in the UK. The major implication for WECA is to build on this strength and sustain growth. In addition, the WoE could look to support the wider South West region, improving performance against wider innovation indicators.
- To facilitate an environment with a stronger flow of ideas, it will be important to assess the level of support for WoE's universities, ability to attract talent and physical and digital infrastructure.

# Business Linkages



# Business Linkages: Report Structure

The UK Industrial Strategy sets out an ambition to “make better connections between high-performing businesses and their supply chains.” Our analysis aims to provide insight into the role that WoE businesses play in the wider supply chain. It explores how important sectors in the WoE could strengthen their supply chain linkages and drive productivity growth by collaborating with businesses across the rest of the UK.

This business linkages section consists of four parts:

**Section A – Agglomeration analysis:** In this section, the economic benefits that arise from between region agglomeration (the concentration of economic activity and resources) are explored as well as the likelihood of the presence of these effects in the WoE region and their strength relative to other economic hubs.

**Section B – Economic value created by growth in WoE:** In this section, a regional economic model of the UK economy has been used to calculate a range of economic multipliers for the WoE, the M8 (excl. London and Bristol) and the rest of the UK. This set of multipliers covers the expected economic benefits from business investment, external trade, GVA and job growth. They serve to illustrate the potential benefits for the WoE economy and spillover impacts elsewhere.

**Section C - Sectoral analysis:** This section identifies the sectors that have high regional concentrations in the WoE compared to the rest of the country. This highlights WoE’s unique sectoral capabilities which have the potential to drive growth in the wider economy.

**Section D – Trade flows:** This section provides insight into the international trade patterns of WoE businesses. It builds a ‘big picture’ view of trade for the WoE using goods trade data from HMRC/ONS and experimental estimated data for the trade of services (from national data) to identify areas of strength that contribute to the WoE trading performance.

# Section A: Agglomeration analysis

# Agglomeration analysis approach

## Purpose of analysis

The purpose of this analysis is to illustrate how well connected the WECA region is to other economic hubs in the UK. In a perfect world we would analyse key linkages between regions such as trade flows (e.g. how much does WoE export to London and vice versa), business trips, strength and type of supply chains. However, this data does not exist, so alternative measures must be used.

There is a body of academic literature that does seek to approximate the scale of these relationships – through what is known as agglomeration elasticities. A typical interpretation of one of these elasticities would be: *what happens to employment growth if travel times between two regions are cut/changed?* However, there are multiple ways in which the analysis can be specified – we look at business revenues per employee and relate that to a range of variables: travel times, land use change, employment growth, business growth, changes in business composition.

The analysis is based on the theory of access to economic mass, often defined as total employment/scale of business revenue . Businesses will benefit from access to economic mass through more integrated supply chains, collaboration with similar businesses and integrated labour markets.

## Areas of analysis

The following slides set out:

- The high-level approach, which includes econometrics work, to quantify agglomeration effects for the WoE with other major economic hubs
- The importance of connectivity and the wider benefits better connectivity brings to the WoE economy, accompanied by an explanation of both short and long-distance connectivity measures.
- A set of graphs which compare different connectivity routes between the WoE and other major economic hubs, including London, Birmingham and Manchester.

# Key findings- Agglomeration Analysis

## Approach

Our analysis of economic linkages between regions captures two different relationships in two separate pieces of analysis.

- 1) A map showing an index of density of economic activity in England and Wales. This index serves in part as a proxy for economic connectedness – more focussed on short distance relationships
- 2) An econometric assessment of the strength of linkages between different regions in the UK – more focussed on long-distance relationships

To conduct our analysis we have used specialist data procured from third parties that incorporates firm level financial data, post code level travel time and wage data.

From these two pieces of analysis we draw the following conclusions:

**The linkages between the WoE region and key hubs such as London, Birmingham, Cardiff and Oxford are much stronger than those with Southern economic hubs such as Exeter, Southampton and Bournemouth/Poole.**

Secondly, the **linkages on a per capita basis between Bristol-London and Birmingham-London are broadly of the same strength and actually potentially larger** if we think of the WoE region collaborating with the Eastern end of the M4 corridor between London and Reading. Links between Bristol-Birmingham are still well above the national average, but not as strong. Separately we also see that these linkages are just as strong as those between Bristol and Cardiff. While the links between Bristol and Oxford are as strong again as Birmingham's.

Overall, this analysis points to the **WoE region's economic connectivity being more focused to the East and North as opposed to the South which it is often associated with.** These linkages are strong and little has been said about their relative size until now. **The implication of this connectivity is that the WoE plays a substantive role in driving the performance of the UK economy through creation of linkages in terms of people, ideas and supply chains.** Going forwards the parts of the WoE's economy that are focussed on services could provide a platform for greater collaboration between these regions. **Linkages tend to be driven more by innovation led activity.**

# Section A: Detailed analysis



# Having a well connected region can will help boost WoE's business productivity

## What is agglomeration?

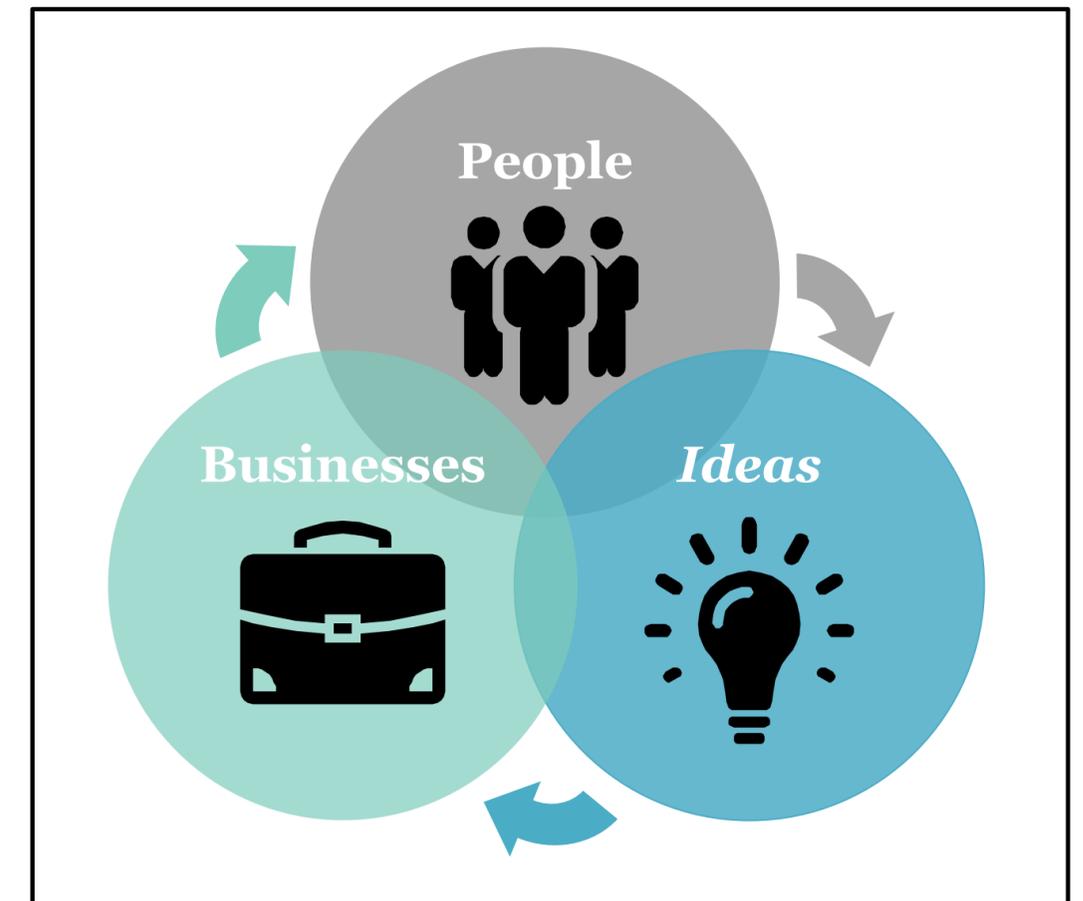
Agglomeration economies are the benefits that arise when firms and people locate closer together in cities and industrial clusters. This can result in higher productivity and lower travel costs, including reduced time costs as well as monetary transport costs. More specifically, a concentration of economic activity brings a combination of scale and density that can make workers and firms more productive and, in many cases, more innovative. **Agglomeration can be measured by an area's access to economic mass**; how easy it is for firms and workers to communicate, compete, and trade with a large mass of other firms, workers, and consumers.

## Why is this important for the WoE?

As highlighted above, the positive externalities that arise from agglomeration in the WoE extend to the wider UK economy - beyond the benefits that accrue to individual firms themselves. There are three main benefits of agglomeration that arise from the WoE having strong connectivity with other areas in the UK:

1. **Labour market interactions** – local businesses are more able to recruit from a larger pool of people with relevant skills
2. **Knowledge spillovers** – concentration of firms and workers makes it easier to exchange ideas and information, which often occurs over smaller geographies
3. **Integrated supply chains** – stronger linkages lead to reduced transport costs, the ability to share resources, supply chains and infrastructure

Strong economic flows between the WoE and other regions through the greater concentration of businesses and workers could unleash additional productivity gains for the WoE and national economy.



# The analysis has been built on a three step approach

As highlighted in the previous slide, agglomeration benefits and connectivity between regions can be measured by access to economic mass. The underpinning data and economic analysis to estimate access to economic mass across different regions has drawn upon work previously completed for Highways England, which has been peer reviewed by expert academics. The approach to the analysis around economic connectivity for the WoE is set out three key stages below.



## Step 1

**Estimate the level of access to economic mass for the WoE and other economic hubs across the UK.** The analysis weights employment by 'optimised travel times'. This is defined as the shortest time taken to travel between regions, rather than straight line distances. This is presented as an index that shows the level of connectivity between regions - a high index implies that an area is well-connected to areas of high economic mass (i.e. employment) across the UK and Europe.

## Step 2



**Illustrate graphically the agglomeration decay between the WoE and other major economic hubs in the UK.** The decay function shows how agglomeration 'decays' over longer distances/travel times between two regions i.e. show how the level of connectivity changes between two areas. Travel time data will be collected between Bristol (as the major economic transportation hub in the WoE) and various locations, including London, Birmingham, Oxford, Exeter and Manchester. This will be mapped out against the levels of agglomeration for each location to produce a decay function reflected by the gradient of the curve.

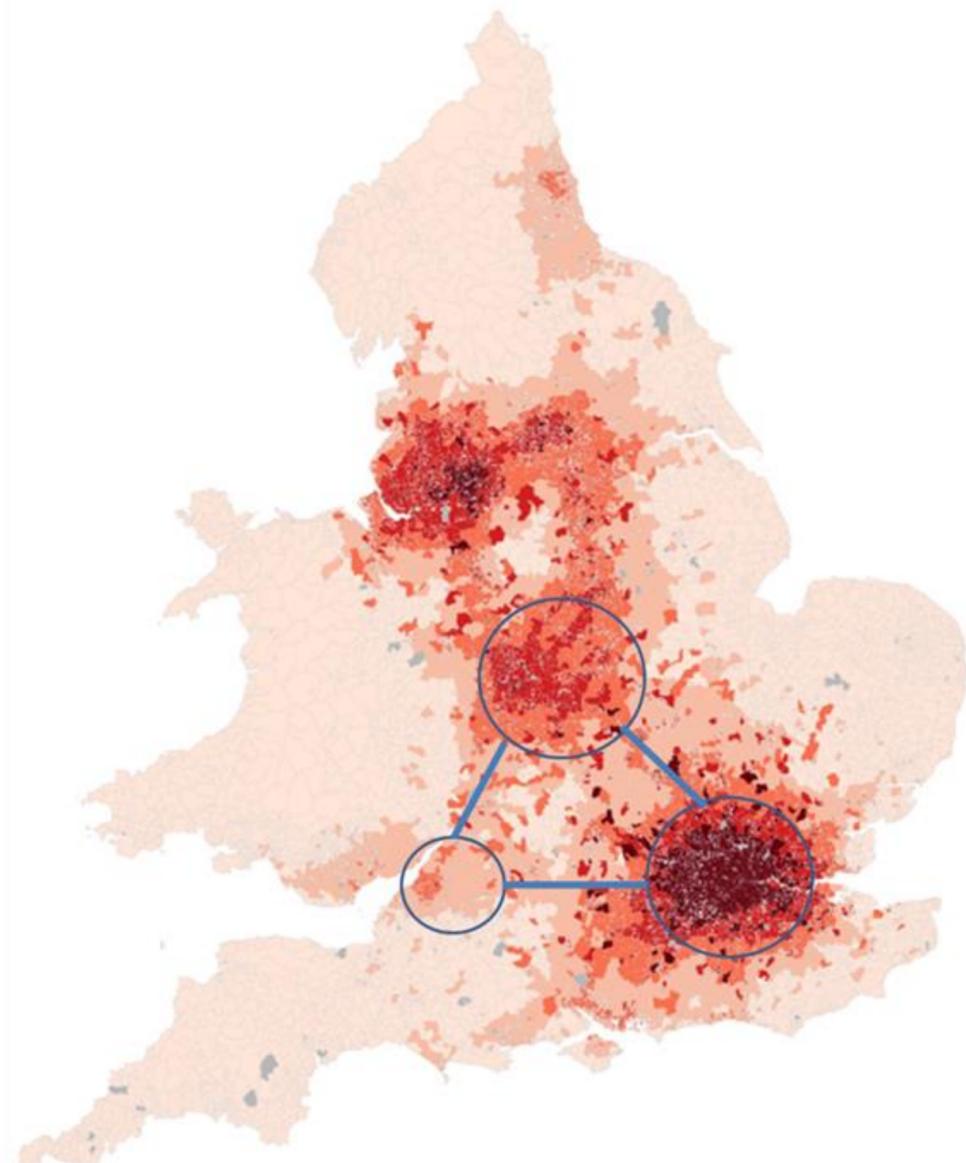


## Step 3

**Assess the strength of linkages between WoE and these areas, highlighting routes with particularly strong linkages.** From the analysis above, we can identify which areas the WoE region is most connected to and likely to have strong linkages with through the movement of businesses and people. For example, a increasing decay function for Birmingham means that connectivity, measured by agglomeration, increases from Bristol to Birmingham, which implies strong linkages between both areas.

# The WoE appears to have higher connectivity potential towards London and Birmingham

Figure 1: UK map of 'short-distance' connectivity



Source: PwC analysis and ESRI road travel time

- Figure 1 to the left maps an index of connectivity across the UK, as measured by an index of agglomeration.
- What we are measuring here is a region's "access to economic mass" i.e. how easy it is for firms to communicate, compete, trade and access a pool of skilled labour. In terms of its raw interpretation the index is measuring the travel time a "firm"/worker would need to undertake to access a consistently sized amount of economic activity (in this case a pool of labour of 1,000 people). The shorter the travel time, the greater likelihood that agglomeration benefits are present.
- On the map, the darker shaded areas show higher levels of connectivity relative to the UK average. There are roughly 2,400 sub areas on the map (referred to as Lower Super Output Areas, LSOA), each has an average population of about 1,500 and relate to post code areas e.g. BS20, BA1.
- There are 5 shades of red on the map – the darkest red means that that on business in that area have on average 40% or more connectedness than the national average. The bulk of the map is shaded light pink (e.g. Cornwall, Wales, Norfolk) which represents below average regions. The shades of red in between represent 10 percentile bands – of which there are three (i.e. 0-10% greater than average, 10%-20% etc.).
- We have highlighted a clear "triangle" that exists between the WoE region, greater London and Birmingham. In the areas between these 3 hubs, it can be seen that the index still remains a darker shade of red than that shown on the bulk of the map which implies that on the major routes between these hubs (the M4, M5, M40) there exists corridors of activity that support between region agglomeration.

# A Two different measures of agglomeration: short distance vs. long distance

The index presented in figure 1 is a measure of short-distance agglomeration – it is not designed to capture linkages between major hubs, but instead takes a granular look at economic hotspots. However, it is possible to infer that adjacent hotspots on the map imply agglomerated areas as each mini shaded area will pull in economic activity from surrounding areas.

An alternative measure would be a measure of long distance agglomeration. Short and long distance can be measured in different ways. This is what we have done, meaning in this case the indexes are not directly comparable, but represent a pragmatic estimation strategy to a complex problem. In terms of the differences between the two:

**Short distance agglomeration:** focused on very granular level data and captures localised and potential overlapping effects between neighbouring regions. Does not capture agglomeration effects over longer distances. The measure used for short-distance agglomeration in this study is travel time to economic mass.

**Long distance agglomeration:** less granular in its approach as it is based on more aggregate data. For this measure we run regressions on business revenue. Take two geographical regions – Bristol and Birmingham – if business revenues in the same sector grow/contract at the same rates and have the same drivers/characteristics underpinning them (e.g. population sizes, journey times, wages, number/type of employees, investment paths) then we can infer that they are in some way linked and therefore agglomerated. We estimate these linkages using a complex econometric model to test whether these co-movements are random or not. Non-random variance in economic activity levels between regions is an established measure of agglomeration.

The remainder of this Section is focussed on long distance agglomeration.

# Interpreting the results: long distance econometrics

## How should the index of connectivity be interpreted?

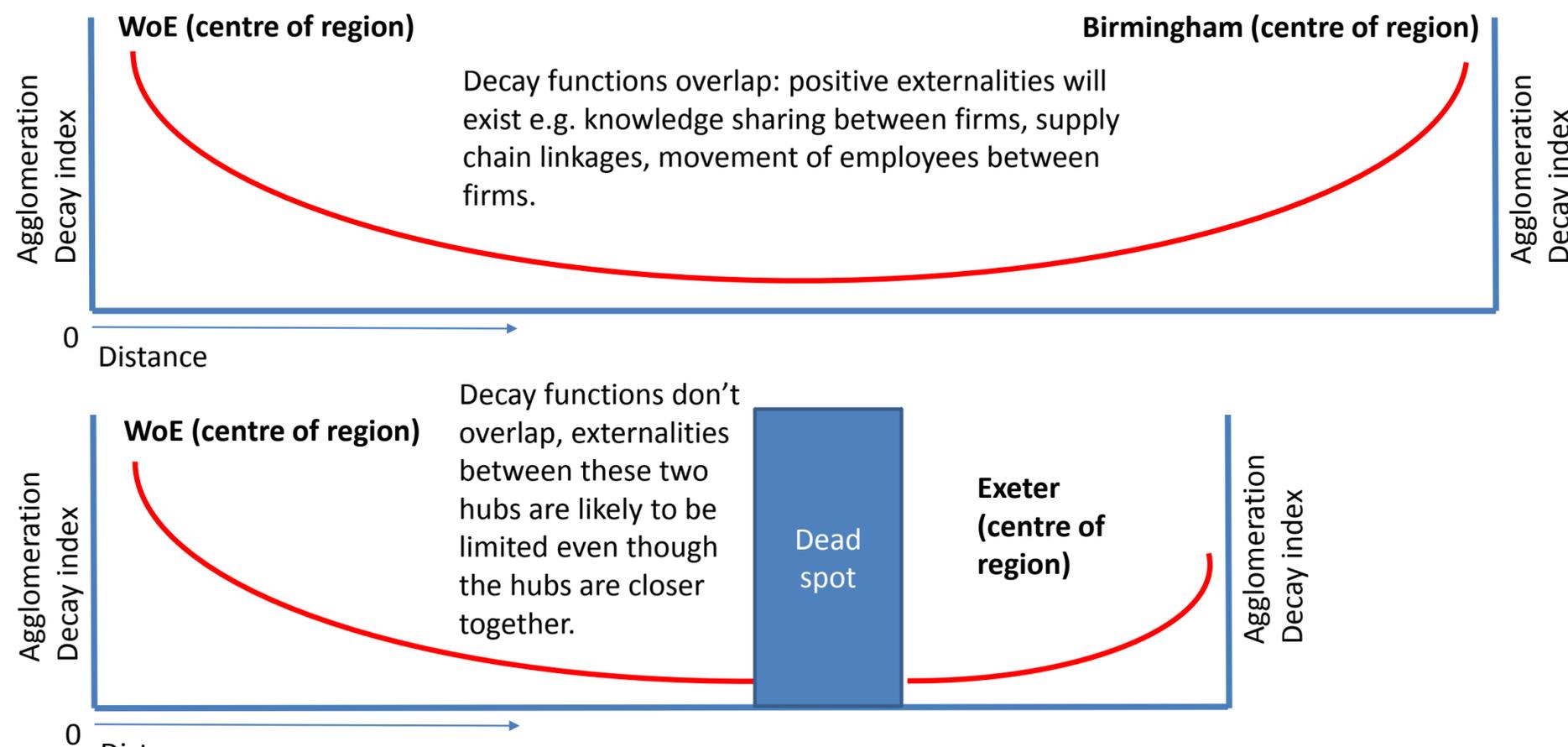
The index of economic connectivity for an area is a measure of its access to economic mass to other regions. Specifically, this measures the level of business linkages/connectivity between the geographical centre of a region and the boundary of other regions. This analysis is based on regions across the UK and Europe.

Depending on the region, scores can vary greatly. The characteristics of a region, such as the level of jobs and good road and air travel times to other major economic hubs, will boost the region's final index score. For the purpose of the analysis, we have indexed all regional scores relative to the UK average, which will help give greater clarity on areas with above and below average economic connectivity. Bristol has been assumed to be the central economic hub for the WoE and therefore all routes start from this location

The charts opposite illustrate the general principles behind our approach.

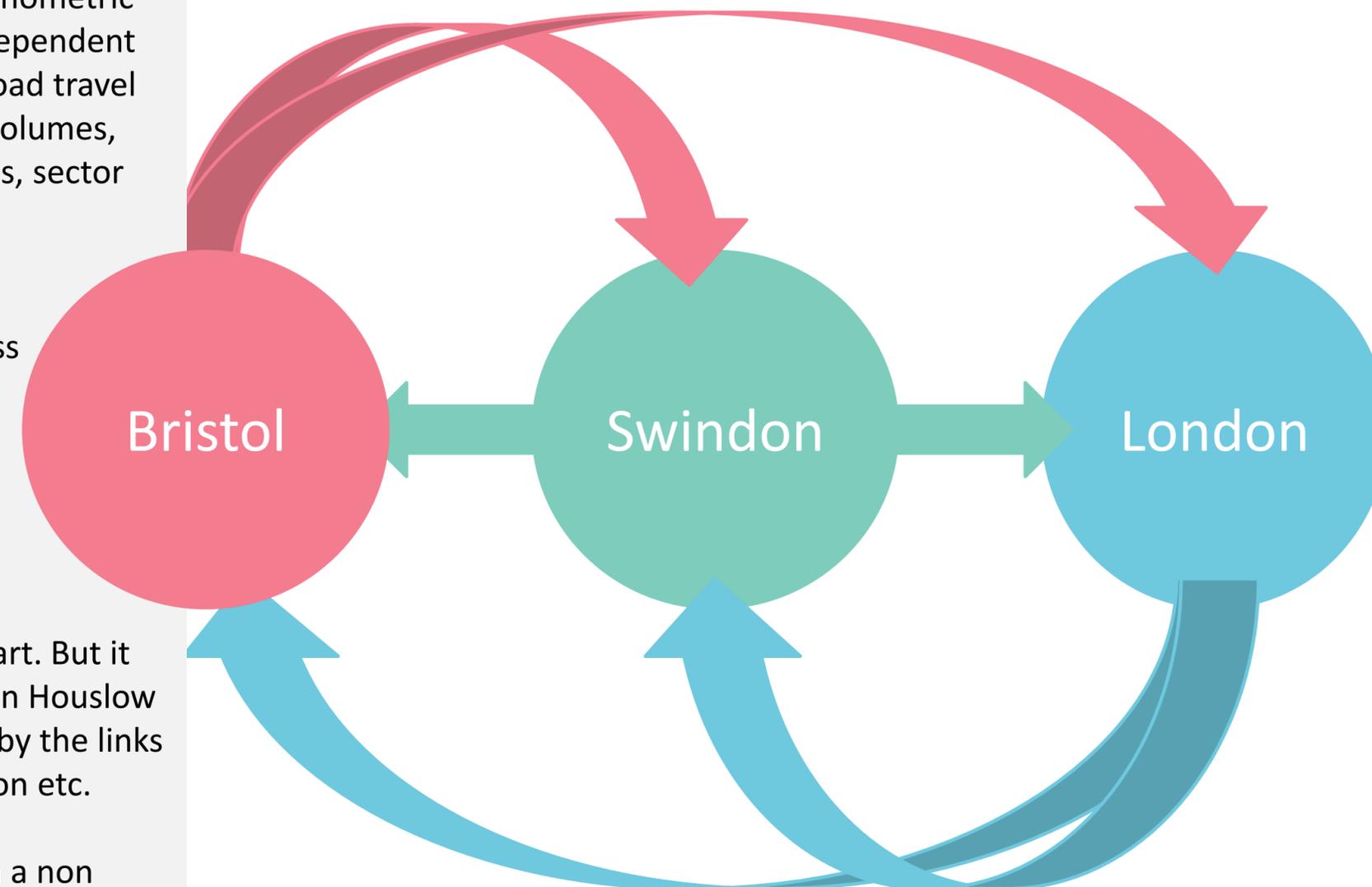
The index could dip between regions – meaning there is less activity between major hubs. Or it could be relatively flat – meaning there is a stronger linkage.

If these linkages do not exist in terms of corresponding business revenue growth then we cannot infer there is agglomeration.



# Approach to index construction

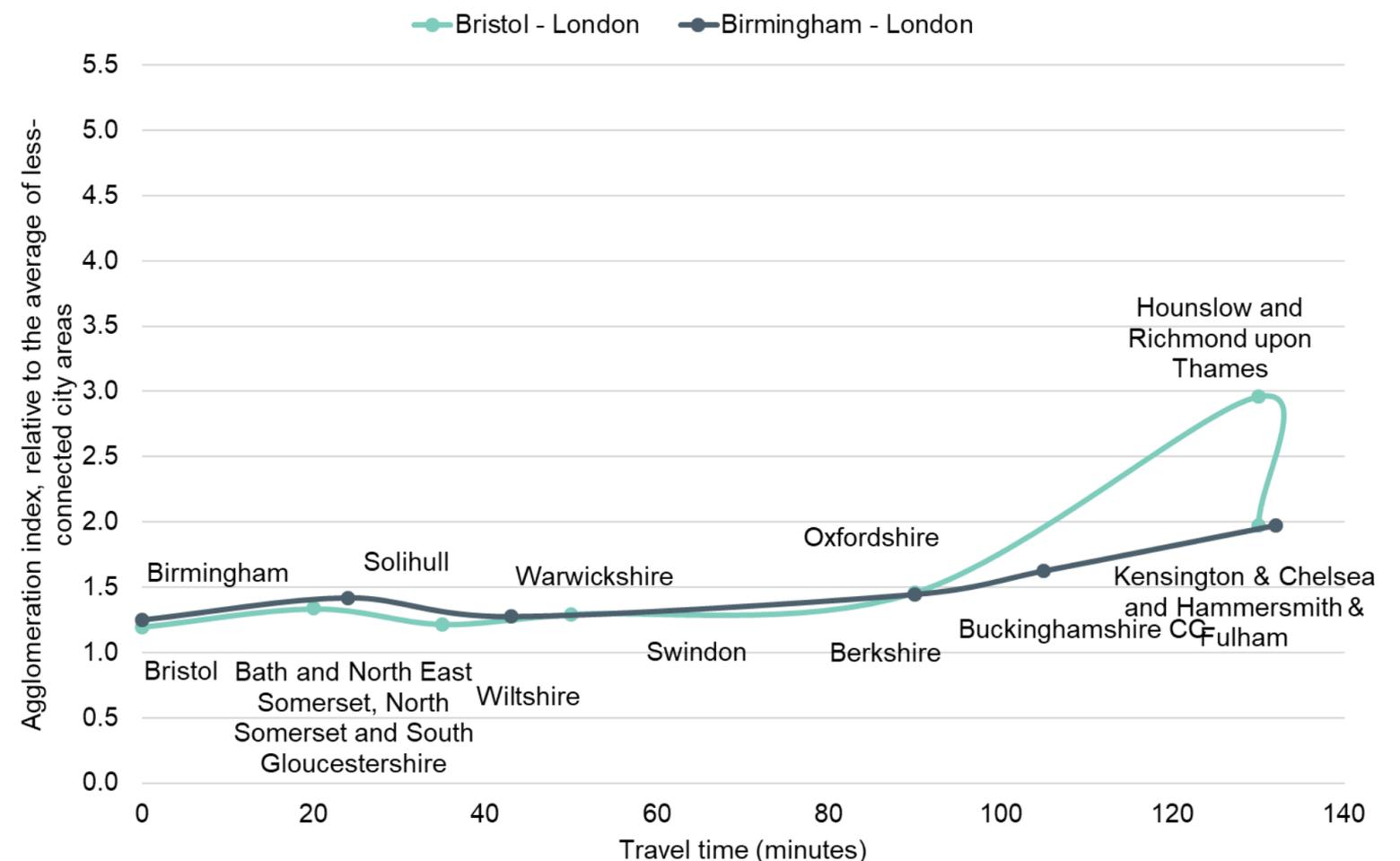
- Our agglomeration index is constructed from a set of region specific econometric coefficients. Take Bristol for example. Business revenues are the key independent variable in the regression – the explanatory variables are distance, air/road travel times, population density, land use change, employment, supply chain volumes, international trade levels, R&D spend, patent levels, commuting volumes, sector mix.
- An equation is constructed for Bristol-London, London-Swindon etc. all permutations are covered. Results are weighted by distance and business population. Not all explanatory variables are significant for all regions.
- The Bristol “dot” on the chart represents the weighted independent variable for linkages to all sub-regions on the chart. The Swindon and London dots are produced in the same way.
- A higher coefficient means stronger links to the other regions on the chart. But it could be biased towards a particular region e.g. the steep hump between Houslow – Kensington captures all linkages in the chart, but is heavily influenced by the links existing within West London as opposed to links between Bristol/Swindon etc.
- The purpose of the econometrics is to show that the regions co-move in a non random way i.e. when Bristol expands, London expands and vice versa. The statistical tests run as part of the econometric modelling process test whether these movements are non-random. The implication of these non-random movements is that there is long-distance agglomeration between Bristol and London – shared labour markets, integrated supply chains and shared knowledge.



# The WoE's long-distance connectivity to London is on a par with Birmingham

- It is evident from Figure 2 that long-distance connectivity from WoE to London and Birmingham to London are like-for-like.
- To construct this graph we have had to pick an arbitrary starting point. In this case Bristol – this is the most dense economic hub in the WoE region and this is compared to the most dense economic hub in the Midlands – Birmingham.
- To interpret the chart: an index of “1” implies long distance connectivity between two measured points is at the national average. For Bristol and central London this figure is roughly 1.25 – meaning business linkages are 25% higher than average. It is the same story for Birmingham.
- The graph is relatively flat and consistently above the national average. Indicating relatively strong linkages between the respective corridors. .

Figure 2: Long-distance connectivity index, Bristol/Birmingham to London



Source: PwC analysis

# WoE/Birmingham/London - further results

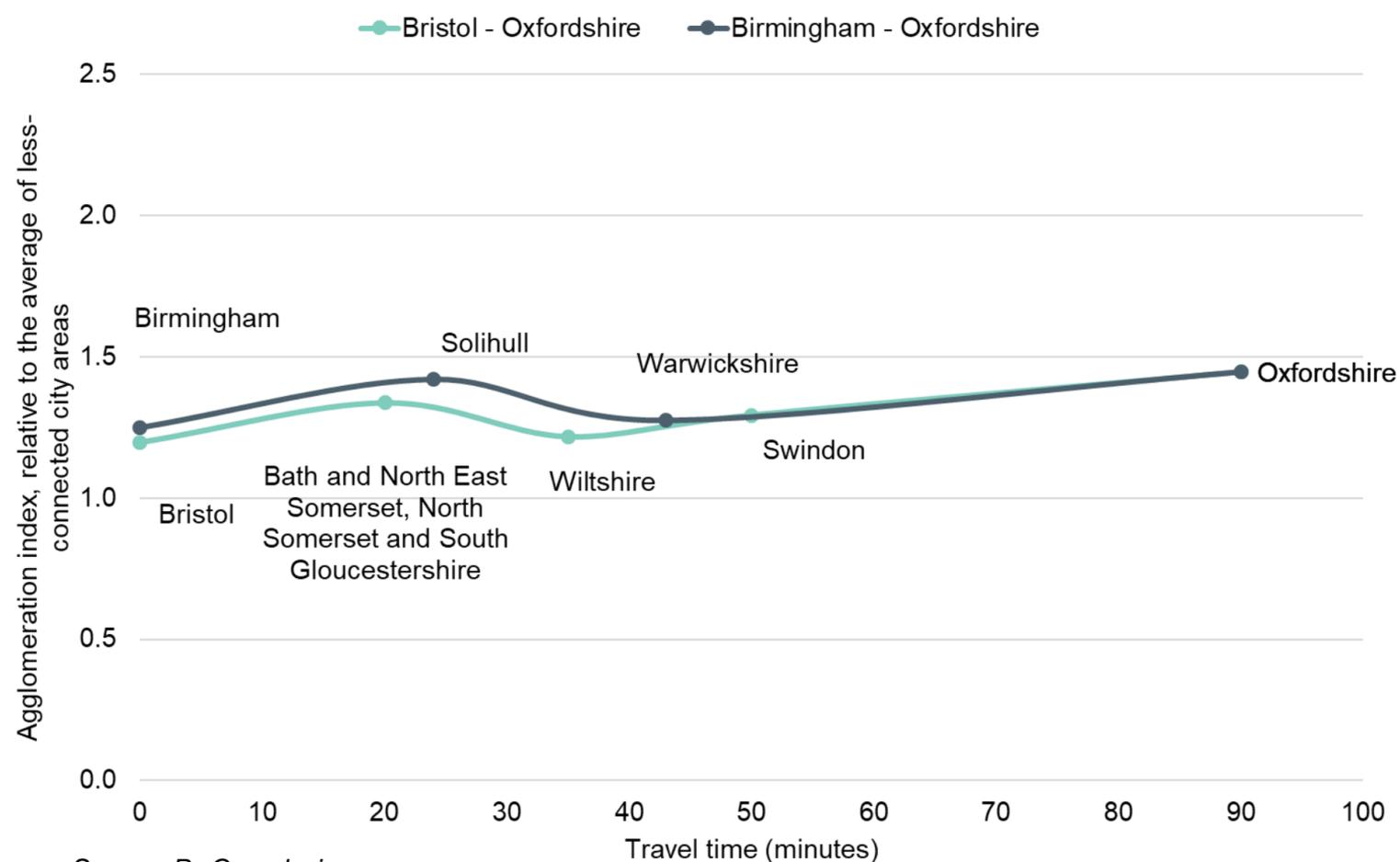
- For Bath and NE Somerset you can see that the figure is slightly higher than Bristol at 1.35 – implying slightly stronger business linkages than Bristol. But only a relatively small amount all coefficients are significant e.g. R&D, patents, land use are not significant.
- A significant step-change in long-distance connectivity occurs in Hounslow (coefficient is closer to 3.0). This is in part due to Heathrow, which facilitates large volumes of passengers daily and is an anchor asset for the UK economy as a whole. This is also coupled with the major business hub in West London associated with the M4 corridor.
- The coefficients are weighted by volume of economic activity, business and workforce population. Per capita flows between Bristol-London, Birmingham-London are broadly similar. If the links to the West London “bubble” are factored in, these links are arguably stronger.
- Not all coefficients are significant for all regions or the same strength. In terms of Bristol-London the linkages on innovation, wages, patents, trade are stronger. For London-Birmingham – supply chain variations, commuting volumes are more important in explaining the corresponding business revenue growth between the regions.

**The remainder of this section sets out different sets of results for other major economic hubs that the WoE has links with.**

# WoE's long-distance connectivity to Oxford is also in line with Birmingham

- Figure 3 shows that long-distance connectivity from the WoE and Birmingham to Oxford respectively are very similar. Both routes range between indices of 1.2 to 1.5, which is well above the UK average. This highlights once again that the WoE compares well against other major economic hubs.
- Furthermore, it takes approximately the same length of time to travel along each route respectively (90 minutes).
- A similar pattern to London occurs with Oxford. Bristol has stronger coefficients for innovation/patents. Birmingham for supply chain, but in this instance its labour market and patent variables are also strong. Bath/N.E Somerset appears to have stronger linkages with Oxford than London.

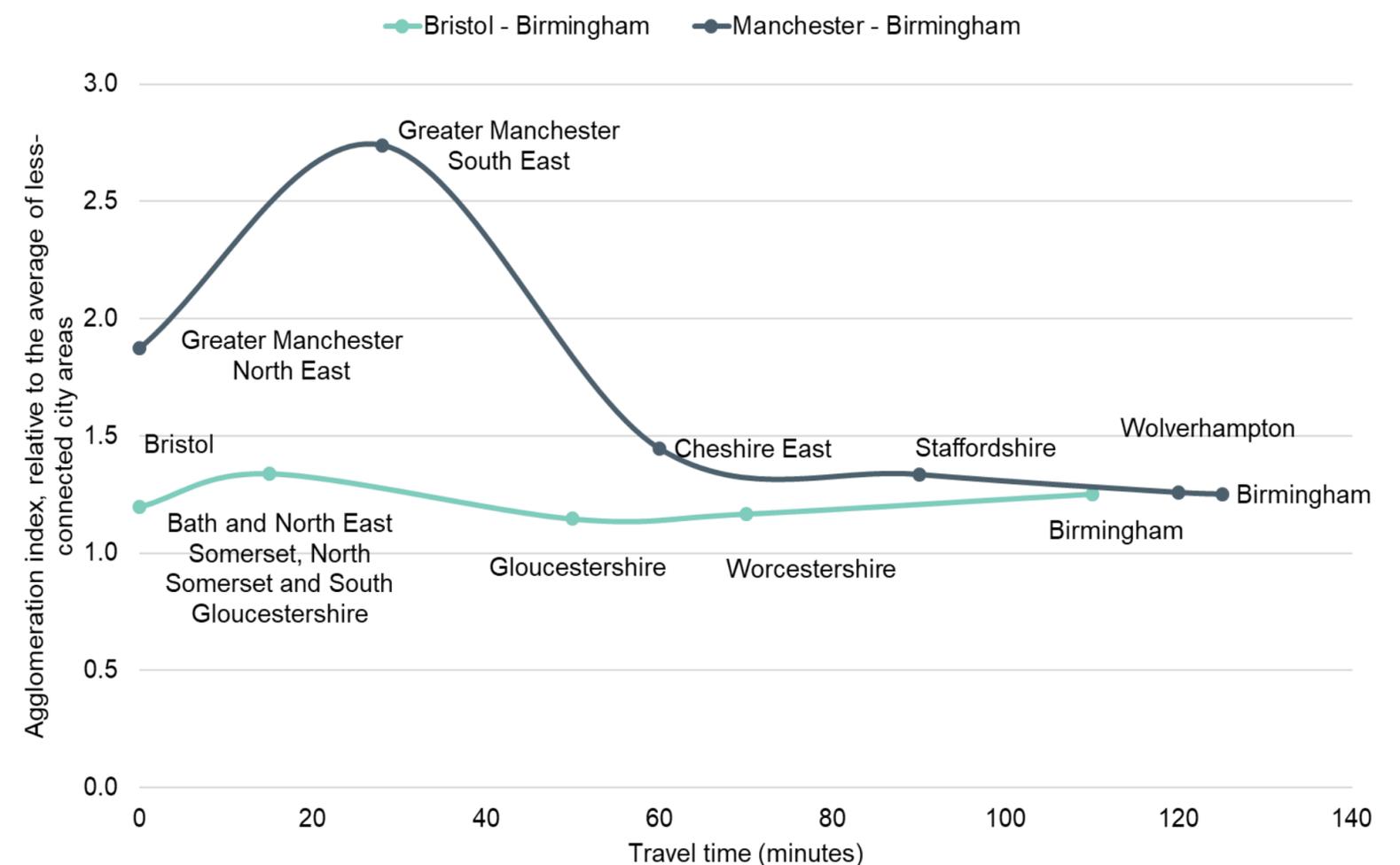
Figure 3: Long-distance connectivity index, Bristol/Birmingham to Oxford



# The linkages between Birmingham-Manchester are strong, but narrower in scope.

- The long-distance connectivity results (right) portray the strong economic connectivity of Manchester (1.8 – 2.7) versus the WoE and the rest of the UK.
- The highest level of long-distance connectivity is found in the south of Manchester, where the main city airport is located. However, these levels of connectivity rapidly decrease after the 40 minute travel time mark to be more closely in line with long-distance connectivity along the WoE route towards Birmingham.
- Coefficients between Manchester and Birmingham are heavily focused on supply chain and labour markets less on innovation. But where linkages exist, they are very strong.
- This again reinforces the evidence that the WoE is well-connected across a broader range of variables than other major economic hubs across the UK.
- This is an important story to tell within a Local Industrial Strategy, as it will support the WoE's capabilities to deliver more diverse growth for the UK economy as a whole (rebalancing from East to West).

Figure 4: Long-distance connectivity index, Bristol/Manchester to Birmingham

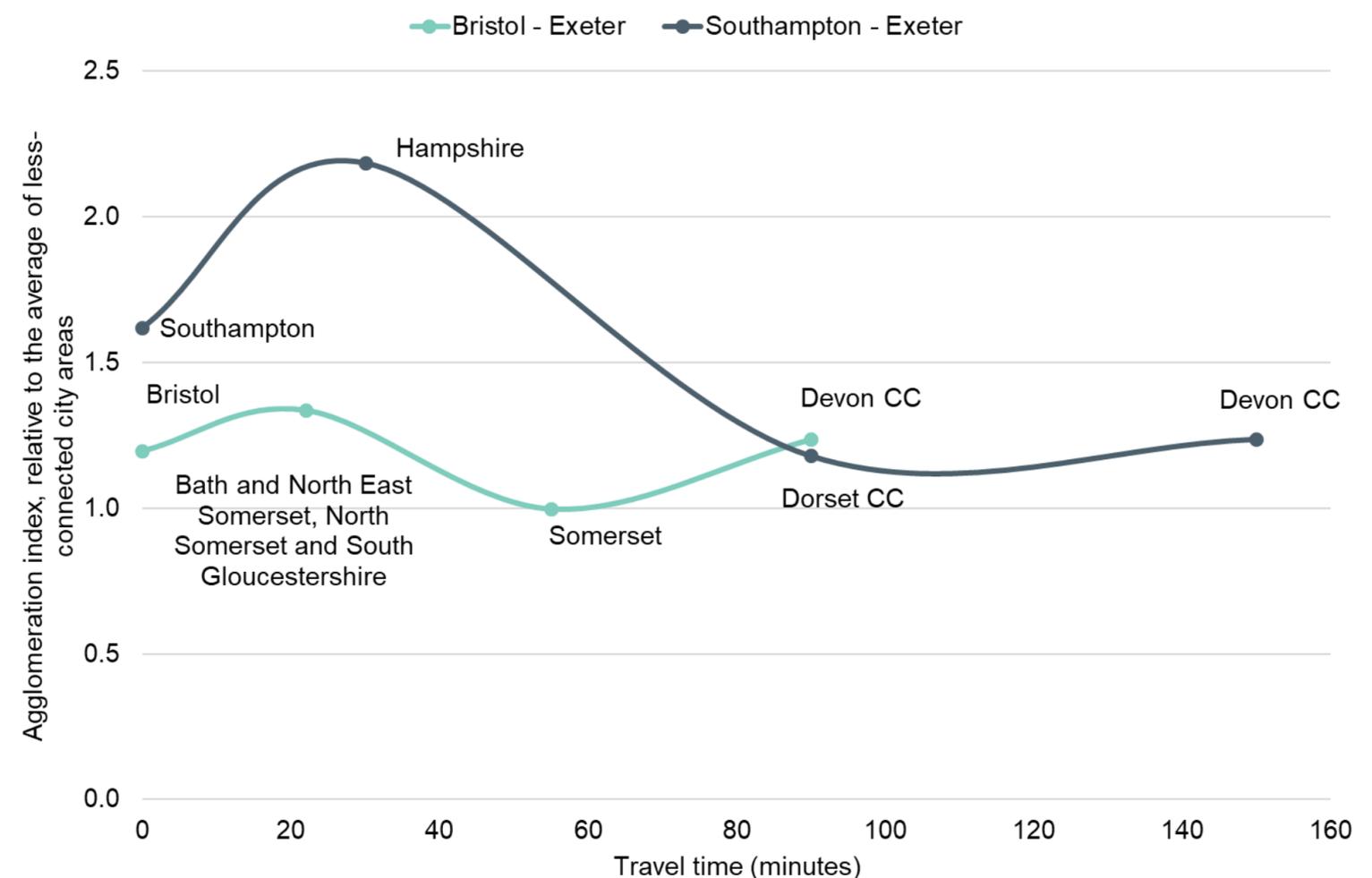


Source: PwC analysis

# A Long-distance connectivity between the WoE and Devon follows the same trend as Southampton

- Levels of linkages between Southampton/Hampshire/Dorset are very strong, but narrow. Linkages die down between Dorset and Devon/Exeter, but are still above national average.
- The linkages are only really explained by wages/commuting/supply chain. Similarly for Bristol-Devon – there is relative strength, but background analysis suggests narrow scope. Coefficients for innovation etc. are not significant.
- These observations reinforce the significant evidence that connectivity, as a whole, between Southampton and Exeter is superior compared to the WoE to Exeter route.
- It is still important to note that as the WoE is the main economic hub for the South West region, maintaining good linkages with supply chains and people flows further south will still bring economic benefits, albeit at a reduced rate.

Figure 5: Long-distance connectivity index, Bristol/Southampton to Exeter

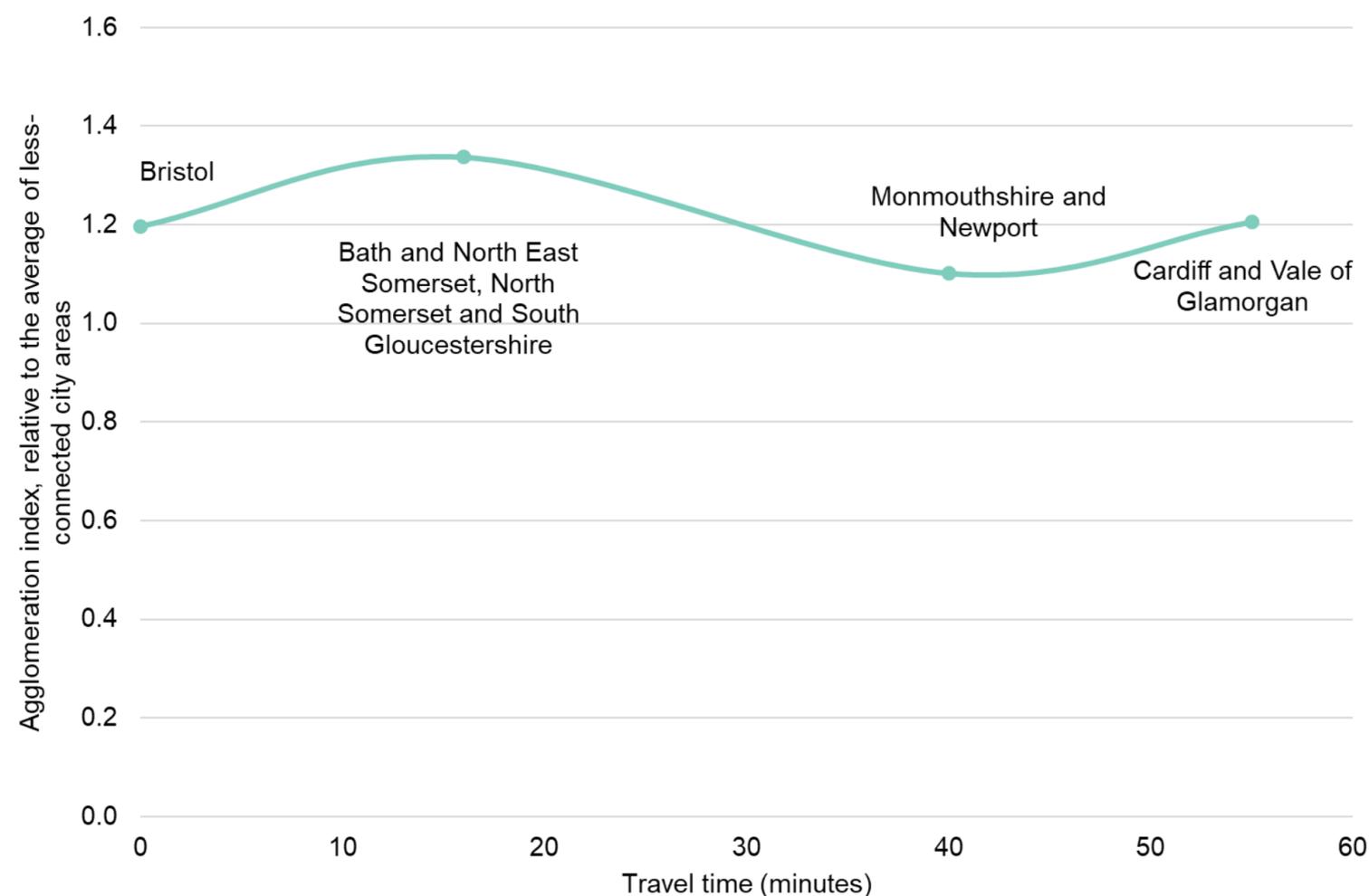


Source: PwC analysis

# A Long-distance connectivity averages 20% above the UK average across Bristol, Newport and Cardiff

- It is clear that long-distance connectivity between Bristol and Cardiff is very similar, averaging an index of 1.2 across the route. Linkages are more wide ranging and include innovation/shared R&D, investment, commuter flows.
- This means that the businesses and people of Bristol and Cardiff are equally well-connected to other economic hubs across the UK and Europe more widely.
- The 2012 City deal for Bristol and West of England noted that the city regional economy had the highest GVA per capita of any core city LEP area. Therefore, it will be imperative to maintain the region's strong connectivity links, bolstering local businesses and the labour market.
- Lastly, strong connectivity to the West is important for the WoE as it supports the argument that the WoE can deliver more inclusive growth for the UK as a whole, rebalancing economic growth from London and the South East.

Figure 6: Long-distance connectivity index, Bristol to Cardiff



Source: PwC analysis

# Section B: Economic Value created by growth in WoE

# Investing in the West of England approach

## Purpose of analysis

The purpose of this analysis is to estimate the total economic benefits from key growth drivers (investment, trade, business growth) that the WoE is expected to retain locally as well as how much of this spills over into the wider UK economy. This directly underpins the value for money proposition that the region offers. This is particularly important for the story which the WoE will tell through its LIS and how attractive the region will be for additional investment from central government.

## Areas of analysis

The following slides set out:

- An introduction to the Computable General Equilibrium (CGE) modelling approach and its role in calculating economic multipliers for the WoE.
- An introduction to economic multipliers and their relevance to policy-making for the WoE region.
- The final economic multipliers calculated for the WoE, accompanied by comparative results for the M8 cities and the rest of the UK and how these multipliers should be interpreted for policy purposes.

## Data sources

The main data sources are as follows:

- PwC have used the input-output table provided by WECA to shape their assumptions. Input-Output tables are a standard statistical approach for proxying economic flows between businesses, Governments, Households. We have taken UK average flows and proxied them at the WoE level.
- A bespoke dynamic CGE model, developed by PwC, to capture the linkages between local and national governments, businesses across different sectors and households. This model has assumptions around economic growth, tax levels, trade elasticities etc.

These data underpin the model, they don't form part of our overall narrative.

# Executive Summary - Business Linkages

## B. Investing in the West of England

**The economic modelling exercise has calculated economic multipliers for the WoE, which highlight that the region delivers above average economic benefits to the wider UK economy.** E.g. For every £1 of business investment within the WoE region, it generates total economic benefits of approximately £2.20 within the region and a further c. 80p for the rest of the UK economy (based on the mid-point of the ranges presented in the table). Correspondingly, M8 (non-London/Bristol) equivalent figures are £1.90 and 75p.

Overall, it is evident that the WoE's economic multipliers are impressive, as in most instances they deliver greater levels of economic benefit for the wider UK economy when compared to the M8 group. This implies the **strong value for money relative to other parts of the UK from a wider economy perspective if policy measures that can boost business investment, trade, GVA or employment growth can be effectively implemented.**

It is critical that the WoE highlights these messages in their LIS, as this is a strong evidence base to underpin the unique story of the region. This ties in closely with the key conclusions drawn from the agglomeration analysis. WoE is a region that has above average connectivity to the North and East and it also has a significant investment case, as it is expected to deliver economic benefits wider for many of the surrounding areas.

# Section B: Detailed analysis



# CGE modelling and economic multipliers: overview of approach

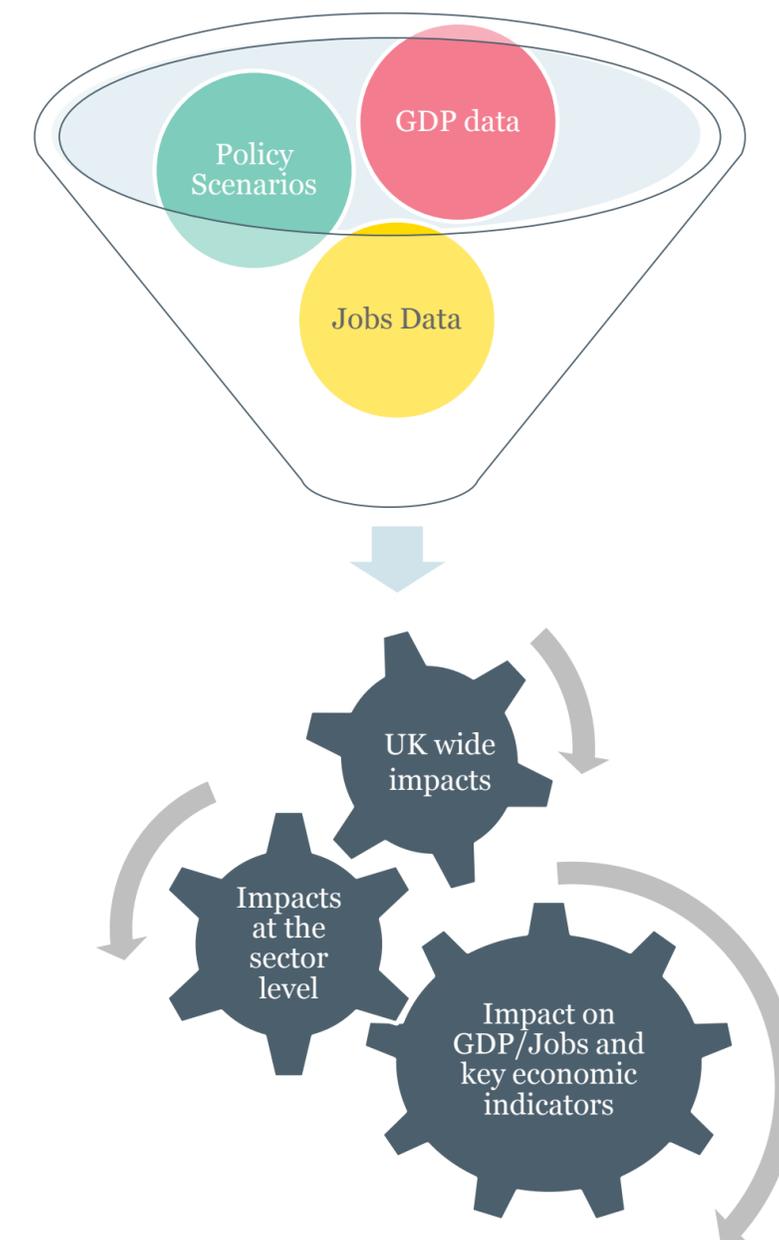
## Our economic model

The economic model we have used for this analysis is known technically as a Computable General Equilibrium (CGE) model. It combines economic data and a complex system of equations to capture the interactions between economic agents – households, firms and the government - through different channels, such as labour markets, capital flows, consumption, product demand, taxes or fiscal transfers.

For the purposes of the model we have applied a regional disaggregation. We have separated out each of the Geographical regions that are Mayoral Combines Authorities (known as the M8) and aggregated the rest of the UK economic into one region. This allows us to apply our economic model to the WoE, core M8 comparators and the rest of the UK. Each of the 9 regions in the model has 5 sectors: Agriculture, Manufacturing, Construction, Services and Public.

## What data have we used?

We have used economic data for the WoE region (GVA, firm growth, employment numbers, location quotients) to derive a basic input output table for each region. The input output table maps linkages between business, consumers and government. There is a very detailed table for the UK and for Scotland. However, the ONS does not produce this data at a regional level. On this basis it must be proxied. We test the model for the sensitivities around the assumptions underpinning this data and this is why we provide our results as a range, rather than point estimates.



# CGE modelling and economic multipliers: key issues

## Why is this analysis useful?

CGE modelling is often used to assess the impact of future policy interventions on a regional economy. More specifically, CGE models are highly regarded in policy research and have been used by HMT/HMRC and other agencies such as DfT, Highways England, DEFRA, DCMS and BEIS to appraise major policy decisions. Recently CGE models have been used by HMT to appraise BREXIT impacts and the effects of fiscal devolution.

## What is an economic multiplier?

An investment multiplier reflects the theory that an investment (public or private) has a more than proportionate positive impact on aggregate income and the general economy. More specifically, the multiplier attempts to quantify the additional effects of an investment beyond those which are immediately measurable. The larger an investment's multiplier, the more efficient a region is at creating and distributing wealth throughout the local and wider economy e.g. for every £1 of GVA generated by WoE based businesses the rest of the UK gains by about 60p.

## How much emphasis should be placed on the results?

It is important to note that these are the results from an economic model (albeit a relatively sophisticated one) and do not represent a full scale evaluation of the success of business investment, international trade policy etc. in the WoE. We have tested critical assumptions and data in the model (hence results are provided as a range rather than point estimates) and the ranking of the results do not alter substantially. That is not to say that the overall robustness of this narrative could be increased by supplementing it with supporting evaluation evidence. However, as far as we have seen, this is the first analysis of this type at the UK regional level.

## What can we tell from the results?

In the slide overleaf, it is clear that across all metrics, results show that the WoE region generates at least as good and in most instances greater levels of economic benefit for the wider UK economy when compared to the M8 group. They imply *strong value for money relative to other parts of the UK from a wider economy perspective if policy measures that can boost business investment, trade, GVA or employment growth can be effectively implemented.*

# B Investing in the WoE generates higher economic benefits than the UK average

Figure 7 shows a set of economic multipliers for the WoE region (blue columns), including comparative multipliers for the rest of the M8 cities (excluding London and shown in the green columns) and the UK as a whole (red column). They show both the benefits which are retained within the WoE region as well as the economic spill over to the wider UK economy. These multipliers represent the total economic benefits (including direct, indirect and induced impacts).

The multipliers are interpreted as follows - take the blue column first row. For every £1 of business investment within the WoE region, it generates total economic benefits of approximately £2.20 within the region and a further c. 80p for the rest of the UK economy (based on the mid-point of the ranges presented in the table). Correspondingly, M8 (non-London/Bristol) equivalent figures are £1.90 and 75p. At the UK level, our modelling suggests that £1 of business investment yields roughly £1.65 – so the multipliers for business investment in the WECA region are considerably higher than comparable M8 cities and the national average.

Figure 7: Economic multipliers for WoE, other M8 Cities and the UK

Multiplier	Benefits kept within <u>WoE</u> region (range)	Spillover effect to rest of UK (range)	Total benefits kept within M8 cities – excluding London/Bristol (range)	Total spillover effect to rest of UK (range)	Average multiplier for UK (average of CGE model and literature review)
£1 of business investment	£2.15 - £2.25	£0.60 - £0.95	£1.65 - £2.30	£0.50 - £1.00	£1.65
£1 of external trade	£1.90 - £2.10	£0.35 - £0.45	£1.55 - £2.00	£0.40 - £0.55	£1.82
£1 GVA growth	£1.60 - £1.75	£0.50 - £0.70	£1.35 - £1.65	£0.35 - £0.55	£1.35
1 FTE employment growth	1.3 - 1.35	0.5 - 0.7	1.2 - 1.4	0.40 - 0.60	1.2

# Section C: Sectoral Analysis

# WoE sector analysis approach

## Purpose of analysis

The purpose of this analysis is to identify sectors that have high regional concentrations in the WoE compared to the rest of the country and which have the potential to drive growth in the wider economy. This aims to provide insight into the sectors that are prominent in the WoE economy. This section draws on data from ONS to identify sectors that are relatively more concentrated, in terms of employment. Further analysis of these sectors has been undertaken to explore potential areas of opportunity in the UK to collaborate with – that also specialise within these sectors. The analysis in this section also informs the analysis in the following section which explores potential supply chain of the sectors.

## Areas of analysis

The following slides set out:

- Which sectors are considered ‘high-value’ for the WoE economy and look at how productivity for the WoE compares to other LEP regions. Identification of prominent sectors across the WoE economy, based on the size of the sector and recent growth of employment.
- Shift share analysis, which aims to understand whether sectoral growth is attributed to national or regional growth.
- Other regions across the UK which also have similar sectoral clusters as the WoE region and are therefore potential areas of commonality in respective Local Industrial Strategies.

## Data sources

The main data sources are as follows:

- UK business register and employment survey (BRES), NOMIS. Limitations of this data source include: it does not consider some people in self-employment (particularly within Agriculture); they only have GB figures (not UK); and the figures are rounded.
- WoE Input-Output tables. The main limitation of this data is that we have not seen original source of data - received from WECA.

# Executive Summary - Business Linkages

## C. Sector Analysis

**The WoE ranks 15th out of all LEPs/CA's (38) for productivity levels (£34.50 of output per hour worked, 2015 nominal prices).** This implies that the region's people and businesses are efficient turning inputs into valuable products and services which are then either consumed locally or sold to other economies. WoE's insurance services sector has a significantly higher level of productivity than other sectors with a GVA per job of £350,000 (WoE Input-Output table, 2014) - which is over seven times the WoE average.

**The Office for National Statistics define a particular sector – the “manufacture of other transport equipment” – and the data shows that this sector has the highest regional concentration of jobs in the WoE, over three times more concentrated than the rest of the UK.** This is most likely influenced by large multinational businesses operating within the region, including Airbus and GKN Aerospace. Since 2009, this sector has grown robustly in the WoE, yet the broader industry has been in decline (based on shift-share analysis). This can be explained by the resilience of the relatively unique activities carried out across these businesses.

Other prominent sectors which have been identified across the region include: information services; financial services; and architecture and engineering activities. The information services sector has seen more than a 40% increase in its concentration in the region between 2009 and 2017.

**WoE businesses often play a specific and specialised role in their industry supply chain.** From the five prominent sectors highlighted, the most relevant sub-sectors appear to be aerospace and spacecraft engineering; data hosting and processing; life insurance and; engineering and technical consultancy. For example, the Filton production site supports the wing assembly and equipping of the A400M multi-role airlifter, which is a military transport aircraft. This has been supplied to various military forces such as the UK, France, Germany and Malaysia.

**As part of the LIS process, other regions are assessing their relative strengths in terms of sector performance and examining opportunities for cross-fertilisation within their regions and across regions e.g. within WoE how could financial services link in with data hosting and processing? Or facing outwards, how could spacecraft engineering better collaborate with other space hubs in Oxford and Cambridge?** Providing platforms for engagement and investment for these linkages to occur will be an essential part of a future growth strategy.

# Section C: Detailed analysis



# C Identifying the WoE's prominent sectors is based on four key steps

Location quotient analysis is widely used in regional economics to highlight whether a regional economy has particular sectoral strengths or weaknesses. In the case of the WoE, we have outlined the four steps taken to identify its prominent sectors.

**Step 1.** Identify sectors with higher employment concentrations in WoE versus the rest of the country, based on location quotient (LQ) analysis in 2017 using two-digit Standard Industrial Classification (SIC) code sectors. LQ analysis identifies how concentrated a particular sector is in a region, compared to the rest of the country. It can therefore identify sectors where the WoE has distinctive strengths.

$$LQ = \frac{\left( \frac{\text{Employment of sector X in WoE}}{\text{Total Employment in WoE}} \right)}{\left( \frac{\text{Employment of sector X in GB}}{\text{Total Employment in GB}} \right)}$$

LQ>1, the industry is considered to be more highly concentrated in that area versus the rest of the country. Sectors within WoE with an LQ>1.25: sector is then considered an “exporter” to other regions of the country.

**Step 2.** Select five prominent sectors for the WoE to further explore based on productivity; employment; likely geographic reach of sector; and growth of employment over time.

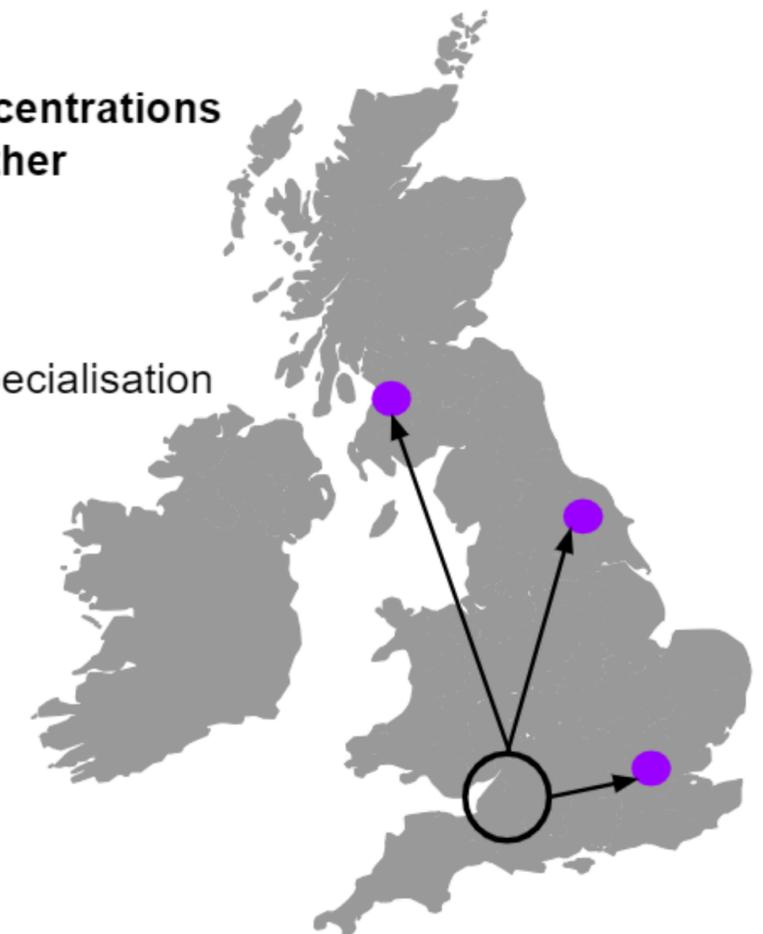
**Step 3.** Undertake a shift-share analysis of prominent sectors to establish how much of regional job growth can be attributed to national trends, and understand the role of the WoE in driving growth.

<sup>1</sup> In 2015, there was a change in the methodology used with the BRES dataset; however the differences within our sectors of interest have not currently been considered as significant

Please note that final LQ results may be higher than expected if a local authority has a small number of jobs with one/two dominating sectors in that area or if the sector accounts for a small percentage of jobs across GB.

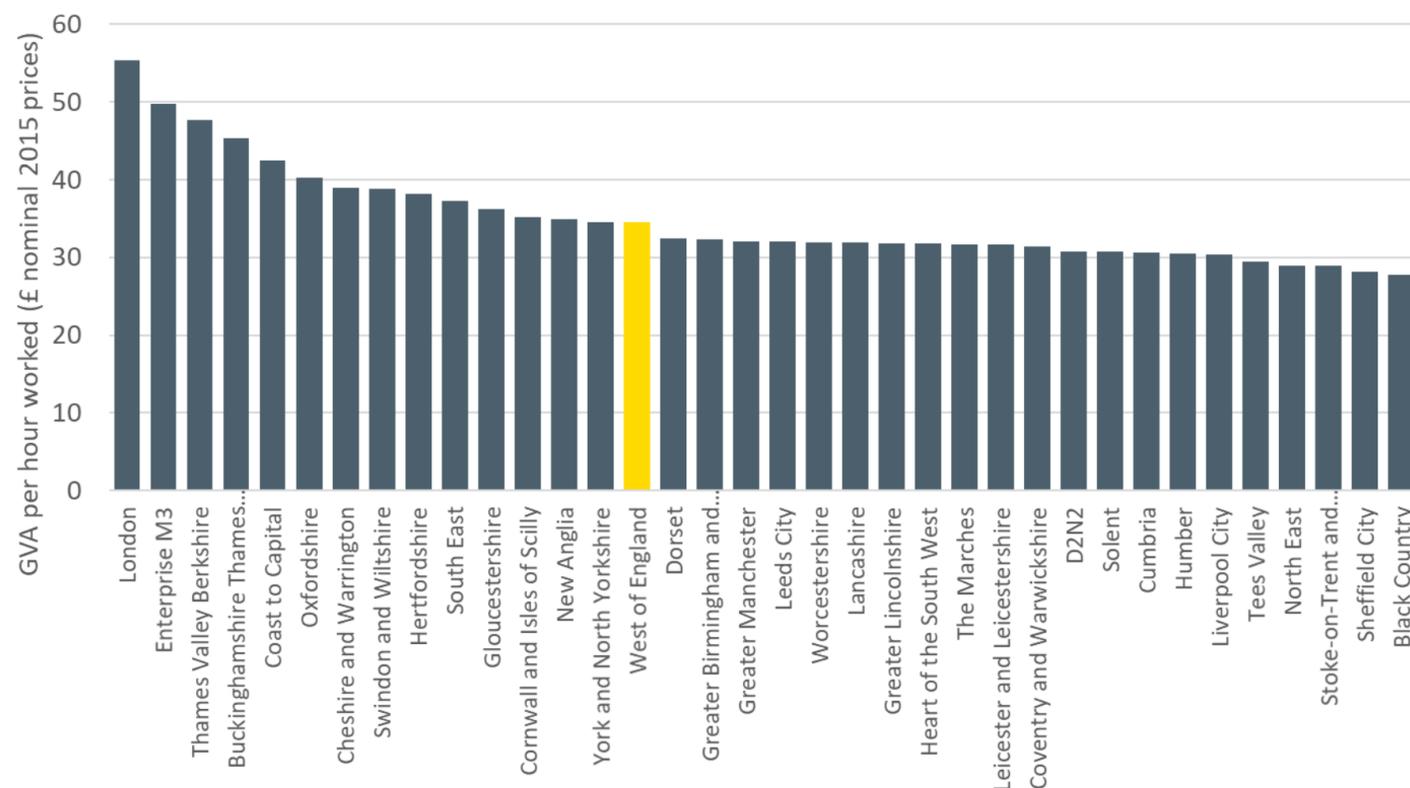
## Indicative map showing concentrations of jobs for Manufacture of other Transport equipment

● Locations of industry specialisation (x, y and z)



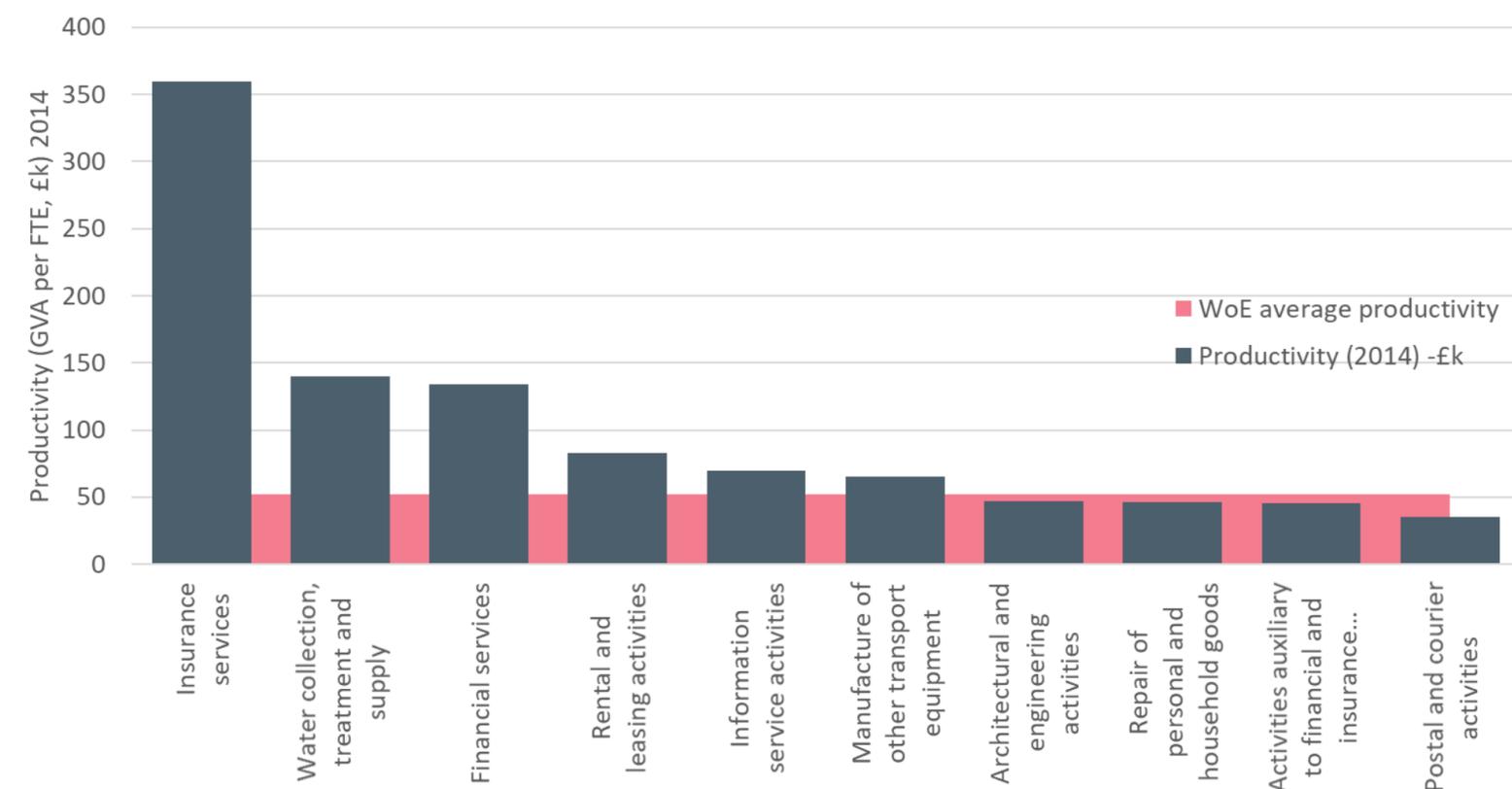
# Productivity in the WoE is £34.50 per hour which is marginally higher than the average for LEPs across England

Figure 8a: Productivity (GVA per hour worked) for the WoE compared to other LEP regions (£ nominal 2015 prices)



Source: PwC analysis, Annual survey of hours and earnings

Figure 8b: Productivity (GVA per FTE, £k) in the WoE by sector (2 digit SIC), 2014

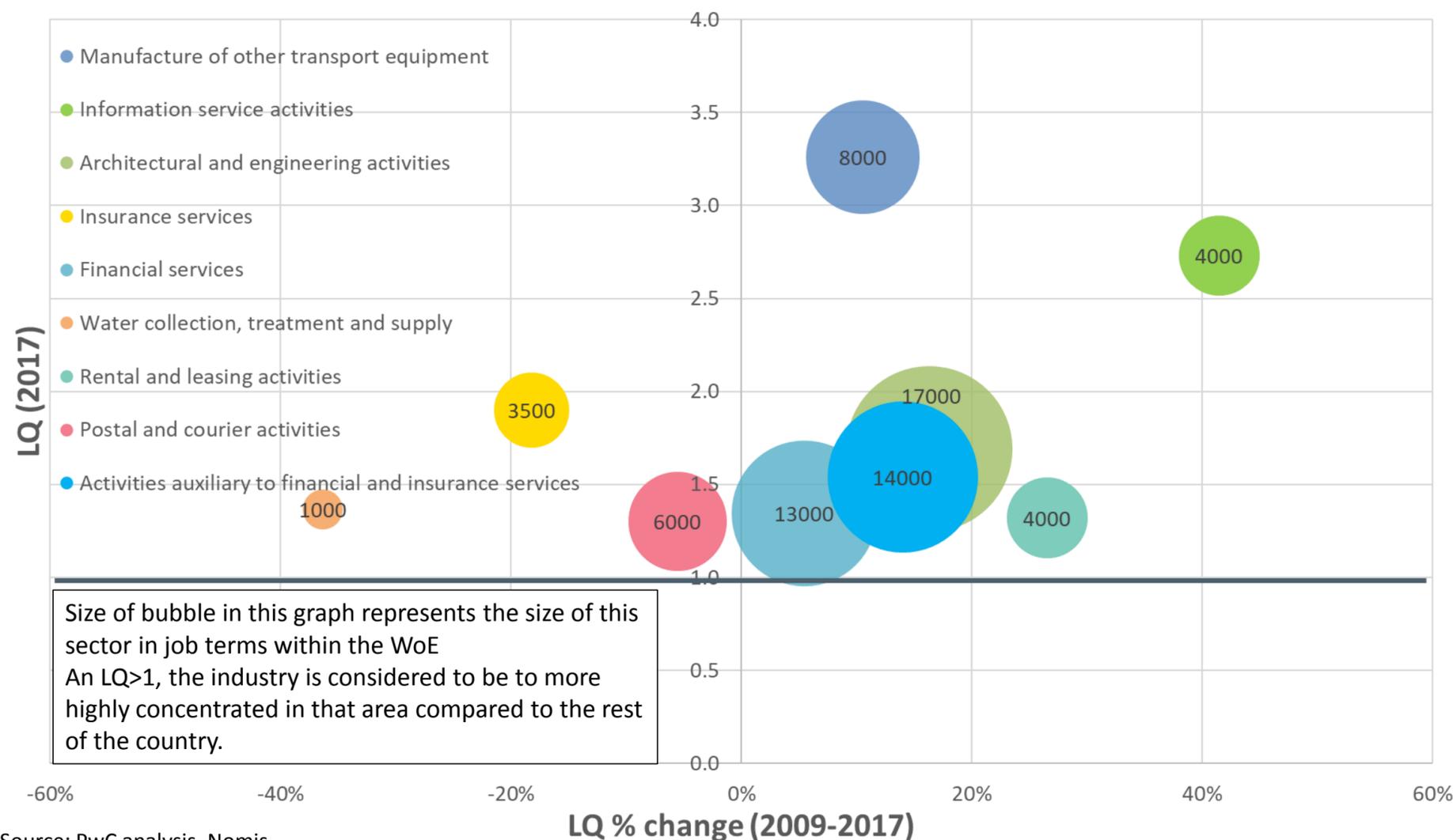


Source: PwC analysis, WoE Input-Output tables

- Figure 8a highlights the WoE's productivity performance versus other LEP areas. Productivity levels in the region are slightly above average, yet still higher than Birmingham, Manchester and Leeds.
- In support of this, figure 8b displays some of the WoE's prominent sectors, as identified from the LQ analysis. It is clear that some of these sectors, such as supportive activities for the financial sector are below the regional average, however the insurance services sector clearly dominates.
- It is important to look at LEPs with higher productivity and consider areas of commonality, in which collaboration could help to better understand the economic conditions that has enabled the sector to be of high value for that LEP region; and identify what could be replicated in the WoE to create a similar step change in economic performance.

# Manufacturing is one of the major employers in the WoE but information services has seen over 40% growth in jobs

Figure 9: Bubble chart of top LQs, LQ growth (2009 – 2017) and sector size for the WoE



Source: PwC analysis, Nomis

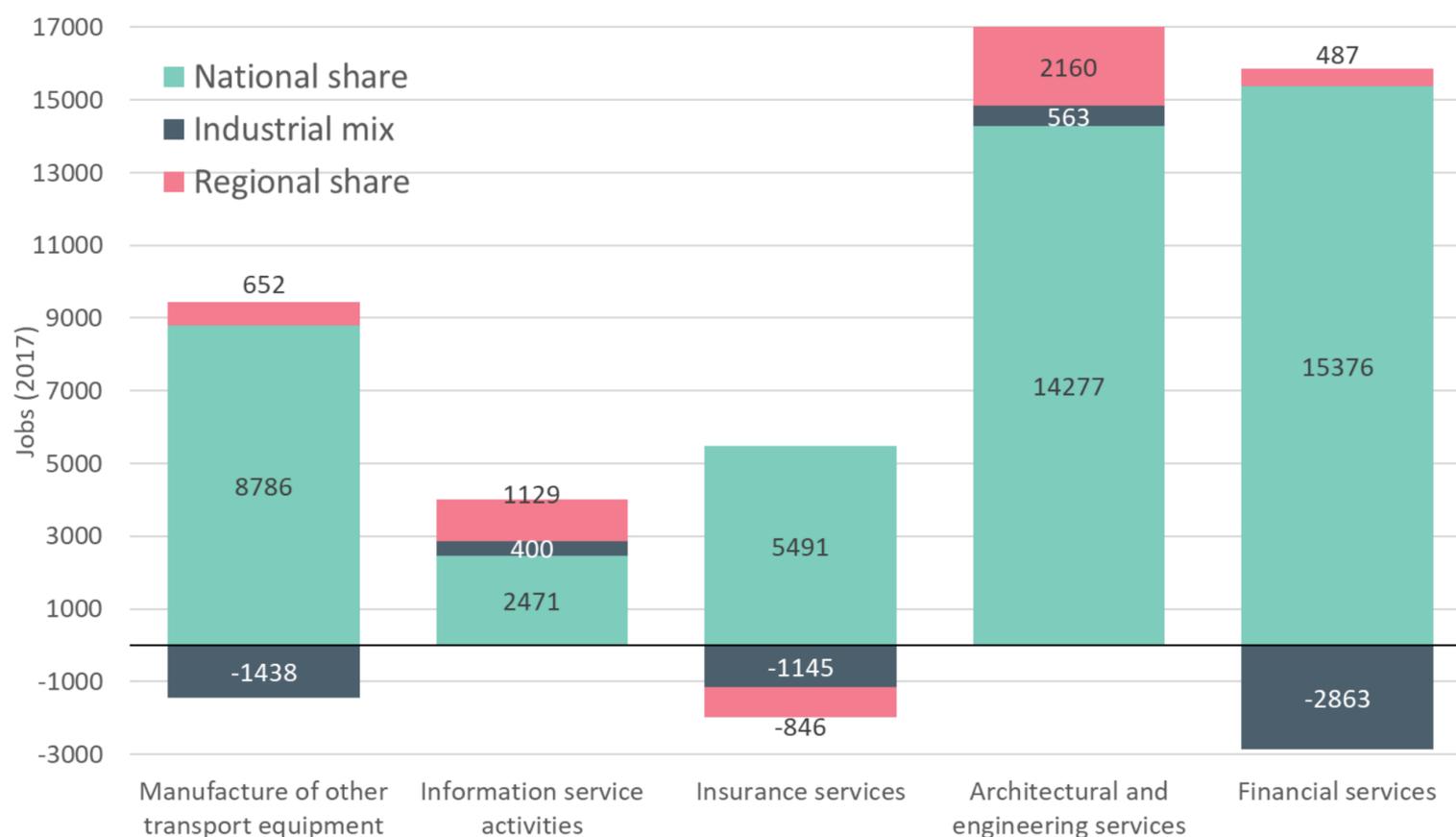
**Please note** Repair of computers and personal and household goods has been excluded from this table as it is an outlier

\*[https://media.nesta.org.uk/documents/tech\\_nation\\_2016\\_report.pdf](https://media.nesta.org.uk/documents/tech_nation_2016_report.pdf)

- In the WoE, the sector with the highest regional concentration of jobs is manufacture of other transport equipment. This is most likely influenced by large multinational businesses such as Airbus and GKN Aerospace.
- The fastest growing sector (in jobs terms) is the information services sector with over 40% growth in LQ between 2009 and 2017.
- Since 2009 the concentration of insurance services jobs in the WoE has decreased by 18%, albeit at a slower rate in recent years.
- The Architectural and engineering sector employs the highest number of people (17,000 jobs) out of the ten sectors that are most “unique” to WoE .
- Based on factors set out in the approach, the following five sectors have been identified to further explore potential supply chain linkages:
  - Manufacture of other transport equipment
  - Information service activities
  - Architectural and engineering activities; technical testing/analysis
  - Insurance services
  - Financial services

# Employment in insurance services has dropped by 1,500 jobs since 2009 but remains the region's most productive sector

Figure 10: Shift-share analysis (2009-2017) of prominent sectors for the WoE



Source: PwC analysis, Nomis

**National share**- the amount of job growth / decline that could be attributed to the overall growth of the national economy

**Industrial mix**- the amount of job growth / decline that could be attributed to the performance of a specific sector at a national level

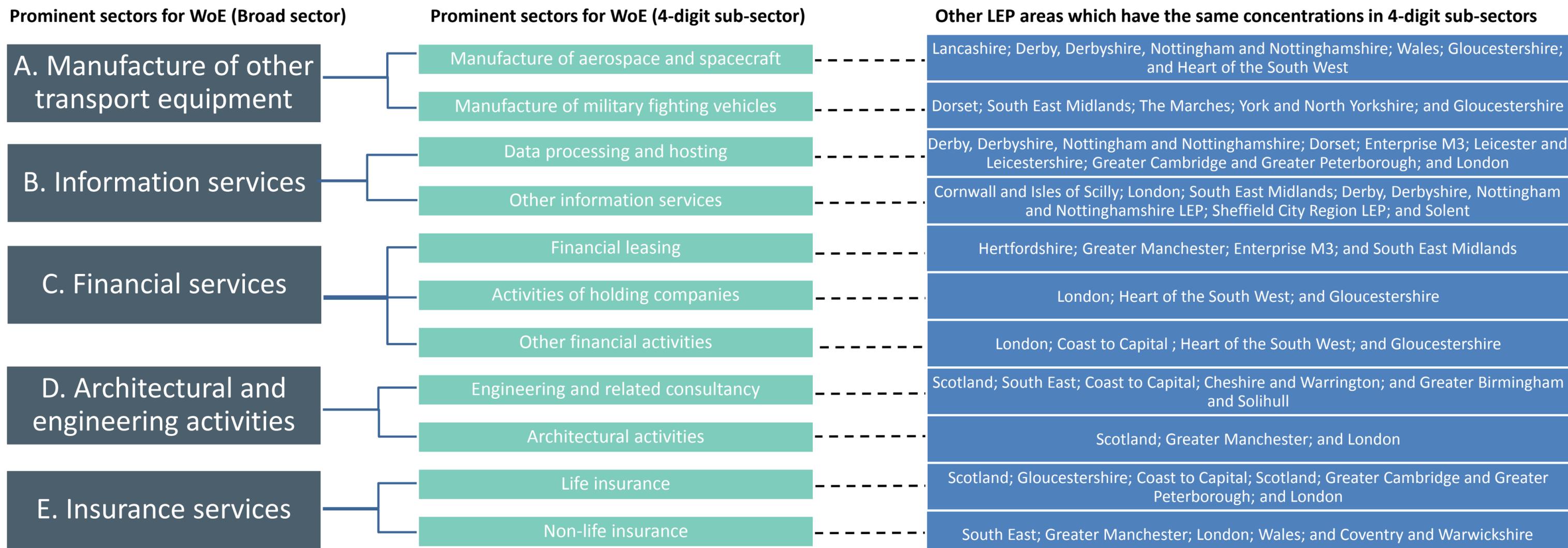
**Regional share**- the amount of job growth / decline in a specific sector that could be attributed to a local factors

To be able to understand the drivers of job growth within the WoE, a shift-share analysis has been undertaken to better understand the drivers of sector growth. Below is a summary for each of the prominent sectors for the WoE:

- The manufacture of transport is growing within the WoE due to local sectoral and national factors; but the broader industry is in decline.
- The strength of the information services sector in the WoE is contributing significantly to overall job growth.
- The performance of insurance services both in the WoE and nationally are both contributing to a reduction in jobs. This sector is productive for the WoE but has a small number of jobs.
- Job growth in architectural and engineering activities for the WoE has increased through all three growth drivers, with a substantial proportion of growth (12.7%) being driven through local factors.
- Financial services jobs have increased within the WoE, as a result of national factors (and local policy) e.g. national economic growth offsetting a national decline in the sector for the WoE.

# Having a well connected region can will help boost WoE's business productivity

Further information, found in the annex of this report, provides a more granular level of insight into the 'prominent' sectors (identified by 2-digit SIC code) by conducting further analysis at a subsector level based on 4-digit SIC codes. A location quotient analysis has been undertaken to identify these "unique" areas for the WoE and to highlight areas of the country that have similar sectoral specialisms. This analysis will identify potential regions with areas of commonality that could lead to future collaboration to drive growth within the WoE and wider UK economy. Below is a summary of the prominent sectors and the relevant sub-sectors that we explore. Collaborative working within these sectors may lead to opportunities with Sector deals being extended to successful partnerships as part of the Industrial Strategy.



# Section D: Trade Flows

# Trade flows analysis approach

## Purpose of analysis

The purpose of this analysis is to provide insight into the international trade patterns of WoE businesses. It builds a 'big picture' view of trade for the WoE using goods trade data from HMRC/ONS and experimental estimated data for the trade of services (from national data) to identify areas of strength that contribute to the WoE trading performance. The analysis also makes comparisons with other "core" cities across the UK so that the relative performance of the WoE can be benchmarked.

## Areas of analysis

The following slides set out an overview of the absolute value and relative value (as a proportion of GVA) of imports and exports for the WoE and comparator NUTS3 regions to give an overall view of trade for the WoE (for both goods and services), how it performs compared to other high-performing regions and how it may contribute to the overall national economy. The analysis then disaggregates goods and services, highlighting what industries could have a strong export potential for the WoE and what countries there may already be existing trading relationships with.

## Data sources

The main data sources are as follows:

- Uktradeinfo, which provides regional estimates to NUTS3 level for trade of goods. This data is built from merging trade data collected by HMRC with employment data from the Interdepartmental Business Register (IDBR). Full methodology can be accessed through the link below: [https://www.uktradeinfo.com/Statistics/OverseasTradeStatistics/AboutOverseastradeStatistics/Documents/RTS\\_Methodology\\_Revision.pdf](https://www.uktradeinfo.com/Statistics/OverseasTradeStatistics/AboutOverseastradeStatistics/Documents/RTS_Methodology_Revision.pdf). The main limitations of this dataset are: it does not consider services; partner country and sectoral data only goes down to NUTS2 region; and data on business counts uses the 'Whole Number Method', which has been excluded from the analysis to prevent double-counting. Please note that this full dataset was released in 2018 for the first time and is only available for one year, therefore no time series analysis has been able to have been undertaken.
- International Trade in Services, which is a dataset from ONS which focuses of the international trade of services for the UK to explore how the UK sells services from different sectors to other countries. The limitation of this data is that there is only UK-level data publically available, so employment (BRES and UK Business Counts, Nomis) has been used to disaggregate data. From using national assumptions, there may be regional variances on net trade flows, which have not been accounted for.

# Executive Summary - Business Linkages

## D. Trade flows

**The WoE economy currently runs a trade surplus of £894m, largely driven by services exports.** This trade surplus is higher than that of many other major economic hubs, such as Manchester, Cambridgeshire, and neighbouring cities like Cardiff. These three areas all present trade deficits. Within Bristol, trade is driven by the export of services. In Bath and North East Somerset, North Somerset and South Gloucestershire, the export of goods is the main driver.

Imported goods make up a considerable proportion of international trade for the WoE, however, this is quite typical of higher growth economic areas where households have higher disposable income and therefore have a greater demand for imported goods. **The trade ratios for the WoE as a proportion of GVA is 19.7% for exports and 18.5% for imports, which is on par with other high performing regions e.g. Manchester and Birmingham.**

Goods and service exports in the WoE are worth 20.7% of GVA which is on par with other regions such as Manchester (16.4%) and Birmingham (23%). While the WoE's export economy is strong, the UK's exit from the EU may bring risks to the region's trading position; as most of the WoE's goods trade is with the EU partners (£2.85bn of exports). This highlights the importance for WoE's businesses to look at trading opportunities not just in EU markets but across other fast growing economies such as Brazil, India and China.

**Our analysis suggests that the WoE is a region that demonstrates strong net positive levels of trade with other countries relative to similar core economic hubs. These linkages could be further built on as part of the WoE LIS.**

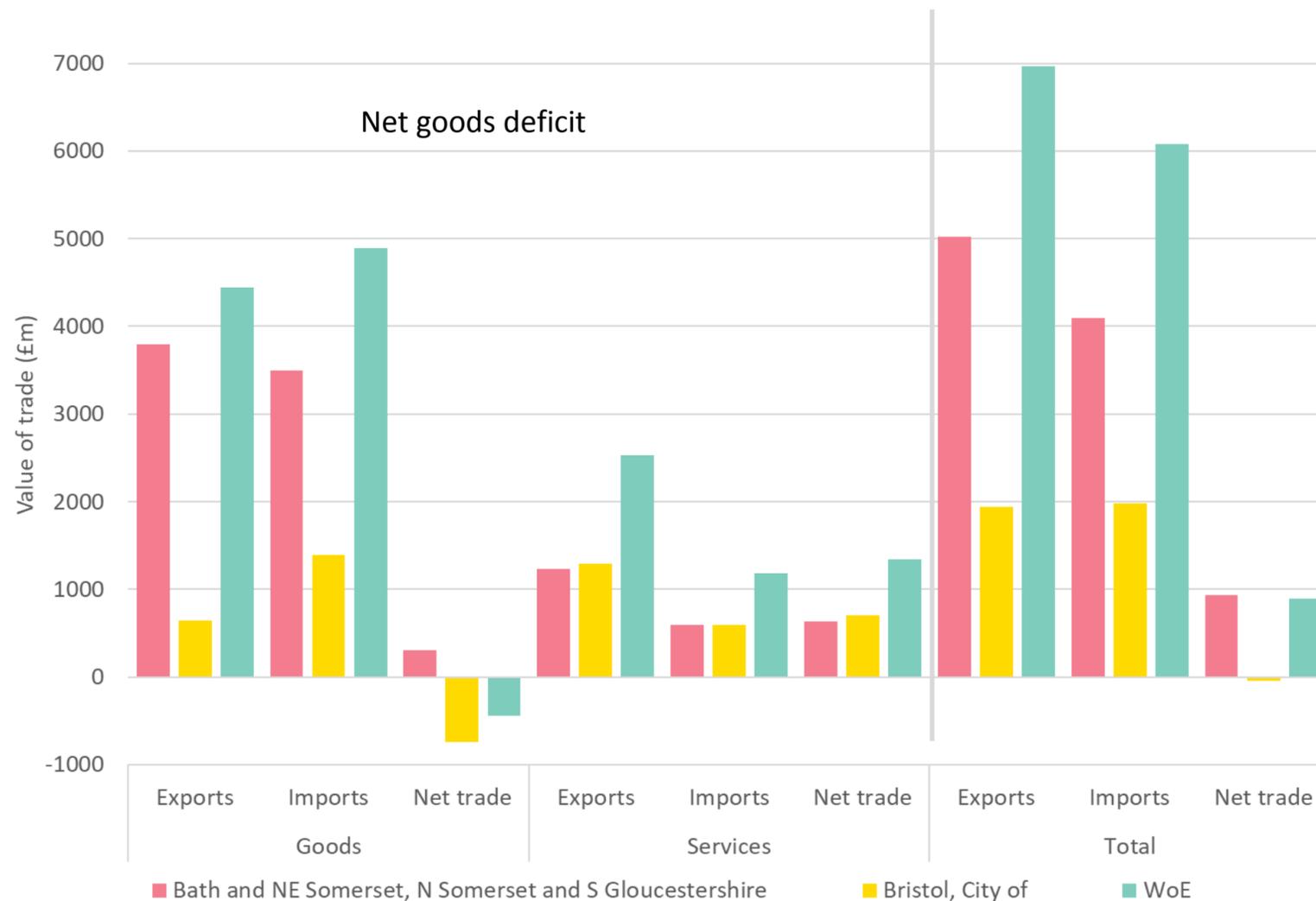
Office for National Statistics data indicates that the WoE's main EU trading partners are Germany, France, Spain and the Republic of Ireland, totalling an export value for the wider region of £3.66bn. Outside of Europe, the US and UAE are the largest Non-EU export countries contributing £2.69bn to the wider NUTS2 region, which may present future trading opportunities. However, we must be careful about the conclusions that we can draw. There is no data on the specific partner countries that the WoE trades with or the specific goods and services. We can only infer potential trading partners based on more aggregate NUTS2 data (which includes Swindon, Wiltshire and Gloucestershire).

# Section D: Detailed analysis



# Overall the WoE economy runs a trade surplus of £894m driven by the export of services (worth £2.5bn)

Figure 11: The overall trade position for the WoE broken down by the import and export of goods and services (2016)



Source, Uktradeinfo (goods), NOMIS ITIS and employment data (services)

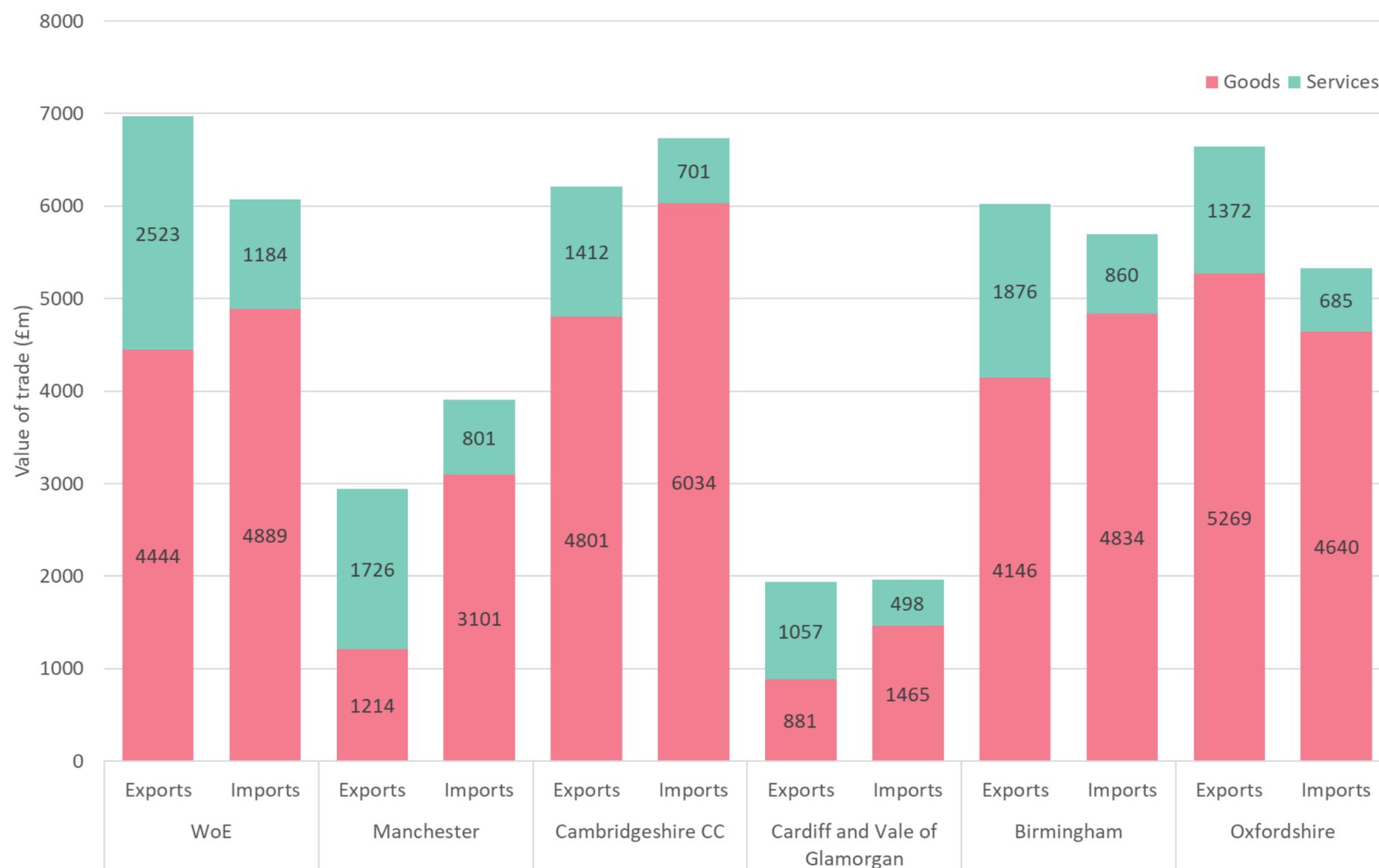
Note: WoE data on traded services are estimates based on international trade data at a national level, apportioned by share of regional employment

- Figure 11 shows the net trade position of the WoE and how this is split in terms of both goods and services in 2016.
- **Trade in goods.** The WoE has a trade deficit of £445m in terms of goods, which is equivalent to 1.4% of GVA. This is driven by a high demand for imported goods in Bristol. However, this reflects the service-based nature of the WoE economy and is also in line with other growing regions in the UK, shown on the next slide.
- **Trade in services.** The WoE operates a significant trade surplus in terms of services (£1,339m) which is equivalent to 4.1% of GVA. Figure 11 shows how in terms of services, exports outstrip imports across the whole WoE region.
- **Overall net trade position** (for both goods and services) is positive (£894m) for the WoE. This shows a positive contribution to the national economy.
- The export of goods for a region is highly dependent on the disbursement of sector jobs across the national economy. For the trade of goods, hard infrastructure such as airports and ports help facilitate trade between countries. For regions with this type of infrastructure, they not only provide benefits for their region but the wider national economy. The WoE has both an airport and port which can promote trade not just for the WoE but act as a gateway to other surrounding regions.



# The WoE operates a trade deficit of £445m in goods terms and a trade surplus of £1,339m in services terms

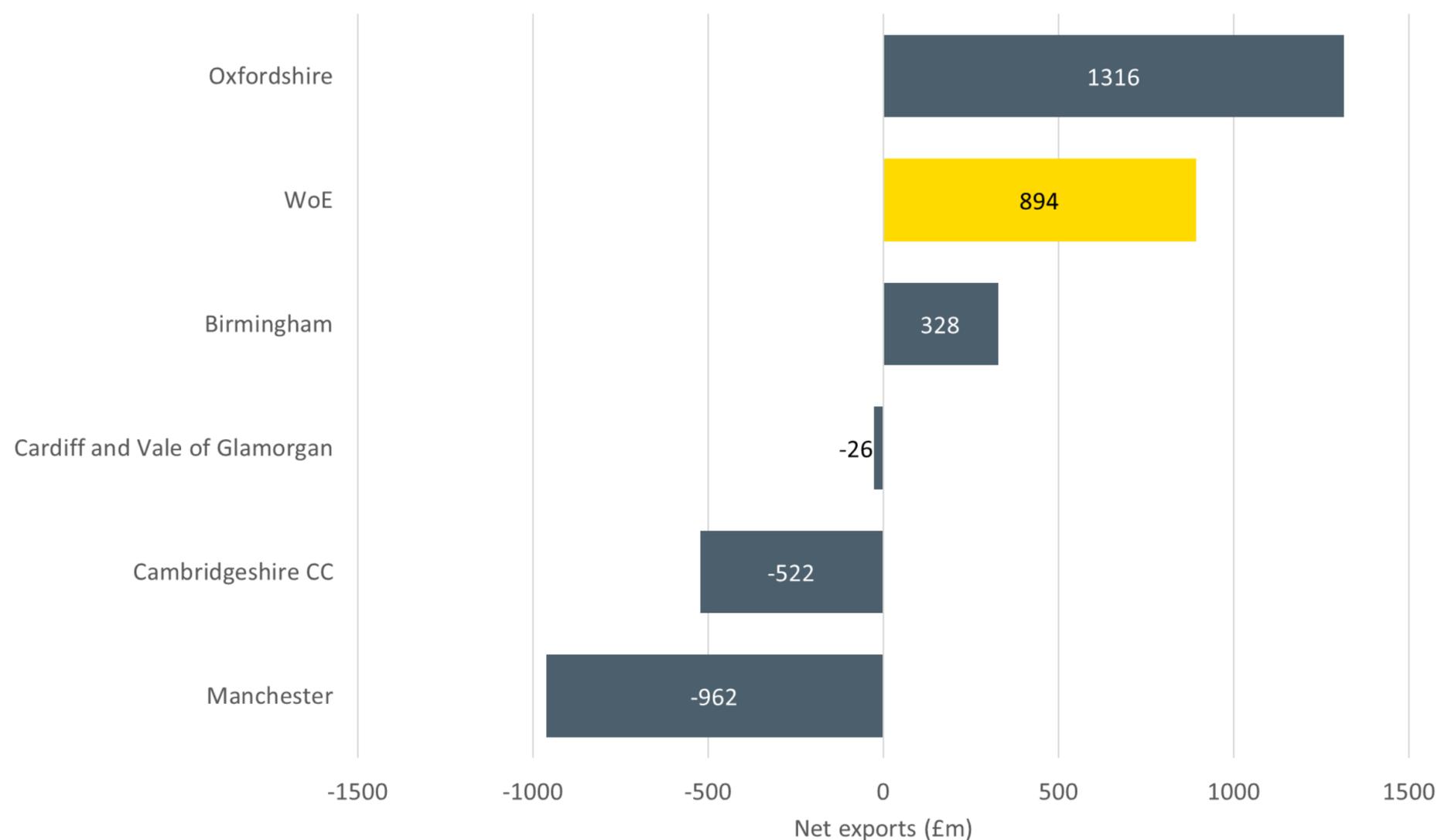
Figure 12: Value of trade for goods and services for the WoE and NUTS3 comparator areas (city councils)



- Net trade in goods.** As shown in Figure 12, the WoE has a trade deficit in terms of goods i.e. it imports more goods than it exports. However, apart from Oxfordshire which has a high level of exported goods, this is quite typical of higher growth economic areas where households have higher disposable income and therefore demand for imported goods is higher.
- Net trade in services.** The evidence suggests that other high-performing areas in the UK also have trade surpluses in services. However, the WoE's particularly strong performance in exporting knowledge and services results in a stronger trade position overall.

# The WoE has a trade surplus of £894m compared to other high-performing regions which present trade deficits

Figure 13: Net exports for the WoE and NUTS3 comparator areas for the trade of goods and services



- **Net trade for goods and services.** Figure 13 compares the level of net exports for the WoE to other high-performing regions across the country. This shows that the WoE's overall trade surplus (in terms of goods and services) is higher than that of many other major economic hubs, such as Birmingham, Manchester, Cambridgeshire; and neighbouring hubs such as Cardiff.
- **Contribution to regional economy.** Having a trade surplus within the WoE has the potential to stimulate the creation of jobs as a result of foreign demand and contribute to economic growth.
- **Contribution to national economy.** Therefore, in terms of the net trade of goods and services, the WoE contributes significantly more to national output than many high-performing areas and core cities in the UK.

# Goods and service exports in the WoE are worth 20.7% of GVA on par with other regions such as Manchester and Birmingham

Figure 14: Proportion of GVA attributed to the export of goods and services (2016) for the WoE, comparator NUT3 regions and the UK



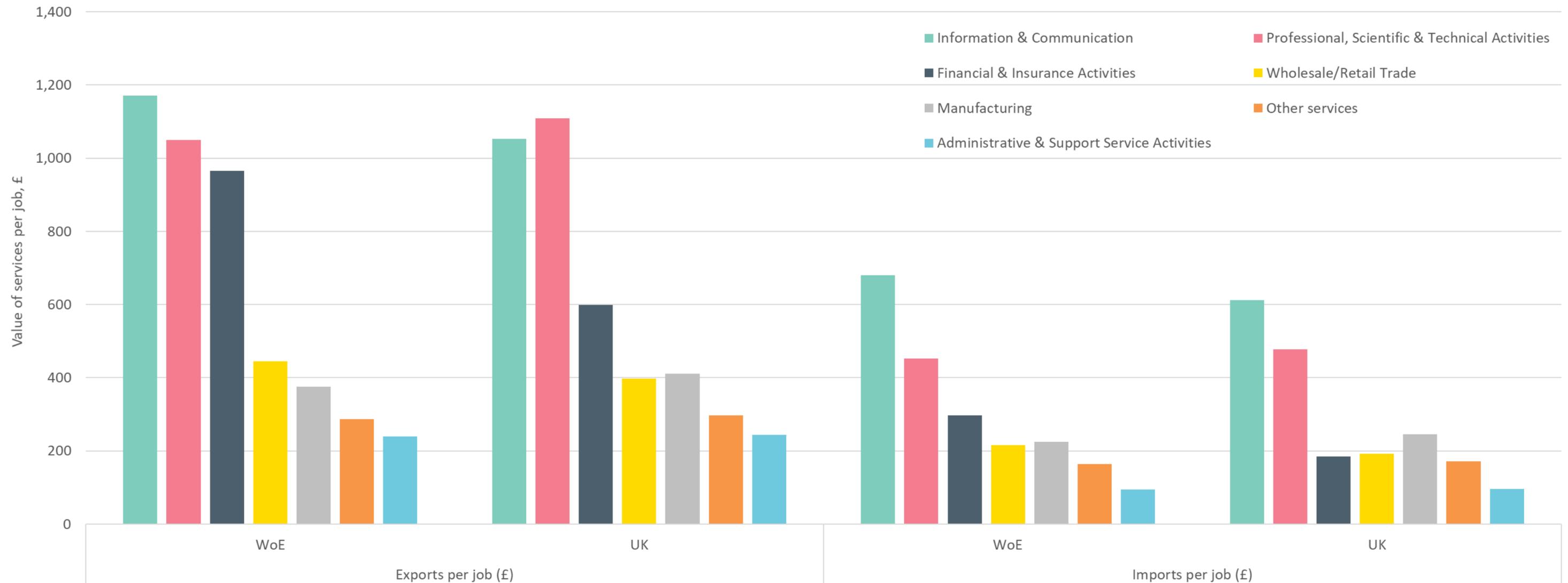
Source: PwC analysis, IT IS and Uktradeinfo, ONS

Note: The UK includes London which will skew the national average for contributions to GVA

- Figure 14 shows that the WoE has a favourable trade position, with a greater trade surplus than areas such as Birmingham, Manchester, Cambridgeshire etc. in terms of goods and services.
- Figure 14 sets out the 'trade intensity' for the WoE in comparison to other high-performing areas in the UK. This is measured as the value of trade (goods and services) as a share of economic output i.e. GVA for a specific area. Compared to the national average, the WoE has lower trade intensity i.e. trade as a share of GVA is lower, meaning that a smaller proportion of the WoE's output comes from international trade. The WoE's trade intensity is broadly in line with other high-performing areas.
- This implies that the WoE does not necessarily trade significantly more relative to the size of its own economy but still achieves a greater trade surplus compared to other major economic hubs in the UK.

# The Information and Communication sector exports £617m from the WoE contributing £1,171 per job<sup>1</sup> to the local economy

Figure 15: Estimate for International trade of services for the WoE and the UK by job (2016)



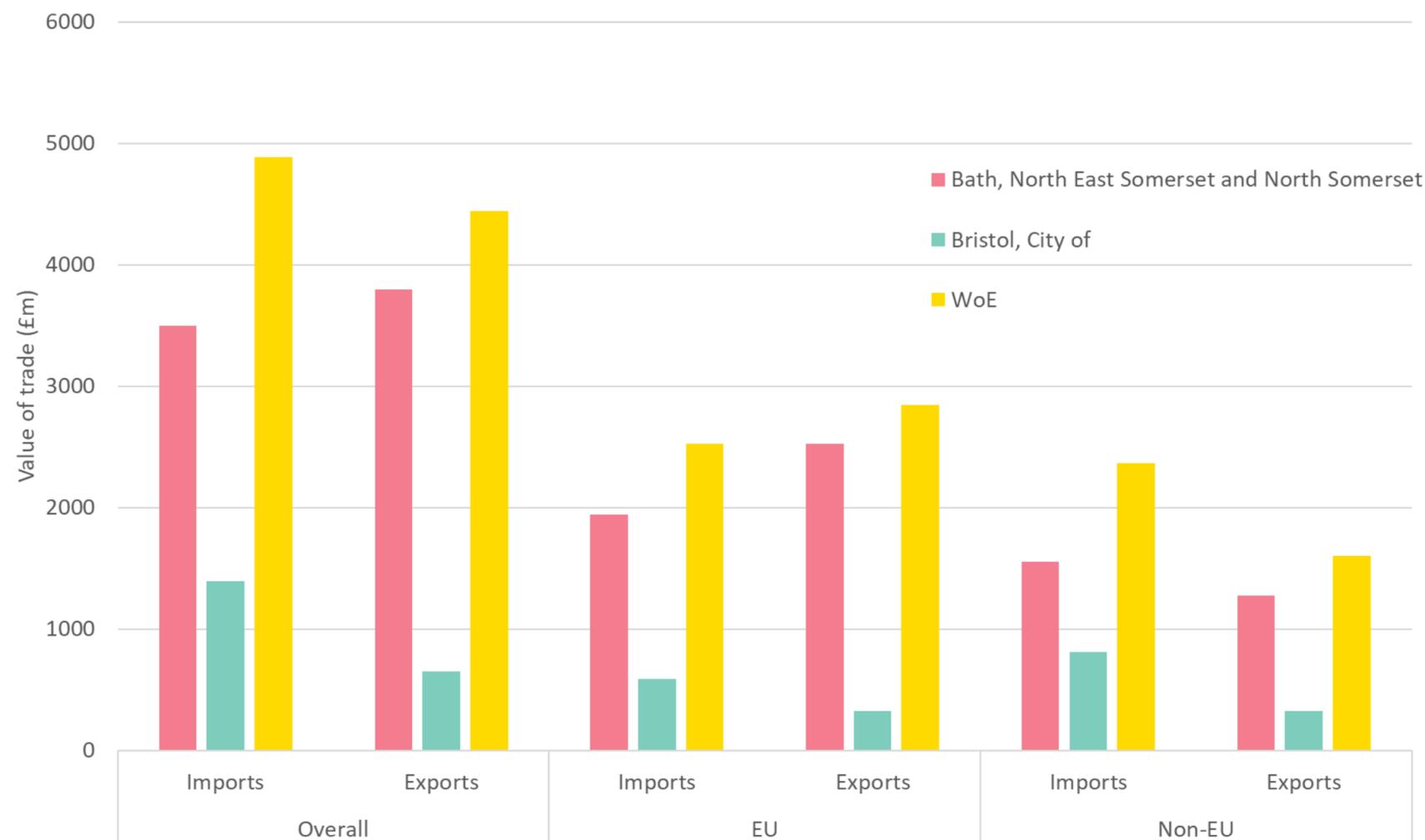
Source: PwC analysis, ITIS, ONS  
<sup>1</sup> per job (all sectors)

# The WoE has an estimated export value of services of £4,679 per job which is above the national average of £4,119

- Figure 15 shows estimates for the value of trade for services (rather than goods) per job for all sectors for the WoE and the UK.
- There is currently only national data available by sector (using broad SIC codes) on the International Trade in Services (ITIS). In the absence of regional-specific data, the value of traded services in the WoE has been estimated by apportioning national trade data (both exports and imports) with regional employment. Therefore, this estimate assumes that the share of services trade in the WoE is proportionate to the WoE's share of national employment for each sector. For example, if the WoE had 20% of the total employment for a particular sector, then they would be apportioned 20% of the value of the sector's trade in services.
- **Net trade position.** Based on these assumptions, the total value of service imports is £1.1bn and the total value of service exports is £2.4bn for the WoE. This gives rise to a net trade surplus for services of £1.3bn. These estimates suggest trade surpluses for each of these sectors. However, given that the estimates are based on national data, there may be regional variances in reality.
- **High-value sectors.** Using these national assumptions, the highest value sectors for both imports and exports for the WoE are: information and communication, professional and scientific services, and financial and insurance services. These top three high-value services align to the service-based prominent sectors identified in Business section A. These sectors are likely contributors to the knowledge/ideas based economy within the WoE.
- **Export value.** Overall for the WoE, there is an estimated export value of £4,679 per job (all sectors) in comparison the UK average of £4,119 per job (all sectors). This implies that WoE has relatively high employment in the sectors that the UK exports the most. Therefore the WoE plays an important role in driving the national level of exports for services and wider economic growth.

# Most of the WoE's goods trade is with the EU (£2.85bn of exports) which puts the WoE at risk from an EU Exit

Figure 16: An overview of the value (£m) of imports and exports of goods for the WoE (2016)



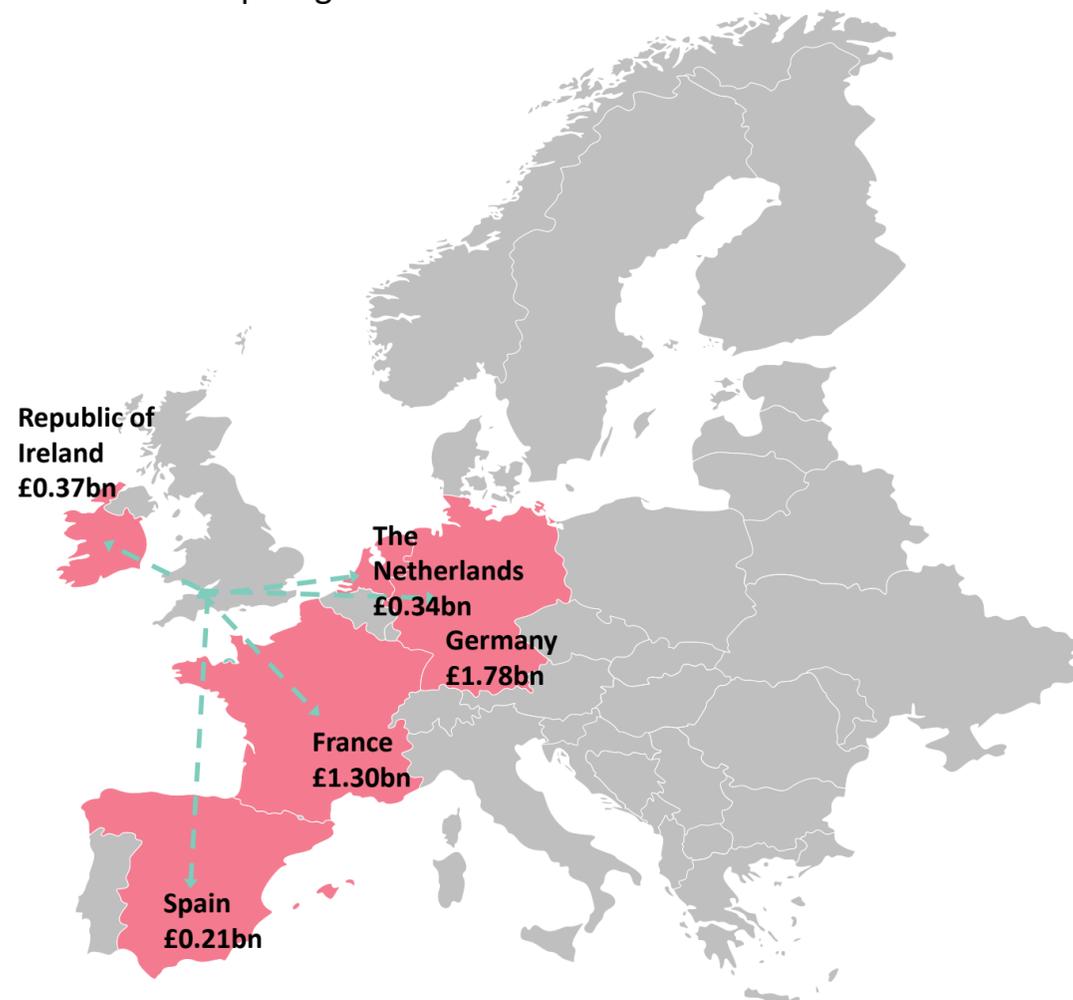
Source: PwC analysis, Uktradeinfo, ONS

Note: This data is the regional estimate for the international trade of goods for the WoE, based off experimental trade statistics from ONS.

- Figure 16 provides further insight into the level of exports and imports (in terms of goods) for the WoE and trading partners for the WoE region to better understand who is buying from WoE businesses.
- The latest data suggests that the majority of WoE's trade in goods is with the EU. The WoE's export-import ratio for goods traded is 1.13 with the EU; and 0.61 for non-EU countries. This provides insight into the reach of the supply chain at an international level, implying that the market that the WoE tends to sell to is generally closer than the market it tends to buy from.
- Therefore, it is important to consider the potential reduction on European demand for goods as the UK leaves the EU.
- The WoE can look to explore further opportunities that may arise by developing stronger trading relationships with other countries outside of the EU.
- The following slides provide more information on the specific trading partners for EU and non-EU countries of the broader region.

# WoE's main EU trading partners are Germany, France, Spain and Ireland, with a combined export value of £3.66bn

Figure 17a: Top five countries for the export of goods in Europe (2016) and the value of export goods



Source: PwC analysis, UKtradeinfo, ONS

There is currently no trade data available that is specific to the WoE on trading partners and sectors - the data above is available at the NUTS 2 level (which includes Wiltshire, Swindon and Gloucestershire)

There is currently no data available for the WoE (at NUTS 3 level) to identify trends with specific countries and sectors. However, there is NUTS2 trade data available for the broader region (which also includes Wiltshire, Swindon and Gloucestershire).

In 2016, the WoE held a 40% (£2.53bn) share of total NUTS2 imports from the EU and 58% (£2.85bn) of exports (in value terms) to the EU. Therefore, we can infer the WoE's trading relationships and sectors that are most likely to be impacted as the UK leaves the EU:

- **Partner countries.** The majority of international trade for the wider NUTS2 region is with Central Europe, including Germany, France, Spain and the Republic of Ireland. This makes up 64% of all EU imports and exports – with an export value of £3.66bn.
- **Export sectors (goods).** The top EU import and export sector (based on value in pounds) is machine and transport equipment (based on Standard International Trade Classification (SITC) codes). This provides further evidence that the transport manufacturing sector is prominent in the WoE.

Figure 17b: Top 3 sectors for the trade of goods in Europe (2016) and the value of these sectors for UKK1 region

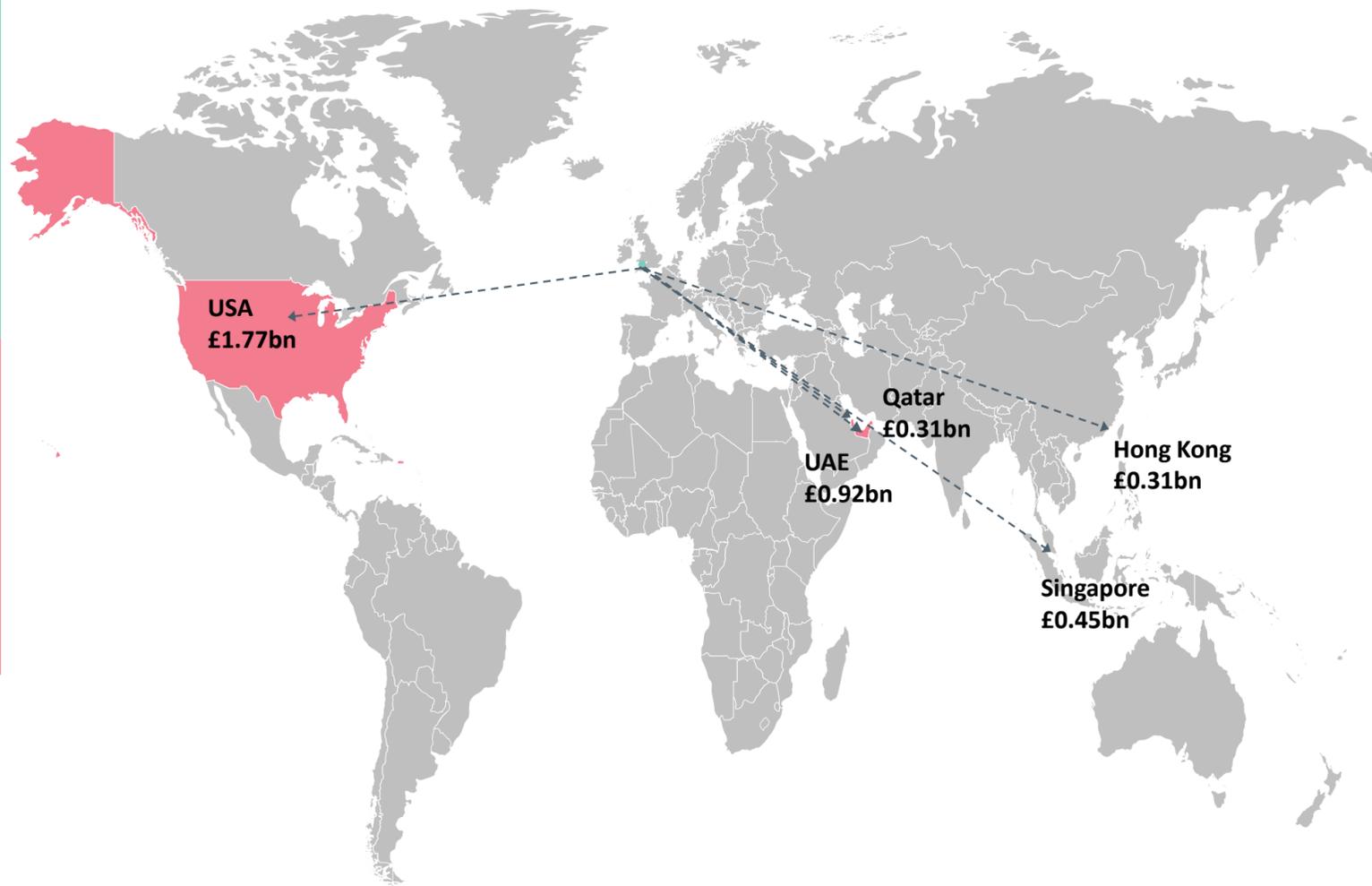
EU Import sectors (total value: £6.3bn)		EU Export sectors (total value: £4.9bn)	
1. Machinery and transport equipment (£3.22bn)		1. Machinery and transport equipment (£3.30bn)	
2. Miscellaneous manufactured articles (£0.74bn)		2. Miscellaneous manufactured articles (£0.59bn)	
3. Food and live animals (£0.73bn)		3. Manufactured goods classified chiefly by material (£0.41bn)	

Source: PwC analysis, UKtradeinfo, ONS

Note numbers do not add up to totals as only top 3 sectors are shown.

# Outside of the EU, the WoE exports the most to the USA and UAE with goods exports worth £2.69bn<sup>1</sup>

Figure 18a: Top five countries for the export of goods outside of Europe (2016) and the value of export goods



Source: PwC analysis, UKtradeinfo, ONS

<sup>1</sup>There is currently no trade data available that is specific to the WoE on trading partners and sectors - the data above is available at the NUTS 2 level (which includes Wiltshire, Swindon and Gloucestershire)

In 2016, the WoE's share of total NUTS2 imports and exports for Non-EU countries was 27% (£2.36bn) and 25% (£1.60bn) respectively. This is modest given the WoE's share of total employment (49%) in the wider NUT2 region. Therefore, there may be further opportunities for the WoE to develop stronger trading relationships with countries outside of Europe and further contribute to the growth of the wider UK economy.

Based on the trends in the wider NUTS 2 region, we can infer that there are opportunities for the WoE in the following countries and sectors:

- **Partner countries.** The top trade partner for the NUTS2 region is the USA for Non-EU imports (£2.71bn) and exports (£1.77bn). Following the USA, the second highest value exports are sold to UAE (£917m); whereas the second highest value imports are bought from China (£1.32bn).
- **Trade sectors (goods).** The top three Non-EU imports are from the same sectors as the top three exports (based on SITC codes). This shows that the broader region has stronger international trading relationships in these particular industries.

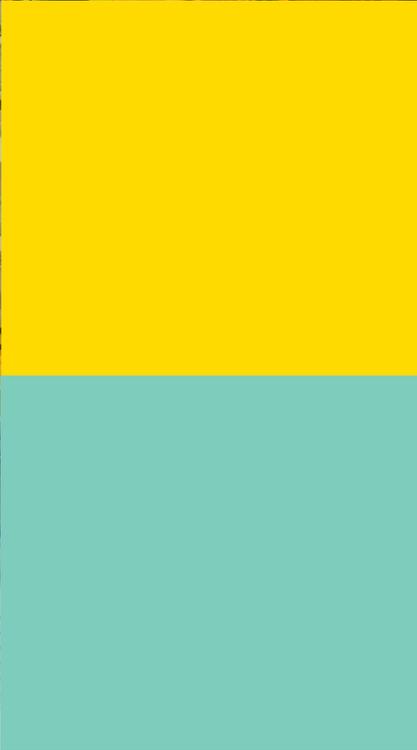
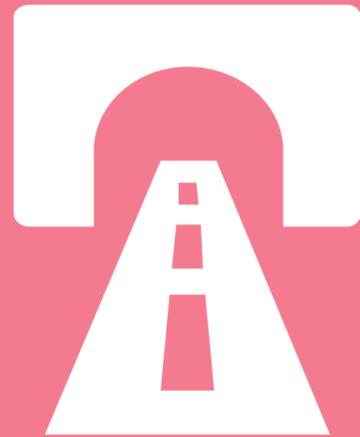
Figure 18b: Top three sectors for the trade of goods outside of Europe (2016) and the value of these sectors for UKK1 region

Non-EU Import sectors (total value: £8.90bn)		Non-EU Export sectors (total value: £6.49bn)	
1. Machinery and transport equipment (£5.86bn)		1. Machinery and transport equipment (£4.69bn)	
2. Miscellaneous manufactured articles (£1.51bn)		2. Miscellaneous manufactured articles (£0.83bn)	
3. Manufactured goods classified chiefly by material (£0.78bn)		3. Manufactured goods classified chiefly by material (£0.44bn)	

Source: PwC analysis, UKtradeinfo, ONS

Note numbers do not add up to totals as only top 3 sectors are shown.

# 2. Infrastructure connectivity



# Infrastructure section overview

## Purpose of analysis

The purpose of the analysis in this section is to better understand the impact on the WoE and the Severn Bridge toll removal and the digital connectivity across the WoE. This is important, because as the WoE develops its LIS to achieve long-term sustainable growth, it will be critical to build lasting infrastructure that connects the WoE to key economic corridors across the country. Greater connectivity with other regions will better connect people to more suitable jobs and enable stronger supply chain linkages for businesses. Furthermore, it is crucial to note that high performing regions, such as the WoE, may experience a slow down or even negative growth if they don't invest in infrastructure. This would lead to the region becoming too congested and subsequently deter investors.

## Areas of analysis

In this section, our analysis covers two main components:

- The Severn Bridge toll removal and potential implications
- An assessment of current digital infrastructure across the region

These topics have been highlighted as areas to uncover with the wider view of upgrading the region's infrastructure which is set to be a key lever for unlocking faster economic growth.

## Data sources

The main data sources are as follows:

- Ofcom Connected Nations, 2017
- The qualitative research on the impact of the Severn Tolls sources papers from the Welsh Government, Department for Transport (DfT), Atkins and uses a FOI request of DfT

# Executive Summary - Infrastructure connectivity

## Severn Bridge Toll Case Study

The Severn Bridge toll was removed on the 17th December 2018, with little publicly available information on the potential impacts of the removal. There were two primary reports available: The impact of the Severn Tolls on the Welsh economy (2012), Welsh Government and The Severn Crossings: Reducing toll prices and other issues consultation documents (2017), Department for Transport (DfT).

**Both reports shows that there would be an increased traffic flows across the bridge but disagreed about how significant this growth may be e.g. 12% (2028) for full toll removal in the report by the Welsh Government; and 17% (2027) for a reduction in toll costs by 50% by the DfT consultation document.** Due to the number of different assumptions used across these two documents, it was difficult to triangulate any findings to give an accurate representation of the impacts the WoE may face as a result of toll removal. In regards to economic impacts, only the Welsh Government report had a primary focus on evaluating economic impacts. However, these were concentrated on the impacts on the Welsh Severnside.

A model released by DfT shows that the removal of the Severn Bridge toll could increase traffic crossing the M48 by over 50% by 2022; with all bridges seeing at least a 30% increase in traffic flow. **Within the WoE, the biggest impact in increasing traffic flow will be seen in Bristol and South Gloucestershire with traffic flows increasing by 41% and 31% respectively in the toll-vs-no toll scenarios.** In July 2018, an FOI request was made to DfT asking to see the traffic modelling that Central Government had undertaken on the impact of the removal of the Severn Bridge toll. There was great interest in how this change would impact the road network around the Bridges and in the South Wales and North Bristol (M4/M5 corridor) corridors. Within DfT's response it states: "The decision to abolish tolling at the Severn Crossings was to support motorists, residents and businesses across Wales and the South-West, to help rebalance the economy as part of the Industrial Strategy."

WoE authorities commissioned Atkins to look at the high-level impacts of increased traffic flows on the WoE network as a result of toll removal, and to assess the level to which existing components in the Transport Vision could contribute towards mitigating the impacts. Atkins highlighted a number of interventions such as: Park & Ride for Bristol and Bath; Freight consolidation (general policy measures; and Financial measures and other controls (e.g. workplace parking levy etc.) from the existing Transport Vision which would mitigate the risks around increased traffic flows but also identified other initiatives such as: Intercept residual trips to Bristol urban area using M48; Intercept trips towards Bath; and Expanded scope of demand management measures for the region to consider.

# Executive Summary - Infrastructure connectivity

## Digital Connectivity

**The WoE has a significantly higher proportion of internet users than the national average; with both Bristol (92.8%) and Bath and North East Somerset, North Somerset and South Gloucestershire (93%) landing in the top 20% of all NUTS3 regions.** Nationally, the proportion of internet users has grown by 11% since 2012 to 89.8% in 2018. This means 89.8% of people aged 16 or over have used the internet within the last three months. With the number of internet users continuing to grow, regionally and nationally, it is important that digital infrastructure improvements are made to keep pace with this trend.

When considering fixed broadband, South Gloucestershire has the best Ultrafast broadband availability in WoE (approximately 60% coverage) with Bristol close behind at 47% coverage. These numbers are above other high-performing areas such as: Cardiff (43%); Cambridge (36%); and Manchester (41%). However, there seems to be significant disparity between the economic hubs within the WoE, particularly for areas which are more rural. For example, North Somerset only has a 1% Ultrafast broadband coverage, well below the WoE average. In a survey of businesses by CBI, 67% of national businesses have identified strong digital connectivity as 'Critical' (CBI Infrastructure report 2017). The WoE should consider further measures to expand digital connectivity across rural areas, as this is likely to improve business connectivity, rebalance growth and overall performance.

**Bristol has high rates of 4G availability (with 98.9% coverage outside and 77.3% inside). This is on par with other high-performing areas. However, similar to fixed broadband connectivity, areas within the region e.g. North Somerset, are lagging behind.** With the rise of smartphones, laptops and tablets; the amount of people accessing internet 'on the go' nationally has increased by 28% since 2013. Strong mobile data availability is now imperative for businesses and commuters who rely on mobile connectivity to be effective in the way they work. According to Ofcom, seven in ten commuters are now using their smartphone on their journey (Ofcom Communications Market Report 2018).

In the WECA Business Plan for 2018/19, it outlines the ambition to have world-leading digital connections across the region. If the region is to achieve this, interventions that upgrade digital connectivity in more rural areas must be prioritised. Improving digital connectivity across the region will boost worker productivity and the capacity of local businesses which will have a significant positive impact on both the regional and national economies.

# Underlying analysis



# Severn Bridge toll case study

This case study provides a summary of the findings from various reports on the removal of the Severn Bridge toll regarding the potential impact on traffic flows, congestion, costs to business and, lastly, which areas might be most affected. This research primarily focuses on the following reports:

- The impact of the Severn Tolls on the Welsh economy (2012), Welsh Government; The Severn Crossings: Reducing toll prices and other issues consultation documents (2017), Department for Transport (DfT)
- Removal of Tolls from Severn Crossings (2017), Atkins
- FOI request (July 2018) Traffic modelling on the removal of the Severn Bridge toll, DfT



## Background

The Severn Bridges are two motorway crossings over the River Severn which connect the WoE and South Wales: the Severn Bridge and the Prince of Wales Bridge. Since their establishment in 1966 and 1996 respectively, they have both operated toll systems in order to raise revenue to help maintain these crossings.

## The proposed policy intervention

In June 2017, there was an announcement from the Welsh Secretary, Alun Cairns, that the tolls on both of these crossings would be removed by the end of 2018. This has caused a mixed response from a variety of different groups across South Wales and the WoE. It is important to note that there are only a small number of reports which undertake their own analysis into the impacts of the Severn crossing toll, each set of modelling using a different base year and in some cases underpinned by different scenarios.

As part of an FOI request in July 2018, the traffic modelling used to inform the decision to remove the tolls was released. Further analysis has been undertaken on this modelling focusing on what this may mean for the WoE. The interventions outlined in the Atkin's report have been considered alongside this analysis to summarise potential mitigating actions.

# A variety of different modelling assumptions have been used since 2012

	Traffic flow modelling
<b>Welsh government analysis</b>	<ul style="list-style-type: none"> <li>• Cites a current traffic flow imbalance of 4.7% Eastbound, which means more people travel from Wales to England, which is the direction where there is no toll.</li> <li>• Baseline traffic flow increased by 10,752 vehicles (11.7%) between 2018 and 2028. There is an estimated further increase of 12% as a result of toll removal (2018).</li> <li>• For the increase in traffic flow from toll removal; modelling suggests that 7% is apportioned to “Re-assignment effect” and 5% is apportioned to “Demand effect”.</li> <li>• Greater proportion of change in traffic flow has been modelled to occur on M48 Severn Bridge (16.5%) compared to the M4 Second Severn Crossing (11.9%).</li> <li>• The profile of users on the M48 is more skewed more towards commuting and leisure journeys with current.</li> <li>• Current traffic flow analysis shows two peak travel times (AM and PM).</li> </ul>
<b>DfT toll reduction proposal</b>	<ul style="list-style-type: none"> <li>• Forecasts indicate that traffic across the Severn crossings will increase by 28% between 2018 and 2027 due to demand factors.</li> <li>• The report states reduction in tolls traffic volumes are forecast to increase by 17% from the baseline (2027) – however this doesn’t consider full removal of toll. This is higher than the forecast of 12% for the full removal of the toll within the Welsh analysis.</li> <li>• A number of toll options were consulted on including: off-peak and free-flow charging however there was no further analysis of the impact of changes to the toll on traffic flow or the economy either side of the River Severn.</li> </ul>
<b>Atkins report</b>	<ul style="list-style-type: none"> <li>• Uses Welsh government report and DfT consultation as basis for its assumptions – with low growth (12%) and high growth (24%) traffic flow scenarios both modelled in a series of traffic flow maps to represent the impacts of full toll removal.</li> <li>• Key takeaways from traffic flow analysis are: increase to travel times by 2.1%; and average delay would increase by 3.7% (high growth scenario) as a result of toll removal.</li> </ul>
<b>Summary of documents analysis</b>	<ul style="list-style-type: none"> <li>• DfT report does not contain any absolute figures in relation to their modelling; instead using proportionate change to look at traffic flows over the next 10 years. It also does not consider full toll removal, which sets a challenge to compare the traffic modelling analysis undertaken by both the Welsh Government and DfT.</li> <li>• From the baseline data, there are significant differences in the assumed proportion of traffic flow growth between 2018 and 2027/28; with the Welsh Government and DfT proposing 11.7% and 28% respectively. This is likely a result of different base years being used within each model.</li> <li>• The Atkins’ reports build upon the impact assumptions from the previous two reports to build a high and low growth assumptions to model impacts to the WoE.</li> <li>• There is little acknowledgement of how the operation of tolls in one direction impacts the modelling which has been undertaken.</li> </ul>
<b>What does this mean for WECA?</b>	<ul style="list-style-type: none"> <li>• An increase in traffic flows will lead to more congestion (in particular in supporting road network near each crossing) if appropriate interventions are not put in place.</li> <li>• Specific interventions aimed at commuters and leisure journeys could have a significant positive impact in reducing traffic flows and congestion for the M48 (focussing on Public Transport initiatives).</li> <li>• Significant impacts on congestion/traffic flow are likely to occur at peak times (AM, PM). For people/vehicles that cannot avail of public transport interventions (e.g. HGV, LGV) policy interventions could be implemented to attempt to re-distribute traffic flow to non-peak times.</li> <li>• Increases in traffic flow, congestion and travel times may have additional pressures on infrastructure elsewhere and potential negative impact on satisfaction of commuters.</li> </ul>

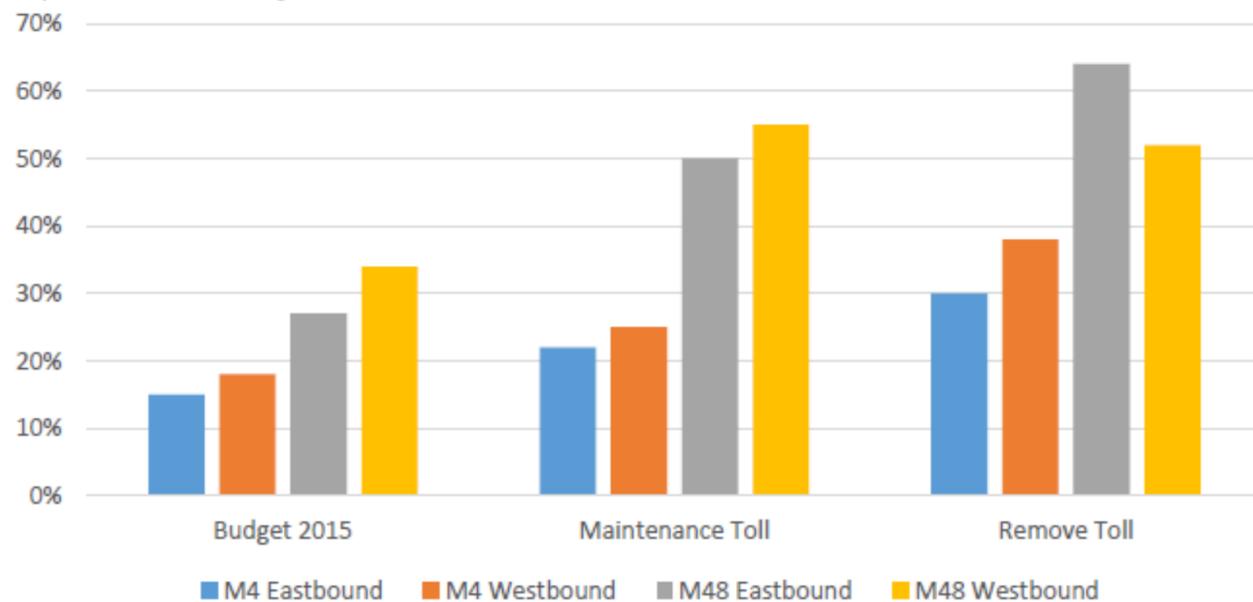
# There is a lack of conclusive evidence on the economic impact of the Severn Bridge toll removal on the wider economy

	Impact on the economy
<b>Welsh government analysis</b>	<ul style="list-style-type: none"> <li>• 50% of businesses consider the crossings to be either “important” or “very important” (with businesses in South Wales considering the crossings to be more important than the South West).</li> <li>• However, the impact on businesses was noted to be significantly less (12% reporting the tolls to be significant and 8% reporting the tolls to be highly significant).</li> <li>• For the vast majority of businesses direct toll costs represent a very small proportion of total costs and would not have a significant impact on the overall business.</li> <li>• Approximately 22% of surveyed residents of South West England said they would expect to make more trips to Wales in the next twelve months .</li> <li>• There is a directional imbalance in the commuting flow of the labour market, with around 6,600 workers commuting from Welsh Severnside to English Severnside with a further 8,500 travelling to other parts of England; and around 2,000 commuters travelling in the opposite direction from the English Severnside to the Welsh Severnside.</li> </ul>
<b>Atkin’s report</b>	<ul style="list-style-type: none"> <li>• It is estimated that the costs of congestion would increase by a further £60 to £100 million per annum (2036 impacts, in 2010 prices).</li> <li>• The evidence suggests that the economic benefits of removing the tolls would be at least partially offset by increased congestion in the WoE.</li> </ul>
<b>Summary of documents analysis</b>	<ul style="list-style-type: none"> <li>• There is little analysis that is publically available that models the impact on the WoE economy as a result of the removal of the tolls; with analysis within 2012 report. focusing on the economic benefits for South Wales.</li> <li>• From the business survey, there is evidence suggests that businesses think the removal of the tolls will benefit their businesses; however this may not be a significant. direct impact in terms of a reduction in their operating costs.</li> <li>• For some industries (e.g. Logistics and transport) increases in traffic flow may bring dis-benefits which will offset the benefit of a reduction in operational costs.</li> <li>• There is likely to be an increase in commuters (generated by the new demand effect within traffic flow modelling) – which when considering current commuting patterns are likely to be commuters travelling from Wales to the WoE.</li> <li>• Within the 2012 report, it was stated that 22% of surveyed residents of South West England said they would expect to make more trips to Wales in the next twelve months – this could have a negative impact of the retail/leisure sectors in the WoE without appropriate interventions.</li> </ul>
<b>What does this mean for WECA?</b>	<ul style="list-style-type: none"> <li>• From the 2012 business survey analysis cited within the Welsh government report, the removal of the tolls could benefit collaboration of businesses and facilitation of trade between South Wales and the South West of England - further impact analysis would need to be done to see if this would significantly benefit the WoE economy.</li> <li>• Targeted support for the retail/leisure sector in the WoE may provide an opportunity to promote consumers coming to the WoE from Wales, which provides 18,000 jobs to the WoE economy.</li> <li>• An increase in commuters travelling from Wales to WoE could have a negative impact on house prices in the region.</li> <li>• The costs of congestion may be considered a deterrent from people moving to/visiting the WoE; with appropriate transport/infrastructure interventions needed to minimise the impact of congestion to the economy.</li> </ul>

# Removal of Severn toll could increase traffic crossing the M48 by over 50% by 2022

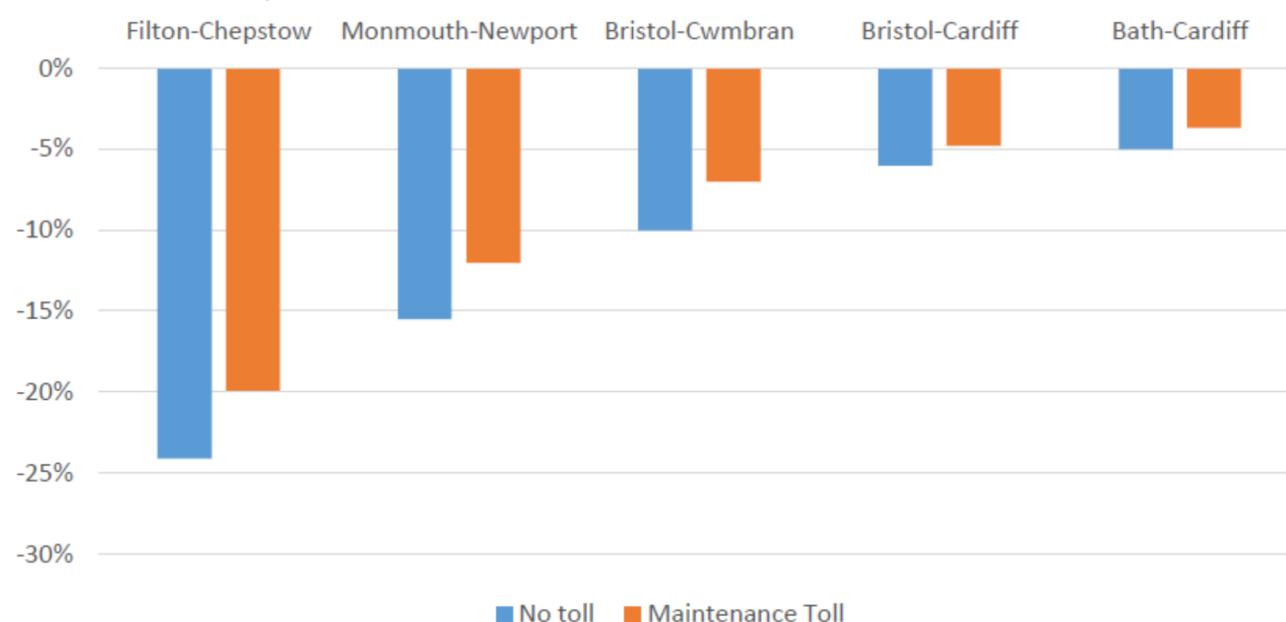
An FOI request was made to the Department for Transport in July 2018 to see the traffic modelling that Central Government has undertaken on the impact of the removal of the Severn Bridge tolls will have on the road network around the Bridges and in South Wales and North Bristol (M4/M5 corridor) corridors. Within the response it states: “The decision to abolish tolling at the Severn Crossings was to support motorists, residents and businesses across Wales and the South-West, to help rebalance the economy as part of the Industrial Strategy.” From the traffic modelling by DfT we can see that the M48 will see the greatest increase in traffic flow (over 50%). In the “no-toll” scenario, it can be seen that for shorter distances (e.g. Filton-Chepstow – 13 miles) this could have a reduction in commute cost of almost 25%. The document also states that under the “no-toll” scenario - by 2022 traffic on the crossings will increase by around 42%; which is significantly higher than the 12% (for traffic flows in 2028) modelled in the Welsh Government report in 2012.

Figure 19: Increase in traffic on the crossings as a result of a change in toll by scenario, bridge, and direction in 2022



Source: DfT FOI

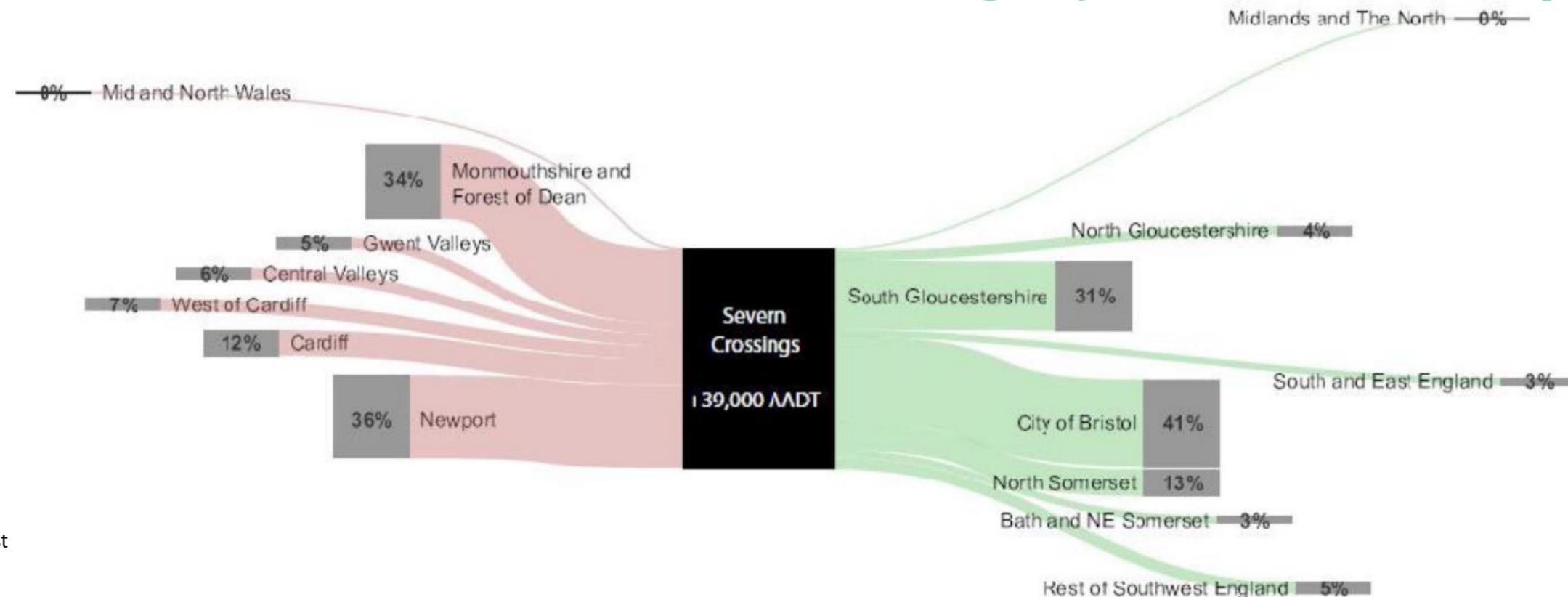
Figure 20: Change in generalised costs compared to Budget 2015 scenario (2014 prices)



Source: DfT FOI

# Bristol is set to be proportionately most affected by the toll removal with traffic flows increasing by 41% in DfT projections

Figure 21: DfT projections in traffic volume changes



Source: DfT FOI request

- Figure 21 above (DfT FOI) presents the percentage change in traffic volumes across the Severn Bridges (2022) in a toll vs “no-toll” scenario; which estimates there will be an average of 39,000 vehicles using the crossings each day.
- On the English Severnside, the biggest impact will be seen in Bristol and South Gloucestershire; with the eastern end of both bridges located in South Gloucestershire.
- Vehicles are coming from Monmouthshire and Forest of Dean and Newport. In a report by Monmouthshire County Council, it suggests, that the existing directional imbalance in commuting and the differentials in pay between ‘English Severnside’ and ‘Welsh Severnside’ concluded that any increase in commuting would relate to residents of Wales travelling to jobs in England.

# Atkins report highlights additional interventions outside of existing Transport vision to reduce impact of toll removal

The Atkins report provides a high-level assessment on the impact of the removal of tolls from the Severn Crossings upon the transport network in the WoE. It summarises potential mitigations from the current Transport Plan and outlines additional proposals, with the view to consider how to reduce the impact of the toll removal on traffic flow in the WoE. This document focuses on the impact of traffic flows (e.g. congestion) and does not include additional economic impacts (e.g. loss of business revenue).

## Existing Transport vision

- General improvements to bus and cycle networks
- Additional MetroBus services
- Mass Transit system
- Park & Ride for Bristol and Bath
- Rail station upgrades
- Capacity improvements road network
- Freight consolidation (general policy measures)
- Financial measures and other controls ( e.g. workplace parking levy etc.)

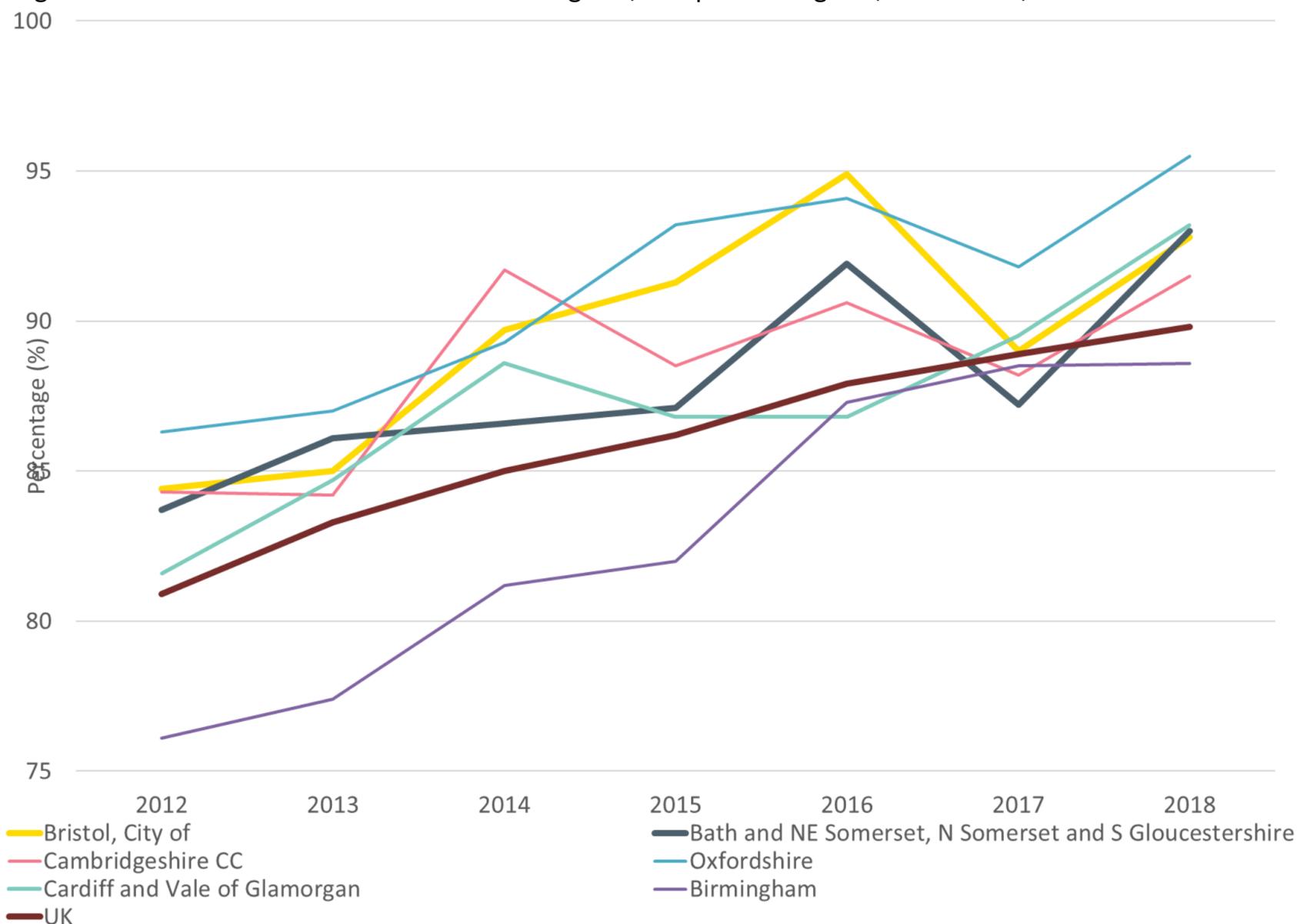
## Additional options to consider

- Divert traffic to Bristol urban area from M4 / Almondsbury towards M49
- Intercept trips to Bristol urban area
- Intercept residual trips to Bristol urban area using M48
- Intercept trips towards Bath
- Expanded scope of demand management measures

- There are currently a number of interventions within the Atkins report (both within the existing Transport vision and additional to this) – which hope to reduce congestion pressure once the tolls have been removed.
- A number of these interventions will be longer term and extend past the removal of the tolls in December 2018.
- It will be essential to prioritise interventions which can be established quickly e.g. additional services.
- There may also be some complimentary interventions such as “special offer” public transport fares for Christmas in order to move people away from driving during at the outset of the removal period.
- There may also be a number of smart technologies solutions e.g. smart traffic lights that you may wish to integrate into the current system.

# The WoE's proportion of internet users is within the top 20% of NUTS3 regions, ahead of Birmingham and Cambridgeshire

Figure 22: Internet users for the WoE NUTS3 regions, comparator regions, and the UK, 2012-2018

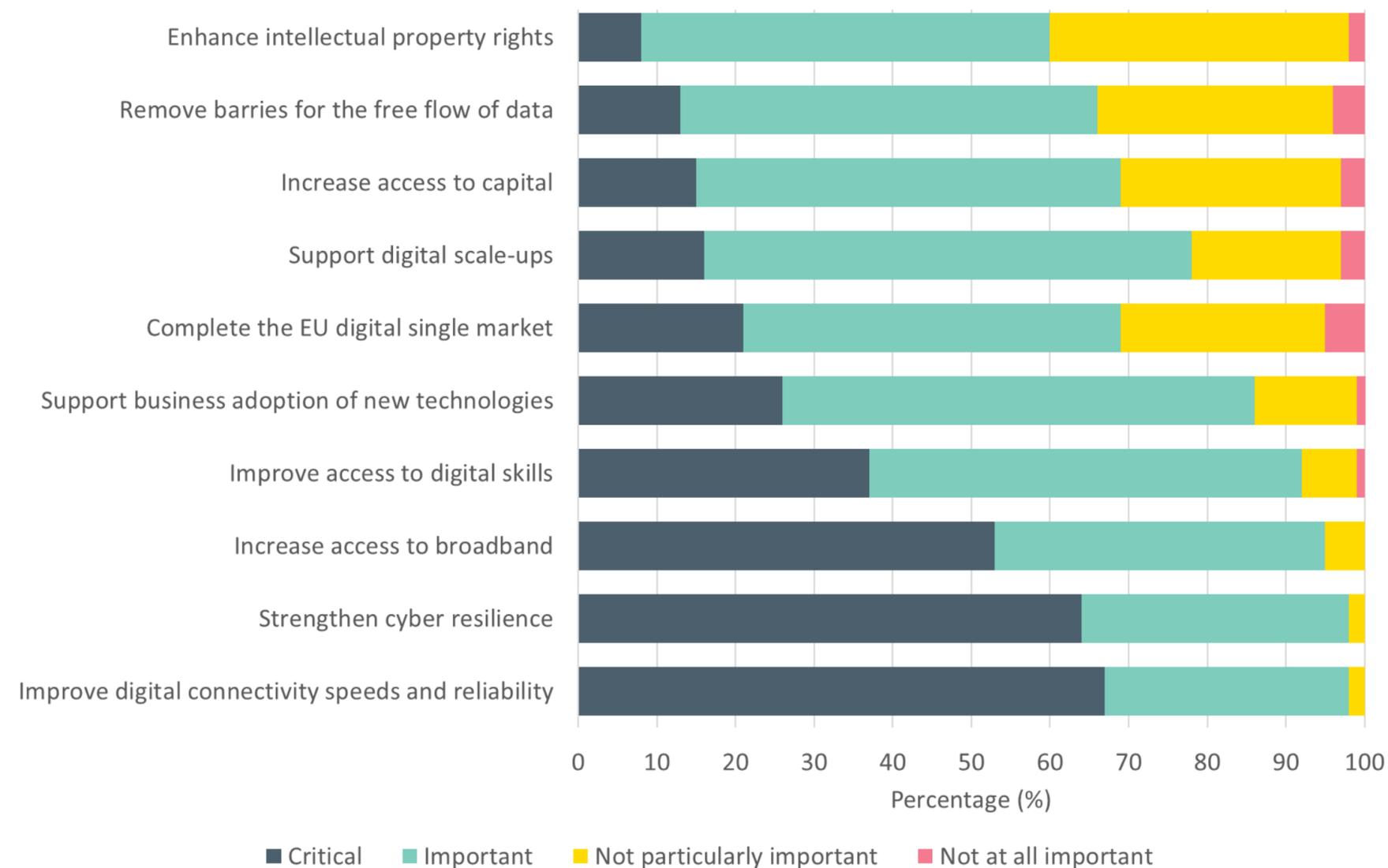


Source: Internet user, ONS

- There has been a significant upwards trend nationally in the proportion of the population who are considered 'internet users' from 2012 (80.9%) to 2018 (89.8%).
- In this dataset, the definition of internet users is a person aged 16 or over who has used the internet within the last three months. There may be volatilities within the NUTS3 level data as they are based on survey estimates.
- Within the WoE region, the proportion of internet users is consistently above the national average, reaching 92.8% and 93% respectively for Bristol, and the group of Bath and NE Somerset, N Somerset, and S Gloucestershire. This puts the WoE region ahead of Birmingham and Cambridgeshire in terms of internet uptake in 2018.
- Between 2012 and 2018 the proportion of internet users has grown by 10.0% in Bristol and by 11.1% in Bath and NE Somerset, N Somerset and S Gloucestershire. This growth is in line/just below the national average (11.0%) but lags behind Birmingham (16.4%) and Cardiff and Vale of Glamorgan (14.2%). This may be as a result of the strong starting position of the WoE in 2012.

# 67% of businesses nationally have identified strong digital connectivity as ‘Critical’

Figure 23: Business priorities for digital infrastructure in the early years of this parliament (%)

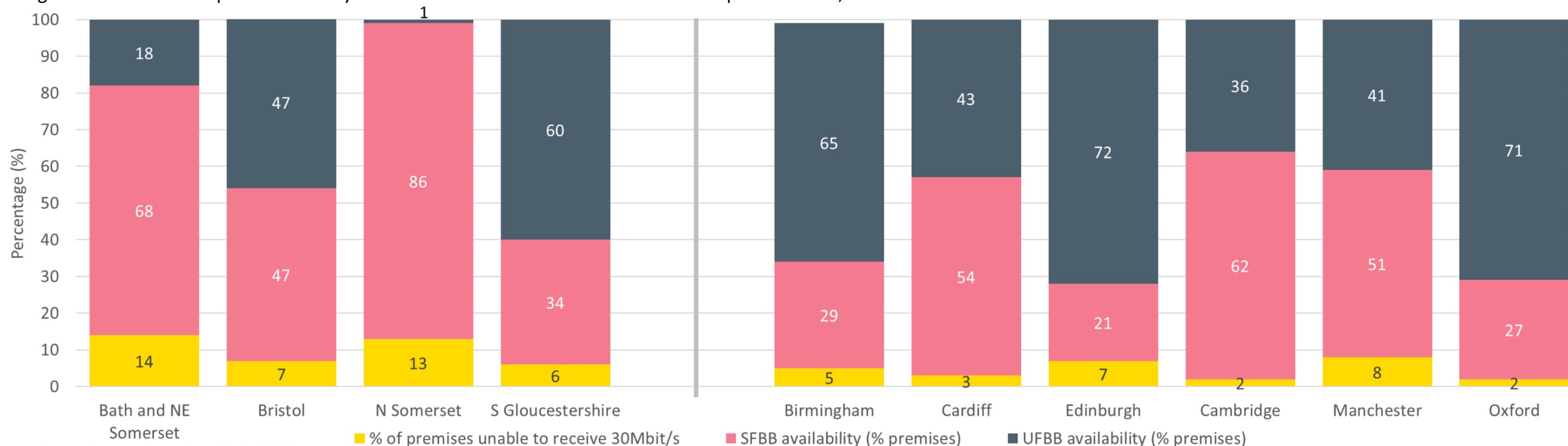


Source: CBI/AECOM Infrastructure Survey 2017

- Digital connectivity is becoming increasingly more important for businesses as a means of working more effectively.
- The UK has an average download speed of 44Mbit/s but it has been noted broadband coverage for small businesses currently lags behind domestic coverage with 7% of small businesses not being able to receive sufficient broadband coverage (OFCOM Connected Nations report 2017).
- Nationally, improving speed and connectivity has been identified as the most business-critical priority ahead of cyber resilience and technology adoption (CBI/AECOM Infrastructure survey 2017).
- Strengthening digital connectivity has also been highlighted as an infrastructure priority within the South West; as an enabler of innovation growth and contributing to the overall productivity of the region (Shaping regional infrastructure priorities for growth – South West, CBI).

## S Gloucestershire has the best Ultrafast broadband availability (60%) in the WoE ahead of Cardiff, Cambridge and Manchester

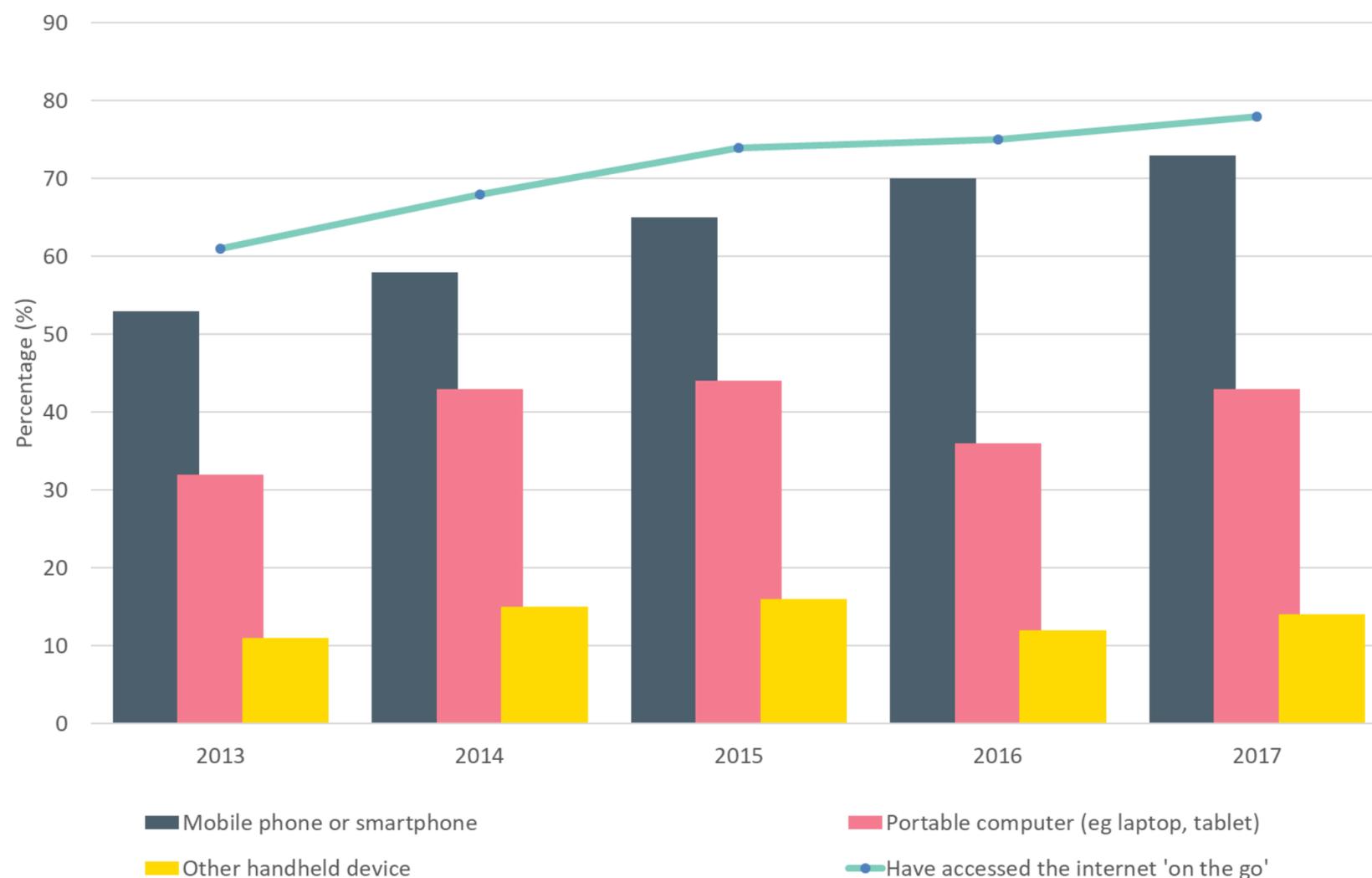
Figure 24: Broadband speed availability for the local authorities in the WoE and comparator areas, 2016



- In the WoE there is significant variability across local authorities in the availability of Ultrafast Broadband (connections that deliver speeds of 300Mbit/s or greater) with 60% of premises in S. Gloucestershire having access to these broadband speeds compared to 1% of premises in N. Somerset. This is likely to be as a result of the rurality of these local authorities; with N. Somerset having a greater level of rurality than S. Gloucestershire.
- Bath and NE Somerset and N Somerset have considerable proportions of premises that do not have access to broadband speeds of at least 30Mbit/s at 14% and 13% respectively. This is much higher than comparator areas e.g. Manchester at 8% and Birmingham at 5%. As a result there may be a direct impact on how firms do business within these local authority areas.
- It is important to note that this is a fast changing landscape with rapid improvements underway e.g. the ultrafast BB programme by BT.

# The amount of people accessing internet 'on the go' nationally has increased by 28% since 2013

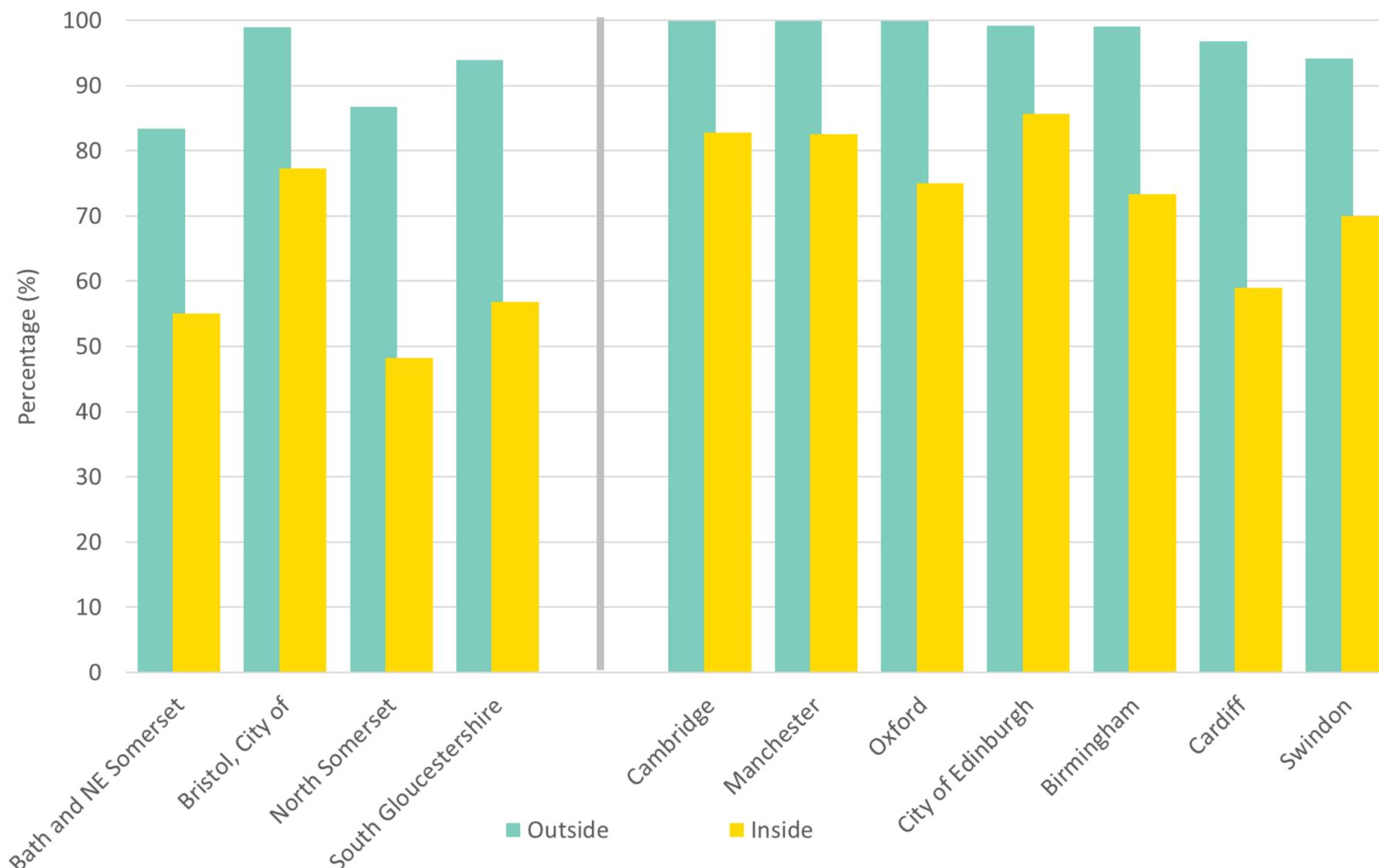
Figure 25: The number of people who have accessed internet 'on the go' and what devices they use for the UK, 2013-2017



- From national data there has been an upwards trend in the use of mobile data from 61% in 2013 to almost 80% 2017.
- There has been fluctuations in the use of portable computers (such as laptops and tablets) over time but a substantial upwards trajectory in the number of people using a mobile phone or smartphone. In 2017, OFCOM identified that 78% of UK Adults use a smartphone through the OFCOM technology tracker.
- As more people are accessing internet on the move, it is becoming increasingly important that people have access to sufficient internet availability.
- Strong mobile data availability is now imperative businesses and commuters who rely on mobile connectivity to be effective in the way that they work; with seven in ten commuters now using their smartphone on their journey and 35% of commuters agreeing to the statement that '*the internet is essential for my commute to complete tasks in my professional life*' (OFCOM Communications Market Report 2018).

# Bristol's 4G availability (98.9% outside) is on par with high-performing regions but other areas within the WoE lag behind

Figure 26: 4G signal availability for all operators for local authorities in the WoE and comparator areas, 2017



- Acknowledging the national upwards trend on using the internet on the move, it is important that people and businesses have good signal availability to be able to use the internet effectively.
- From Figure 26 it shows that Bristol has the strongest 4G connection within the WoE both inside (77.3% coverage) and outside (98.9% coverage) of buildings which is similar to other high performing regions such as Birmingham and Oxford.
- Other local authorities in WoE are lagging slightly behind in terms of 4G availability. This may be as a result of the rurality of the local authority area. With Agritech and similar industries growing in popularity, this lag could present a potential barrier to their growth.
- All local authorities followed the same pattern that 4G connectivity is reduced inside of premises.

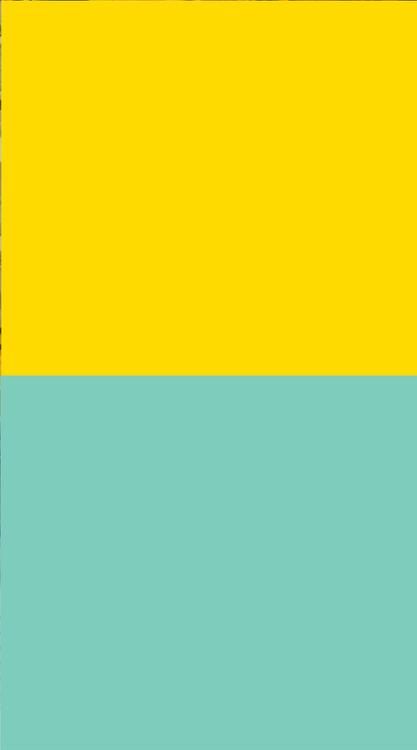
# 5G and full-fibre broadband are the future of digital connectivity for the WoE

The West of England Combined Authority Business Plan for 2018/19 states their ambition to have *world-leading digital connections across the region*. This includes: improving broadband coverage; upload and download speeds and mobile coverage; and being leaders in 5G technology. The WoE ambition for improving digital connectivity aligns with the national digital connectivity agenda driven by DCMS and the National Infrastructure Commission.

In a bid to improve the UK's digital connectivity, the Autumn Budget 2017 launched a £190 million Challenge Fund to help roll out full-fibre to local areas with the Spring Statement 2018 allocating the first wave of funding to regions such as: Manchester, London and Cambridgeshire. This fund has the primary focus to improve Britain's digital infrastructure, ensuring the UK is ready for a digitally enabled future of part of the UK Industrial Strategy.

This analysis infers that some areas within the WoE such as Bristol and South Gloucestershire are on par with other high-performing regions across the country; in terms of their digital connectivity. However, Bath and North East Somerset and North Somerset (who have greater areas of rurality) generally lag behind. The WoE can take advantage of the numerous private/public funding opportunities to strengthen their digital connectivity across the region, in particular in more rural areas. With industries such as Agritech becoming more prominent and suggested economic benefits for tourism and healthcare within rural communities; improving digital connectivity across the WoE could boost productivity and capacity of local businesses which will have a significant impact on both the regional and national economies.

# 3. Movement of people



# People section overview of approach

## Purpose of analysis

The purpose of the analysis in this section is to develop an understanding of the economic flows of the WoE with the rest of the UK through the movement of people. In order to promote clean and inclusive growth, the WoE economy needs to prepare for rapidly changing social demographics and understand the potential impact on its workforce and infrastructure. This section reveals insights into how people travel for work and what sectors are in need of support to facilitate higher growth. It also explores the flow of people with other areas in the UK to identify areas of potential collaboration with other Local Industrial Strategies.

## Areas of analysis

In the following slides, we set out analysis around:

- Travel to work flows (by sector, distance, occupation and mode).
- Migration flows (short-term international migration, long-term international migration, internal migration, trends by age).
- Origins of where people move to WoE from and destinations of where people leave the WoE to.
- Population projections for the WoE.

## Data sources

The main data sources are datasets extracted from the ONS and Nomis.

- It is also worth noting that data on travel to work flows and commuter analysis has been drawn from the Census 2011, which is the latest available commuting data that has sufficient geographical coverage across the UK.
- As previously identified with WECA, purchasing HESA (Higher Education Statistics Agency) data would provide further insight into graduate movements (profile and geography) to support this analysis.

# Executive summary - Movement of people

## Commuting Patterns

On average, across all sectors in the WoE, 81.7% of residents commute for work, which is similar to the average across England/ Wales of 81.2%. More specifically: the proportion of residents that commute for work varies by sector, from 47% in construction to 95% in the finance and public sectors. **With an average propensity to commute to work, the WoE should continue to prioritise actions on congestion and investment in infrastructure.**

In the finance and insurance sector, 12% more people in the WoE travel under 10km to work compared to the England and Wales average for the sector. Similarly, 13% more working professionals in the WoE travel less than 10km to get to work versus England/Wales. These shorter commute distances can have a significant impact on quality of life, and adds to the region's reputation as a desirable place to work. However, this can vary depending on the industry that is worked in. For example, 32% of people who work in manufacturing commute over 10km to get to work whereas only 24% of people who work within public administration commute over 10km.

The Travel to Work survey (Travel West, 2018) estimates that 44% of WoE employees favour their car to commute versus other modes of transport. With average levels of commuting, and more people using cars as the primary transport, WoE should continue to consider initiatives to encourage the use of alternative modes of transport. Public bus (44%) and trains (45%) currently have the lowest percentages of people satisfied with their normal journeys to and from work. **Respondents in Bristol and South Gloucestershire explained the main reasons they travel by car versus public transport, walking, cycling or car sharing, is (i) it is too far to walk, (ii) they have a quicker journey time travelling by car and lastly (iii) car sharing would not give them sufficient flexibility.**

## Short-term International Migration

The overall growth in short-term international migration for the WoE region has largely been driven by international students moving to South Gloucestershire, with the area experiencing a significant rise in students between 2011 and 2016. **Since 2011, people moving to the WoE for employment have also increased significantly, driving up the overall levels of short term international migration. Bristol is responsible for around 64% of this increase.** Historically the majority of short-term international migration has comprised of students into the WoE area. However, over recent years this is not as pronounced with shares of short term international migration more evenly split between people moving for employment and for study. This change in reasons for migration could impact accommodation and housing, as students and employees will have different housing needs.

# Executive summary - Movement of people

## Long-term International Migration

Since 2015, the WoE's long-term international migration has fallen sharply across all areas in the region - decreasing by 13% in 2017. This pattern aligns with the announcement of the of the EU exit referendum, but data is too recent to claim a direct cause. The WoE had the fifth highest outflow of long-term international migration compared to other LEPs in 2017, primarily driven by Bristol, which seen increased outflows of 28% between 2015/16. **This suggests that the area has an encouragingly high level of international connectivity, but WoE could consider initiatives to help retain skilled people in the region.**

The WoE attracts more international migrants than its neighbours, with a larger net inflow than Swindon and Wiltshire LEP, and Gloucestershire LEP. However, the region does have lower net inflows compared to other high performing regions like Greater Birmingham and Solihull, and Greater Manchester. This indicates that more could be done to build the region's brand as a great place to both work and live.

## Internal Migration and Population Projections

The WoE's consistent inflow of young people suggests that the region remains an attractive place to study and start a career. The WoE has consistently had a positive net inflow of people moving into the region each year since 2005. When looking at internal migration broken down by age, there is a positive inflow with the 15-24 (+5,220) and 25-44 (+1,090) age categories; with all other age categories experiencing a net outflow in 2017.

The WoE is an attractive place in the M4 corridor for innovation and development – with consistent inflows of young people from London and the South East boosting connectivity. When considering the overall net flows of people, the WoE attracts people from London (950) and the South East (870) but loses people to neighbouring areas in the West. **This is an interesting pattern, as net inflows tend to be for younger people from the North and the East, while outflows tend to be from older generations moving to the South and West.**

**The expected growth in working population, and continued attractiveness for students, suggests that the WoE has an opportunity to take advantage of a significant demographic dividend.** Based on ONS projections, the WoE is forecast to see growth in its working age population of 10.4%. This is significantly higher than the South West (2.4%) and England (2.6%). The WoE can expect to have a proportionately larger pool of workers to support businesses in their growth plans. Over 70% of students from the WoE stay in the region immediately after graduating. Bristol also gains the third highest number of graduates of cities outside London - ahead of Oxford, Cambridge and Edinburgh (Centre for Cities, 2016).

# Underlying analysis



# Previous work has provided a clear view on WoE commuting patterns and their implications

Analysis of economic flows was carried out by Metro-Dynamics at the end of 2016 for the WoE region. This work highlighted four key points around commuting patterns which help provide context for additional analysis explored throughout this report.

1. The WoE is a strong magnet for economic activity and commuting flows, with around 90% of residents working across the WoE footprint, behind only Cardiff Capital Region (92%) and London (91%).
2. The commuting inflow and station usage analysis concluded that stations such as Bristol Temple Meads, Bristol Parkway and Bath Spa act as integral commuting hubs for internal workforce flows but also for incoming commuters, which accounts for 15% of people working in the WoE.
3. Wiltshire, Mendip, Sedgemoor and Stroud, are the main locations from which people commute into WoE to work, and WoE residents commute to for work.
4. Bristol airport has seen robust growth in passenger numbers in recent years, however there is a limited range of European and inter-continental flights compared to the likes of Birmingham. This could be hindering the region's connectivity to areas beyond the rest of the UK.

The following slides will build on this existing analysis. This will cover commuting distance travelled broken down by sector and by occupation, which helps provide insight into the characteristics of WoE residents that are required to commute longer distances. In addition, we have included summary statistics of the most recent Travel West Travel to Work survey, outlining average commuting times and journey satisfaction. Lastly, we have included analysis on migration trends, which can indicate how attractive WoE is as a place to both work and live.

## Major conurbations:

Destination of WoE residents	No. commuters 2011	Prop. change 2001-11
Greater London	3480	34.9%
Cardiff City Region	2553	29.7%
Greater Manchester*	1104	430.8%
West Midlands	830	10.2%

\*care should be taken with this estimates as they might be biased for this specific Census week

Origin of WoE workers	No. commuters 2011	Prop. change 2001-11
Cardiff City Region	9535	37.5%
Greater London	2502	164.8%
West Midlands	802	32.6%
Greater Manchester	759	153.8%



West of England LEP

## Analysis of economic flows

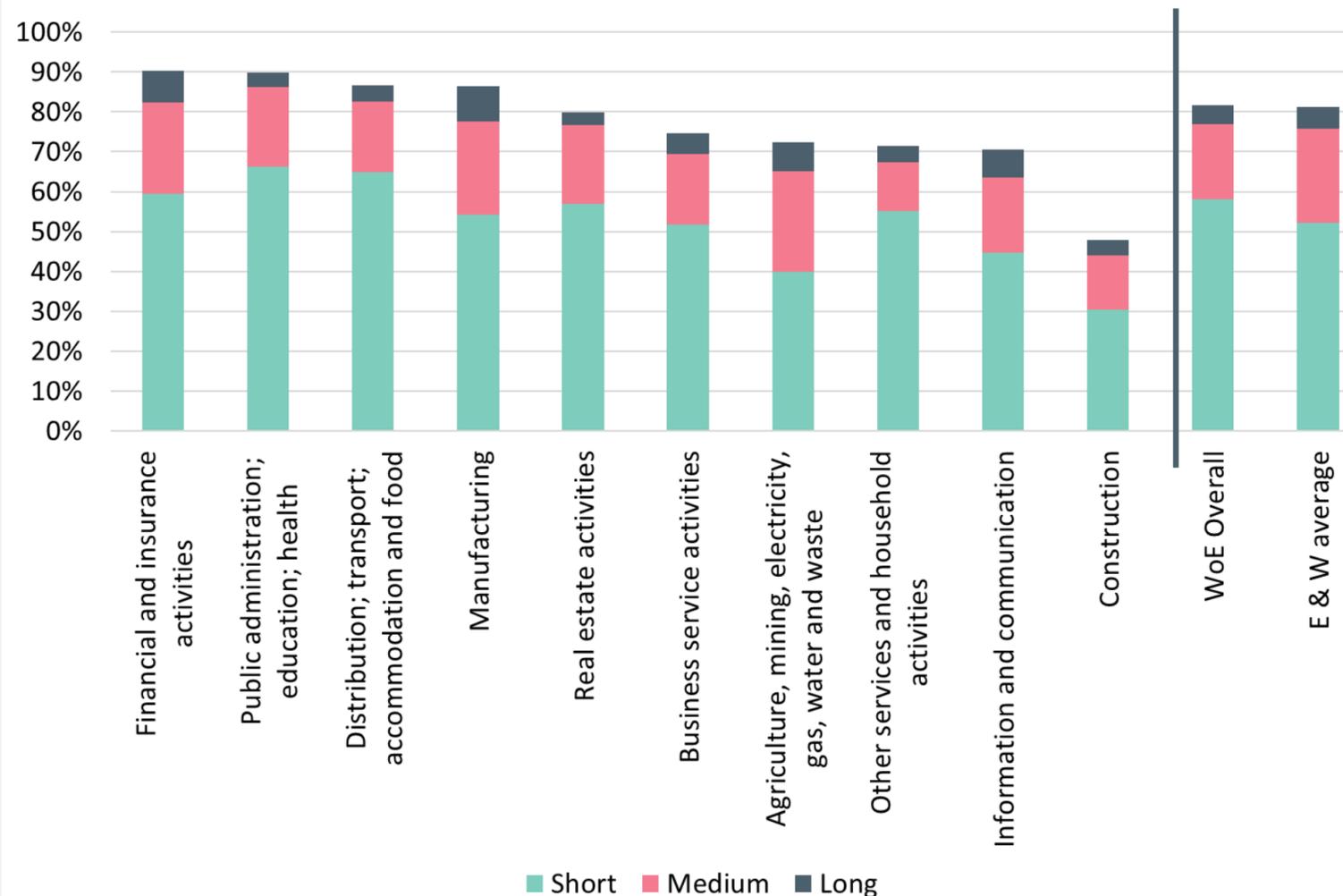
16<sup>th</sup> December 2016

Metro-Dynamics

# 81.7% of WoE residents commute for work which is similar to the national average

- The proportion of residents that commute for work varies by sector, from 47% in Construction to 95% in the Finance and Public sectors (see Figure 31).
- On average, across all sectors in the WoE, 81.7% of residents commute for work, which is similar to the average across England and Wales of 81.2%.
- Construction and agriculture sectors have the lowest percentage of residents commuting. This is partly explained by the fact many of these workers have no fixed place of work, meaning they are not defined as commuters in this survey.
- Oppositely, finance and insurance (90%) and the public sector (90%) have the largest percentages of residents who are required to commute.
- In terms of commuting distances, WoE residents working in the agriculture, manufacturing and finance sectors are commuting proportionately longer distances, with 32%, 32% and 31% of residents having to commute over 10km to their work place.
- On the other hand, residents working in the transport, and accommodation and public sector tend to commute shorter distances on average.

Figure 27: Percentage point difference between WoE and the rest of England and Wales, in the proportion of people commuting short, medium, and long distances, by industry



Source: Nomis Census 2011, PwC analysis, (Broad SIC code)

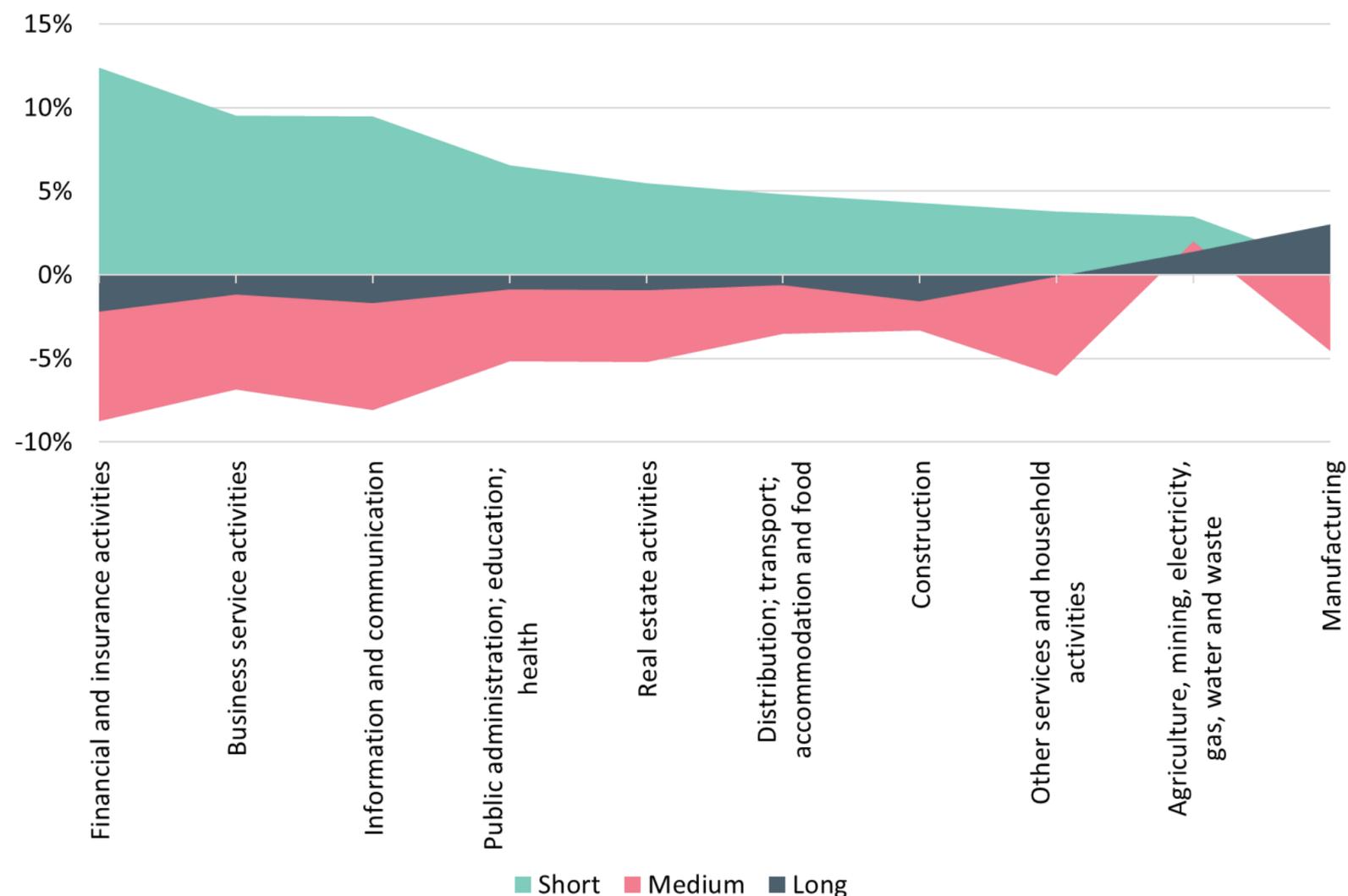
Note: People who are not commuting for work are typically people working from home or do not have a permanent fixed work location e.g. this may include self-employed people

Definitions of distances – Short (less than 10km), Medium (10km – 40km) and Long (40km and over)

Note: Usual place of work is the address given by each respondent in the survey, this is defined as either the address of their work location, working mainly at home or no fixed place of work.

# The proportion of people commuting to work is in line with the England and Wales average

Figure 28: Percentage point difference between WoE and the rest of England and Wales, in the proportion of people commuting short, medium, and long distances, by industry



Source: PwC analysis, Nomis Census 2011

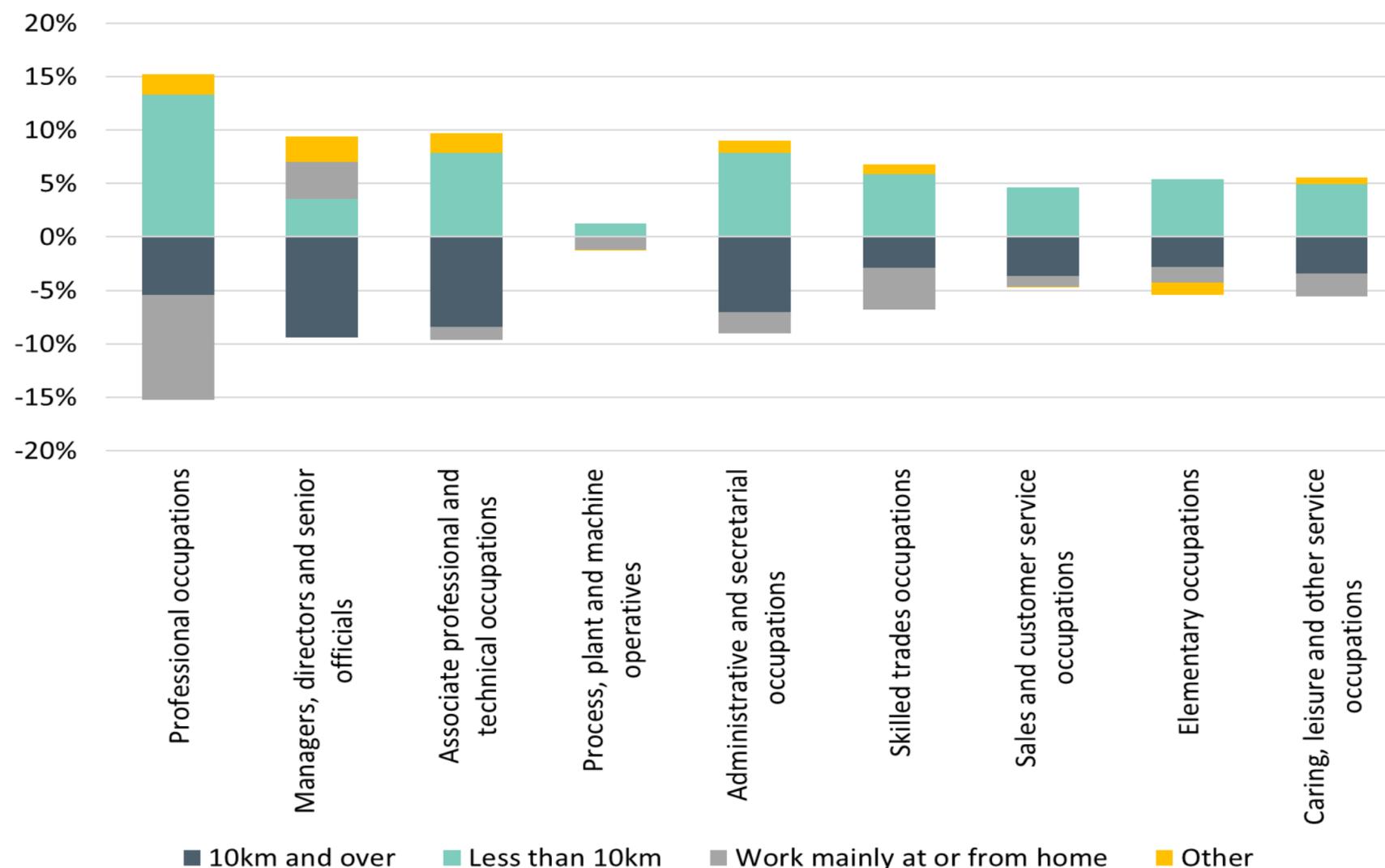
Definitions of distances – Short (less than 10km), Medium (10km – 40km) and Long (40km and over)

- While the proportion of people commuting to work in the WoE is similar to the average across England and Wales, the data generally shows that people are travelling shorter distances to go to work in the WoE.
- Figure 28 shows the difference in proportions of people commuting short, medium, and long distances, by industry. A positive value shows that a greater proportion of people in the WoE are taking that journey length, compared to the English and Welsh average. A negative value, on the other hand, shows that fewer people take that length of journey in the WoE compared to the average.
- The trend shows that the number of medium and long journeys in the WoE is lower than the national average. Short term journeys, conversely, tend to be more common.
- This is particularly true in some of WoE's prominent sectors, including Financial services and Information and communication. In Financial and insurance activities, for example, compared to England and Wales, more people took a short journey to work (12%), and less people proportionately took a medium or long journey (-11%).

# Working professionals in the WoE are over 13% more likely to travel under 10km to work

- Figure 29 shows that across all occupations, aside from process, plant and machine operatives, relatively more people in the WoE are commuting shorter distances (less than 10km) and a smaller proportion of people are commuting 10km and over to get to their place of work – compared to the England and Wales average.
- More specifically, longer commuting journeys made by managers, directors and senior officials in the WoE show the greatest level of disparity versus their England and Wales counterparts. This indicates that WoE residents are not having to travel longer distances on average to work in jobs which are typically highly paid.
- On average, over 13% more working professionals in the WoE are travelling less than 10km to get to work. This could help encourage more people in the WoE region to take up more of these occupations, given the shorter commuting distances required.
- From an economic perspective, it is logical to reduce journey times for employees as much as possible, given that it will boost productivity.

Figure 29: Percentage point difference between WoE and the rest of England and Wales, in the proportion of people commuting different distances or working from home, by occupation



Source: Nomis Census 2011, PwC analysis

Note - 'Other' includes no fixed place of work, working on an offshore installation and working outside of the UK.

# 44% of employees working in the WoE are favouring their car to commute versus other modes of transport

Every year, local authorities in the WoE invite local businesses and organisations to take part in the Travel to Work Survey to record how their staff are travelling to work across the WoE area. This survey is an important tool for measuring commuter travel and satisfaction, which should be used to inform future transport and planning policy decisions. We highlight key points from the survey and analysis below.



## Mode of transport

- **Car (44%)** is the most popular mode of transport, followed by cycling (14%) and walking (13%).
- **Train (6%)** was the second least popular mode of transport after other (5%).



## Commuting times

- **55%** of respondents spent on average between 16 – 45 minutes travelling to work.
- **Those travelling by train** had on average a longer commuting time of **46 – 60 minutes**.



## Satisfaction with commute

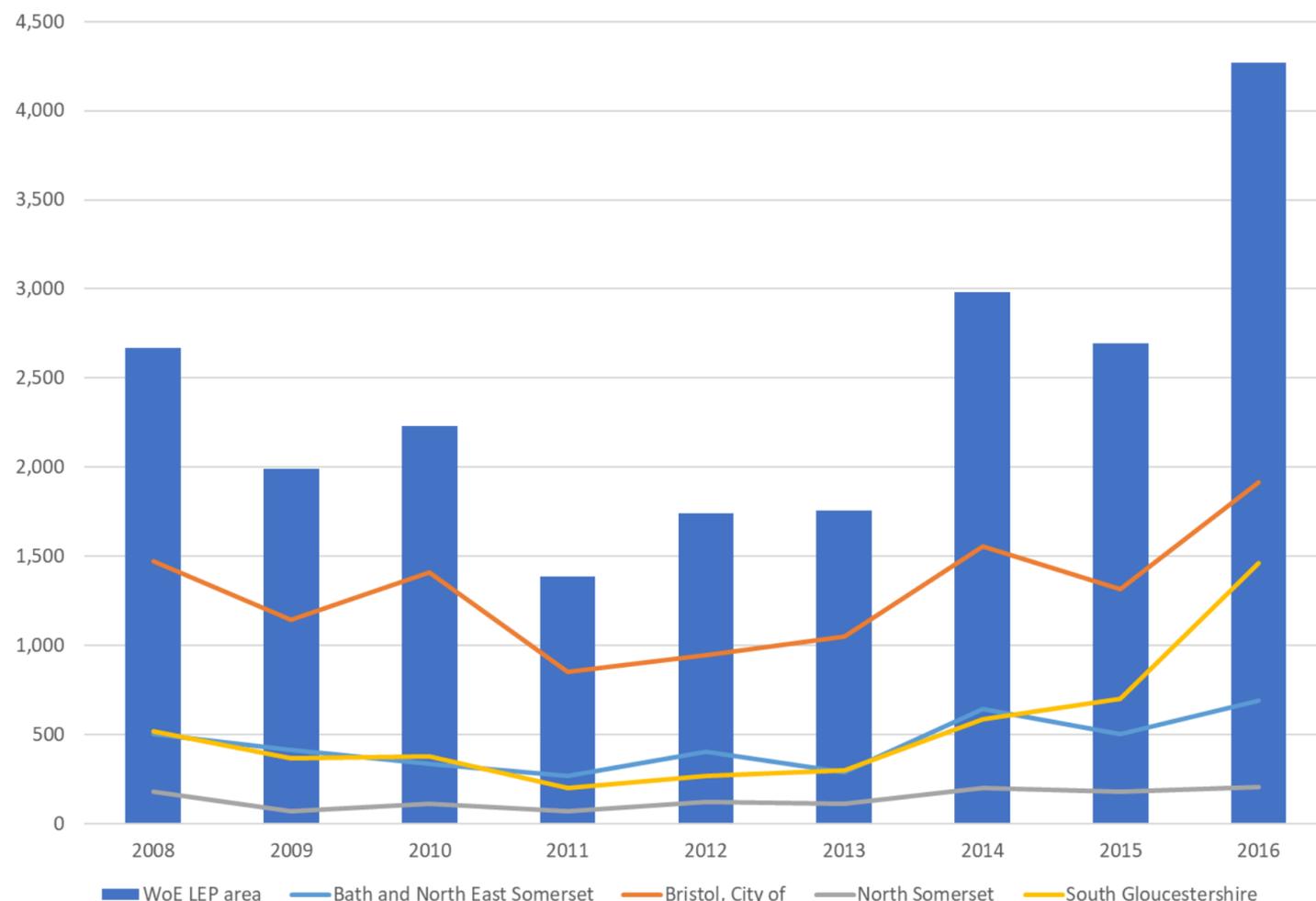
- **57%** satisfaction with getting to work.
- **48%** satisfaction with getting home.
- **Public bus (44%) and trains (45%)\*** had the **lowest percentages of people satisfied** with their normal journeys to and from work.

\* Aside from the 'Other' category

- At a local authority level, there are further interesting findings to note. Respondents in Bristol and South Gloucestershire explained the main reasons they travel by car versus public transport, walking, cycling or car sharing, is (i) it is too far to walk, (ii) they have a quicker journey time travelling by car and lastly (iii) car sharing would not give them sufficient flexibility.
- It seems, that although there are signs of road congestion, people prefer this mode of transport because of the increased flexibility it gives them. This sheds light on the fact that rail infrastructure could be improved to incentivise a change in commuting preferences and increase satisfaction levels of those already using these modes.
- A number of incentives proved most popular for respondents to move towards alternative transport options away from car. These included discounting bus and rail fares, increased provision of alternatives to the car for business travel and increased flexibility with regards to working patterns.

# Short-term international migration is driven by Bristol which accounts for 45% of total migration in the WoE

Figure 30: Inflows only: short term international migration



Source: PwC analysis, ONS

Note: (i) Definition of 'short-term international migrant' is based on the UN definition i.e. "A person who moves to a country other than that of his or her usual residence for a period of at least three months but less than a year except in cases where the movement to that country is for purposes of recreation, holiday, visits to friends and relatives, business, medical treatment or religious pilgrimage.";

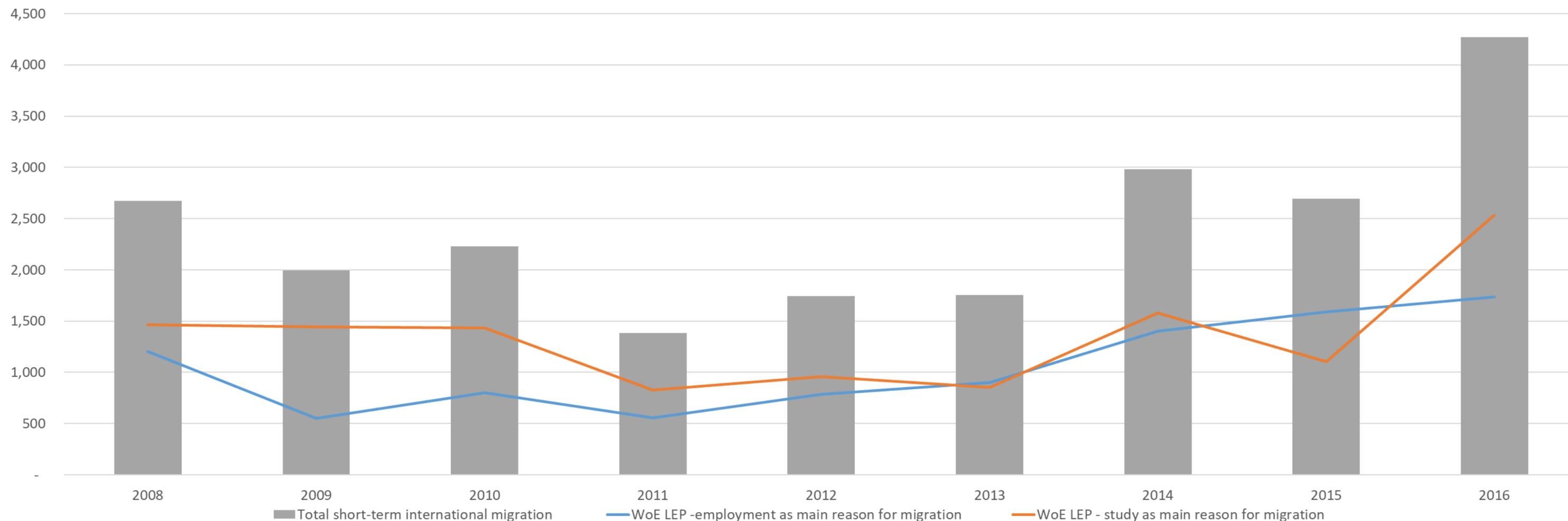
(ii) flow estimates refer to number of migrations commenced (migrant moves) rather than number of people who commence migrations (migrants).

(ii) only data for inflows is available (this does not include outflow data)

- Figure 30 shows the inflows of short-term international migrants into the WoE region. This is primarily based on moves made to the WoE for 3-12 months, for the purposes of employment or study by non-UK residents from mid-2008.
- Since the financial crisis, there was a decreasing trend in the level of short term international migration, almost halving between 2008 and 2011.
- However, as the economy recovered between 2011 and 2016, inflows of short-term migration from abroad into the WoE region more than tripled. This was particularly driven by growth in South Gloucestershire, which increased seven-fold in this period.
- The latest data suggests that the majority of migration flows to Bristol, closely followed by South Gloucestershire, accounting for 45% and 34% of total migration respectively.
- This means that almost 80% of total short term migration is going to Bristol and South Gloucestershire. Whereas Bath and North East Somerset and North Somerset only had a share of 16% and 5% respectively.

# There has been fluctuation in the number of people coming to the WoE to study with 2,534 students coming in 2016

Figure 31: Inflows of short-term international migration

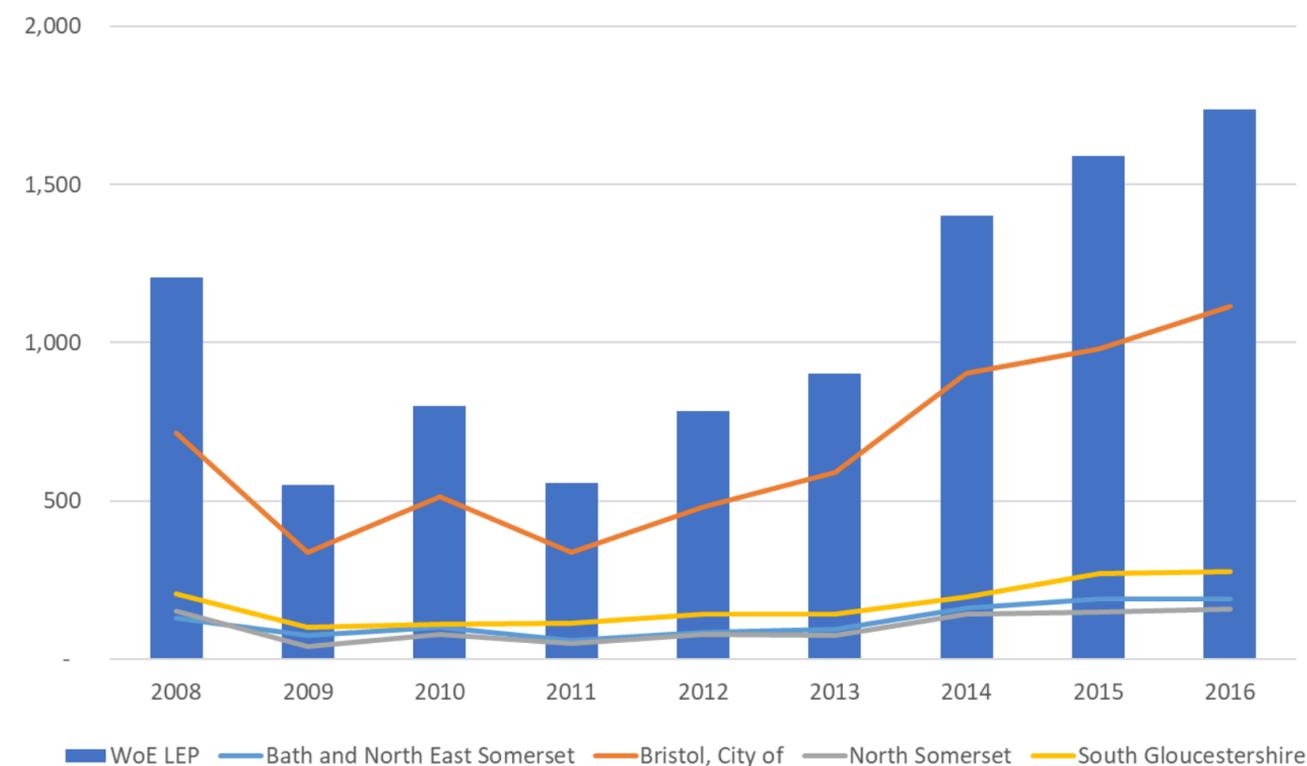


Source: PwC analysis, ONS

Historically the majority of short-term international migration has comprised of students into the WoE area. However Figure 31 suggests that this gap has narrowed and the share of short term international migration has been more evenly split between people moving for employment and for study since 2013.

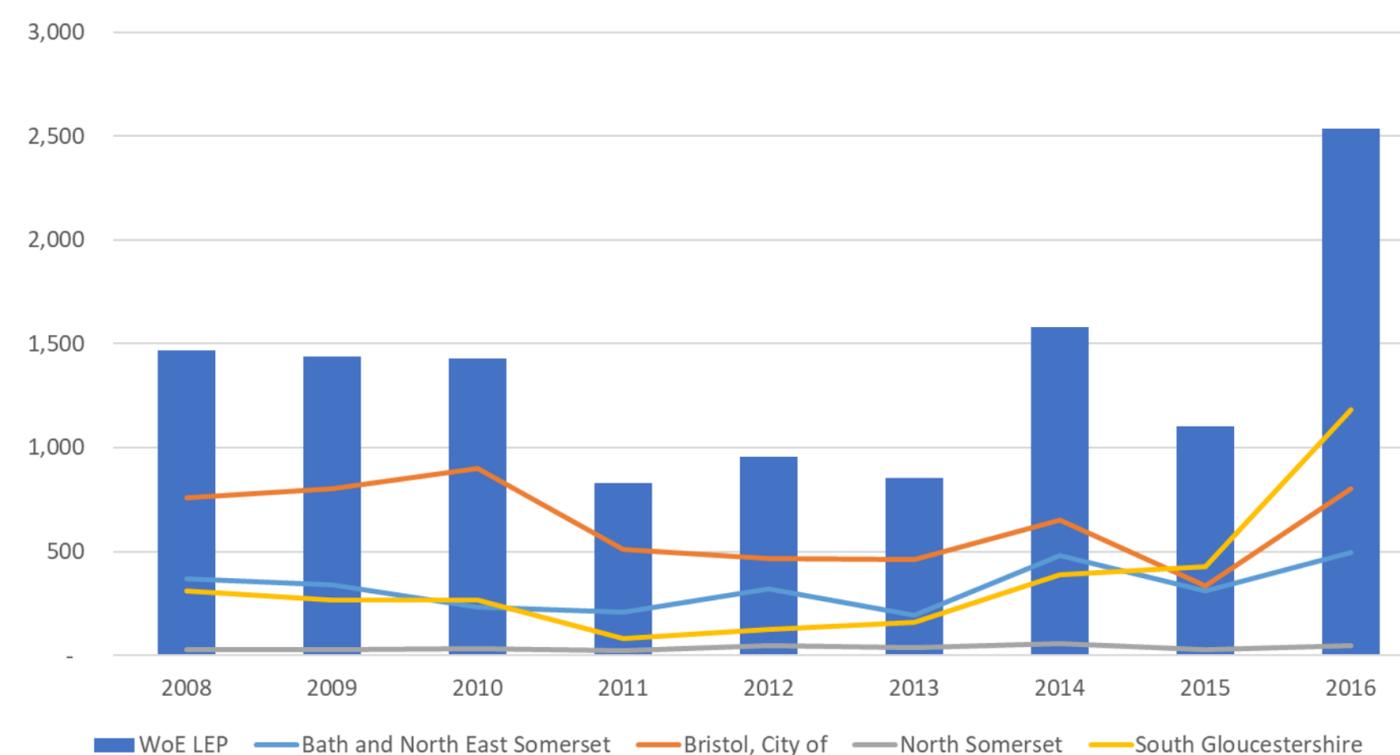
# 64% of people moving to the WoE for short-term work are going to Bristol

Figure 32: Inflows of short-term international migration with employment as main reason for migration



Source: PwC analysis, ONS

Figure 33: Inflows of short-term international migration with study as main reason for migration

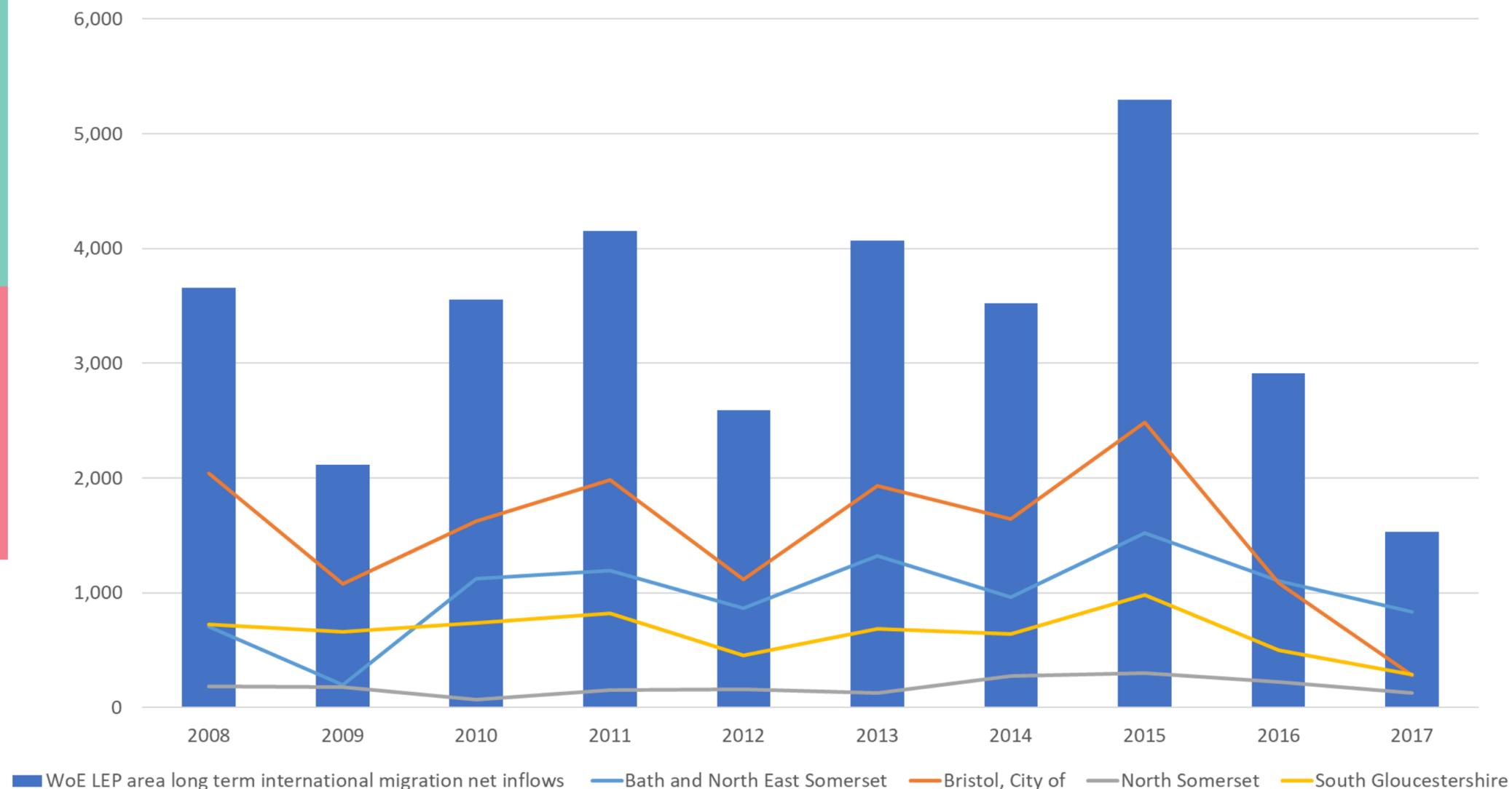


Source: PwC analysis, ONS

- Figure 32 shows that since 2011, inflows of short-term international migration of people moving to the WoE for employment have increased significantly, driving up the overall levels of short term international migration, with growth mainly in Bristol. However, more recently growth has slowed down, particularly in the rest of the WoE.
- Figure 32 and Figure 33 demonstrate that the growth in short-term international migration flows to South Gloucestershire (Figure 34), which was driving overall growth for the WoE region, is mainly due to the sharp increase of incoming international students. After the number of international students moving to South Gloucestershire fell sharply between 2008 and 2011 from 309 to 83 students, the area experienced a significant rise between 2011 and 2016 to a total of 1185 students.

# Net inflows of long-term international migration have recently fallen to below 2,000 people

Figure 34: Net inflows in long-term international migration



- Figure 34 shows that since 2015, the WoE's long-term international migration has fallen sharply across all areas in the region but primarily driven by decreasing net inflows in Bristol.
- The charts in Figure 39 and 40 (on the next slide) show 'long-term international migration', which is defined as people who move to a country other than that of his or her usual residence for a period of at least a year (12 months), so that the country of destination effectively becomes his or her new country of usual residence.

Source: PwC analysis, ONS

# A drop in net inflows for the WoE has been driven by outflows in Bristol which increase by 28% between 2015 and 2016

Figure 35: Inflows of long-term international migration by local authority

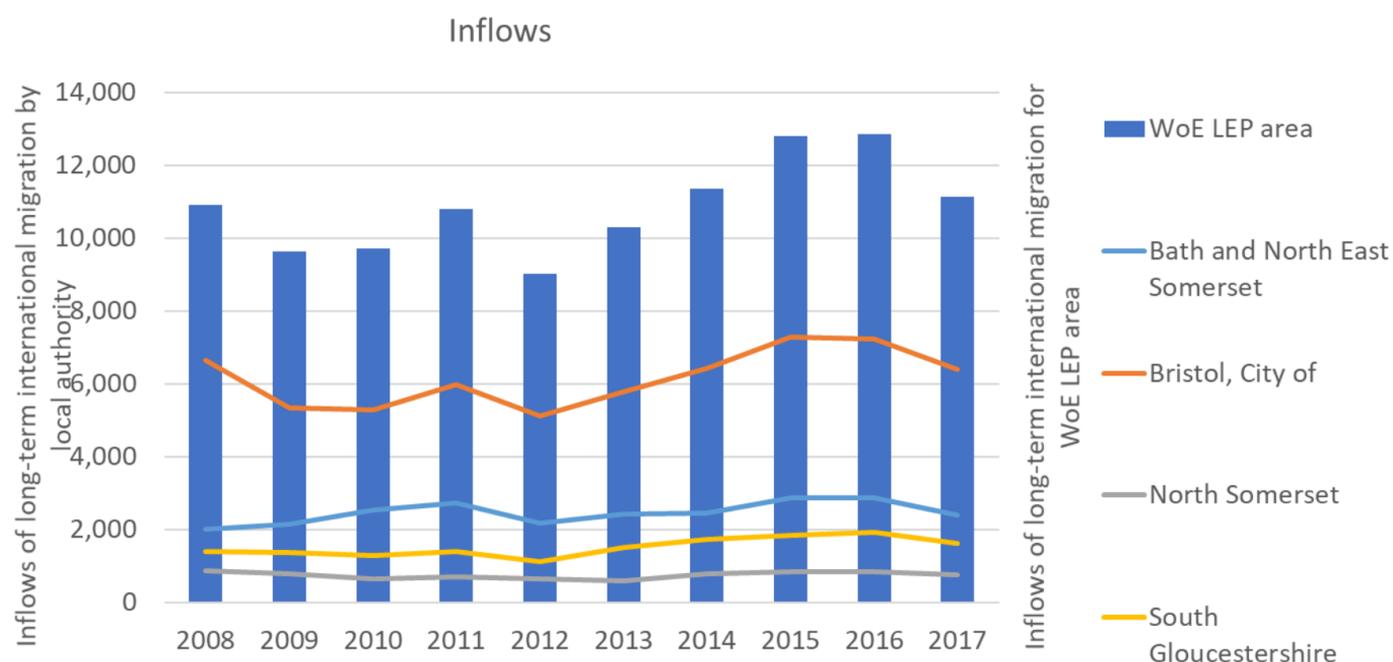
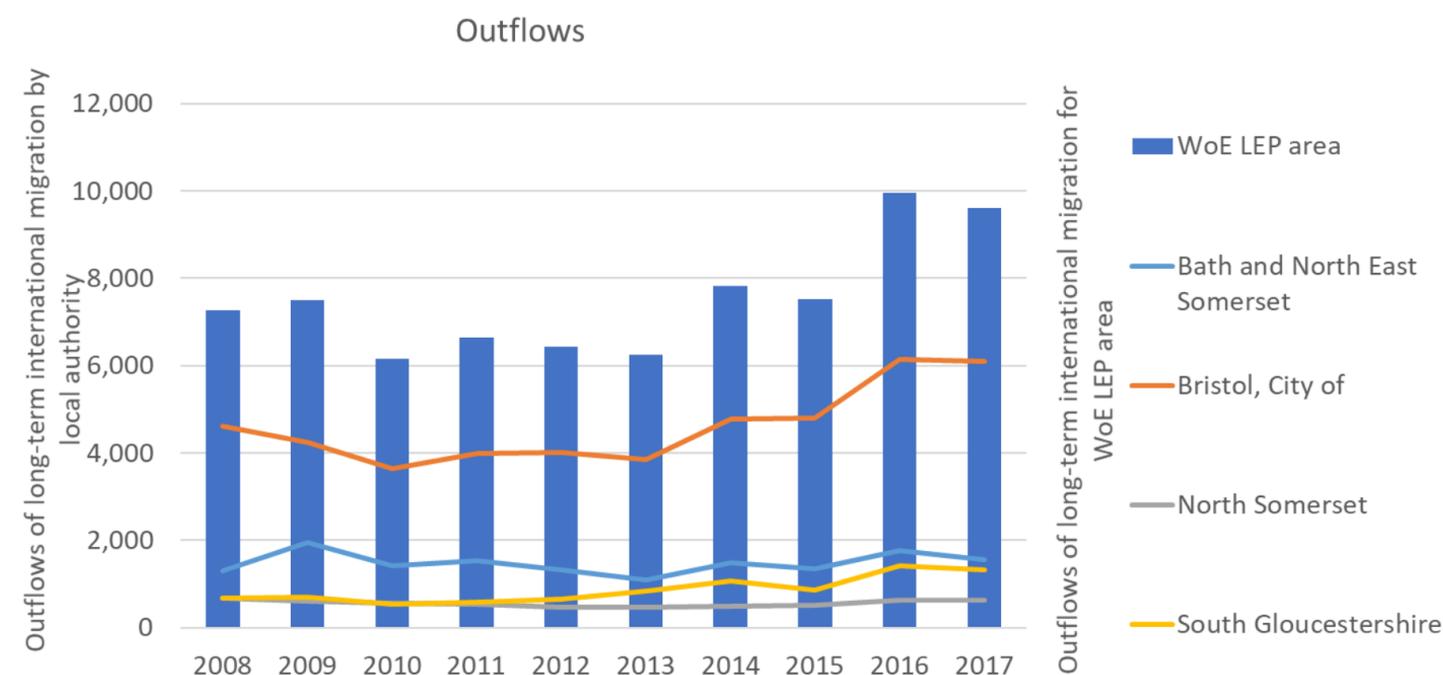


Figure 36: Outflows of long-term international migration by local authority



- The analysis by local authority suggests that this is recently driven by falling inflows but mainly rising outflows out of the WoE area.
- In particular, Bristol experienced significant increases in outflows of long-term migration abroad. The following two slides compare the changes in these flows to the rest of the country.
- From 2015, there has been a significant downward trend in the net inflows from long-term international migration for the WoE. This pattern aligns with the announcement of the of the EU exit referendum.

# WoE inflows for long-term international migration typically follow national trends decreasing by 13% in 2017

Figure 37: Growth rates in long-term international migration - inflows

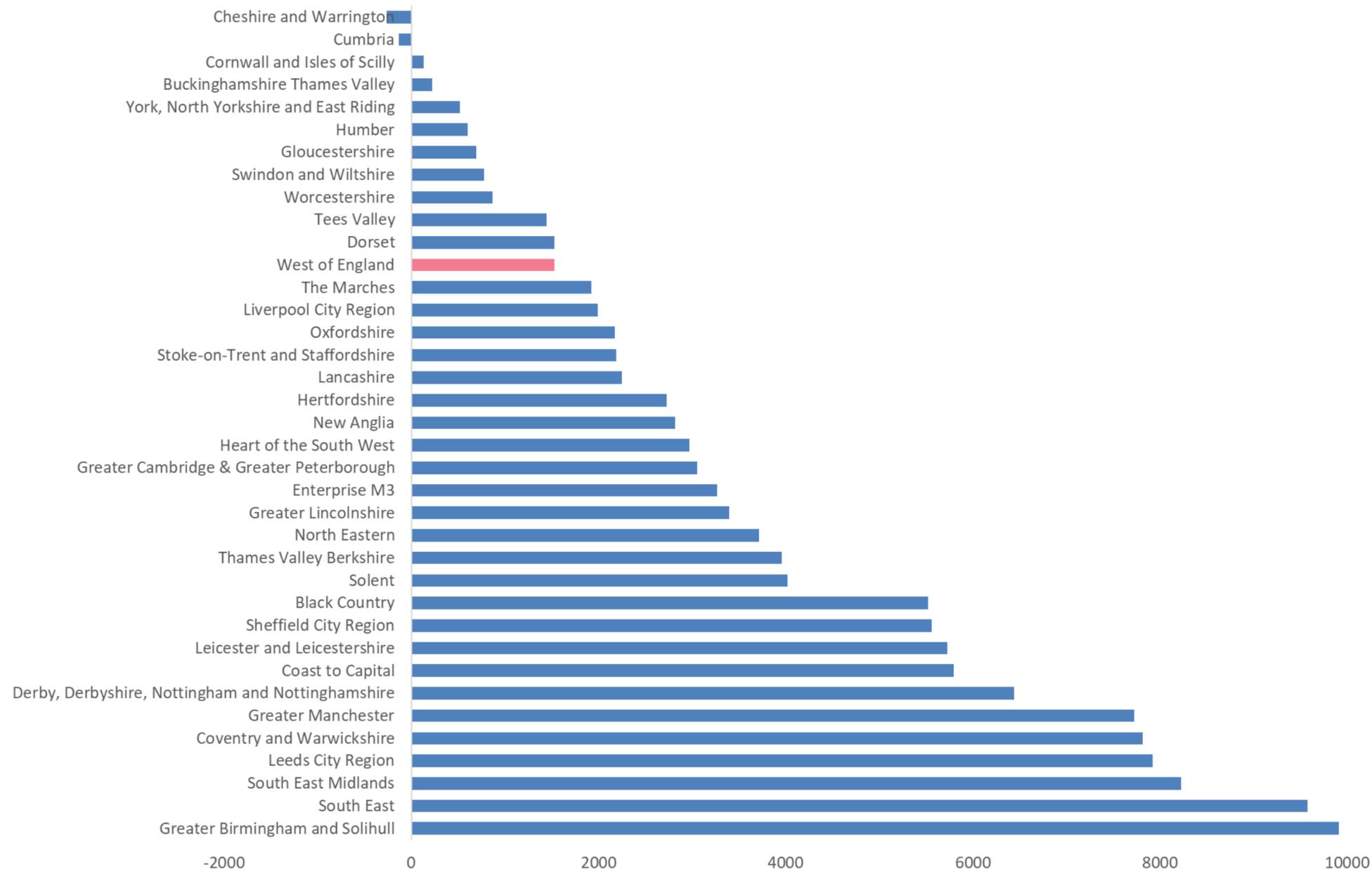


Source: PwC analysis, ONS

- The previous slide showed that long-term international migration had experienced a recent fall due to falling inflows and rising outflows, mainly driven by Bristol.
- However, Figure 37 shows that there was also a similar decreasing trend of growth rate in the national average long-term international migration. This indicates that the rest of the country was also experiencing decreases in long-term migration from abroad.
- Both in the WoE and nationally there has been a downwards trend in the inflows from long-term international migration from 2015.

# The net inflow of 1,531 people in the WoE is ranked 26<sup>th</sup> out of all LEP regions

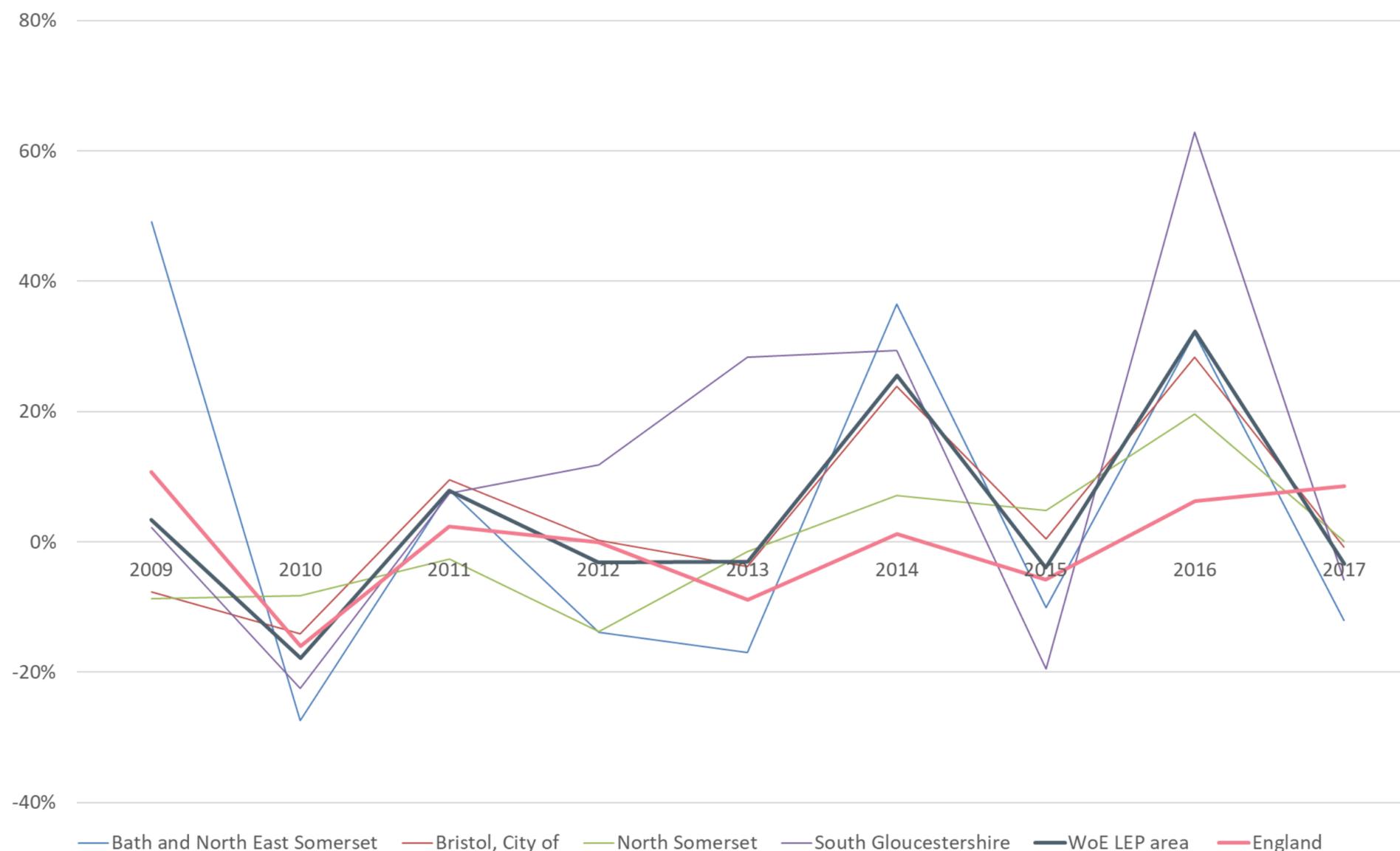
Figure 38: net inflow of long-term international migration by LEP, 2017



- The WoE ranks 26th out of all LEPs with a net inflow of 1,531 people who are migrating from outside of the UK into the WoE for 12 months or longer.
- The WoE has larger net inflows than its neighbouring LEPs (e.g. Swindon and Wiltshire LEP and Gloucestershire LEP) but it currently lagging behind high performing regions such as Greater Birmingham and Solihull and Greater Manchester.
- The next slide provides greater detail on the underlying explanations of this trend.

# WoE outflows are higher and more volatile than the national average with outflows increasing by 32% in 2016

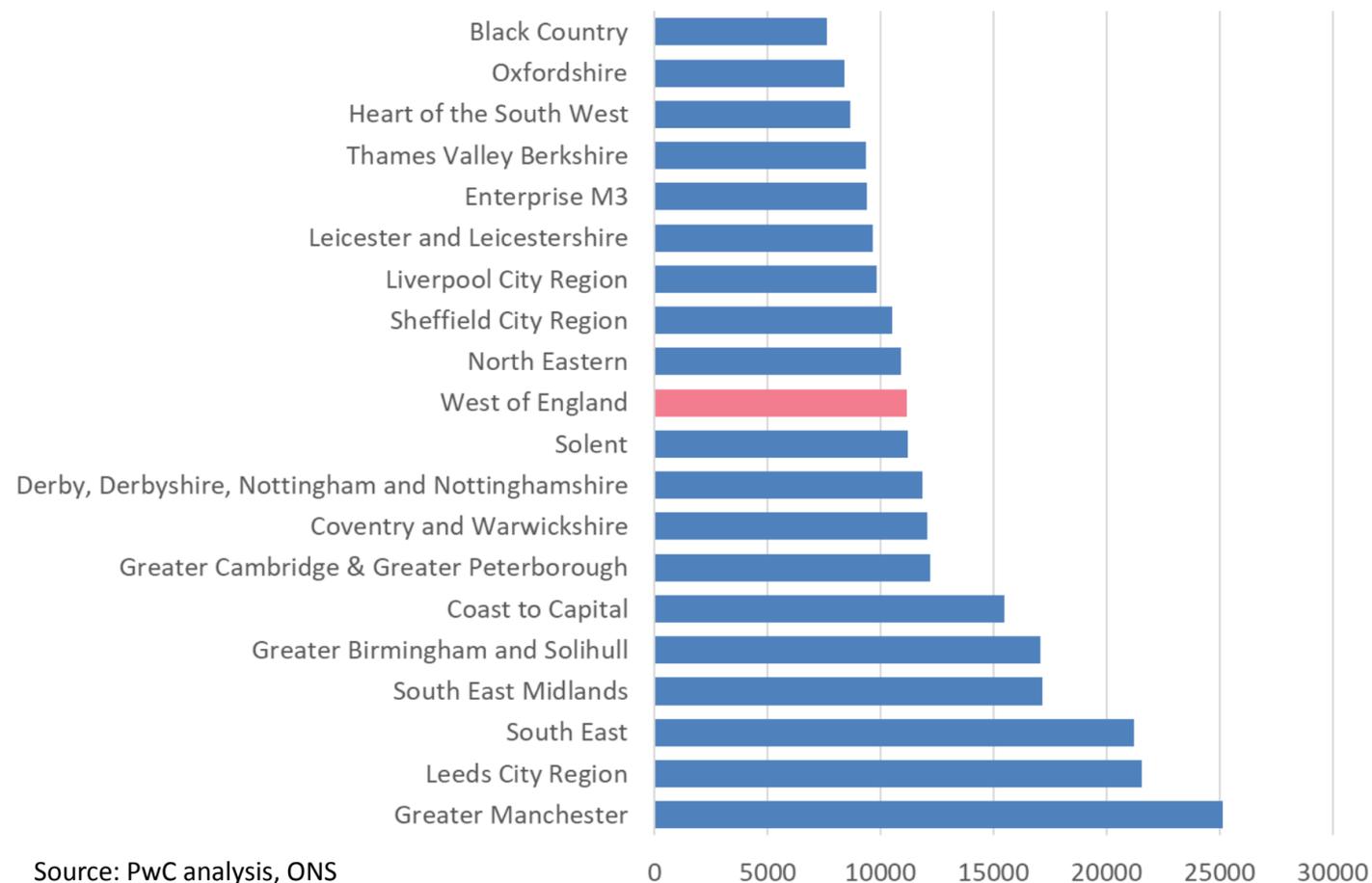
Figure 39: Growth rates in long-term international migration - outflows



- Figure 39 suggests that the average growth rate in the outflows of long-term international migration for the WoE follows the same trend as the national average but is generally higher in recent years.
- North Somerset is generally closer to the national average but recent trends in growth rates of outflows from Bristol, South Gloucestershire and Bath and North East Somerset are more volatile and often significantly higher than the national average.
- In 2016, there's a spike in the growth rate of outflows by more than 30% which coincides with the WoE in the year of the EU exit referendum vote however this has since reduced.

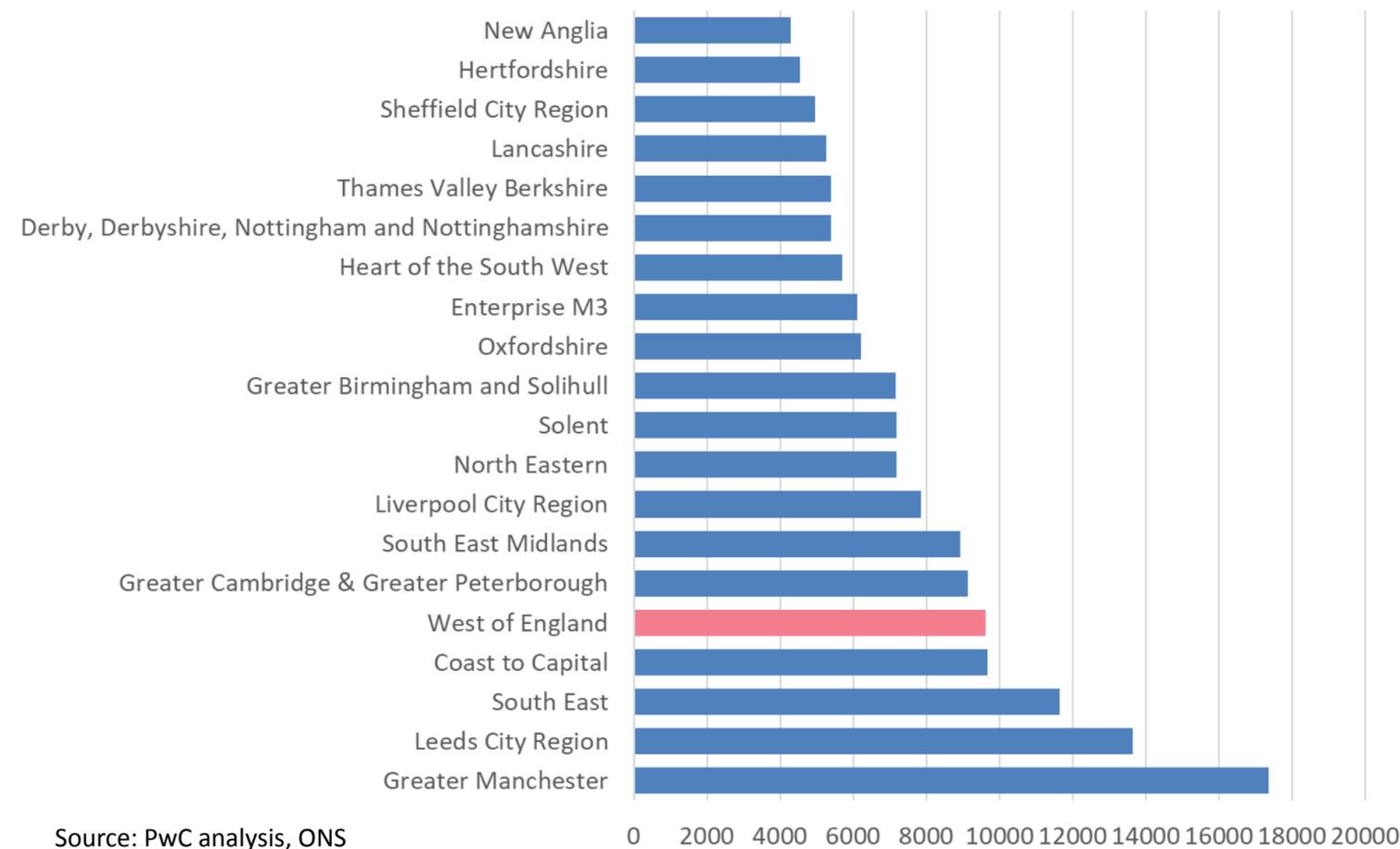
# WoE has the fifth highest outflow of long term international migration compared to other LEPs

Figure 40a: inflows of long-term international migration (top 20 LEPs) 2017



Source: PwC analysis, ONS

Figure 40b: outflows of long-term international migration (top 20 LEPs) 2017

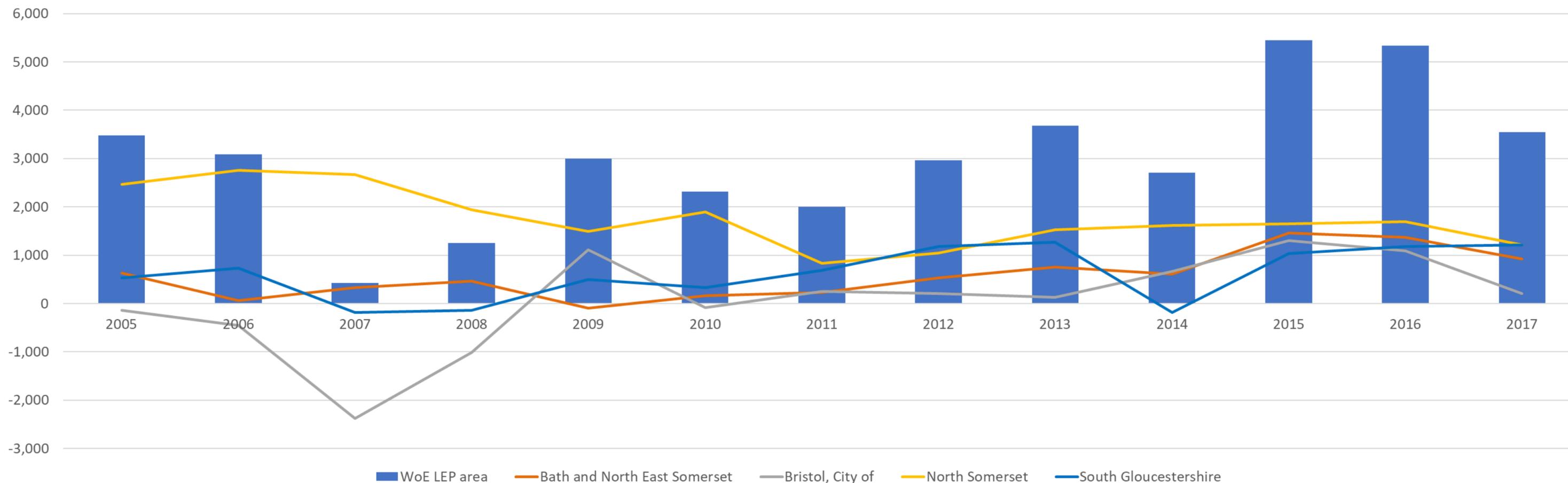


Source: PwC analysis, ONS

- This analysis is drawn from ONS data on long-term international migration. This data for local authorities has been aggregated to estimate this for LEPs so that the WoE LEP area can be compared to migration trends of other LEPs across the UK.
- The WoE has 11<sup>th</sup> highest inflows of long term international migration out of all LEPs (in Figure 40a) but has the 5<sup>th</sup> highest outflow (Figure 40b).

# North Somerset consistently has the highest net inflow of internal migration with 1,209 people moving to the area

Figure 41: net inflow of internal migration



Source: PwC analysis, ONS

As shown in Figure 41, since a steep fall in the net inflow of internal migration in 2007 to 430 moves, there has been an upwards trend reaching 5443 moves in 2015. However, similar to the net inflow of long-term international migration, the net inflow of migration from other areas in the UK has declined since then.

# In 2017 Bristol drove almost half of the WoE's internal migration inflows and outflows

Figure 42a: Net inflows of internal migration

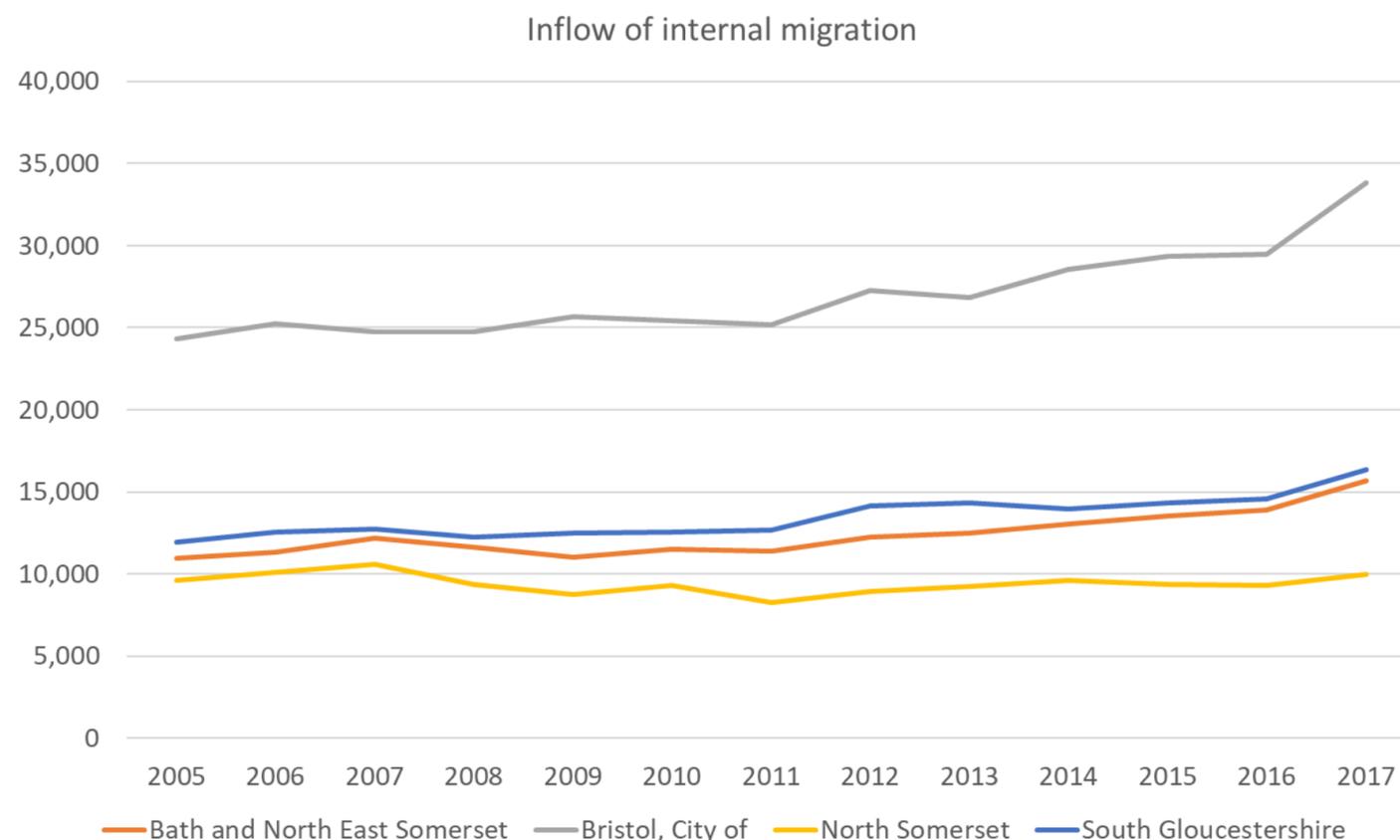
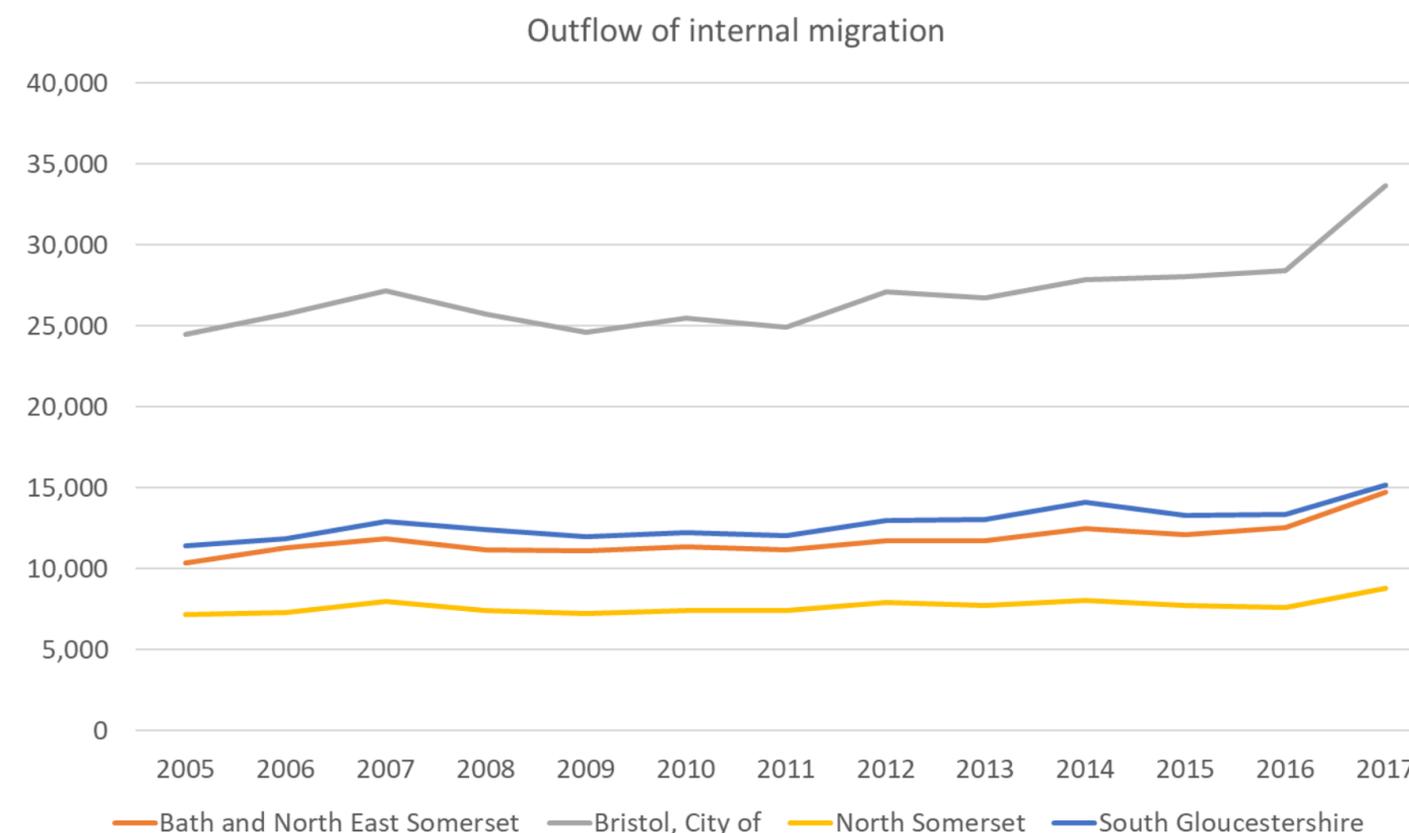


Figure 42b: Net outflows of internal migration

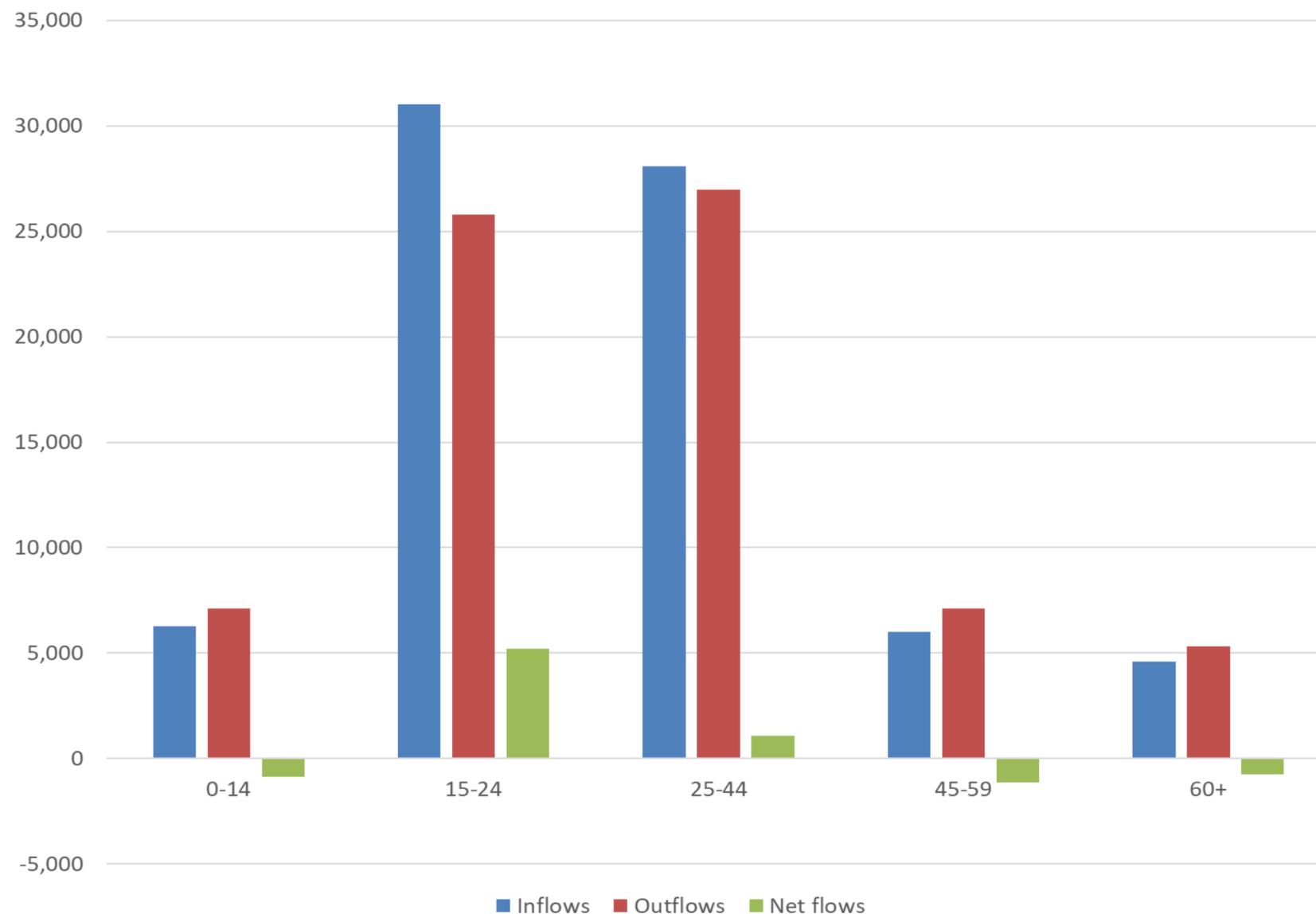


Source: PwC analysis, ONS

There is still a positive net inflow of internal migration of 3549 moves in 2017 and the WoE still experiences positive inflows of people moving into the region but Figure 42b shows that this has recently been outstripped by the growth in the outflow of internal migration i.e. people moving out of the WoE area.

# Young people aged 15-24 account for 40% of total inflows into the WoE region

Figure 43: Inflows and outflows of internal migration for the WoE by age, 2017

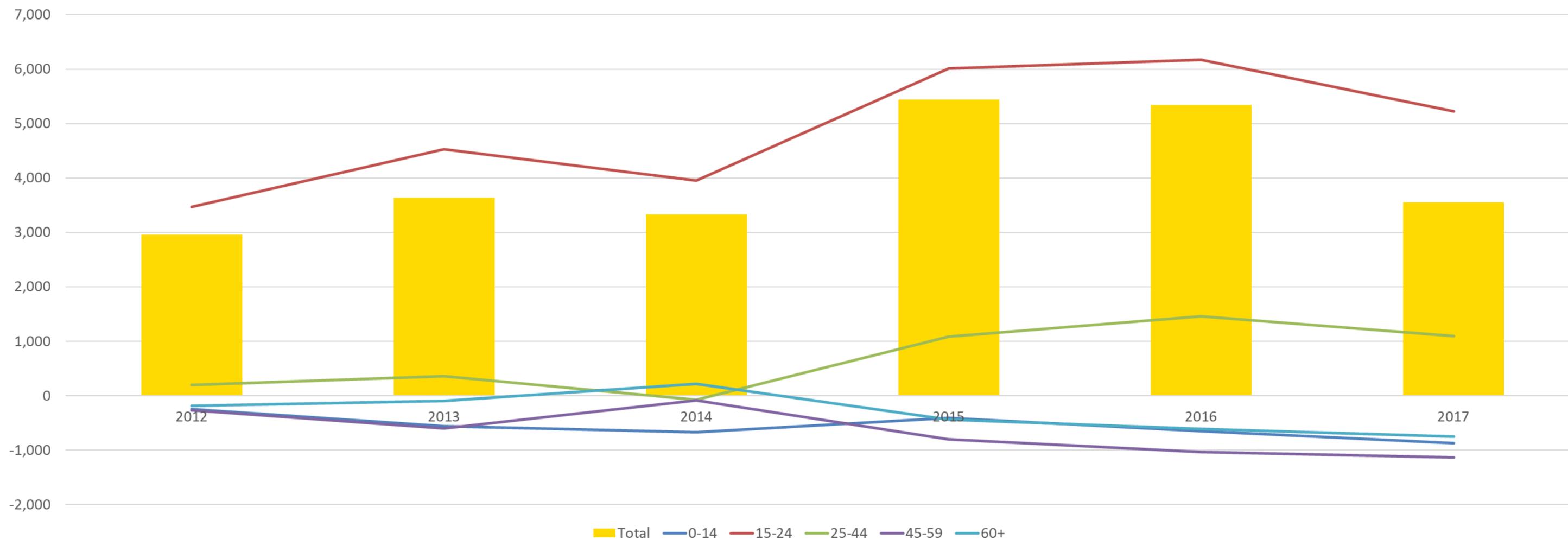


Source: PwC analysis, ONS

- As shown in Figures 42a and b on the previous slide, in 2017 there was a positive net inflow of internal migration of 3550.
- Figure 43 shows that in 2017, there was an inflow of 31,000 moves from people aged 15-24 years old, which represents over 40% of the total inflows of people moving into the WoE region (72,330 moves). This may be due to a high number of students and graduates that are attracted to the WoE region and its universities.
- In this 15-24 age bracket, there was a high outflow of almost 26,000 young people leaving the WoE region, resulting in a net inflow of over 5000 young people.
- It would be possible to further explore student and graduate movements with HESA data.
- In the 45-59 year old age group and 60+ age group, there was a negative net inflow of 1140 and 750 people.

# Net inflows of young people moving to WoE have slowed down with a 15% decrease between 2016 and 2017

Figure 44: net inflow of internal migration by age over time for the WoE

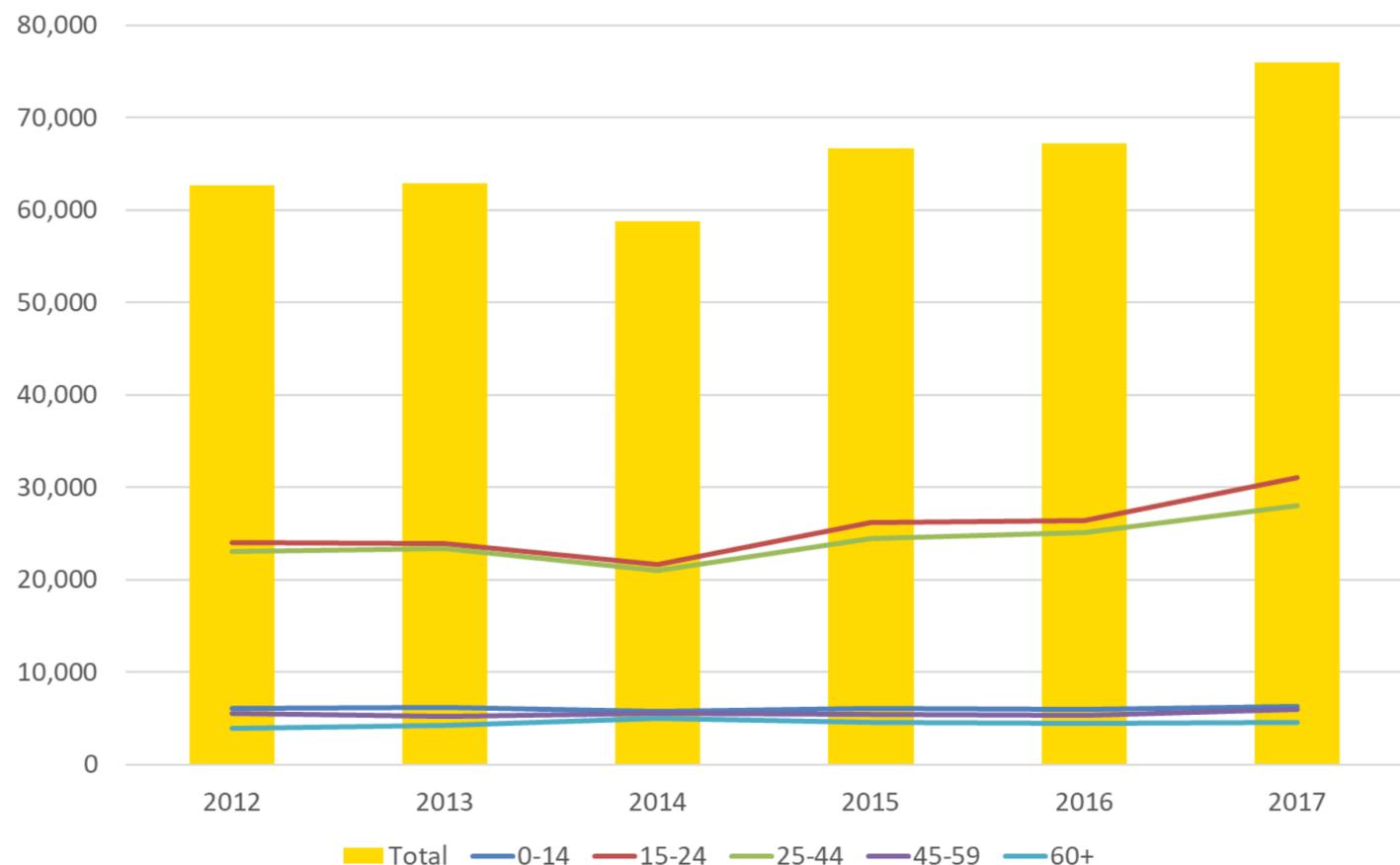


Source: PwC analysis, ONS

Overall, there has been a decrease in the net inflow of internal migration overall, driven by falling net inflows at all ages but particularly for people aged 15-24 and 25-44 which has fallen by around 17%.

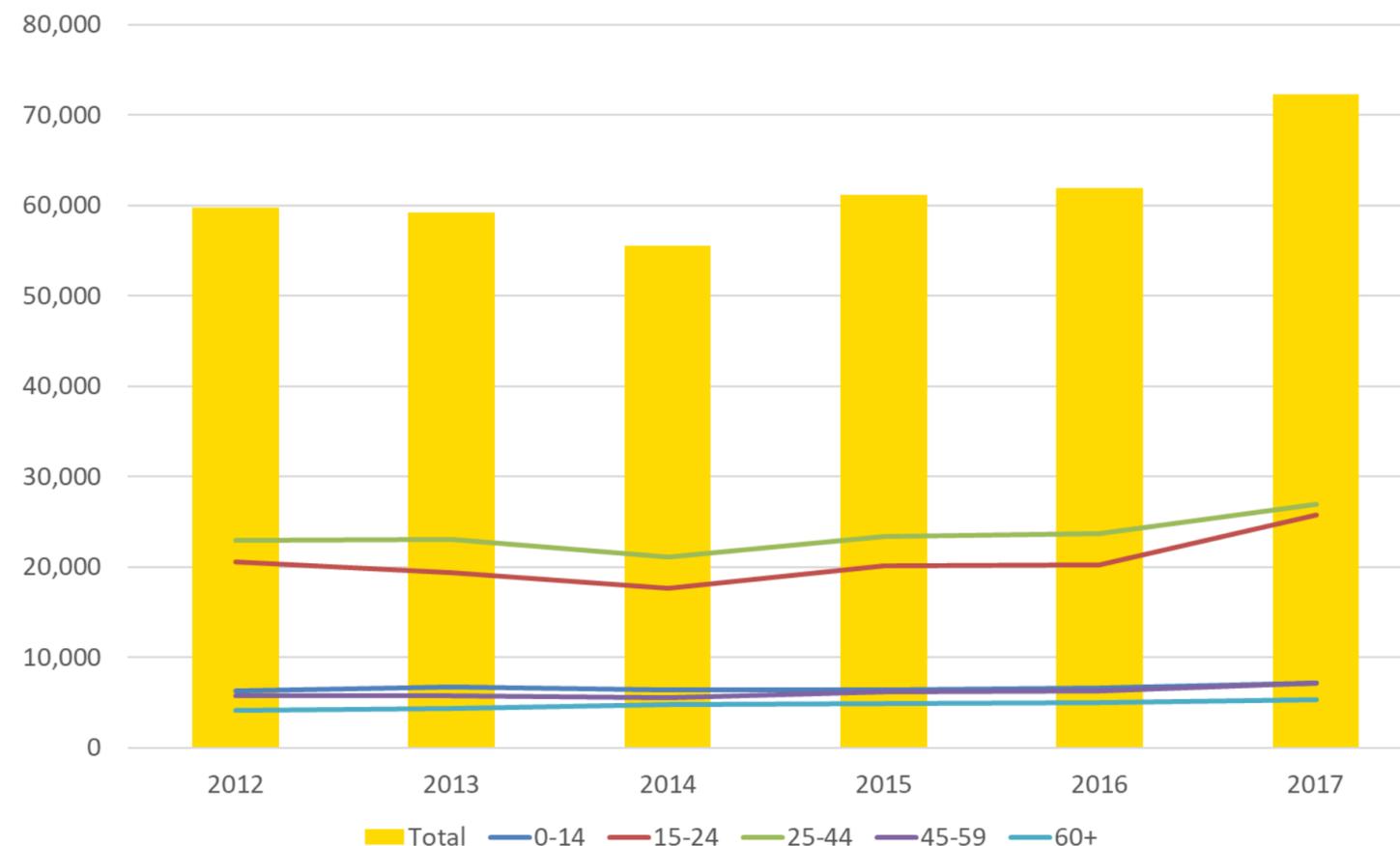
# The number of people moving out of the WoE increased by 17% in 2017 driven largely by 15-24 year olds

Figure 45a: inflows of internal migration by age over time for the WoE



Source: PwC analysis, ONS

Figure 45b: outflows of internal migration by age over time for the WoE

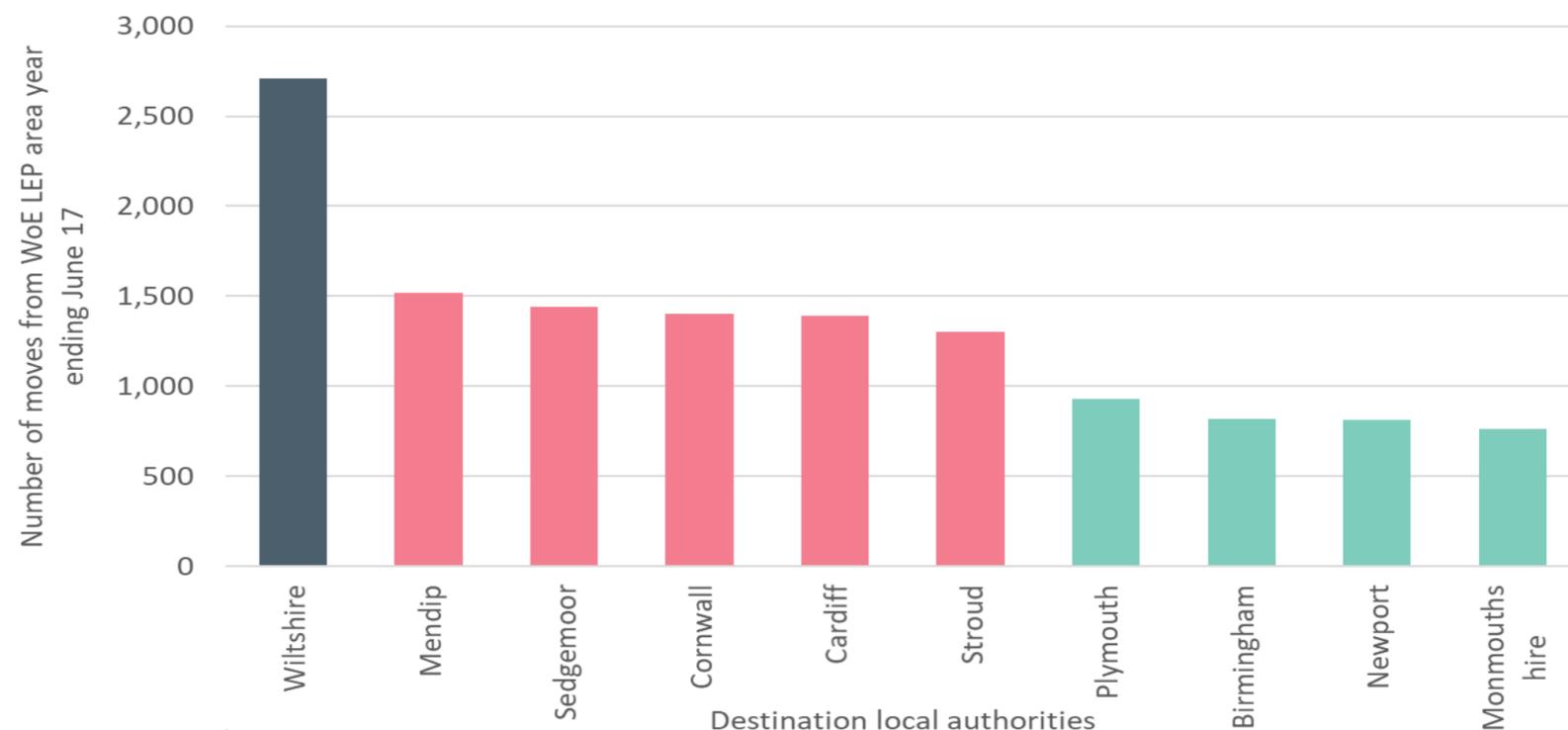


Source: PwC analysis, ONS

The figures above show the trends in internal migration by age over time. Figure 45b shows an upwards trend in the proportion of young people aged 15-24 moving into the WoE over time. However, in 2017 this has been offset by increasing outflows of young people, which has resulted in a decline in the net inflow of young people entering the WoE region.

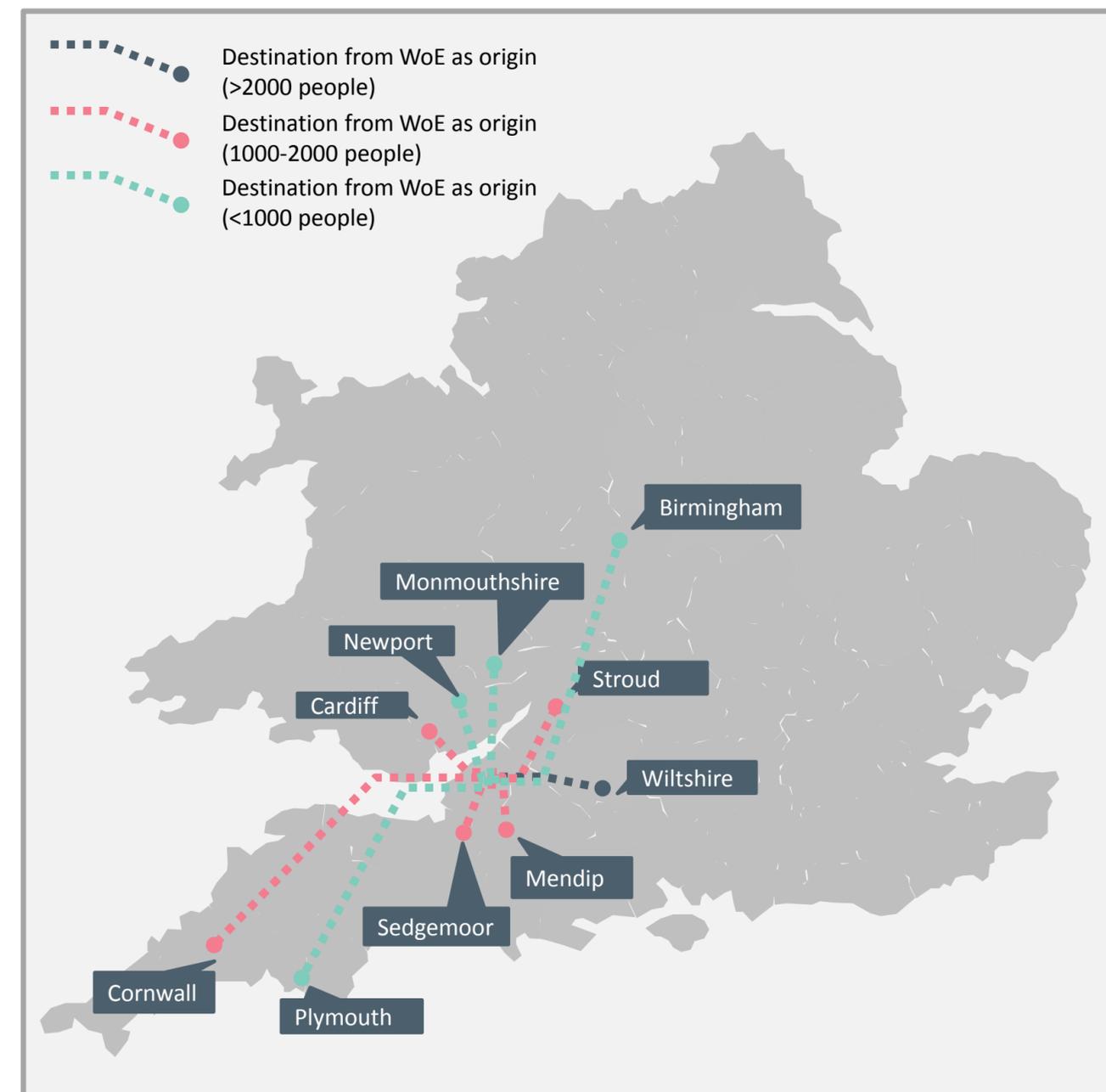
# The majority of people leaving the WoE tend to move to nearby areas including over 2,000 people moving to Wiltshire

Figure 46: Top destinations for people moving from inside WoE (i.e. outflows)



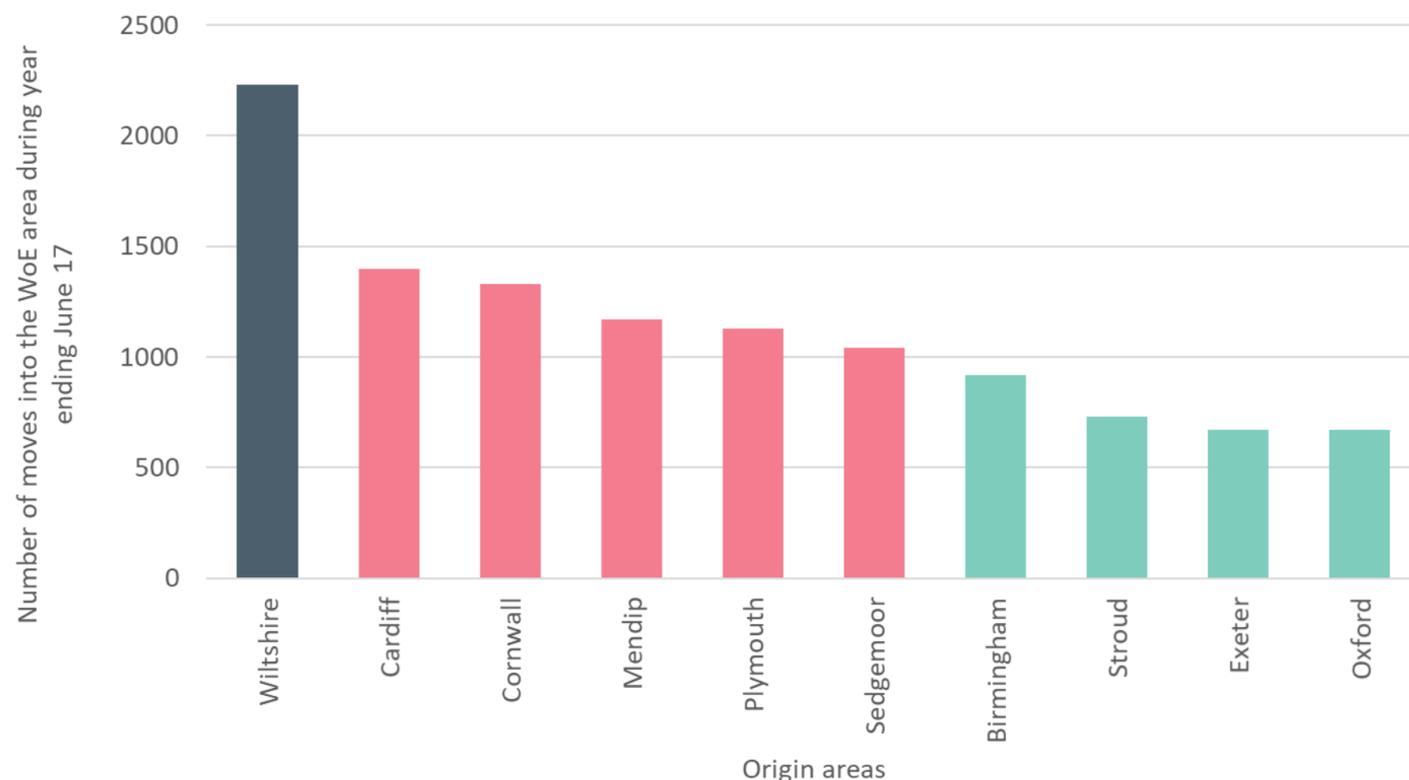
Source: PwC analysis, ONS

- The top destination for people moving from inside to outside of the WoE region was Wiltshire in year ending June 2017, followed by other close areas such as Mendip and Sedgemoor.
- However, there are a number of destinations further afield in the top 10 destinations such as Cornwall, Plymouth and Birmingham.
- Destinations for leavers from Bristol are more spread out across multiple areas whereas in Bath and North East Somerset, South Gloucestershire and North Somerset, the majority of leavers move to fewer areas that are close by.



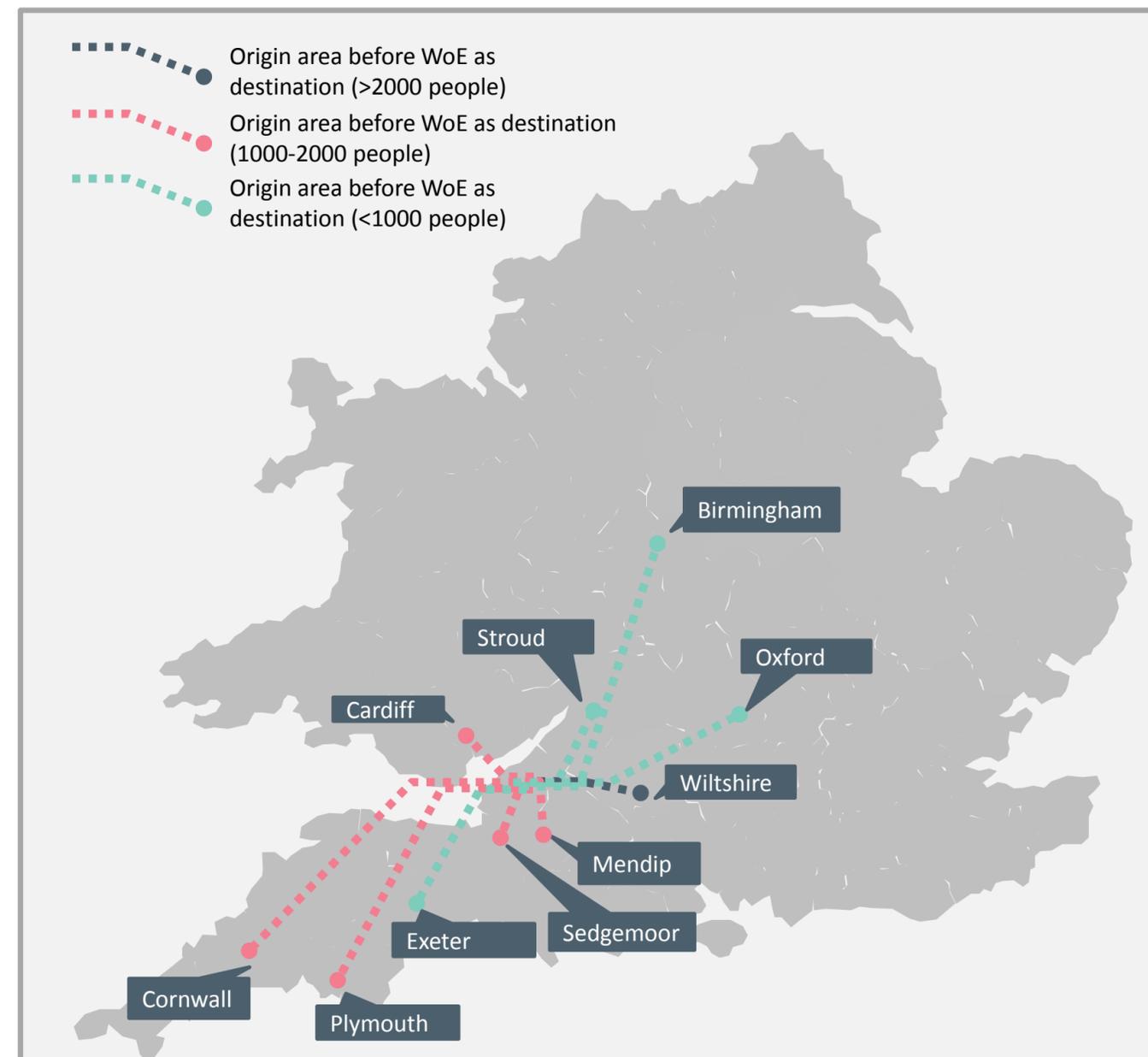
# The areas people are coming from are similar to where people move to e.g. Wiltshire, Cardiff and Cornwall

Figure 47: Top origins for people moving into the WoE (i.e. inflows)



Source: PwC analysis, ONS

- The areas that people moving into the WoE from are similar to the areas that people move out to when leaving the region.
- However, there are more people coming to the area from Exeter and Oxford.



# WoE attracts more people from London and the South East but loses people to neighbouring areas in the West

The previous slides showed that migration patterns are largely driven by neighbouring local authorities. Here, we aggregate to LEP level, and show the net migration patterns.

- Figure 48a below shows the regions with the highest net internal migration rates for WoE. A positive rate shows that more people came to WoE from that region than left WoE for that region. A negative number shows a net emigration, i.e. more people left WoE for that region than came to WoE. To take London as an example: 8,330 people arrived in WoE from London in 2017, while 7,380 left WoE to move to London. This gives a net migration rate of 950 people. The ONS data we use only gives us this level of detail on internal migration patterns.
- The heat map opposite (Figure 48b) shows that the WoE is generally a magnet for internal immigration from London and the South East. This may reflect the ‘quality of life’ appeal of the WoE.
- The main net outflows show that people move to South Wales, Gloucestershire, and further into the South West.

Figure 48a: Net migration flows to/from WoE, by LEP area

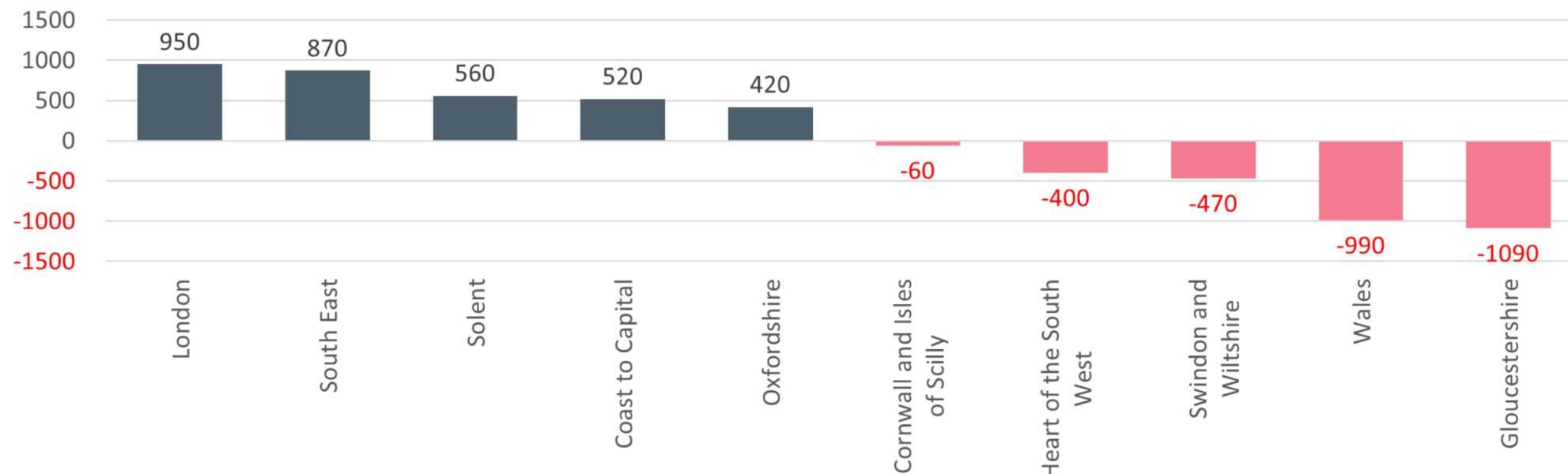
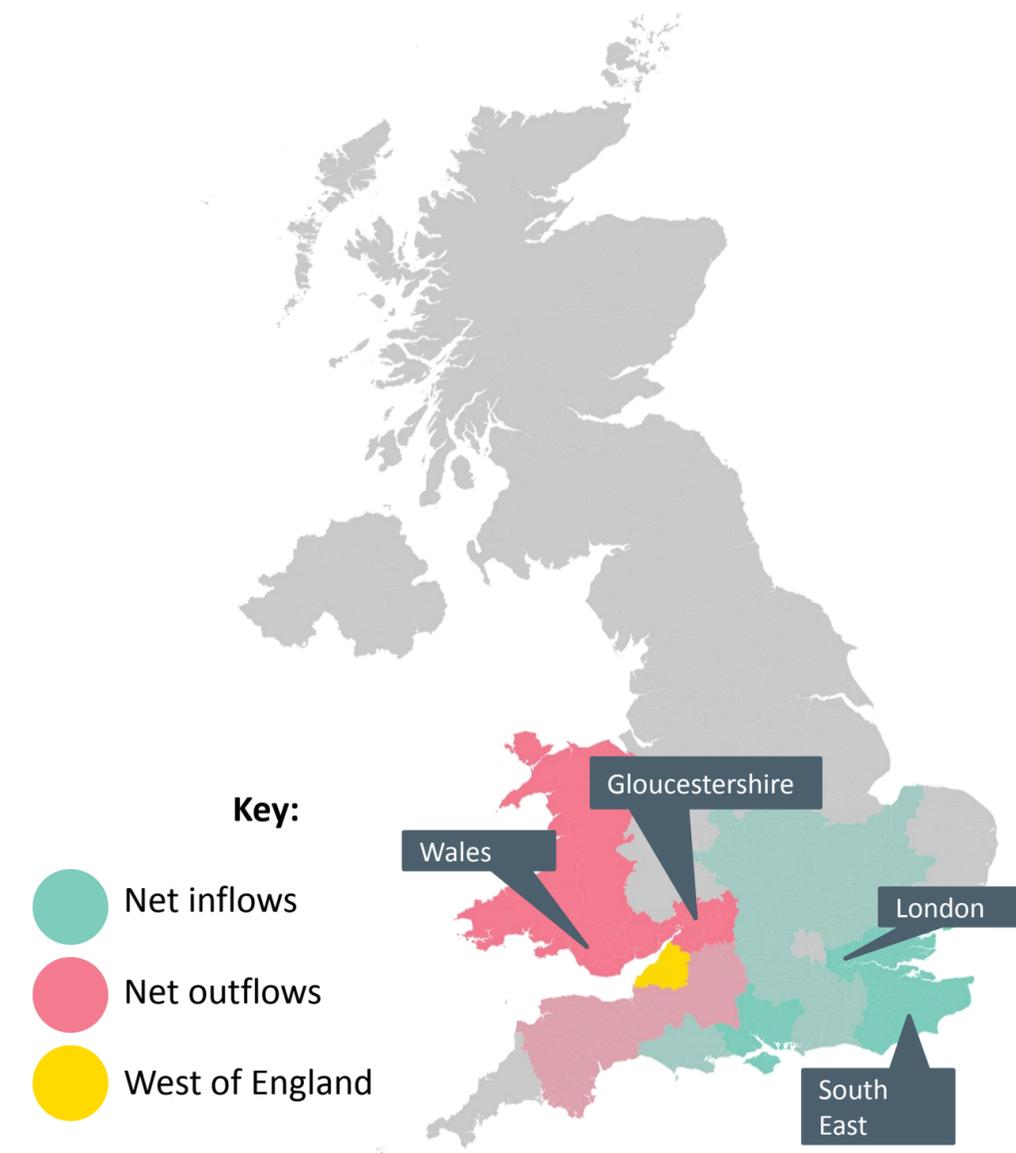


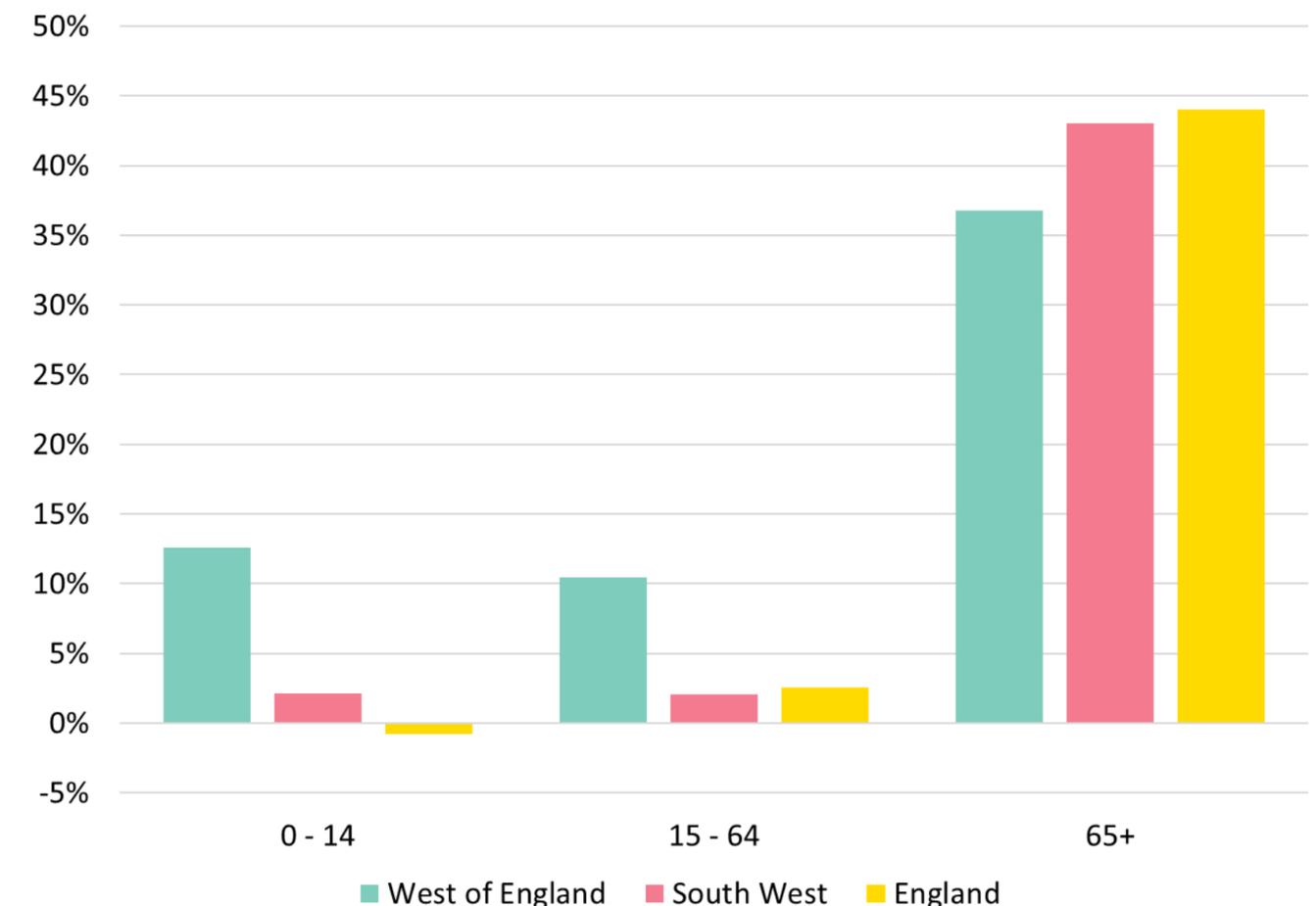
Figure 48b: Net migration flows to/from WoE, by LEP area



# The WoE is forecast to see its working age population grow by 10.4% compared to the South West (2.4%) and England (2.6%)

- ONS population forecasts are long-term trend-based projections. They show what the population and future workforce could look like in the coming years, helping inform policy decisions.
- Forecasts suggest that there will be approximately 180,000 more people living in the WoE by 2038 than there is today. This is equivalent to a 15% increase. The South West region and England are expected to see an increase of 11% and 10% respectively. This proportionately large increase in the WoE's population will likely place greater strain on housing and transport infrastructure across the region.
- However, it is crucial to note that the WoE is forecast to see a much larger increase (10.4%) in its working age population, versus the wider region (2.4%) and country (2.6%). Historically the WoE has a larger proportion of young people moving in from other regions of the UK but this becomes a net outflow as the population gets older (as seen in figure 49). This means the WoE can expect to have a proportionately larger pool of workers to support businesses in their growth plans.
- In addition, all three geographies are expected to see a substantial increase in their elderly population, WoE (36.8%), SW (43%) and England (44%). This further evidences one of the grand challenges outlined in the UK Industrial Strategy, which highlights the increasing importance to adapt to an ageing society.
- As a result of this, the dependency ratio is also estimated to rise, moving from 0.54 in 2018 to 0.60 in 2038 for the WoE region (0.57 to 0.68 for England). This highlights the additional pressure on the working population to maintain levels of economic output, further emphasising the importance of productivity growth.

Figure 49: Population projects by broad age group, 2018 - 2038



Source: ONS

# Over 70% of students originally from the WoE stay in the region immediately after graduating

Any economy needs talented people to grow and thrive. One of the easiest ways to maintain a strong talent base is to keep students in the region after they have graduated. Losing students who have grown up in the region can constitute a 'brain drain' that could be damaging to longer term growth prospects

- BIS used graduate retention data from HESA to explore this 'brain drain' effect. They were able to identify where students lived before going to university, where they went to university, and then where they were living six months after graduating. BIS look at the retention of 'home students', i.e. students who grew up and were educated in that region.
- On this graduate retention measure, the WoE ranks 13<sup>th</sup> across all LEPs in England. Figure 50 shows that almost 73% of students from the WoE remain in the region after graduating. This is ahead of comparable areas like Oxfordshire, Cambridgeshire, and Coventry and Warwickshire, but behind cities like Manchester, London, and Birmingham.

This data does have some limitations:

- We cannot draw conclusions on where WoE students come from, or where exactly graduates go to (apart from London, which is explored on the next slide). HESA only make data available on graduate destinations at a NUTS 1 regional level, which is too broad for this study.
- The data is relatively old, as it refers to retention rates from 2012/13. This is due to data availability. For more up to date and specific insights on WoE graduates, HESA require a direct data request, which WECA have chosen not to follow through in this study.

Figure 50: Retention of home students within the region, six months after graduation, 2012/13

	% of home graduates who stay in LEP area	Rank among all LEPs
<b>Liverpool City Region</b>	83.3	1
<b>Greater Manchester</b>	81.7	3
<b>London</b>	81.7	4
<b>Greater Birmingham and Solihull</b>	75.6	8
<b>Cornwall and the Isles of Scilly</b>	74.9	9
<b>Leeds City Region</b>	74.9	10
<b>West of England</b>	72.7	13
<b>Coast to Capital</b>	66.9	22
<b>Coventry and Warwickshire</b>	66.6	23
<b>Thames Valley Berkshire</b>	66.0	25
<b>Derby, Derbyshire, Nottingham and Nottinghamshire,</b>	64.9	26
<b>Oxfordshire LEP</b>	63.4	27
<b>Greater Cambridge &amp; Greater Peterborough</b>	62.5	28
<b>Swindon and Wiltshire</b>	61.3	31
<b>Enterprise M3</b>	58.4	37

Source: PwC analysis, BIS (2015), Mapping Local Comparative Advantage in Innovation, HESA

# WoE escapes the ‘London effect’ despite one in ten students from the WoE moving to the capital after graduating

Despite the limitations of the BIS analysis presented on the previous slide, it does give some insight into the general profile of graduate movements. One movement worth exploring is how much of a ‘pull’ London has on graduates.

BIS discuss a ‘London effect’ that is particularly strong on LEPs in the ‘Greater Thames Valley Six’ - Coast to Capital, Thames Valley Berkshire, Enterprise M3, Buckinghamshire Thames Valley, Oxfordshire and Hertfordshire. This can be seen in figure 51 opposite where over a quarter of graduates from Enterprise M3 move to London. This rises to over a third of graduates in the Coast to Capital LEP.

Being close to the capital comes with agglomeration benefits we have discussed earlier, but this clearly represents a risk to retaining talent.

With over 10% of WoE graduates moving to London, there is clearly still some pull from London, but WoE is in the middle of the rankings, coming 17<sup>th</sup> out of 38 (London is excluded from the ranking). This suggests that WoE does not suffer a disproportionate brain drain to London.

Figure 51: Percentage of students from the LEP area living in London six months after graduating, excluding London, 2012/13

	% of graduates who move to London	Rank among all LEPs (excl. London)
<b>Coast to Capital</b>	35.1	1
<b>Enterprise M3</b>	26.4	4
<b>Thames Valley Berkshire</b>	20.3	6
<b>Oxfordshire LEP</b>	17.4	7
<b>Greater Cambridge &amp; Greater Peterborough</b>	16.7	8
<b>Swindon and Wiltshire</b>	14.5	11
<b>West of England</b>	10.6	17
<b>Coventry and Warwickshire</b>	9.7	19
<b>Cornwall and the Isles of Scilly</b>	9.6	20
<b>Derby, Derbyshire, Nottingham and Nottinghamshire,</b>	7.2	26
<b>Greater Birmingham and Solihull</b>	6.7	27
<b>Leeds City Region</b>	6.5	28
<b>Greater Manchester</b>	5.0	33
<b>Liverpool City Region</b>	4.7	36

Source: PwC analysis, BIS (2015), Mapping Local Comparative Advantage in Innovation, HESA

# Bristol gains the third highest number of graduates outside London - ahead of Oxford, Cambridge and Edinburgh

Centre for Cities' 2016 report, the Great British Brain Drain, offers more data from HESA that can help us explore graduate retention in the WoE.

Data in figure 52 below looks at the number of graduates gained for various cities across the UK in 2014. We show the top 10 cities on this scale, excluding London which is a significant outlier. 'Graduate gain' measures the difference between the number of students who grew up in the city and left for university elsewhere, and the number of graduates who did not grow up in that city but who are working there six months after graduating. A high number of graduates gained suggests that a city is good at both attracting graduates from outside the region, and holding on to students who have grown up in the area.

**Figure 52 shows that, excluding London, Bristol<sup>1</sup> gains the third highest number of graduates of all cities in the UK.** Given that retention of home students in the WoE was moderate (ranking 13<sup>th</sup> out of 39), this suggests that WoE is good at connecting graduates from elsewhere to employment opportunities in the region. This ability to attract external graduates to the region, and to retain them there, strengthens the diversity of the WoE's talent pool, and can potentially lead to greater levels of innovation. This will be discussed more in the following section on the Flow of Ideas.

Further areas of analysis here would be to explore where WoE is gaining the most graduates from, which could open up more avenues for exploration. This analysis would be possible with a bespoke data request made to HESA. This was out of scope for the current study.

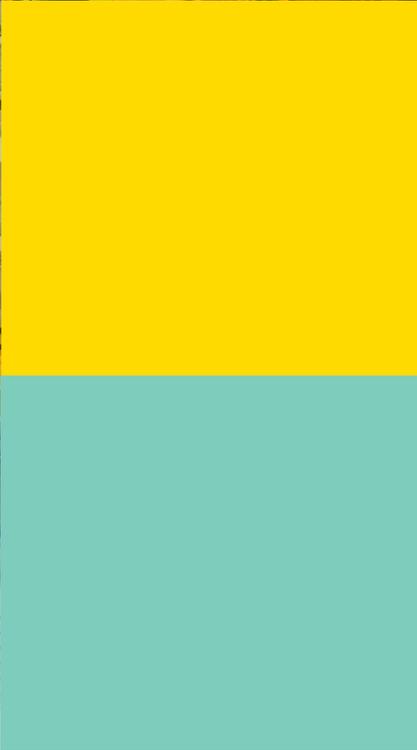
Figure 52: 2014 graduate gain for UK cities, showing top 10 ranked cities



Source: PwC analysis, Centre for Cities, HESA (<https://www.centreforcities.org/data-tool/dataset/the-great-british-brain-drain/#graph=bar&city=show-all&sortOrder=high&indicator=graduate-gain\single\2014>)

<sup>1</sup>The Centre for Cities definition of the Bristol is the City of Bristol and South Gloucestershire local authorities combined

# 4. Flow of ideas



# Our approach to the analysis

## Purpose of analysis

The WoE's Local Industrial Strategy should set out how it could help the UK to achieve its ambition of being “the world's most innovative economy.” This analysis provides strategic insight into the whole innovation life cycle from seeding an idea; to testing and developing; and finally to scaling and commercialisation. It demonstrates the impact of collaboration between universities and businesses and how this could further drive productivity growth across the country.

## Areas of analysis

Our analysis is structured by the life-cycle of innovation: from coming up with an idea, to testing and refining it, and finally in growing and commercialising the idea. We explore data relating to universities, businesses, and broader economic indicators around innovation:

- **Universities:** level of collaboration, links with businesses, and experience in seeding spin-offs.
- **Businesses:** growth, connections to investment opportunities, and barriers to growth.
- **Wider economic indicators:** R&D spend, patents, and R&D tax credit claims.

## Data sources

The main data sources used throughout this section of analysis include:

- University collaboration - Elsevier Scopus and HESA
- Impact of the flow of ideas on businesses – HMRC, ONS and Innovate UK
- Quantifying wider spillover effects from ideas in WoE – Eurostat and UK IPO
- Connectivity barriers which could restrict growth – Beauhurst and ScaleUp Institute

We have not been able to explore exhaustive data around patents and trademarks. This is because businesses often register intellectual property near their headquarters, but could do much of the R&D work in another location. This means that patents applied for in one area often reflect an amalgamation of work from lots of different areas. There is currently no publically available data to unpick this ‘ideas supply chain.’ There are also limitations on the data around R&D tax credit claims, and gross R&D spend. These are not available at a granular enough geography to give conclusions specific for the WoE.

# Executive Summary - Flow of Ideas

The UK industrial strategy has set the UK's ambition to become "the world's most innovative economy." This section examines how the WoE supports the wider UK economy to achieve this ambition. It looks at how collaboration and connectivity can affect innovation: if people are able to connect with each other more easily, then it should be easier to come up with new and compelling ideas. We look at innovation in universities and in businesses.

The WoE is a highly innovative economy, which positions it well to see more rapid economic growth in the coming years. The WoE is a key player along the M4 innovation arc, stretching from London to Cardiff. Factors that contribute to its success include the high level of collaboration between WoE universities and other top institutions, and the growing success of university links with businesses. Constraints to finance, workspace, and skills may hamper future growth.

## Academic Collaboration

The first step in the innovation lifecycle is coming up with a compelling idea. The WoE has a strong and well-connected academic base for seeding these ideas. To explore this, we looked at the extent to which universities in the WoE collaborate. We were interested to see how they worked with each other, how they worked with other institutions in the UK, and how they worked with universities across the rest of the world.

We found that WoE universities tend to collaborate more than other universities do, both nationally and internationally. **In terms of the proportion of papers written in collaboration with other UK universities, the Universities of Bristol and Bath average around 9% points higher than the UK average.** They have also kept pace with the growth in international collaboration over the last 15 years. They have grown their proportion of papers with international research partners by around 60% since 2002. While UWE and Bath Spa do fare lower on these measures of international collaboration, they interact strongly with Bristol and Bath, suggesting that there is a compelling local academic hub underpinning innovation in the WoE.

In terms of who WoE collaborates with, **the Economic and Social Research Council have identified that the WoE sits in an 'innovation arc' stretching across the M4 corridor, from London to Cardiff.** The WoE contributes significantly to the strength of this arc as WoE universities tend to collaborate most often with Oxford, Imperial College, and University College London. The universities in the WoE also appear to have strong working relationships with businesses, particularly in manufacturing, aerospace, and transport. The University of Bristol has the seventh highest level of income from business services of all UK universities.

# Executive Summary - Flow of Ideas

**Our research suggests that collaboration between universities and businesses is one of the major factors contributing to the region's high innovation performance.** The National Composites Centre (NCC) is an example of this in practice: based in University of Bristol, but tied to innovation in aerospace. A study of the NCC highlighted that the WoE is a national leader in high value manufacturing, with over 200 academics dedicated to ground-breaking composites research. Going forward it will be important to build out these case studies in more detail and link their relevance to the Industrial Strategy's Grand Challenges.

## Connectivity in Business Innovation

The next stage of the innovation lifecycle is testing and scaling an idea. We considered this by looking at the connectivity of innovative businesses in the WoE. WoE businesses appear to be well-connected to public investors, for example, with the WoE earning the third highest value of Innovate UK grants across all LEPs. Scale-up businesses, i.e. those businesses that are disrupting existing industries and pushing to scale-up activities, are often most dependent on finance for future growth. SETsquared, a scale-up incubator largely led by activity from Bath and Bristol universities, was set up to help connect innovators to investors. The organisation has been a huge success for the region, and has been recognised by UBI Global as the number one university-managed incubator platform in the world. These kinds of connections help build a supportive ecosystem for scaling innovative businesses.

**Research and development activity is strong in the WoE with the area having the fourth highest proportion of R&D employment across all LEPs at 10% versus the average of 7%.** This is especially interesting considering that WoE businesses only spend an average amount on R&D. This could indicate a high level of productivity for WoE 'Ideas' workers. This potentially opens up an area for further investigation in the LIS.

Connectivity to public finance appears to be strong in the region, but insights from Engine Shed, a scale-up incubator based in Bristol, suggests that greater availability of private finance could lead to more growth in innovation. That said, the WoE is starting from a good base of private innovation, as the region has had the second fastest growth in scale-up density over the last five years. Scale-up activity is considered a leading indicator for growth, so this may help position WoE for resilient growth in the future economy. To continue this success WoE could consider, methods to overcome some of the barriers to scale-up growth identified by the ScaleUp Institute, namely restrictions on talent, infrastructure, and access to international markets.

# Executive Summary - Flow of Ideas

## Innovation and Patents

The final stage of the innovation lifecycle lies in commercialisation of the idea. We have looked at patents as a way of understanding how successful the region is at protecting and commercialising its ideas. We found that the WoE files over twice the number of patent applications per million inhabitants than the UK average.

This success in patent filings is partly driven by large, highly innovative firms like Airbus and Rolls-Royce. Data on individual patent inventors, however, shows that the WoE has also consistently supported a high numbers of individual inventors over time. **In 2015 they had the fourth highest number of registered inventors on patents developed over the last three years. This suggests that the WoE is equally effective at facilitating innovation at a large scale, and with smaller scale innovators.**

# Underlying analysis



# WoE universities collaborate with UK universities more than the Russell Group by over 10 percentage points

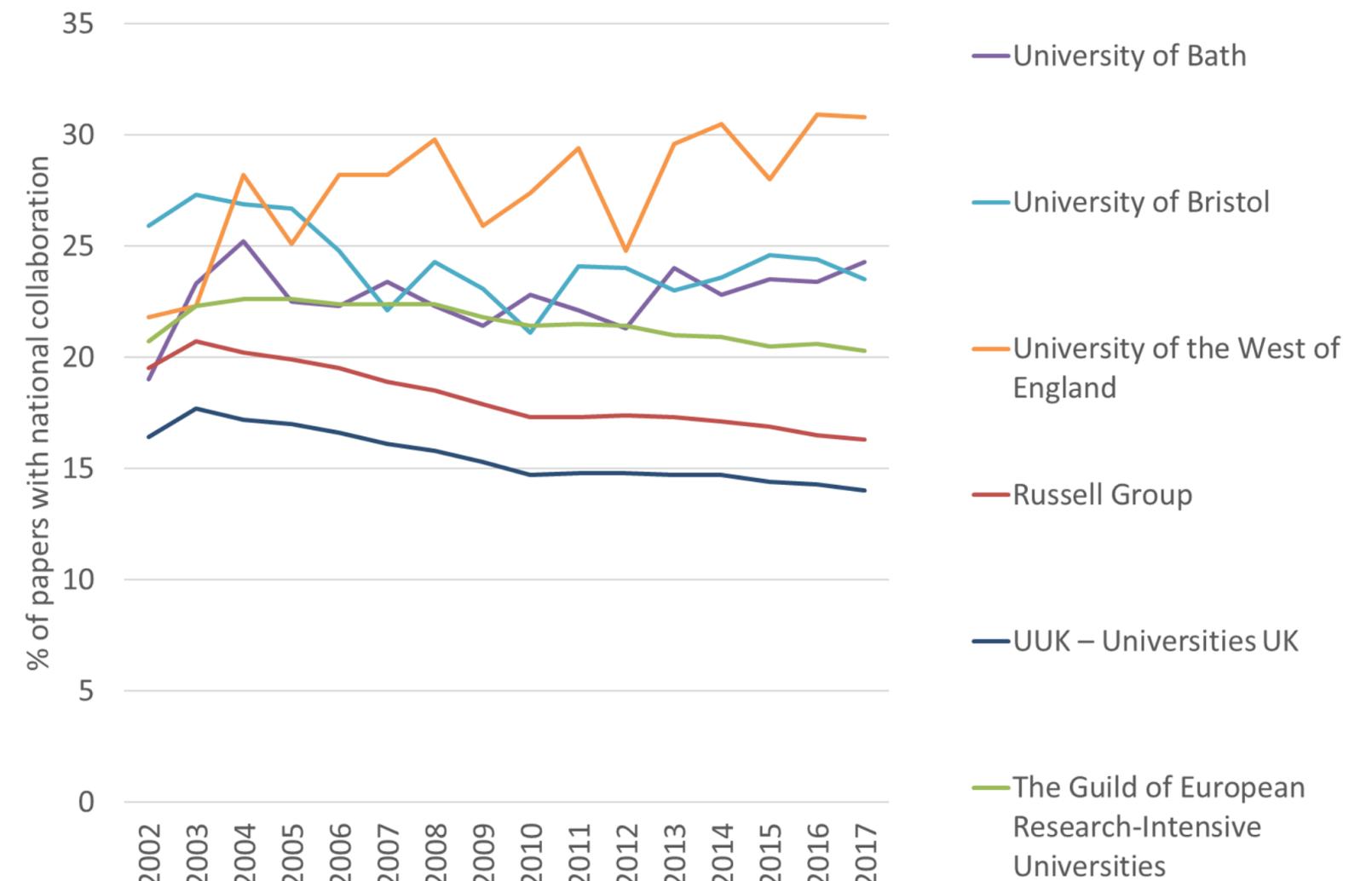
One way to understand the flow of ideas in the WoE is to consider how universities in the region interact with others institutions. The major way that universities interact with one another is through collaboration on research projects. When academics from different institutions work on the same project, the result is often a co-authored paper, which lists both of their names and institutions.

We have explored the proportion of co-authored papers using data from Elsevier, one of the largest and most commonly-used databases of academic output. We would expect a highly collaborative university to have a high proportion of their output as co-authored papers. By looking at the proportion of output we can more easily compare institutions of different sizes.

Figure 53 shows that **Bath, Bristol, and UWE collaborate with other national institutions more than the Russell Group average**. They also produce a higher proportion of papers with other national institutions than the UK average, and comparable EU benchmarks. This suggests that the WoE institutions are well-connected with other UK institutions. It is notable that **UWE is significantly farther ahead in UK-based research connections, with almost a third of scholarly output written with some degree of national collaboration**.

The UK average rate of national collaboration from 2002 to 2017 sits around 15.5%, while Bristol, Bath and UWE had an average rate of around 24.8%. This 9.3 percentage point difference equates to a roughly 60% change over the UK average.

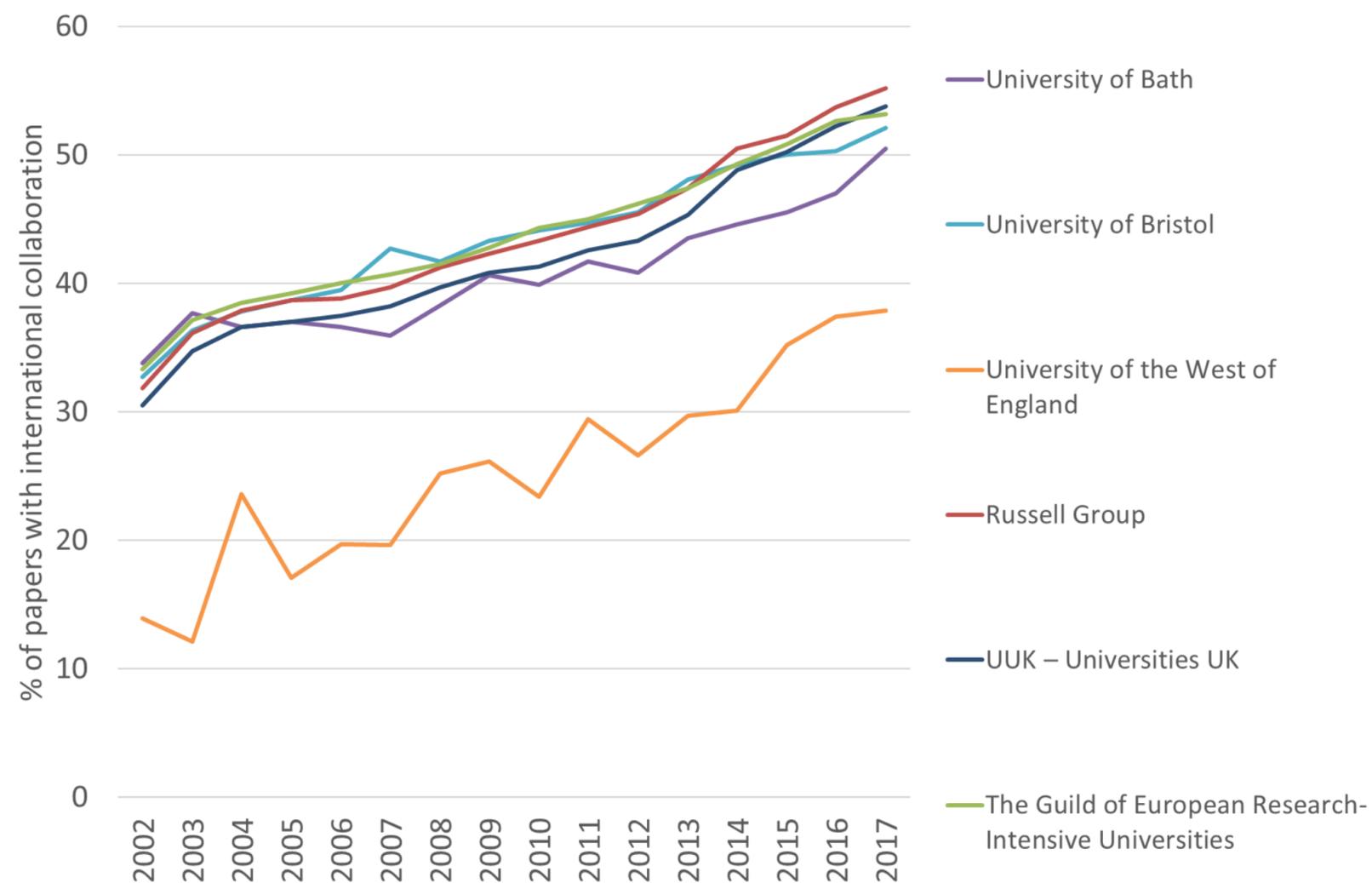
Figure 53: Proportion of scholarly outputs produced with national collaboration



Source: PwC analysis, Elsevier Scopus  
Bath Spa omitted because of high data variability

# Bristol and Bath have increased their levels of international collaboration by over 60% in the last 15 years

Figure 54: Proportion of scholarly outputs produced with international collaboration



Source: PwC analysis, Elsevier Scopus  
Bath Spa omitted because of high data variability

WoE universities tend to perform well on levels of national collaboration, but international collaboration is increasingly important, as the rate of growth in Figure 54 suggests. Interestingly, **the Universities of Bristol and Bath have matched this rapid level of growth in international collaboration over the last 15 years.** Collaboration levels have improved by around 20 percentage points between 2002 and 2017, equating to a roughly 60% growth in relative size. This has been supported by programmes such as Bath’s [International Research Funding Schemes](#), and Bristol’s [International Strategic Fund](#).

UWE, on the other hand, shows a consistently lower level of international collaboration than the other benchmarks in Figure 54. Their rate of growth, however, has been faster than the UK average. Between 2002 and 2007, UWE was roughly 18 percentage points behind the UK average on international collaboration. For the average between 2012 and 2017, UWE had reduced this gap to 16 percentage points. [UWE Bristol’s 2020 Strategy](#) stresses a “proactive and systematic approach to developing and enhancing our strategic partnerships at home and overseas.” This should help build on the progress in the last 15 years.

Figure 54 uses the same Elsevier dataset that as in Figure 53. International collaboration is defined as any paper with at least two different countries listed in the authorship byline. While co-authoring paper is not the only way for universities to collaborate, it does provide a quantitative indication of the level of connectivity.

# WoE universities collaborate most often with Oxford, Cambridge, Imperial, and UCL

We have seen that universities in the WoE tend to produce a high volume of collaborative output. Figure 55 starts to unpick with whom they are building these relationships.

Again using data from Elsevier, we have analysed each university's top collaborating higher education providers (HEP) in terms of co-authored papers. We show the top 10 institutions for each of the WoE institutions. Bath Spa, for example, collaborate most often with the University of Bath, with 131 co-authored papers published between 2010 and 2018.

We have highlighted the WoE HEPs in blue to help show that the WoE institutions tend to work well with each other. **Bath, UWE, and Bath Spa all have local WoE institutions as their primary research partners.**

Figure 55: Location and number of co-produced papers for the top 10 WoE-collaborating universities (2010-2018)

Rank	Bristol		Bath		UWE		Bath Spa	
	Collaborating HEP	Frequency	Collaborating HEP	Frequency	Collaborating HEP	Frequency	Collaborating HEP	Frequency
1	University of Oxford	4198	<b>University of Bristol</b>	<b>1124</b>	<b>University of Bristol</b>	<b>927</b>	<b>University of Bath</b>	<b>131</b>
2	Imperial College London	3902	University of Oxford	941	<b>University of Bath</b>	<b>210</b>	Baylor College of Medicine	38
3	UCL	3121	University of Cambridge	730	Cardiff University	190	<b>University of Bristol</b>	<b>32</b>
4	University of Cambridge	3027	Imperial College London	729	UCL	158	University of South Wales	21
5	University of Manchester	2445	UCL	594	University of Nottingham	130	<b>University of the West of England</b>	<b>16</b>
6	University of Edinburgh	2392	University of Birmingham	459	The University of Warwick	123	University of Gloucestershire	14
7	University of Birmingham	2197	University of Manchester	442	University of Sheffield	114	University of Reading	13
8	University of Glasgow	2185	University of Nottingham	384	University of Plymouth	111	Beijing Institute of Technology	13
9	Istituto Nazionale di Fisica Nucleare, Roma	2138	University of Southampton	380	University of Oxford	111	University of Exeter	12
10	Massachusetts Institute of Technology	2073	Cardiff University	370	University of Birmingham	107	University of Oxford	11

Source: PwC analysis, Elsevier Scopus

# According to the ESRC the WoE sits within an academic ‘arc’ of collaboration across the M4 corridor

Looking at the WoE’s major academic collaborators in the UK can help us understand the places where the WoE is most connected to.

We have looked at the top 145 collaborating institutions for each WoE university. Adding together the number of co-authored papers from each of these institutions gives us a picture of where to find the WoE’s top collaborating institutions.

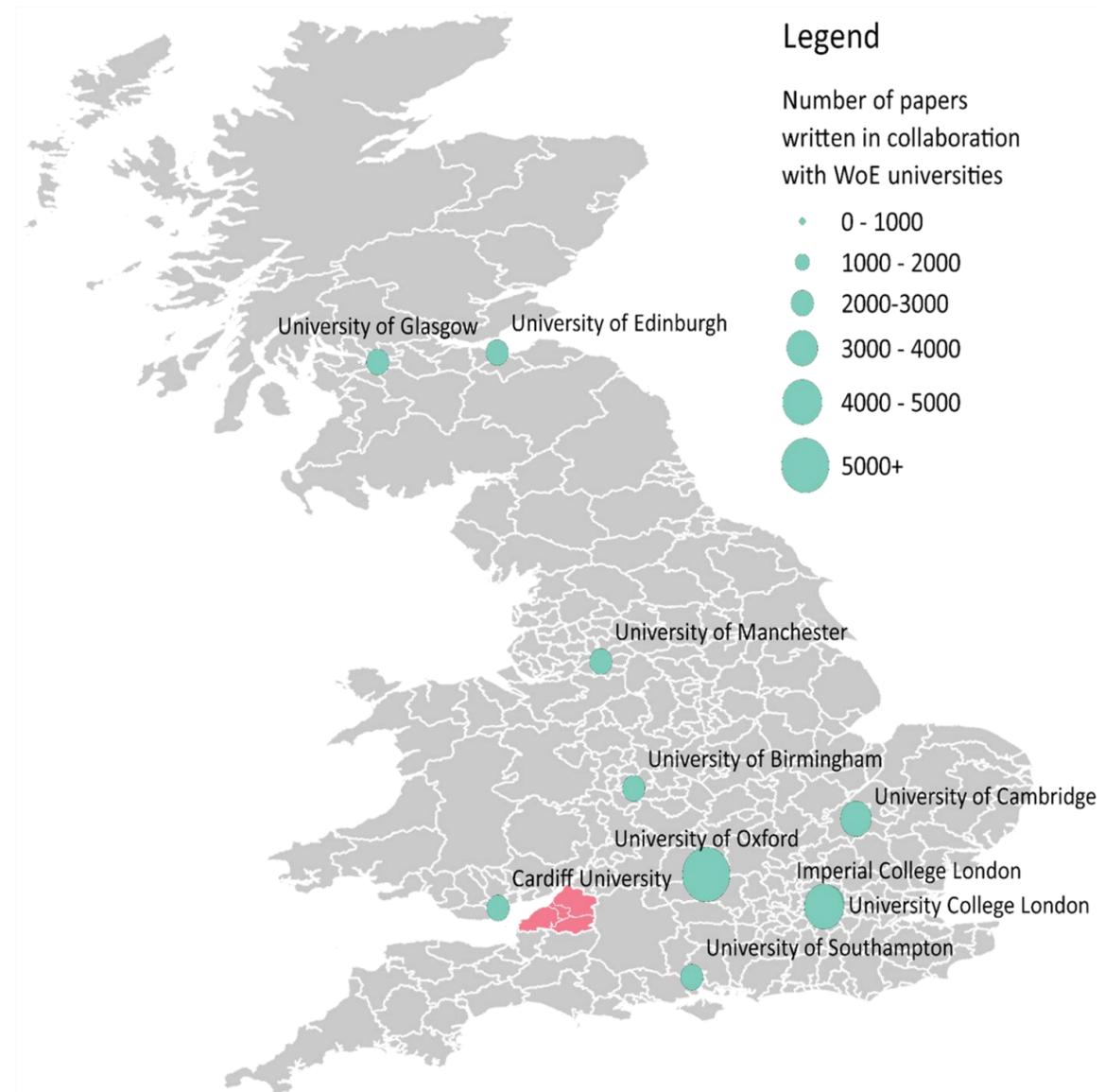
**The strongest areas of academic collaboration come across the M4 corridor.** Oxford, London (UCL and Imperial), and Cambridge are the areas with the highest levels of co-authorship.

[The Economic and Social Research Council](#) have identified “an arc that stretches from Greater Cambridge and Greater Peterborough, through the South-East Midlands, to Oxfordshire and west along the M4 corridor towards the West Country and Wales.” The data in Figure 56 supports this idea, and reflects the WoE’s place within this M4 ‘innovation arc.’

Some notable collaborations with these institutions include:

- Bristol-Oxford: South West Nuclear Hub
- Bristol-Cambridge-Oxford-Leeds-Manchester: BHF Oxbridge Centre of Regenerative Medicine
- Bristol-Cambridge-Imperial-Oxford-UCL: Quantum Information Processing Interdisciplinary Research Collaboration

Figure 56: Location of top-10 collaborating institutions for the WoE universities (2010-2018)



Source: PwC analysis, Elsevier Scopus

# The Universities of Bristol and Bath are collaborating with businesses 40% more than the UK average

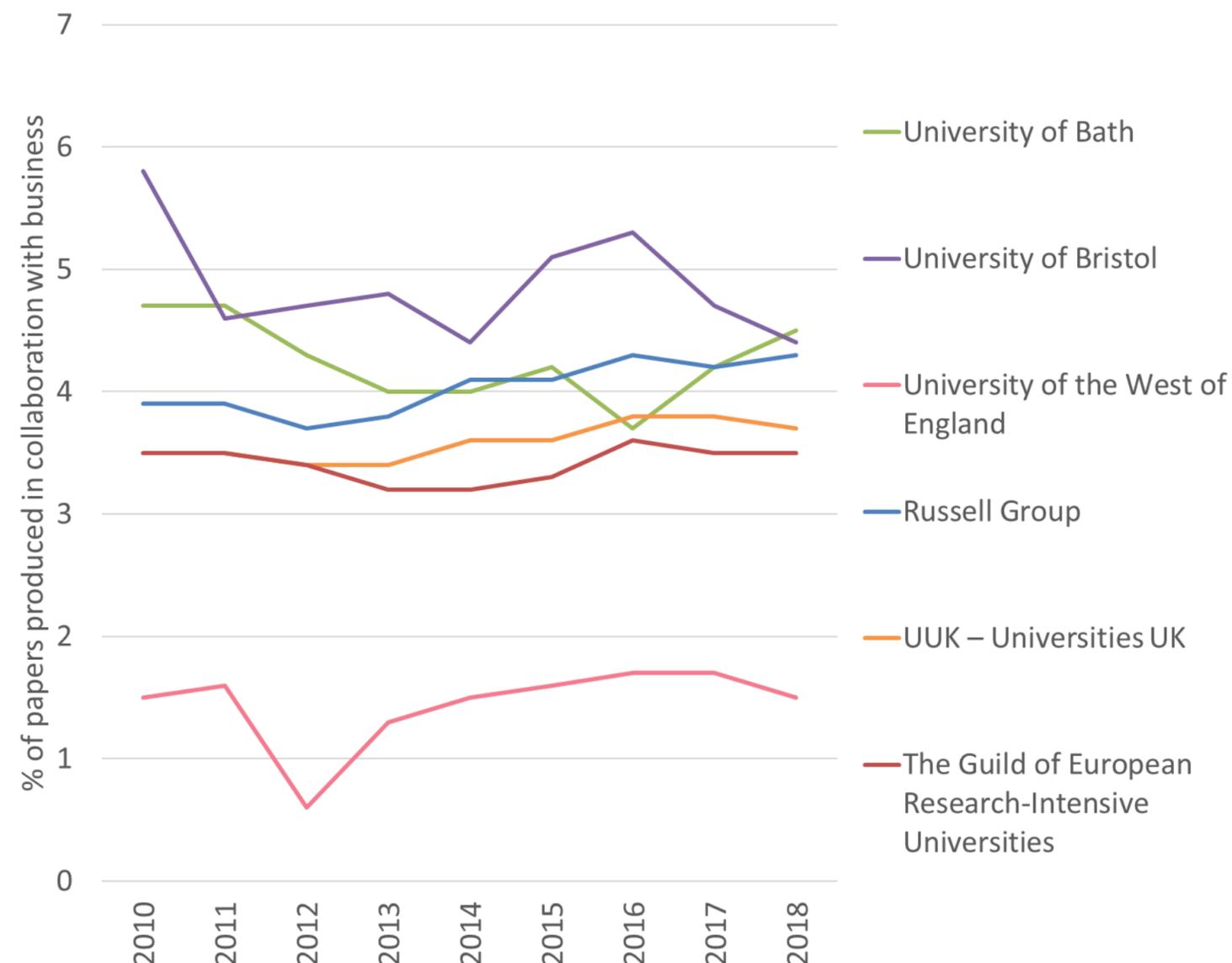
The previous slides set out the extent of collaboration between academic institutions. However, collaboration with business is another important factor that can affect the flow of ideas. Elsevier data also suggests that the University of Bristol is one of the strongest UK institutions at building links with business.

Involving businesses in academic research can have several benefits: for both the business and the university. Research done in collaboration with business has a higher potential of leading to 'new-to-the-market' innovation.<sup>1</sup> Students also stand to benefit from greater research links with business, as education can be more closely tied to cutting-edge trends and developments in the market.

Figure 57 shows that **Bristol and Bath tend to write more papers in collaboration with businesses than the Russell Group, UK average, and other comparable European institutions.** They have tended to write around 4.5% of their papers in collaboration with business, while the UK average sits around 3.5%. This 1.5 percentage point difference equals around a 40% change between the Bristol and Bath, and the UK average. UWE, on the other hand, do not tend to conduct joint research activities with business to the same extent.

Some of the major research links with businesses are driven through the [Bristol and Bath Science Park](#). This facility enables businesses and academics from the area of composites research and manufacturing to work together. This work is led by the University of Bristol and notable business partners include Airbus, GE, GKN Aerospace, Leonardo Helicopters, QinetiQ and Rolls-Royce.

Figure 57: Academic-Corporate Collaboration vs Publication Year



Source: PwC analysis, Elsevier Scopus  
We have excluded Bath Spa because of high data variability

<sup>1</sup> <https://esrc.ukri.org/news-events-and-publications/evidence-briefings/more-innovation-through-university-business-collaboration/>

# The National Composites Centre is a flagship example of how collaboration in the WoE supports wider UK growth

The National Composites Centre (NCC) is based in the Bristol and Bath Science Park and owned by the University of Bristol. We are using the NCC as a case study to explore how academic links with business can improve the quality and application of research, and how innovation in the WoE supports future growth in a variety of sectors across the UK economy.

Composite materials are “composed of at least two materials, combined to produce improved properties superior to those of the individual components.”<sup>1</sup> They allow manufacturers to build products that are lighter and more durable. This technology has the potential to disrupt industries from aerospace and automotive, to oil, gas, and renewable energy. **The 2016 UK Composites Strategy predicting 160% growth over the next five years, and a potential 700% growth over the next fifteen years.** It is no surprise that “UK expertise in composites” is referenced directly in the UK Industrial Strategy.

The centre is leading UK efforts to capture the potential of the global composites market. **Since launch in 2011, headcount has shot up by 30 times over: from 12 people to 360.** The NCC works with some of the biggest clients in manufacturing, including Airbus, Rolls-Royce, Shell, Vestas, Siemens and a number of leading automotive companies. They also work with multiple academic institutions, notably Nottingham, Bristol, Cranfield, Manchester, Southampton and Imperial.

Connectivity has been a recurring theme in the NCC’s success. Below are examples of their connectivity with academics and private enterprise. These insights have come from discussions with the NCC’s Head of Government Affairs and Strategic Partnerships.

<sup>1</sup> UK Composites Strategy, 2016, <https://compositesuk.co.uk/about/industry/uk-composites-strategy>

# The NCC's success has helped establish Bristol as a global centre of excellence with over 200 composites researchers

## Academic

- Since NCC's founding, **the University of Bristol has grown their faculty to over 200 composites researchers. Their publications have earned over 8,000 citations.** The only comparable institution at this scale is Harbin, in China.
- The NCC is a partner in the Centre for Innovative Manufacturing in Composites (CIMComp). Over the next 7 years, this programme will train 150 researchers to advanced levels, giving NCC and UK industry access to cutting-edge talent.
- These collaborations are already bearing fruit, for example with ground-breaking research of Z-pinning and tufting technology coming through collaboration with Bristol and Cranfield Universities.



## Industry

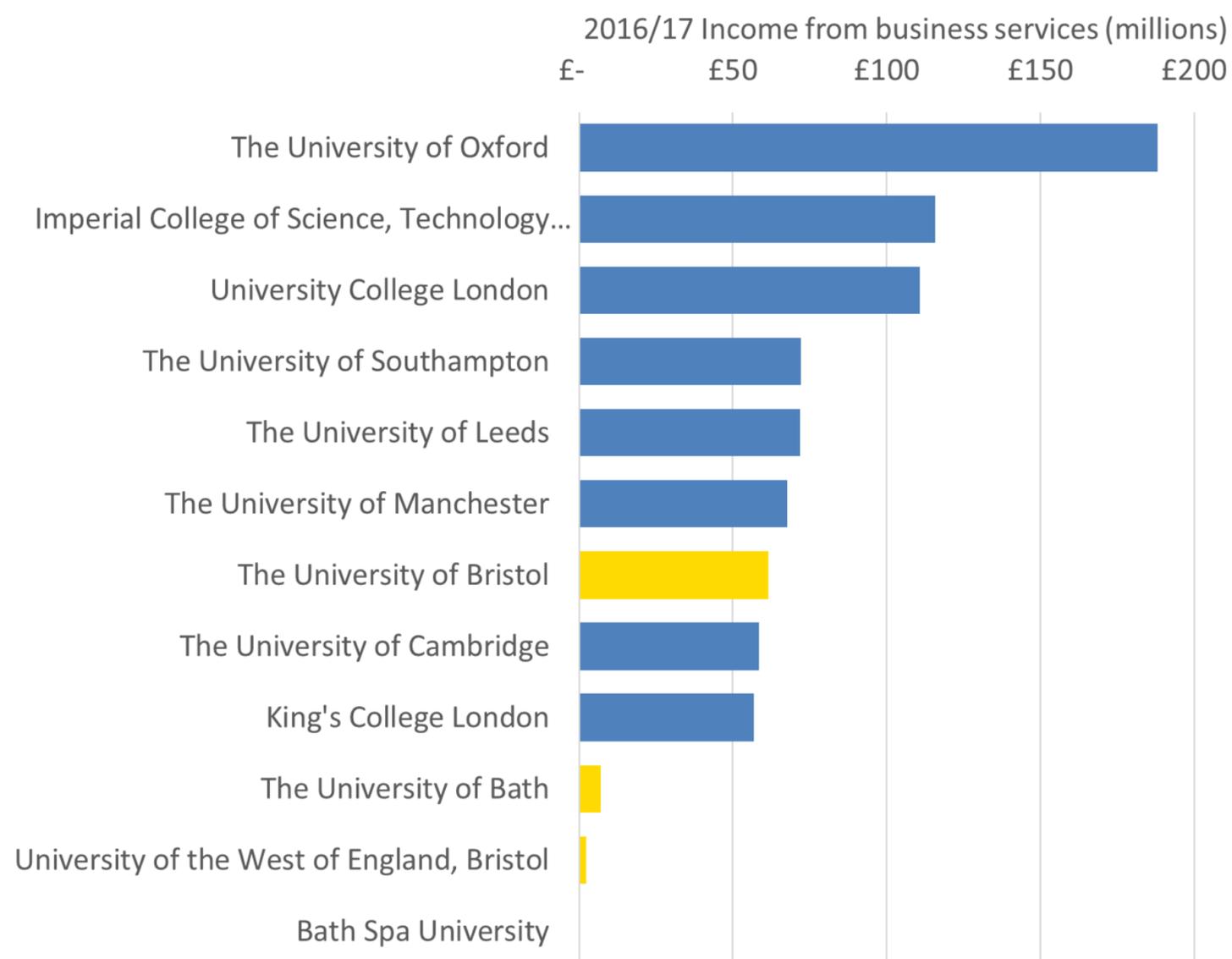
- NCC is based in Bristol because of strong links with aerospace. Projects include Airbus' Wing of the Future programme, GKN's engineering and manufacturing activities, and Rolls-Royce's work on future engines.
- This link with aerospace has strengthened. The NCC is the one of the biggest recipient of Aerospace Technologies Institute funding, alongside businesses like Rolls-Royce and Airbus.
- **Wider industries, like energy and construction, are exploring how best to use composites.** These industries are now making more enquiries than aerospace, but turnover from this work is still far off aerospace levels.



To maintain their level of success, **the NCC identify a 'trinity of needs': world-class talent, cutting-edge machines, and high-profile clients.** The NCC are concerned about the risk of talent shortage, and that the UK remains an attractive place for advanced R&D, design, and manufacturing post-Brexit. Increased collaboration with universities, e.g. collaborative modules in composites, may help the UK and WoE better prepare for the market opportunities of large-scale composite manufacturing.

# Bristol ranks seventh in the UK in income from business services - ahead of Cambridge and King's College London

Figure 58: 2016/17 Income from business services (£m)



HESA data suggests that the University of Bristol is one of the strongest UK institutions at monetising their links with business. The Higher Education Business-Community Interaction (HEB-CI) survey collects annual data on the level of interaction between higher education institutions, SMEs, social enterprises, and other larger commercial bodies.

Figure 58 shows that **the University of Bristol ranks seventh in the UK, ahead of Cambridge, on their level of income from business services.** 'Business services' include such activities as consultancy, contract research, and facilities and equipment hire. For the University of Bristol, two examples of previous work which has generated income for the university are: *Research to provide insight to help extend life of nuclear power stations, Magnox* and *Developing an innovative imaging and analysis device for commercial exploitation, Renishaw*. We should note that Bath Spa have no reported income from business services in 2016/17.

The income from business services is important as it can be reinvested back into the universities to improve teaching and research, and innovating with business to support local and national growth.

# Bath is in the top 10 universities for turnover from its spin-off businesses

One way that universities can push innovation, research, and design, is through supporting entrepreneurial spin-off opportunities. These are businesses that are set up directly or indirectly due from university research activities. They range from graduate start-ups and social enterprises, to large university-owned enterprises. HESA data suggests that WoE universities are good at supporting spin-offs, but that more could be done to increase employment opportunities.

Figures 59 a, b and c are completed using three-year averages of spin-off data, from 2014/15 – 2016/17, for 167 UK institutions. We show the top 5 institutions for each measure, and highlight the positions of the WoE universities. Notably, Bath Spa do not feature in the rankings, as the turnover of spin-off companies being set up is small. Figure 59a shows that **Bath is in the top 10 universities for spin-off turnover**. Figure 59b shows **Bristol and Bath are both in the top 20 for external investment**. In this figure, the University of Northampton is a significant outlier in terms of how much external investment it receives. This may be as a result of programmes at UoN e.g. Social Venture Builder Programme which promotes social enterprise and innovation which helps participants to support candidates in attracting investment. Figure 59c shows lower positions for Bristol, Bath, and UWE for total spin-off employment (FTE). This suggests that turnover and investment growth does not automatically flow into direct effects on the WoE labour market.

Figure 59a: Turnover from spin-offs

Rank	Estimated current turnover of all active firms (£m)	Institution
1	209	The Queen's University of Belfast
2	184	The University of Strathclyde
3	181	The University of Edinburgh
4	147	The University of Glasgow
5	144	The University of Oxford
9	81	The University of Bath
16	43	University of the West of England, Bristol
36	21	The University of Bristol
-	-	Bath Spa University

Source: PwC analysis, HESA

Figure 59b: External investment received

Rank	Estimated external investment received (£m)	Institution
1	618	The University of Northampton
2	253	The University of Oxford
3	214	Imperial College of Science, Technology and Medicine
4	100	The University of Edinburgh
5	92	The University of Glasgow
14	21	The University of Bristol
18	14	The University of Bath
22	11	University of the West of England, Bristol
-	-	Bath Spa University

Source: PwC analysis, HESA. 'External investment' comes "from external partners but excluding investment from HEFCE (now OfS)/BIS (now BEIS) third stream funds")

Figure 59c: Employment of active firms

Rank	Estimated employment of active firms	Institution
1	2932	The University of Oxford
2	2671	Kingston University
3	2153	The University of Strathclyde
4	2061	The University of Central Lancashire
5	1802	The Queen's University of Belfast
25	513	The University of Bath
32	450	University of the West of England, Bristol
40	389	The University of Bristol
-	-	Bath Spa University

Source: PwC analysis, HESA

# Bath's average turnover per spin-off is the second highest in the UK and they rank fourth highest for average employment

The previous rankings on spin-off turnover, investment, and employment did not account for the overall number of firms. When we weight the previous measures by the number of active firms under each institution, the WoE, and particularly Bath, appears to be seeding highly successful spin-offs. In general, WoE universities have smaller numbers of spin-offs. Against a national average of 84 active firms per institution, Bath Spa have had 49, Bristol have had 67. Bath is at the average with 84, and UWE is the highest performer in WoE with 106. The top 5 all have upward of 500 active firms, so WoE institutions do tend to manage a comparatively small portfolio of active spin-offs. (Source: PwC analysis, HESA)

Figure 60a shows the average turnover per active spin-off firm. **Bath notably comes out as second highest in the UK for average turnover per spin-off**, with UWE and Bristol both in the top 25. In Figure 60b, we see that Bath, Bristol, and UWE are all in the top 25. WoE spin-offs tend to be more around the mean level of external investment (£246,000) than the maximum. Figure 60c, though, paints more of a mixed picture. **Bath ranks fourth in the country for average employment per spin-off**, with Bristol and UWE lag towards the lower end of the rankings. Their average employment of 6 and 4 people, respectively, is far off the higher levels seen in Belfast and Aberdeen, for example. We have filtered results in these figures to only rank institutions with more than 15 active firms on average in the years 2014/15 – 2016/17.

Figure 60a: Average turnover per spin-off

Rank	Turnover by number of active firms (£ thousands)	Institution
1	£4,327	The Queen's University of Belfast
2	£2,812	The University of Bath
3	£2,151	The University of Glasgow
4	£2,096	The University of Surrey
5	£1,390	University of Ulster
6	£1,310	University of Durham
21	£408	University of the West of England, Bristol
24	£311	The University of Bristol
-	-	Bath Spa University

Source: PwC analysis, HESA

Figure 60b: Average external investment per spin-off

Rank	Investment by number of active firms (£ thousands)	Institution
1	£6,262	The University of Northampton
2	£1,722	The University of Aberdeen
3	£1,681	Imperial College of Science, Technology and Medicine
4	£1,669	The Queen's University of Belfast
5	£1,339	The University of Glasgow
9	£492	The University of Bath
13	£322	The University of Bristol
23	£102	University of the West of England, Bristol
-	-	Bath Spa University

Source: PwC analysis, HESA.

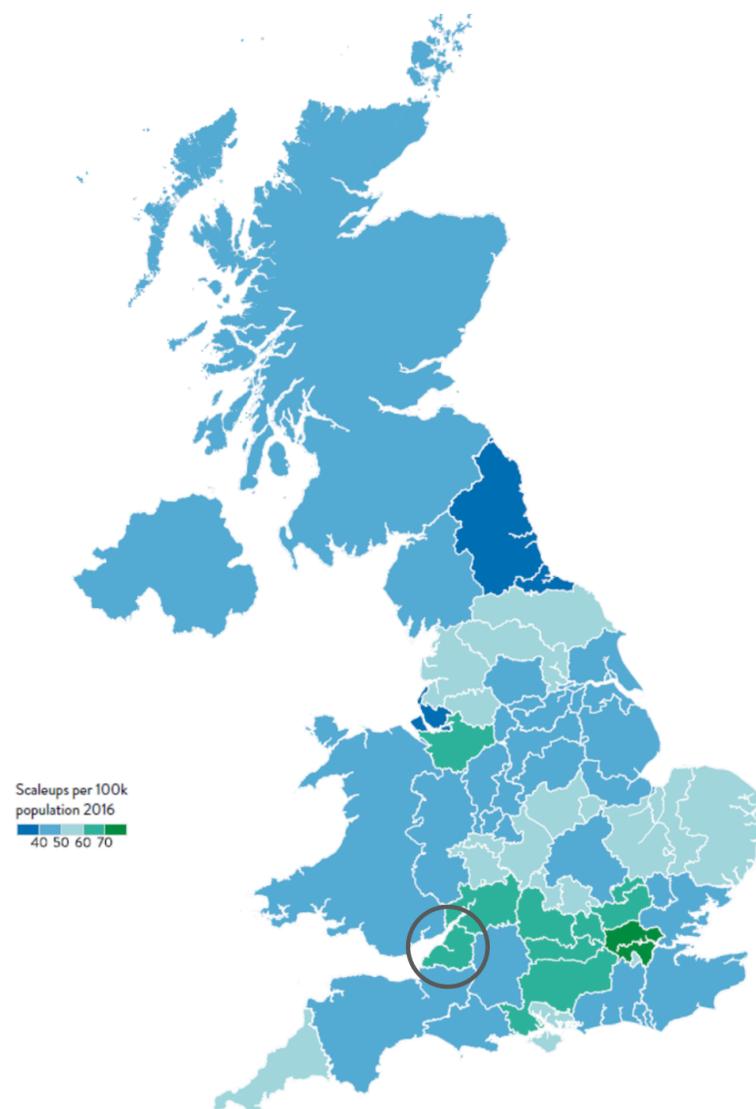
Figure 60c: Average employment of active spin-offs

Rank	Employment by number of active firms	Institution
1	37	The Queen's University of Belfast
2	29	The University of Aberdeen
3	21	University of Ulster
4	18	The University of Bath
5	13	The University of Strathclyde
6	13	The University of Oxford
19	6	The University of Bristol
26	4	University of the West of England, Bristol
-	-	Bath Spa University

Source: PwC analysis, HESA

# WoE has had the second fastest growth in scaleup density over the last five years but future growth may begin to slow

Figure 61: Number of scaleups per 100,000 of the population, 2016, by LEP



Another way of looking at business innovation is by focusing on the prospects of scaleup businesses. The OECD defines a scaleup as “an enterprise with average annual growth in employees or turnover greater than 20 per cent per annum over a three year period, and with more than 10 employees at the beginning of the period.” These are businesses in the growth phase of their development, often trying and testing new ideas to disrupt existing industries.

Evidence from the ScaleUp institute’s 2018 scaleup review<sup>1</sup> showed that **85% of scaleups in the WoE were able to grow their turnover in 2016, compared to 78% in Oxfordshire, and the UK average of 82%**. This also comes through in employment, where 26% of scaleups in WoE grew both turnover and employment. This compares well to 19% in Oxfordshire and a UK average of 21%. This does not show the size of growth, only the number of firms successfully growing. It is nonetheless a useful proxy for the degree of success for WoE scaleups.

**WoE has grown one of the highest densities of scaleup businesses in the UK.** Figure 61 opposite highlights in green those LEPs with higher numbers of scaleups per 100,000 of the population. There appears to be a high density developed from London and across the M4 corridor, with the WoE connected to this trend. The scaleup review also shows **WoE has had the second fastest growth in scaleup density in the UK since 2013**, sitting only behind Cornwall and Isles of Scilly.

However, there is a risk of physical, digital, and market constraints limiting further growth. The 2018 Scale-Up Institute identified the three major constraints to the growth of scaleups in WoE as:

**1. Access to talent**

**2. Access to international markets**

**3. Access to infrastructure (physical and digital)**

Discussions with Engine Shed, a scaleup accelerator based in Bristol, suggested that the availability of flexible office space could be one notable infrastructure constraint. Runway East, a flexible co-working space often used by start-up and scaleup firms, have chosen Bristol as their first location outside of London, and 85% of capacity was filled before the doors opened. Now, six other co-working spaces are searching for space in the WoE.

# WoE businesses are well-connected to public investors with the third highest value of Innovate UK grants across all LEPs

Access to finance is a common barrier for smaller businesses looking to grow their scale. This is, of course, also true for businesses in the WoE, but recent evidence suggests that programmes are making it easier for them to find investment.

The ScaleUp Institute's 2018 ScaleUp review praised the actions taken by WoE LEP scaleup programmes to improve access to financing. These include the innovative Scaleup Generator company map, and the role of the Scaleup Enabler in matching up investors with innovators.<sup>1</sup>

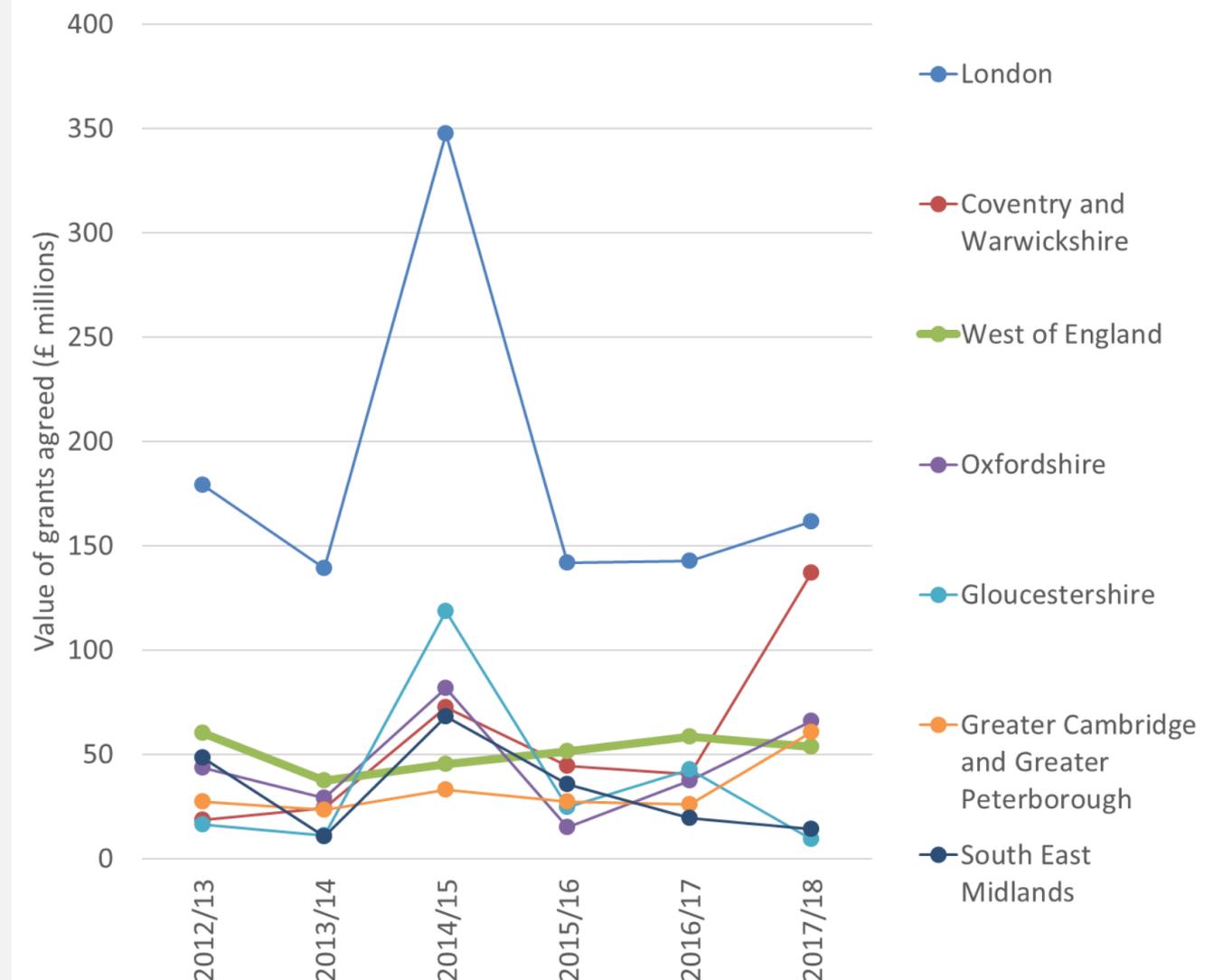
Innovate UK grants are available to UK-based businesses that want to develop a process, product or service, test your innovation ideas or collaborate with other organisations. SETsquared, a scaleup incubator largely led by activity from Bath and Bristol universities, has been recognised by UBI Global as **the number one university-managed incubator platform in the world**. SETsquared is primarily designed to connect hi-tech start-ups to Innovate UK grant awards.

Figure 62 shows the value of grants awarded to organisations from 2012-2018, and organises them by LEP area. We show the top seven LEPs for value of grants agreed over the period. The graph suggests:

- WoE is a consistent high performer in innovation investment. Between 2012/13 and 2017/18, **WoE's cumulative value of grants agreed is the third highest in the UK**, only behind London and Coventry and Warwickshire, and ahead of Cambridge and the South East.
- WoE's growth does not always keep pace with wider trends. Growth has been flat across the period, subverting the trend of spikes in 2014/15 and 2017/18.
- The WoE has fallen into fifth place in 2017/18, following a slight decline from the previous year. It will be important to try to reverse this trend in coming years, as was successfully done in 2013/14, following the decline in 2012/13.

<sup>1</sup> <http://www.scaleupinstitute.org.uk/wp-content/uploads/2018/11/westofengland.pdf>

Figure 62: Value of Innovate UK grants, for top 7 LEPs



Source: PwC analysis, Innovate UK

# WoE has the fourth highest proportion of R&D employment despite an average level of business spend

The previous slide showed that the level of public investment in innovation is relatively high in the WoE compared to high performing LEPs in England and Wales. The data below looks at the level of business R&D spend, and the proportion of employees working in R&D. While WoE's businesses spend an average amount of R&D, they seem to employ comparatively more people. This suggests that WoE R&D employees may be more productive than on average, as more R&D output can be produced for comparatively less spend. However, we should note that there is a lack of conclusive evidence on the productivity of R&D workers in WoE. This could be an interesting avenue for further research in the WoE LIS.

R&D spending is usually reported at too high a geographical level to make any conclusions about WoE. Using analysis from the 2015 BIS report on innovation in LEP areas, Figure 63 shows the level of business R&D spend split by LEP. Data is only available for 2013. **The WoE is only just over the national average**, and behind other high performers like Cambridge and Coventry and Warwickshire.

Figure 64 shows that **only three LEPs have a higher proportion of people employed in science, research, engineering and technology than WoE**. This represents all businesses, not just those in an 'R&D sector'.

Figure 63: 2013 Business Spending on R&D, by LEP

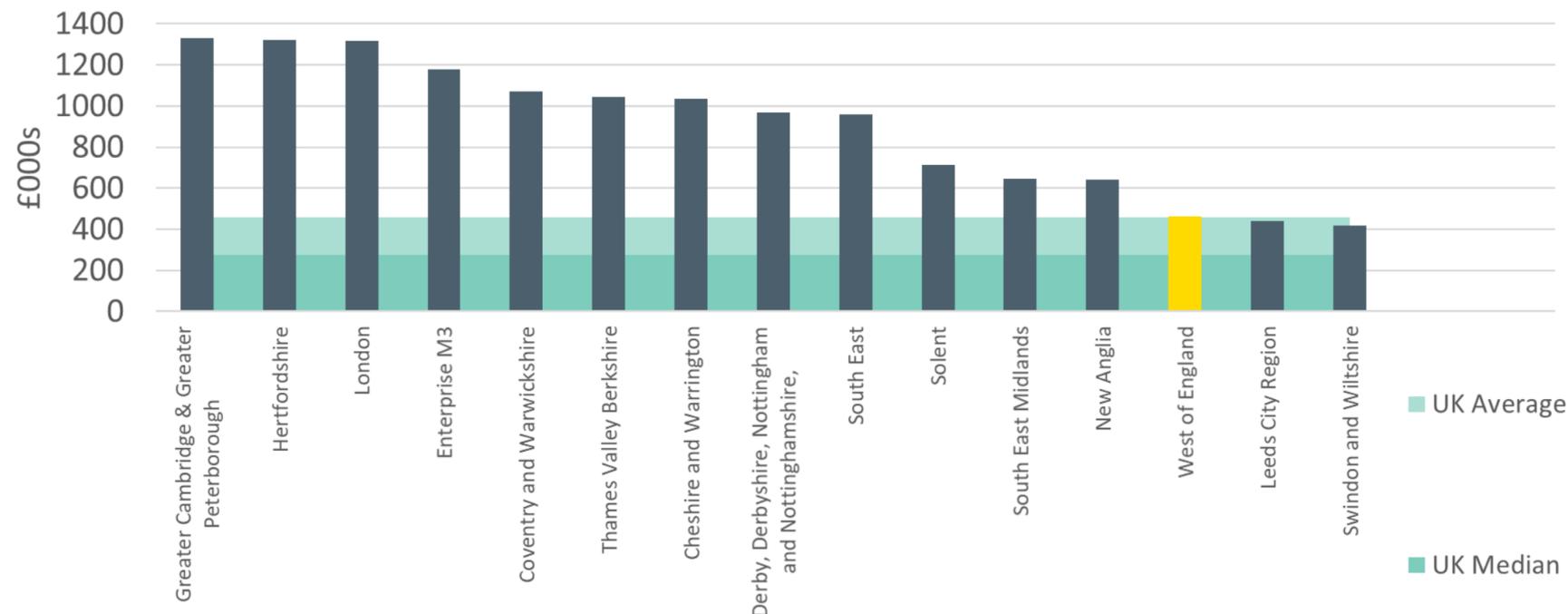
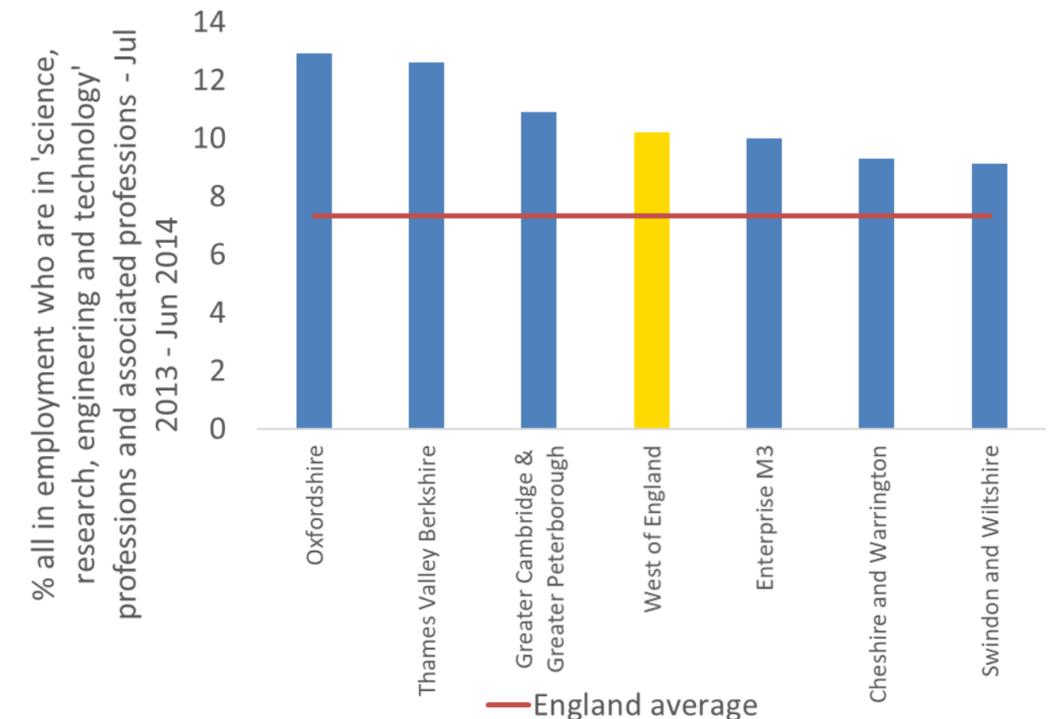


Figure 64: R&D employment by LEP



# The South West claims the sixth highest value of R&D tax credits in the UK which is likely focussed in the WoE

Figure 65a: Total R&D tax credit claims, 2016/17

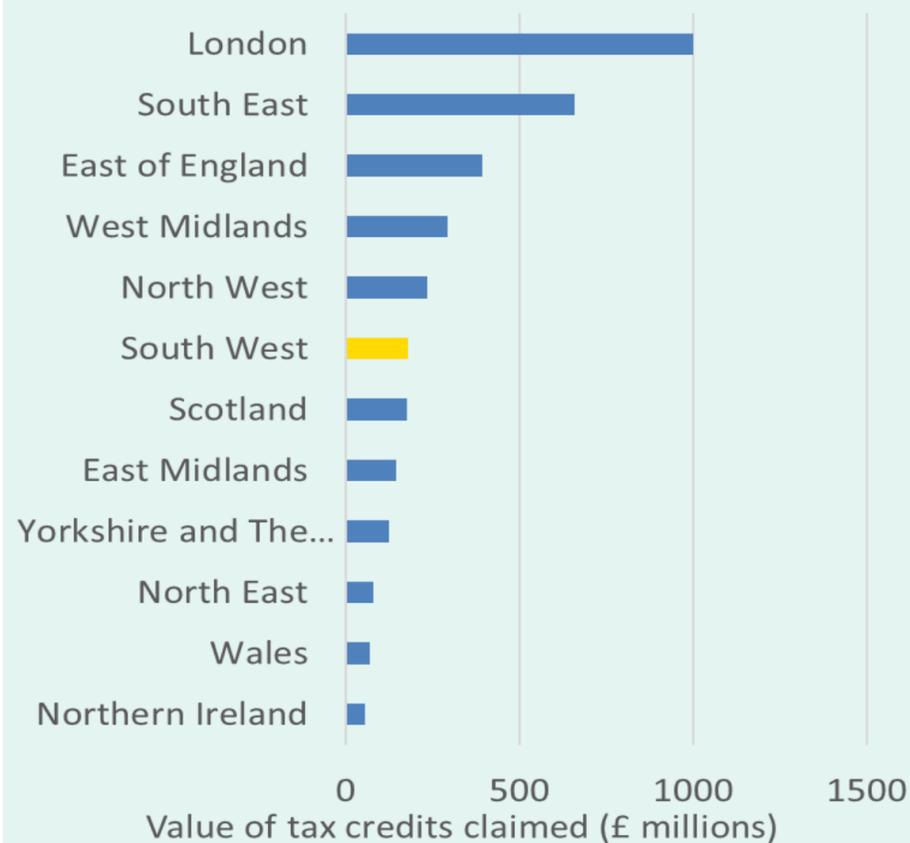


Figure 65b: Weighted R&D tax credit claims, by population

Region	Weighted tax credit claims (£ per resident)	Rank
London	113.3	1
South East	72.7	2
East of England	64.0	3
West Midlands	50.3	4
<b>South West</b>	<b>32.4</b>	<b>5</b>
North West	32.4	6
Scotland	32.3	7
East Midlands	30.4	8
North East	30.2	9
Northern Ireland	29.4	10
Yorkshire and The Humber	22.9	11
Wales	22.4	12

Source: PwC analysis, HMRC, ONS

- We use R&D tax credits and gross R&D spend as proxies for innovation activity. The major limitation is that the data is only available at a NUTS1 regional level. Despite these limitations, data from HMRC and the ONS appear to show that the wider South West region tends to lag behind other areas of the UK in macro-measures of innovation, potentially opening up an opportunity for WoE to lead the region.
- Figure 65a shows the value of R&D tax credit claims in the South West is only sixth highest in the UK, behind the Midlands and South East.
- Figure 65b weights this by size of population, and the South West still falls behind other high-performing regions, balancing their level of performance with Scotland and the North West.

# The WoE could collaborate with high performing regions to contribute to the UK R&D investment target of 2.4% of GDP

Figure 66a: Total 2016 R&D spend, by NUTS 1 Region



Figure 66b: Weighted R&D spend, by population

Region	Weighted R&D spend (£ per resident)	Rank
East of England	918	1
South East	734	2
London	555	3
East Midlands and West Midlands	457	4
North West	436	5
Scotland	430	6
South West	388	7
Northern Ireland	346	8
Yorkshire and the Humber	257	9
North East	238	10
Wales	229	11

Source: PwC analysis, ONS

- As for R&D spend (across all sectors, government, academic, non-profit, and business), Figure 66a shows that the South West region has the 5th lowest overall spend across the UK.
- This are at the same rank when weighted for population, as shown in Figure 66b, where they have almost half the weighted spend of the South East.
- R&D spending is fundamental in the delivery of the UK's Industrial Strategy, with a national investment target of 2.4% of GDP (Investing in R&D, Royal Society).
- The wider South West region tends to lag behind other regions such as South East and East of England which places even more importance on why the WoE should look to collaborate with regions of greater R&D activity, such as the South East and West Midlands.

# The WoE files over double the UK average for the number of patent applications per million inhabitants

Patents are a useful proxy for the connectivity of Ideas, but they do not tell the whole story around innovation. Firstly, not all innovations are patented. Secondly, it is difficult to pin down the geography of innovation through patents, as a company's registered office may be different to where the innovation takes place. Finally, recording the quality and return on patents is very difficult, and is not reflected in publicly available data from the UK Intellectual Property Office (IPO).

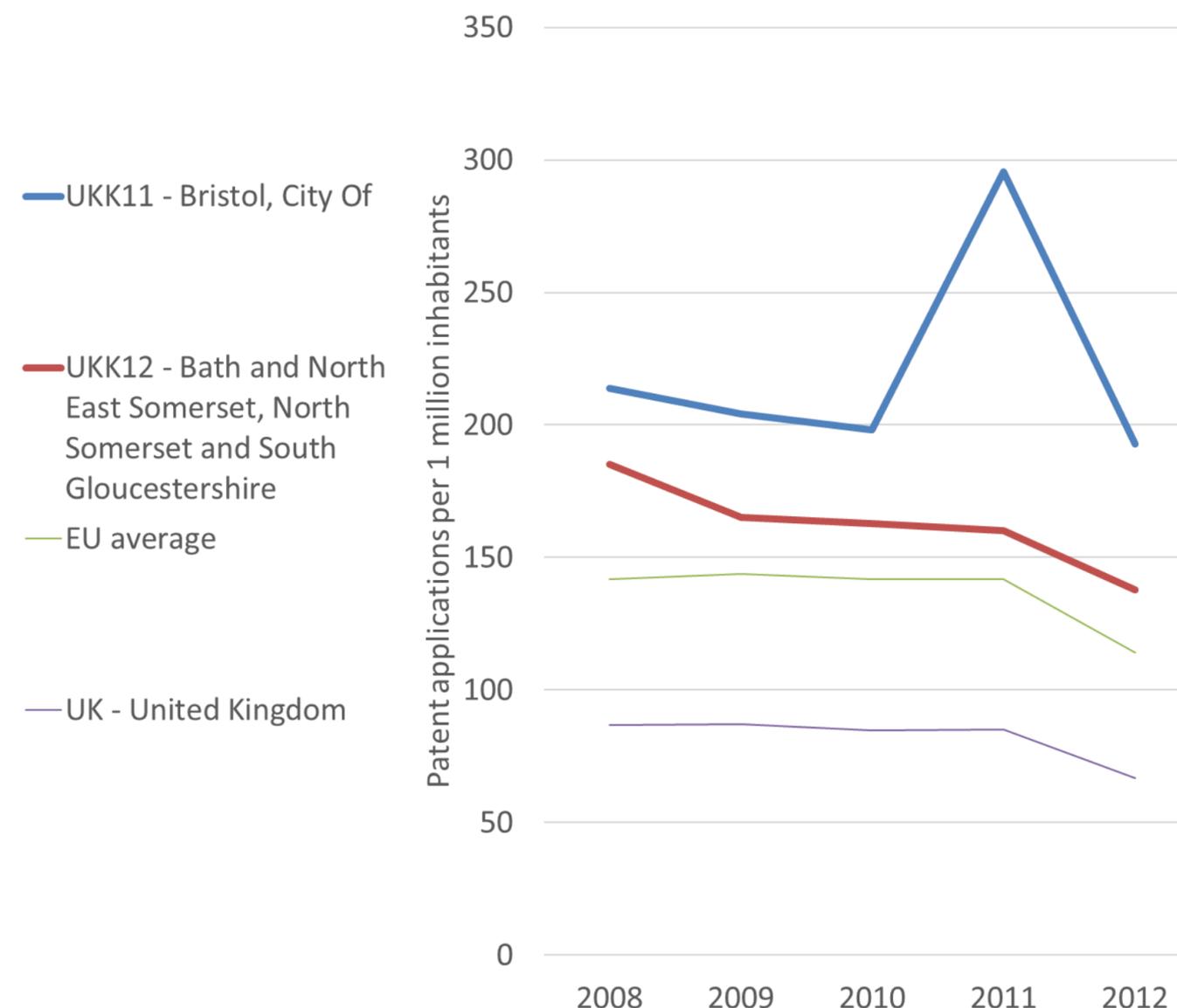
Despite the limitations, however, patent data does give some interesting insights to the connectivity of Ideas in the WoE. The following slides explore how the WoE's patenting rate compares to the South West region, UK and European benchmarks, other areas along the M4 corridor, and the top performing LEPs across England.

The key metric that we focus on is the number of patents filed to the European Patent Office per one million inhabitants in the region. This is to give a fairer comparison between regions, and so to give an idea of the innovation in the region.

The most recent data available from Eurostat goes from 2008-2012. This data source allows for comparison of NUTS3 regions across Europe.

Figure 67 opposite shows that **the WoE consistently files more patent applications per million inhabitants than both the UK and European averages.** This has been consistent over time.

Figure 67: Patent applications against the South West region



Source: PwC analysis, Eurostat

# Bristol region is seventh best in the UK at filing patent applications per head of population

Figures 68a and 68b below show the performance of the top performing LEPs for number of patents filed per one million inhabitants. **The City of Bristol's average applications over the years 2008-2012 are the seventh largest in the UK.** Inner London ranks one spot behind in eighth, suggesting that, relative to its size, Bristol is one of the more innovative cities in the UK. While Bath and North East Somerset, North Somerset, and South Gloucestershire place in 13th, they do appear to have a more stable innovation landscape than some LEPs that placed higher on average.

This data has been taken from Eurostat, where the most recent data released on patent applications is from 2012. The relative stability of the trend from 2008, however, suggests that we may still take some robust conclusions from these statistics.

Figure 68a: WoE compared to the top 5 LEPs by number of patent applications per 1 million inhabitants

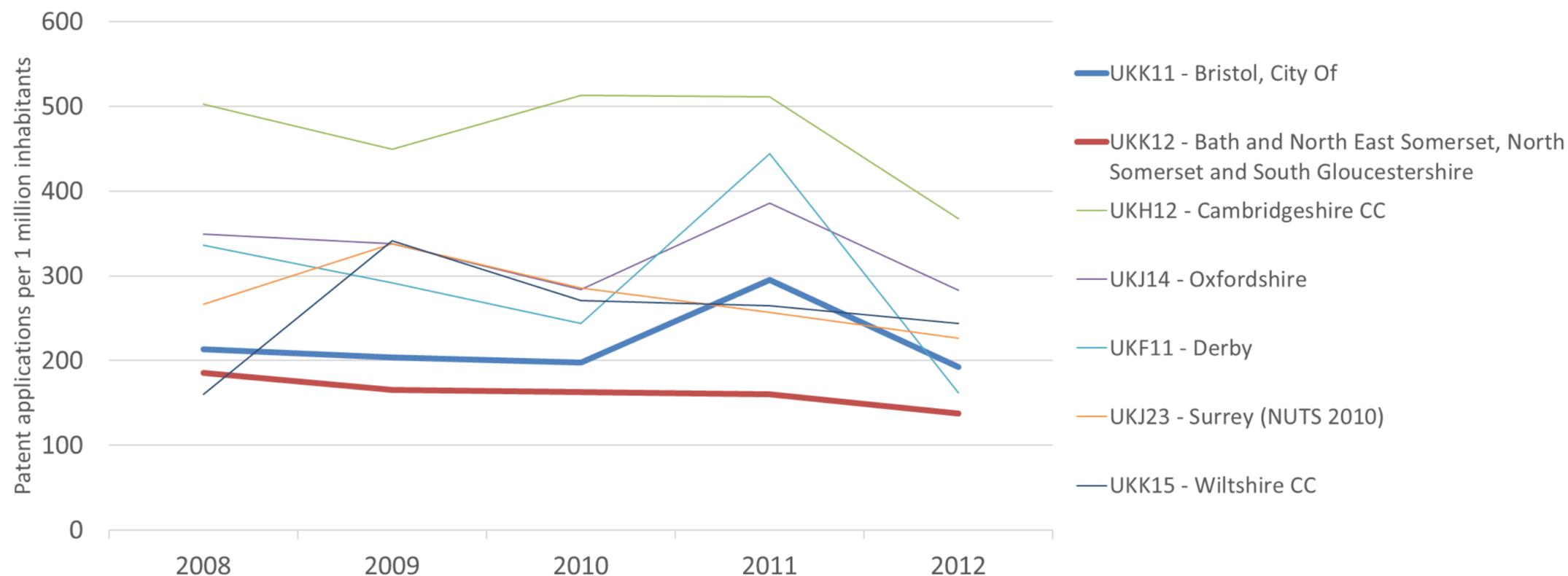


Figure 68b: Rank of LEPs in England by the average patent applications made per 1 million inhabitants, 2008-2012

1	UKH12 - Cambridgeshire CC
2	UKJ14 - Oxfordshire
3	UKF11 - Derby
4	UKJ23 - Surrey (NUTS 2010)
5	UKK15 - Wiltshire CC
6	UKJ11 - Berkshire
7	UKK11 - Bristol, City of
8	UKI11 - Inner London - West (NUTS 2010)
9	UKD74 - Wirral
10	UKH24 - Bedford
13	UKK12 - Bath and NE Somerset, N Somerset and S Gloucestershire

Source: PwC Analysis, Eurostat

Source: PwC Analysis, Eurostat

# WoE's leading role in aerospace innovation could help the UK to realise the benefits of emerging technologies

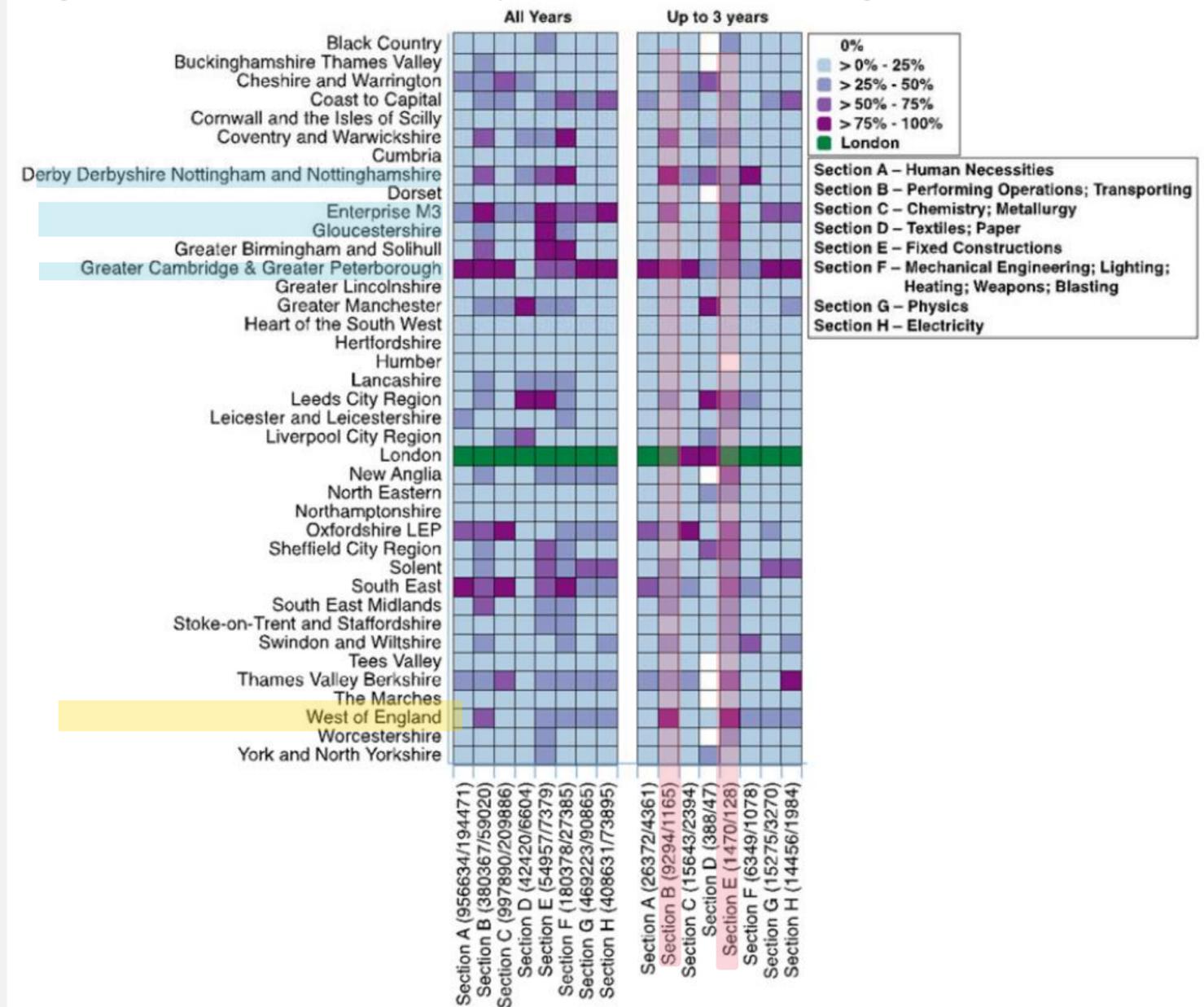
Given that the absolute number of patents and inventors in the WoE is high compared to the UK average, it is useful to look into what technologies those patents support. The International Patent Classification (IPC) system allows us to explore in figure 69.

In their 2015 report, BIS mapped inventors' addresses to LEP areas and broke down inventor numbers in these areas by IPC classifications. The x axis shows IPC codes, and has two numbers in brackets showing, respectively, the total number of inventors and the highest value in the section in question. Colours indicate quartile ranges for numbers of inventors by LEP area, as defined by the key. Where panels are in the 75%-100% category, for example, this means that the LEP has between 75% and 100% of the largest number of inventors. London is often an outlier for numbers of inventors. Where London is shaded in green, BIS excluded it from the analysis to make it easier to compare the remaining LEP areas.

Patents under 3 years old can more accurately locate where innovation activity is taking place. The main conclusion from the right-hand panel, therefore, is **that WoE is a national leader in innovation activities under categories B and E**. Category B innovations are likely to be driven by aviation (sub-category B64), while category E innovation is likely driven by civil engineering. For category B, other high performing LEPs include D2N2 and Cambridgeshire; while for category E, they are Gloucestershire and Enterprise M3. WoE is a part of this leading group.

As the NCC case study previously showed, category B innovations in aerospace are likely to add value across multiple sectors. Therefore, the WoE's leadership in category B innovation is likely to lead to greater spill-over effects across the wider UK economy.

Figure 69: Distribution of Inventors by IPC code and LEP area in England



Source: PwC analysis, BIS (2015), Mapping Local Comparative Advantages in Innovation

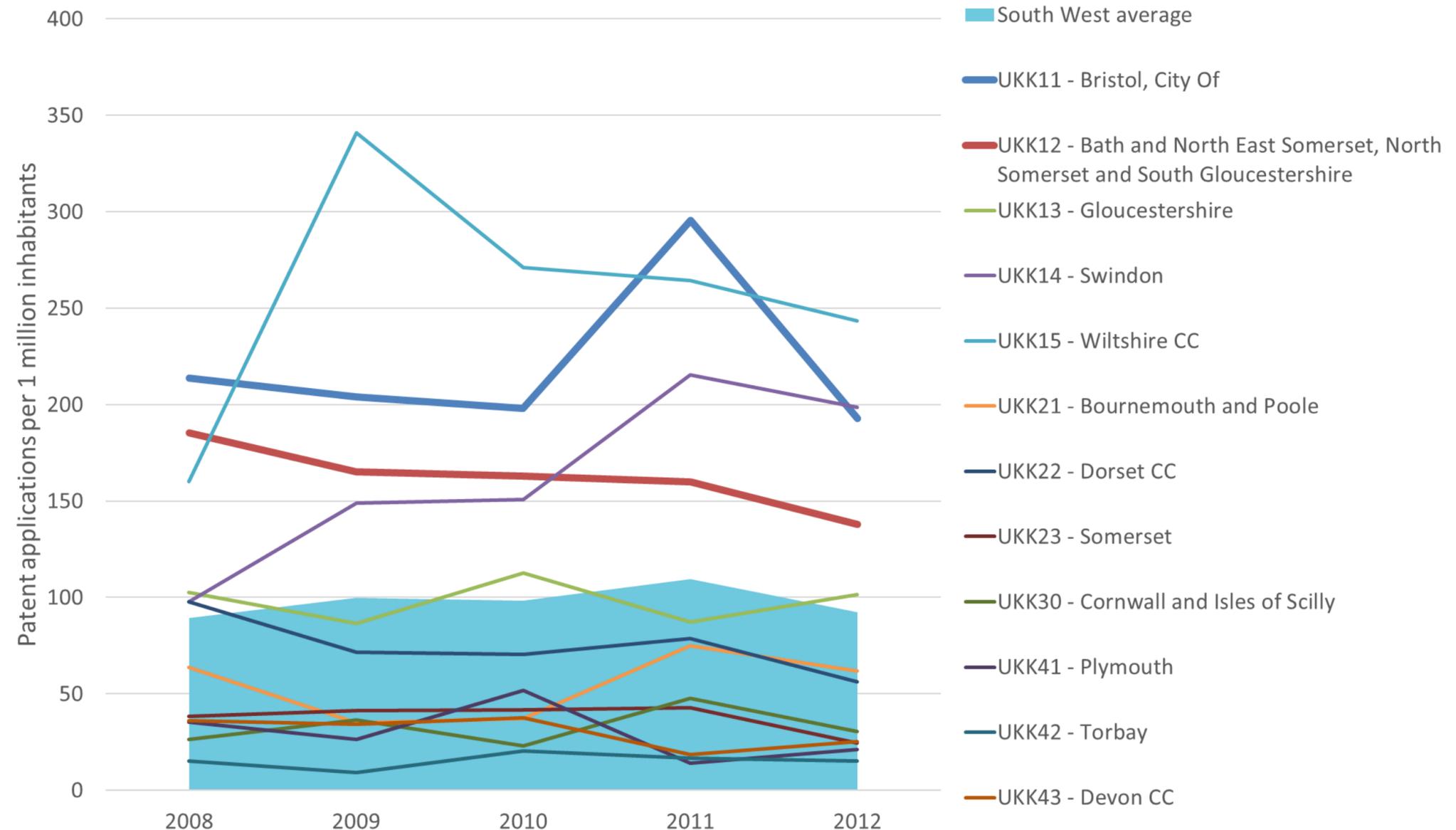
# Bristol files up to 200 more patents per million inhabitants than other areas in the South West

Figure 70 opposite compares the patents filed in the areas of the South West region.

The two WoE regions consistently perform in the top four. **Bath and North East Somerset, North Somerset and South Gloucestershire consistently file between 50 and 70 more patents per million inhabitants than the South West average, and Bristol files consistently between 100 and 200 more.** This suggests that WoE is significantly ahead of comparable areas in the South West.

The top four areas in the South West appear to stand out from the general level of patent activity across the region. These four areas are Bristol; Bath and North East Somerset, North Somerset and South Gloucestershire; Wiltshire; and Swindon. Interestingly, these four regions all border each other, suggesting a strong connectivity of ideas between the locations.

Figure 70: Patent applications per million inhabitants in the South West region



Source: PwC analysis, Eurostat

# The WoE is a higher performer in patent applications versus areas across the innovative M4 corridor

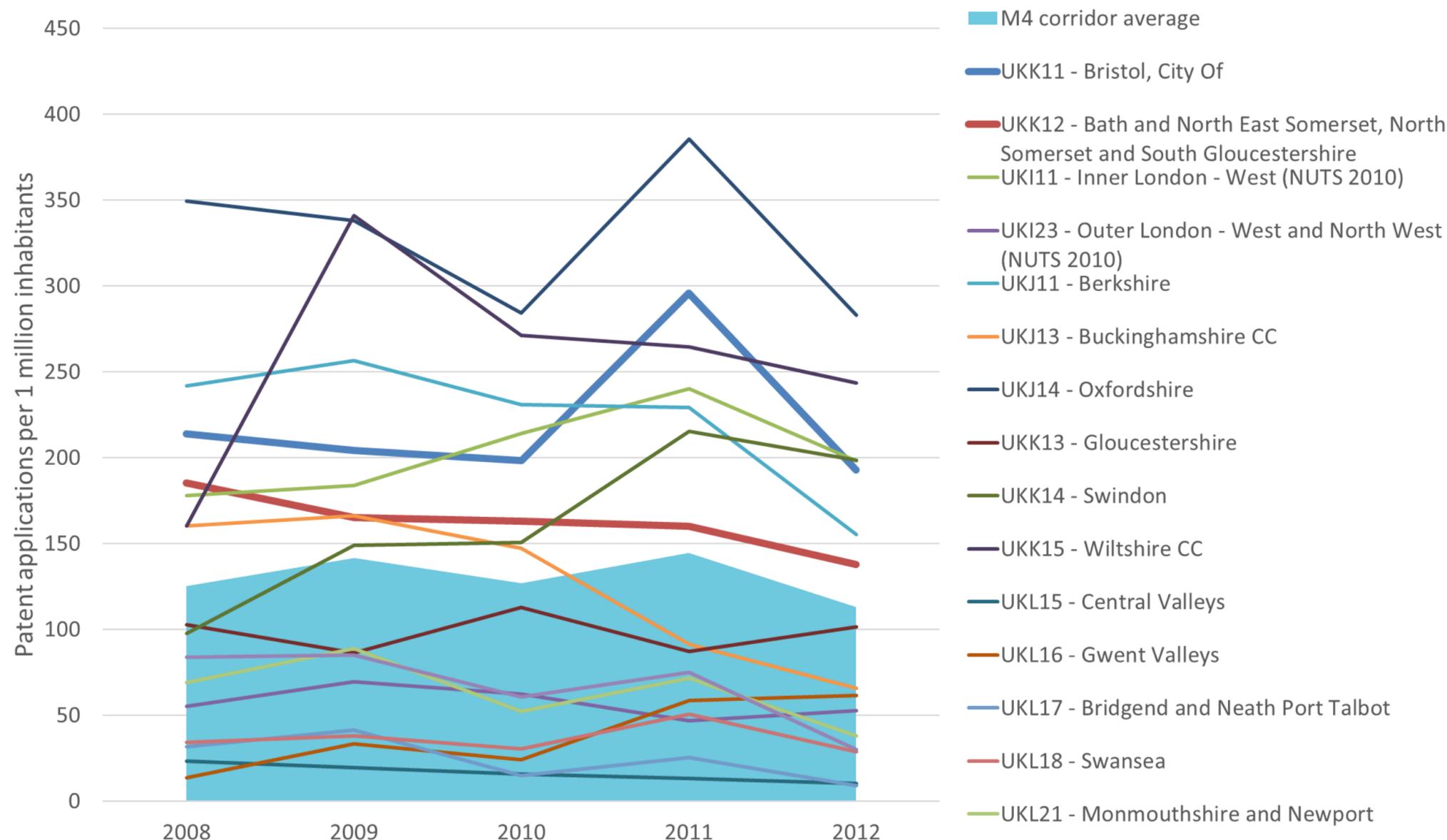
Figure 71 shows us the patent filings across several areas on the M4 corridor.

The M4 corridor is a highly innovative region, with Oxfordshire, Berkshire, London, and Bristol leading the way. The consistent high level of performance for both WoE regions suggests that the WoE is well-connected to innovation happening across the M4 corridor.

While the WoE regions are relatively high performers along the M4 corridor, the fall in Bristol's applications between 2011 and 2012 has left Bristol the fifth highest in the M4 corridor, despite starting in the third place in 2008.

Bath and North East Somerset, North Somerset, and South Gloucestershire have a consistent level of applications. Despite having the fourth highest level of applications in 2008, though, the region had fallen to seventh in 2012.

Figure 71: Patent applications against local competitors



Source: PwC analysis, Eurostat

# However the higher level of patent applications may be driven by a smaller number of highly active firms (1/2)

The tables below summarise the top 20 companies filing patents across the UK as a whole.

Figure 72a: Top 20 patent applicants 2015

Ranking	Applicant	2015 Patent applications
1	Private applicant	827
2	Rolls-Royce plc	353
3	Jaguar Land Rover Limited	266
4	Ford Global Technologies, LLC	210
5	Arm Limited	185
6	Halliburton Energy Services, Inc.	170
7	BAE SYSTEMS plc	160
8	Johnson Matthey Public Limited Company	150
9	GM Global Technology Operations LLC	139
10	Canon Kabushiki Kaisha	138
11	Intel Corporation	128
12	GE International Business Machines Corporation	123
13	Corporation	121
14	Airbusgroup Limited	114
15	Micromass UK Limited	109
16	Dyson Technology Limited	104
17	Baker Hughes Incorporated	103
18	Delphi International Operations Luxembourg S.à.r.l.	103
19	Imagination Technologies Limited	100
20	Hitachi, Ltd.	88

Figure 72b: Top 20 patent applicants 2016

Ranking	Applicant	2016 Patent Applications
1	Private applicant	623
2	Halliburton Energy Services Inc.	447
3	Jaguar Land Rover Limited	328
4	Rolls-Royce plc	322
5	Ford Global Technologies, LLC	271
6	Private applicant	186
7	Johnson Matthey Public Limited Company	139
8	Google Inc. International Business Machines Corporation	133
9	ARM LIMITED	127
9	ARM LIMITED	127
11	Canon Kabushiki Kaisha	120
12	Oxford University Innovation Limited	118
13	BAE SYSTEMS plc	112
14	British Telecommunications Public Limited Company	104
15	Wal-Mart Stores, Inc.	102
16	Cirrus Logic, Inc.	100
17	Airbus Group Limited	95
18	Delphi Technologies Inc	92
19	Shenzhen China Star Optoelectronics Technology Co. Ltd.	90
20	Baker Hughes Incorporated	89

Figure 72c: Top 20 patent applicants 2017

Ranking	Applicant	2017 Patent Applications
1	Ford Global Technologies, LLC	533
2	Halliburton Energy Services, Inc.	506
3	Jaguar Land Rover Limited	423
4	Private applicant	359
5	Google LLC	276
6	Rolls-Royce plc	246
7	Cirrus Logic International Semiconductor Limited	181
8	Shenzhen China Star Optoelectronics Technology Co., Ltd.	159
9	Johnson Matthey Public Limited Company	120
10	British Telecommunications public limited company	117
11	Canon Kabushiki Kaisha	114
12	Dyson Technology Limited	112
13	Oxford University Innovation Limited	109
14	ARM Limited	98
-	BAE SYSTEMS plc	98
16	Airbus Operations Limited	96
17	British American Tobacco (Investments) Limited	95
18	International Business Machines Corporation	92
19	nChain Holdings Limited	81
20	Katholieke Universiteit Leuven	79

Source: PwC analysis, Intellectual Property Office

## However the higher level of patent applications may be driven by a smaller number of highly active firms (2/2)

On the previous slide, annual data from the Intellectual Property Office suggest that large firms in WoE may be driving the region's high patent applications. The IPO's annual 'Facts and Figures' on patents reveal the businesses making the most applications each year. The top 50 combined, on average, file around 25% of the UK's patents. Figures 72 a, b and c show that three WoE-based businesses consistently feature in the top 20 for annual patent applications: Rolls-Royce, BAE Systems, and Airbus. This suggests that the WoE's relatively high level of patent applications could be driven by the several large businesses operating R&D practices in the area.

A major limitation of this analysis, though, is that the regional patent application data we looked at previously reported on patents up to 2012, whereas the below stats refer to 2015-2017. Secondly, even for businesses with a large presence in the WoE, they may not file all their patents from the region. This is particularly important for businesses like Rolls-Royce, for example, who have an R&D hub in WoE, but a significantly larger manufacturing presence in Derby.

# The WoE supports the seventh highest number of named inventors of all LEPs

The 2015 BIS report, Mapping Local Comparative Advantages in Innovation, compiled a database of over 120 million documents, referring to 12 million patents, to compare how LEPs in England were able to commercialise research and knowledge assets. This dataset brings out some useful insights on the WoE's connectivity of Ideas.

As previously discussed, patent data does not tell the whole story on innovation. One of the major issues with patent data is that it can be difficult to pin down the exact location where businesses have done their research and development work. For example, a business could file for the patent from their registered office, while they could have done much of the work behind the patent from a different office. To get around this geographical ambiguity, BIS looked at the number of inventors.

BIS considered the 'number of inventors' metric because inventors' addresses are often more accurate than business addresses at showing where innovation activity has taken place. This is important for our analysis, as we want to focus on the strength of the WoE in producing and supporting people to drive new ideas.

Figure 73 opposite shows a rank of the top 20 LEPs in England by the number of named inventors who have patents between 5 and 10 years old. The WoE comes seventh overall, behind areas like Cambridgeshire, Oxfordshire, and Thames Valley Berkshire, but ahead of areas like Derby, London, and Coventry and Warwickshire. This suggests that WoE is among the top performing LEPs at supporting inventors through to applying for patents. Additionally, this suggests that WoE innovation has 'strength in depth' in that innovation is driven by individuals as well as large firms such as Airbus.

Unfortunately, we do not have access to the absolute numbers, so we cannot compare how close WoE is to the nearest LEPs, for example.

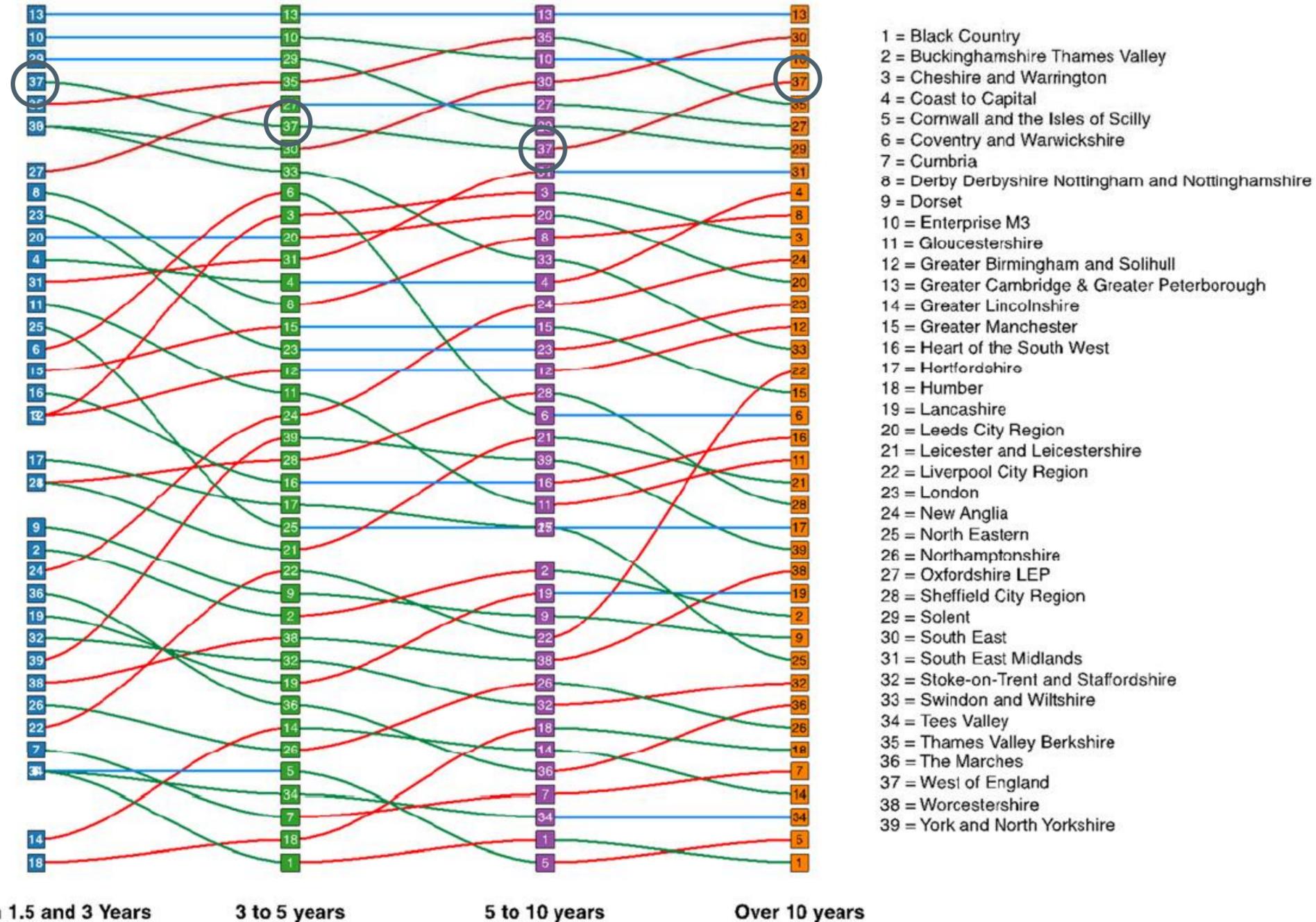
Figure 73: Inventor population (with patents 5 to 10 years old), (up to October 2014), Highest is ranked '1'

Rank	LEP
1	Greater Cambridge and Greater Peterborough
2	Thames Valley Berkshire
3	Enterprise M3
4	South East
5	Oxfordshire
6	Solent
7	West of England
8	South East Midlands
9	Cheshire and Warrington
10	Leeds City Region
11	Derby, Derbyshire, Nottingham and Nottinghamshire
12	Swindon and Wiltshire
13	Coast to Capital
14	New Anglia
15	Greater Manchester
16	London
17	Greater Birmingham and Solihull
18	Sheffield City Region
19	Coventry and Warwickshire
20	Leicester and Leicestershire

Source: BIS (2015), Mapping Local Comparative Advantage in Innovation, United States Patent and Trademark Office, and Espacenet

# The WoE is in the top five for supporting individual inventors and this has been consistent over time (1/2)

Figure 74: Rankings of LEP areas by inventor numbers across patenting time periods (WoE circled)



- 1 = Black Country
- 2 = Buckinghamshire Thames Valley
- 3 = Cheshire and Warrington
- 4 = Coast to Capital
- 5 = Cornwall and the Isles of Scilly
- 6 = Coventry and Warwickshire
- 7 = Cumbria
- 8 = Derby Derbyshire Nottingham and Nottinghamshire
- 9 = Dorset
- 10 = Enterprise M3
- 11 = Gloucestershire
- 12 = Greater Birmingham and Solihull
- 13 = Greater Cambridge & Greater Peterborough
- 14 = Greater Lincolnshire
- 15 = Greater Manchester
- 16 = Heart of the South West
- 17 = Hertfordshire
- 18 = Humber
- 19 = Lancashire
- 20 = Leeds City Region
- 21 = Leicester and Leicestershire
- 22 = Liverpool City Region
- 23 = London
- 24 = New Anglia
- 25 = North Eastern
- 26 = Northamptonshire
- 27 = Oxfordshire LEP
- 28 = Sheffield City Region
- 29 = Solent
- 30 = South East
- 31 = South East Midlands
- 32 = Stoke-on-Trent and Staffordshire
- 33 = Swindon and Wiltshire
- 34 = Tees Valley
- 35 = Thames Valley Berkshire
- 36 = The Marches
- 37 = West of England
- 38 = Worcestershire
- 39 = York and North Yorkshire

Source: BIS (2015), Mapping Local Comparative Advantage in Innovation

## The WoE is in the top five for supporting individual inventors and this has been consistent over time (2/2)

Figure 74 on the previous slide showed the ranking of number of inventors for all 39 LEPs in England, but for different patenting time periods: between 1.5 and 3 years, from 3 to 5 years, 5 to 10 years, and finally for those patents over 10 years old. Potential benefits of patents within a region are the promotion of innovation and knowledge sharing and encouraging investment to stimulate regional and national economic growth.

The WoE performs strongly and consistently over all patent time periods shown. **For patents between 1.5 and 3 years old, the WoE has the fourth highest number of registered inventors in England.** The WoE is also fourth for longer-lasting patents, i.e. those still active after 10 years.

The flow chart does not show the progress of individual patents over time but is counting instead the number of inventors listed on patents within the indicated age ranges. Also, it shows the rank order, so a rise or fall in the ranking does not necessarily mean a rise or fall in the absolute number of inventors.

The WoE's pattern is fairly flat over the different time classifications, suggesting that there has been a consistent level of innovation for a number of years. It is interesting to compare this to other areas:

1. Cambridgeshire is also a consistent high performer, topping the LEP rankings for all patenting time periods
2. Swindon and Wiltshire appear to be 'up and coming' centres of innovation, as they are joint sixth for inventors 1.5 to 3 year old patents, but are 16<sup>th</sup> for inventors with patents over 10 years old. This suggests a more recent burst of patent and innovation activity.
3. New Anglia appears to be in a more declining trend. They are 12<sup>th</sup> for patents over ten years old, but 26<sup>th</sup> for patents between 1.5 and 3 years. This suggests a potential decline in patent activity in recent years.

Of these three categories, WoE most closely resembles the consistent high performance of Cambridgeshire, but WoE should look to connect to the up and coming performance of neighbours in Swindon and Wiltshire and with continual high performers Enterprise M3.

# Annex

A: Areas with common sector strengths (Business linkages section A)

B: Summary of activities in 2-digit SIC code sectors

C: Summary of ideas data

D: Reference list of universities



# There are regional concentrations in aerospace manufacturing clustered towards the West of GB

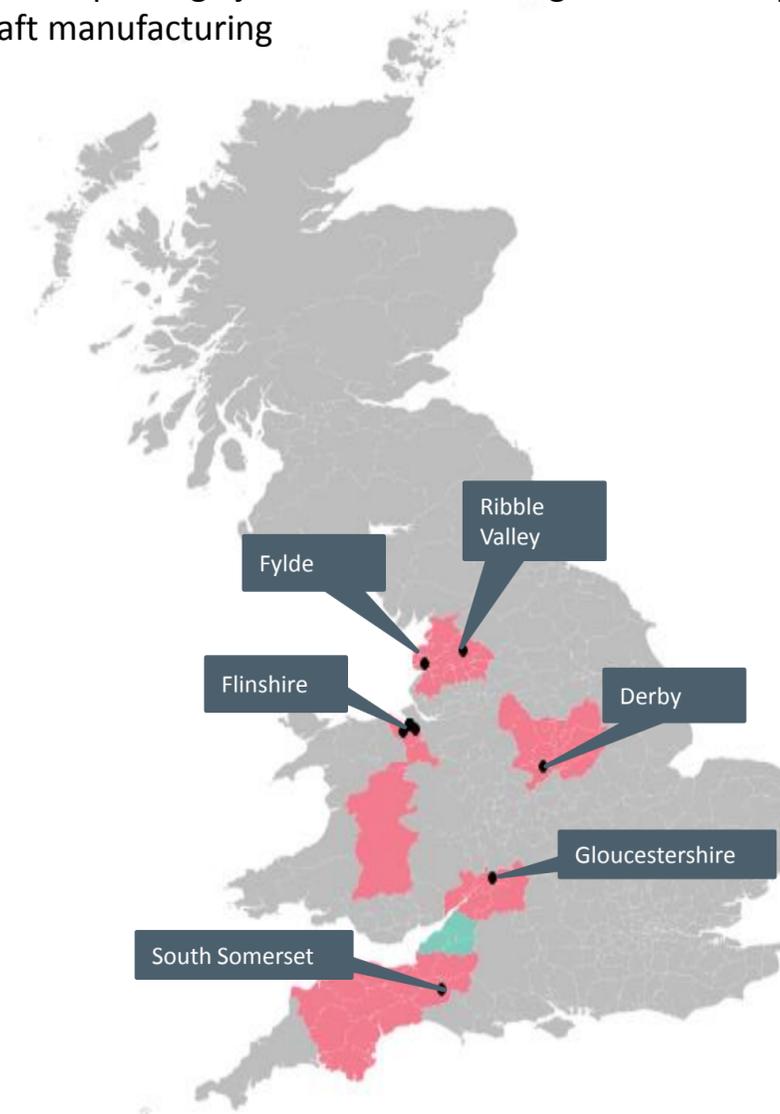
## The manufacture of other transport equipment: The manufacture of aerospace and spacecraft

- Within the manufacture of other transport goods sector in the WoE, there is a high concentration of jobs in aerospace and spacecraft manufacturing (LQ 4.92).
- Jobs within aerospace are most highly concentrated within South Gloucestershire (LQ 17.2) for the WoE.
- Regions that also have high levels of employment or regional concentrations within aerospace and spacecraft manufacturing are: Lancashire, Wales and Derby – with regional clusters typically in the West of GB. Strong connectivity links with these regions could enable sector growth and greater collective contribution to national growth.
- A large proportion of the market share in aerospace manufacturing is made up of Rolls-Royce, BAE Systems and Airbus (39.2%) in the UK – with Airbus having a headquarters in the WoE.

Source: IBISWorld

LQ	LA	Jobs	LEP/Region
51.7	Fylde	6000	Lancashire
50.8	Ribble Valley	4000	Lancashire
39.6	Derby	14000	Derby, Derbyshire, Nottingham and Nottinghamshire,
30.0	Flintshire	6000	Wales
23.7	Tewkesbury	3000	Gloucestershire
21.3	South Somerset	4000	Heart of the South West
4.9		8000	West of England

Figure 79: Map of high job concentration regions for aerospace and spacecraft manufacturing



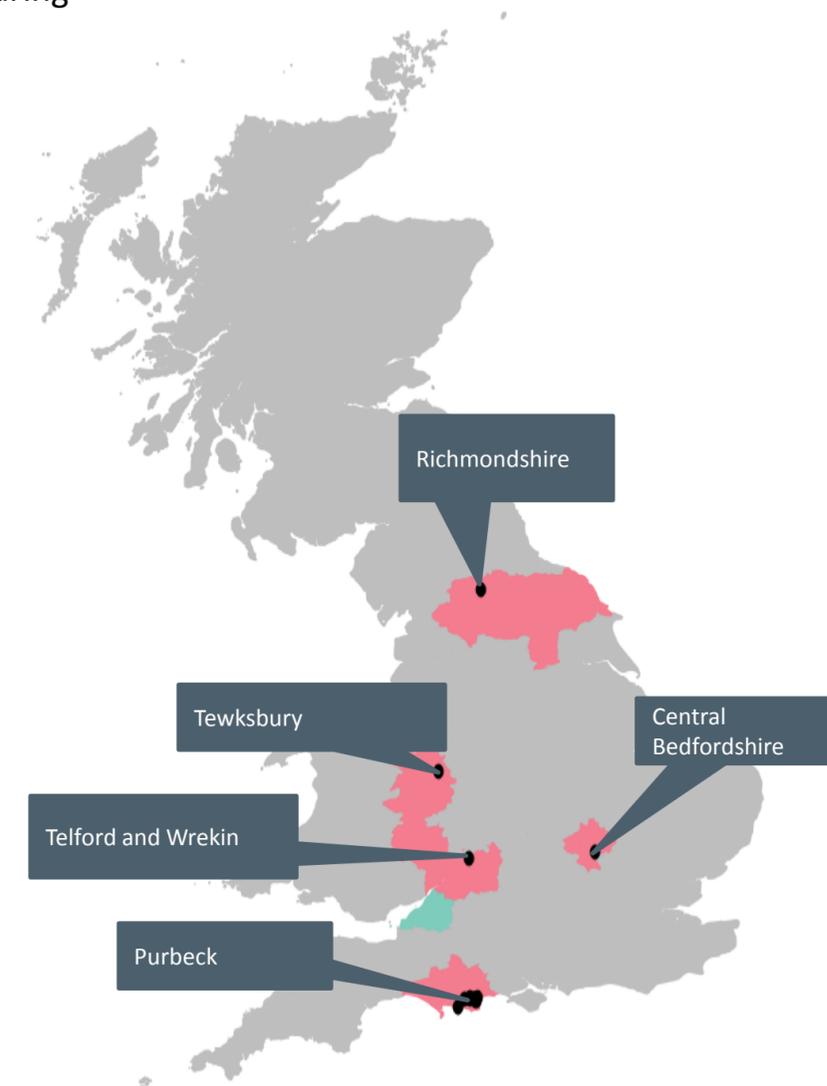


# Regions with high job concentration for military vehicle manufacturing are within close proximity to the WoE

## The manufacture of other transport equipment: The manufacture of military fighting vehicles

- In the WoE, there is a high concentration of jobs in the manufacture of military fighting vehicles (LQ 1.68).
- Jobs within military vehicle manufacturing are predominantly in Bath and North East Somerset (LQ 11.2).
- The manufacture of military vehicles is a relatively small sector, with only 3000 jobs in GB - collaboration between these regions could enable the sector to grow
- There area with a high job concentration within close proximity to the WoE (e.g. in Gloucestershire and The Marches) while some regional concentrations are further away (e.g. Dorset and York and North Yorkshire).
- Improving infrastructure connectivity between these areas could enable collaboration between these regions due to the goods-based nature of this sector, by reduced transportation costs.

Figure 80: Map of high job concentration regions for the military vehicle manufacturing



LQ	LA	Jobs	LEP/Region
162.6	Purbeck	300	Dorset
75.4	Central Bedfordshire	800	South East Midlands
71.0	Telford and Wrekin	600	The Marches
50.70	Richmondshire	100	York and North Yorkshire
43.2	Tewkesbury	200	Gloucestershire
1.7		100	West of England

# Nottingham is an economic hub for data processing and hosting related jobs

## Information service activities: Data processing and hosting

- The prominent sub-sector for the WoE within information services is data processing and hosting with a job concentration of 3.88.
- This majority of the jobs within the WoE for data processing and hosting are Bristol (with an LQ of 5.75) and South Gloucestershire (with an LQ of 4.64).
- D2N2 LEP could be a strong region for collaboration to better understand the economic conditions that has enabled the sector to grow as Nottingham has 3000 jobs within this sector.
- The information services sector is continuing to grow nationally, driven by increasing IT adoption and greater access to the internet – the digital infrastructure of the WoE provides opportunities to collaborate with regions both within the UK and internationally.

LQ	LA	Jobs	LEP/Region
10.2	Nottingham	3000	Derby, Derbyshire, Nottingham and Nottinghamshire (D2N2)
9.4	Christchurch	250	Dorset
8.2	Hart	400	Enterprise M3
6.3	North West Leicestershire	500	Leicester and Leicestershire
5.3	Peterborough	800	Greater Cambridge and Greater Peterborough
4.1	Southwark	1250	London
1.9	City of London	1250	London
3.9		3000	West of England

Figure 81: Map of high job concentration regions for data processing and hosting activities



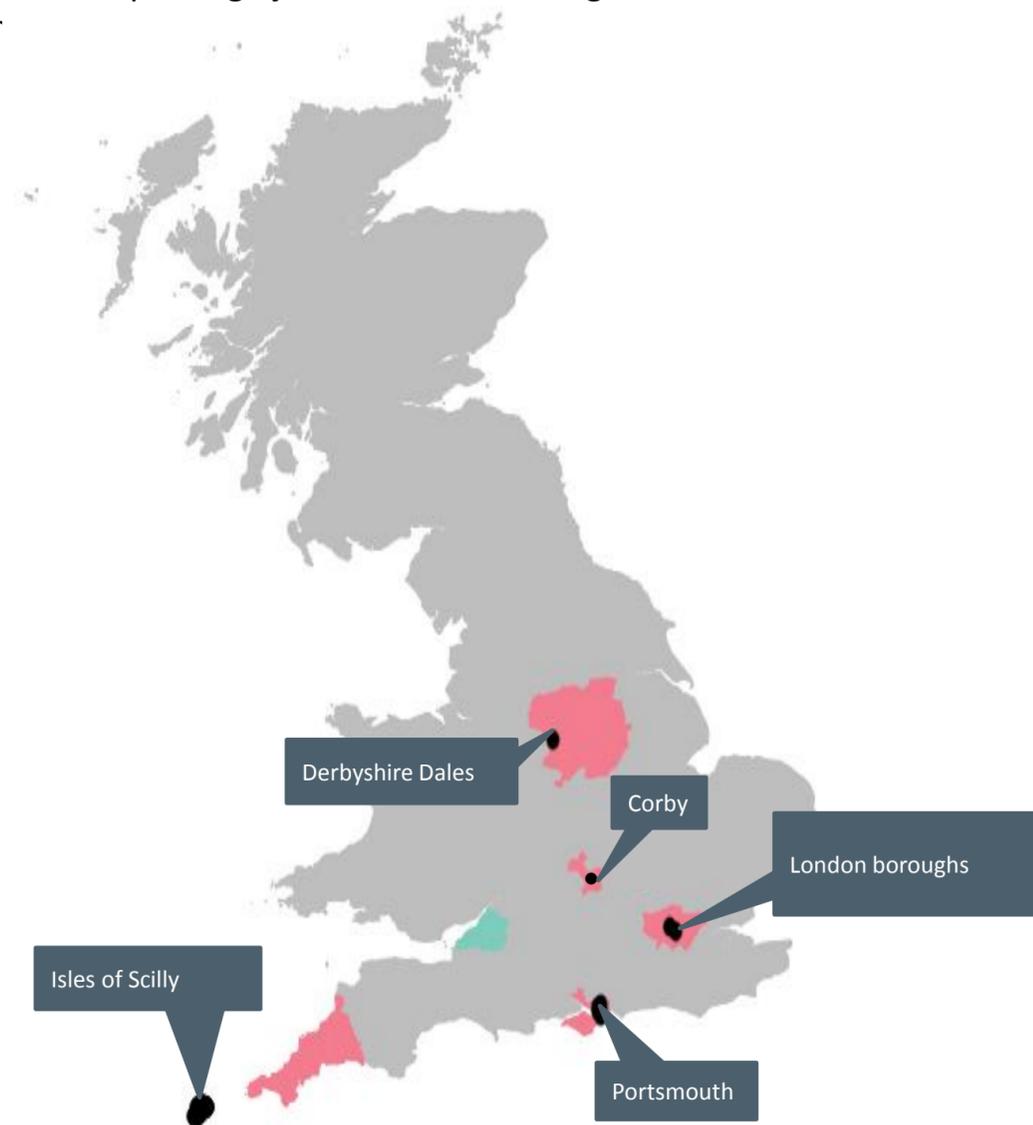
# A

## Other information service activities tend to be clustered within the South of England

### The manufacture of other transport equipment: The manufacture of aerospace and spacecraft

- Another sector of high regional concentration for the WoE within information services is other information services activities with a job concentration of 2.11.
- Other information services include activities such as: pictures and features to the media e.g. news clipping services; computer-based telephone information services; and information search services on a contract or fee basis.
- The majority of the jobs within the WoE are based in for Bristol (with an LQ of 2.79) and South Gloucestershire (with an LQ of 2.51) – these are same two local authorities as for data hosting and processing.
- The majority of the regions with high regional concentrations within this sector are predominately within the South of England (with the exception of Sheffield and Corby).

Figure 82: Map of high job concentration regions for other inforr



LQ	LA	Jobs	LEP/Region
18.4	Isles of Scilly	10	Cornwall and the Isles of Scilly
15.9	Southwark	1500	London
13.7	Corby	175	South East Midlands
10.8	Derbyshire Dales	150	Sheffield City Region
9.6	Portsmouth	400	Solent
1.6	Westminster	450	London
2.1		500	West of England

# A

## London is the main driver of other financial services activities jobs

### Financial services: other financial services activities

- The most prominent sector for the WoE within financial services is the other financial activities sector with a location quotient of 3.36.
- The other financial services activities sector is primarily concerned with distributing funds other than by making loans e.g. security dealing on own account and factoring.
- Within the WoE, all local authority areas would be considered an “exporter” of these financial service activities, with North Somerset having the greatest regional concentration of jobs (5.44).
- Regions which have high concentrations or high levels of jobs in wider financial services sector are mostly focused in the South of England, with London being a key driver of employment.
- Both digital connectivity and hard-infrastructure such as roads, rail etc. within the South of England will be an enabler of collaboration between these regions for financial service activities.

Figure 83: Map of high job concentration regions for other financial services



LQ	LA	Jobs	LEP/Region
13.3	City of London	10000	London
9.3	Tower Hamlets	4000	London
8.3	Arun	600	Coast to Capital
6.9	Sedgemoor	500	Heart of the South West
4.9	Cheltenham	450	Gloucestershire
3.8	Westminster	4000	London
3.4		3000	West of England

# A

## M4 corridor links the WoE to Enterprise M3 LEP for collaboration within financial leasing

### Financial services: financial leasing

- The financial leasing sector is a sector of high regional job concentration for the WoE, with an LQ of 3.36.
- Financial leasing is leasing where the term approximately covers the expected life of the asset and the lessee acquires substantially all the benefits of its use and takes all the risks associated with its ownership.
- Job concentrations is driven by South Gloucestershire, Bristol and Bath and North East Somerset, with LQ of 4.47, 4.36 and 2.98 respectively.
- There is a significant proportion of regional job concentration within the Enterprise M3 LEP. This LEP area is connected to the WoE via the M4 motor-way.
- Lloyds Bank has a significant UK market shares in financial leasing - with Bristol hosting one of their main offices employing 3700 employees in 2016.

LQ	LA	Jobs	LEP/Region
55.2	Runnymede	500	Enterprise M3
33.5	Three Rivers	200	Hertfordshire
26.7	Trafford	600	Greater Manchester
24.4	Basingstoke and Deane	300	Enterprise M3
22.6	Milton Keynes	600	South East Midlands
3.4		300	West of England

Figure 84: Map of high job concentration regions for financial leasing



# A Westminster hold over a third of jobs for financial activities of holding companies

## Financial services: activities of holding companies

- Activities of holding companies boast a location quotient of 2.16 for the WoE, however they make-up a relatively small proportion of jobs (145 jobs).
- The activities of holding companies are considered as holding companies that do not provide any other service to the businesses in which the equity is held, i.e. they do not administer or manage other units.
- Over a third of jobs (35.7%) within this sector are located within the London Borough of Westminster – with other regions having relatively small numbers of jobs.
- Collaboration between the WoE and these other smaller regions (e.g. Gloucestershire and Heart of the South West) could have a positive impact on the WoE economy.

LQ	LA	Jobs	LEP/Region
15.1	Westminster	1250	London
13.1	Merton	125	London
7.7	South Hams	35	Heart of the South West
6.5	Forest of Dean	20	Gloucestershire
5.8	Cotswold	30	Gloucestershire
2.2		150	West of England

Figure 85: Map of high job concentration regions for financial activities of holding companies



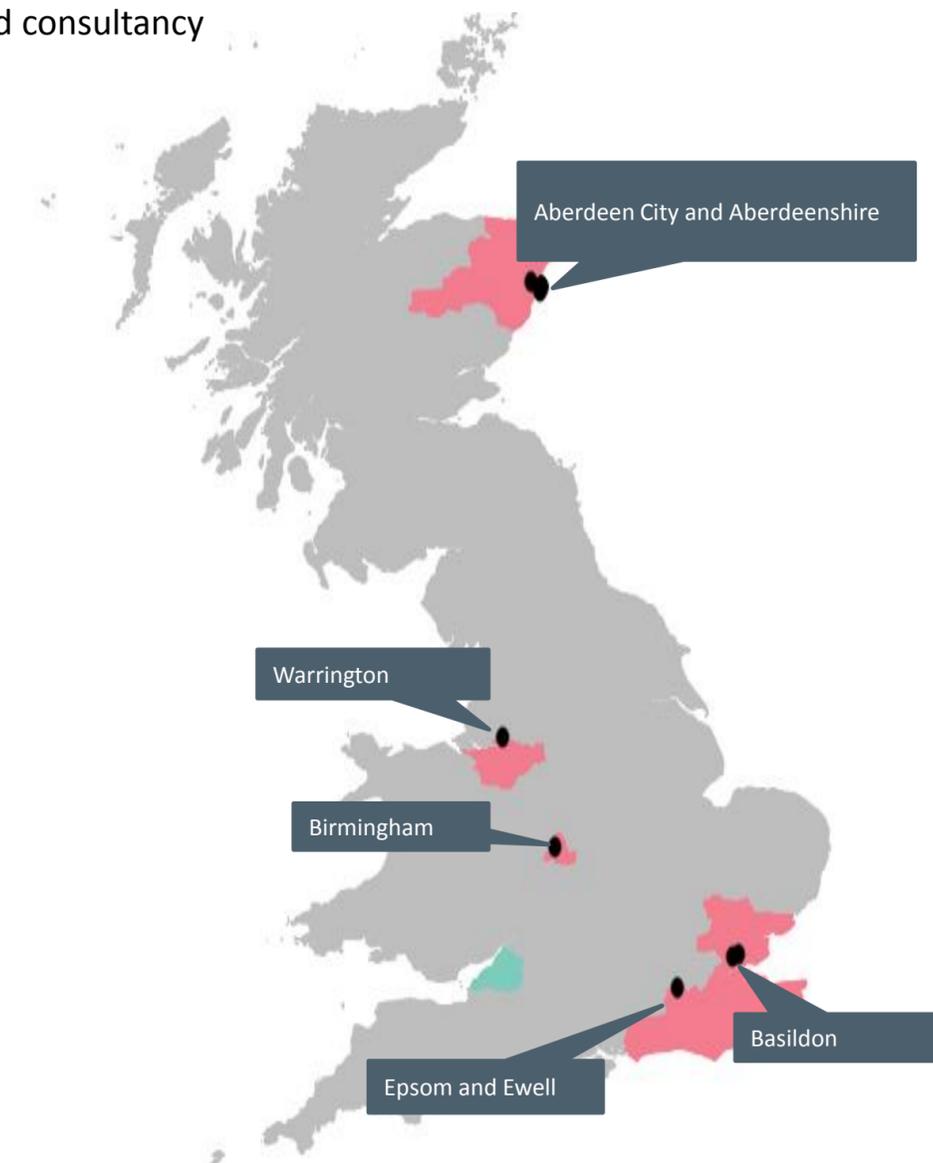


# Aberdeen has a significant prominence within the engineering sector

## Architectural and engineering activities: Engineering and technical consultancy related activities

- Within the WoE, the regional job concentrations for engineering and technical consultancy related activities is 1.89 – which equates to around 14,000 jobs.
- Most predominant regional concentration of jobs within engineering is in South Gloucestershire (LQ of 2.70).
- This sector includes activities such as: the provision of surveying and mapping services, engineering design and projects involving civil engineering, hydraulic engineering, traffic engineering etc.
- There are regional pockets of engineering throughout GB, with a significant number jobs within the wider Aberdeenshire area (22,000 jobs).
- Within this sector, there are no companies with a significant UK market share – this means that collaboration between firms both within the WoE and within other regions may provide greater economic benefits.
- The connectivity of infrastructure between the WoE and the UK is significant for this sector, as it includes a number of locality-based service activities (e.g. surveying).

Figure 86: Map of high job concentration regions for engineering and related consultancy



LQ	LA	Jobs	LEP/Region
7.0	Aberdeen City	15000	Scotland
5.0	Aberdeenshire	7000	Scotland
4.2	Basildon	4500	South East
4.0	Epsom and Ewell	1500	Coast to Capital
3.6	Warrington	6000	Cheshire and Warrington
1.1	Birmingham	7000	Greater Birmingham and Solihull
1.9		14000	West of England



# London boroughs host a significant number of Architecture jobs

## Architectural and engineering activities: architectural activities

- For architecture activities, the WoE has a regional job concentrations of 1.56, with the location quotient being driven by jobs in Bath and North East Somerset (3.31) and North Somerset (2.16).
- Key activities within this sector include: building design, the supervision of construction and town and city planning etc.
- There is an economic hub of architecture jobs within the London with the region contributing over a third of GB jobs (33.7%).
- Businesses within the WoE could collaborate with businesses within the London region to better understand the economic conditions that has enabled to be a regional exporter.
- Connectivity of hard infrastructure e.g. the road network of the WoE to the rest of the UK is important for architectural activities such as supervision of construction which is typically locality-based.

Figure 87: Map of high job concentration regions for architectural activities



LQ	LA	Jobs	LEP/Region
8.4	Islington	5000	London
6.2	Wandsworth	2000	London
4.8	East Lothian	400	Scotland
4.6	Hackney	1500	London
3.9	Southwark	2500	London
2.2	Manchester	2250	Greater Manchester
1.6		2500	West of England

# A

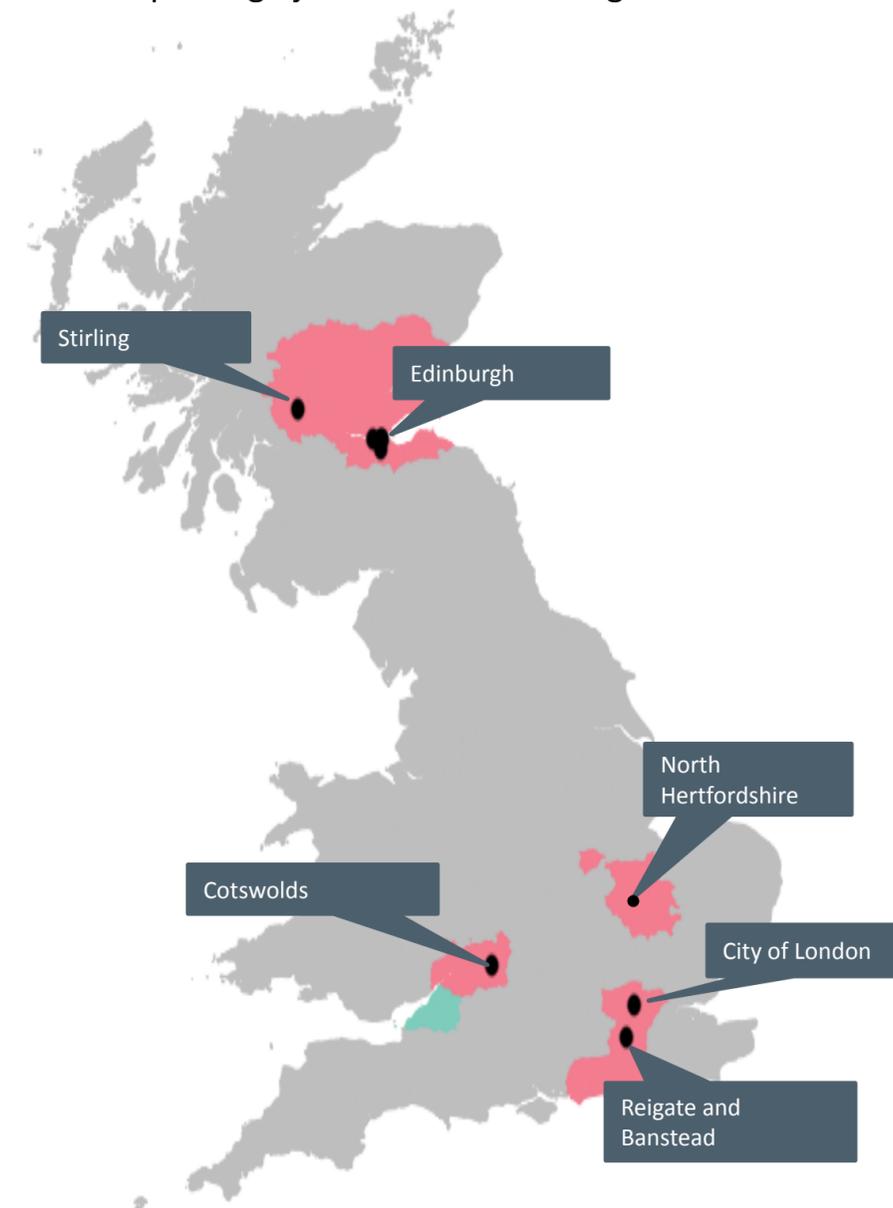
## Scotland has a strong presence in the Life insurance sector

### Insurance services: Life insurance

- Within Insurance services, one of the primary sectors which has a regional job concentration for the WoE is Life insurance (2.10).
- South Gloucestershire has driven this job concentration with an LQ of 5.59 (this is equivalent to 1000 jobs).
- There are regional pockets of job concentration, with a large proportion of jobs in Life insurance within Scotland. When considering the high productivity of this sector for the WoE, economic benefits from collaboration may have a national impact.
- Canada Life is a Life insurance firm with one of its UK operations bases in the WoE, has been cited as a notable player within the wider UK market.

LQ	LA	Jobs	LEP/Region
35.5	Stirling	2000	Scotland
18.7	Cotswold	1000	Gloucestershire
15.8	Reigate and Banstead	1250	Coast to Capital
15.3	City of Edinburgh	6000	Scotland
12.8	North Hertfordshire	800	Greater Cambridge and Greater Peterborough
7.5	City of London	4500	London
2.1		1500	West of England

Figure: 88: Map of high job concentration regions for life-insurance





# Greater Manchester has a high proportion of jobs located within Non-life insurance activities

## Insurance services: Non-life insurance

- Non-life insurance is another sector within insurance services which has a regional job concentration for the WoE (1.58).
- The sector definition for non-life insurance activities is: “The provision of insurance services other than life insurance”. This includes: motor insurance, health insurance, property insurance etc.
- This job concentration is most significant within Bristol with an LQ of 2.50 (equivalent to 1250 jobs).
- There are regional pockets of job concentration across London, Wales and Greater Manchester; with 4250 across Manchester and Salford.
- Collaboration with the Greater Manchester region could have positive economic benefits for the WoE and wider UK economy, with Insurance services having a significantly high productivity (£359k) for the WoE.

LQ	LA	Jobs	LEP/Region
17.5	Tunbridge Wells	1750	South East
10.4	Salford	2500	Greater Manchester
9.6	City of London	9000	London
7.6	Cardiff	3000	Wales
7.6	Stratford-on-Avon	1000	Coventry and Warwickshire
2.4	Manchester	1750	Greater Manchester
1.6		1750	West of England

Figure 89: Map of high job concentration regions for non-life insurance



# Annex B: Summary of 2-digit sectoral activities

SIC code	Description of activities in this sector
24.1-3 Basic iron and steel	Firms in this industry produce iron and steel in blast furnaces or reprocess steel in electric arc furnaces. They make a variety of basic steel products, such as ingots, sheets and plates.
25 OTHER Fabricated metal products, excl. machinery and equipment and weapons and ammunition - 25.1-3/25.5-9	This sector includes the manufacturing of structural metal products as well as other fabricated metal products such as steel drums.
30 Manufacture of other transport equipment	This sector includes the manufacturing of aircraft, spacecraft and train parts. It is clear that the WoE region has a particular specialisation in the aerospace portion of the sector.
63 Information service activities	This sector includes operators that provide infrastructure for hosting, data processing services and related activities. Specifically, these include web and application hosting, streaming services, and providing mainframe facilities, data processing and data entry services.
71 Architectural and engineering activities; technical testing and analysis	Architectural firms provide information on design and construction procedures, zoning regulations, building codes and building materials. In addition, firms in this industry apply engineering principles to the design, development and use of machines, materials, instruments, structures, processes and systems.
64 Financial services	The financial services sector includes, monetary intermediation, banking and building society activities, investment fund activities as well as credit and financial leasing.
65 Insurance, reinsurance and pension funding, except compulsory social security	This sector includes activities in life insurance and non-life insurance, such as accident and fire or home insurance. The Pension Funding industry provides retirement benefits for people no longer earning an income.
82 Office administrative, office support and other business support services	This sector includes both general and specialised office administration, activities of call centres, organisation of conventions and trade shows and activities of collection agencies and credit bureaus.
69.1 Legal services	This sector includes firms that provide legal services, including solicitors, barristers, patent agents, notaries and bailiffs.
84 Public administration and defence services; compulsory social security services	This sector includes a wide variety of activities, however defence and fire service activities are some examples of sub sectors which would require products from other transport.
69.2 Accounting, bookkeeping and auditing services; tax consulting services	Firms in this industry prepare and examine financial accounts, record commercial transactions for businesses and other organisations for the purpose of record keeping and accounting.
70 Services of head offices; management consulting services	This sector includes the overseeing and managing of other units of the company or enterprise as well as advice and guidance to businesses on public relations and communication and financial management.
61 Telecommunications services	This sector includes the activities required for transmitting voice, data, text, sound and video. The transmission facilities that carry out these activities may be based on a single technology or a combination of technologies.

# Annex C: Ideas section overview - data sources

Question	What data is available?	Sources used	What data is not available?
<b>How well do universities in the region work with each other, and with institutions elsewhere?</b>	<ul style="list-style-type: none"> <li>Proportion of research output produced in collaboration with national and international institutions, and with businesses.</li> <li>The top collaborating partners for each of the WoE universities.</li> </ul>	<ul style="list-style-type: none"> <li>Elsevier Scopus – An online database of academic publications, from a variety of subjects. Elsevier is an increasingly standard data source for analysing university research output.</li> </ul>	<ul style="list-style-type: none"> <li>The research quality of WoE collaborative output.</li> <li>Number and location of businesses WoE universities regularly partner with.</li> </ul>
<b>How do WoE universities seed and support innovative businesses?</b>	<ul style="list-style-type: none"> <li>Income received from business services, by institution.</li> <li>Turnover, employment, and investment information for spin-offs, by institution.</li> </ul>	<ul style="list-style-type: none"> <li>Higher education Statistics Agency (HESA) – Largely from HESA’s Higher Education Business and Community Interaction (HE-BCI) survey.</li> </ul>	<ul style="list-style-type: none"> <li>Institution-level information on graduate movements and employment. Cannot locate exactly where WoE graduates go to.</li> </ul>
<b>How are WoE businesses connecting and contributing to disruptive trends in UK industry?</b>	<ul style="list-style-type: none"> <li>R&amp;D tax credit claims, and total R&amp;D spend for the South West region.</li> <li>Proportion of actively innovative businesses.</li> <li>Value of Innovate UK grants, by LEP.</li> </ul>	<ul style="list-style-type: none"> <li>HMRC – Information on R&amp;D tax credit claims are released annually.</li> <li>ONS (UK Innovation Survey) – Gives insight to business’ tendency to innovate.</li> <li>Innovate UK – Detailed records of awarded grants are made public.</li> </ul>	<ul style="list-style-type: none"> <li>R&amp;D tax credit claims, or total R&amp;D spend, at a more geographically granular level.</li> </ul>
<b>What are the wider spillover effects of Ideas from the WoE, such as knowledge transfer and intellectual property?</b>	<ul style="list-style-type: none"> <li>Employment in R&amp;D jobs, by LEP area.</li> <li>Business spending on R&amp;D, by LEP area.</li> <li>Patent applications, but NUTS 3 area, compared to UK and European benchmarks.</li> </ul>	<ul style="list-style-type: none"> <li>ONS (Business Enterprise Research and Development (BERD) survey)</li> <li>Eurostat and UK Intellectual Property Office – Eurostat report all patent applications to a NUTS 3 level.</li> </ul>	<ul style="list-style-type: none"> <li>Number of patent renewals</li> <li>Number of trademark applications by LEP area.</li> </ul>
<b>What barriers in connectivity could restrict growth in Ideas?</b>	<ul style="list-style-type: none"> <li>Turnover and employment growth for scale-up businesses.</li> <li>Density of scale-up businesses, by LEP (i.e. number of scale-ups per 100,000 people).</li> </ul>	<ul style="list-style-type: none"> <li>Beauhurst – An database tracking scaleups, used to build the annual ScaleUp index.</li> <li>ScaleUp Institute – Annual scaleup review, and LEP area analysis of scaleup support.</li> </ul>	<ul style="list-style-type: none"> <li>Qualitative insights from specific businesses and innovators.</li> </ul>

# Annex D: List of University Groups in the UK

Russel Group Universities	Universities UK (A – G)	Universities UK (H – P)	Universities UK (Q – T)	Universities UK (T – U)	Universities UK (U – U)	Universities UK (U – Y)
University of Birmingham University of Bristol University of Cambridge Cardiff University Durham University University of Edinburgh University of Exeter University of Glasgow Imperial College London King's College London University of Leeds University of Liverpool London School of Economics & Political Science University of Manchester Newcastle University University of Nottingham University of Oxford Queen Mary, University of London Queen's University Belfast University of Sheffield University of Southampton University College London University of Warwick University of York	Aberystwyth University Anglia Ruskin University Aston University Bangor University Bath Spa University Birkbeck, University of London Birmingham City University Bournemouth University Brunel University London Buckinghamshire New University Canterbury Christ Church University Cardiff Metropolitan University Cardiff University City, University of London Coventry University Cranfield University De Montfort University Durham University Edge Hill University Edinburgh Napier University Falmouth University Glasgow Caledonian University Goldsmiths, University of London Guildhall School of Music and Drama	Heriot-Watt University Heythrop College Imperial College London Keele University King's College London Kingston University Lancaster University Leeds Beckett University Leeds Trinity University Liverpool Hope University Liverpool John Moores University London Business School London Metropolitan University London School of Hygiene and Tropical Medicine London South Bank University Loughborough University Manchester Metropolitan University Middlesex University Newcastle University Northumbria University Nottingham Trent University Oxford Brookes University Plymouth Marjon University Plymouth University	Queen Margaret University Queen Mary University of London Queen's University Belfast Regent's University London Robert Gordon University Royal College of Art Royal College of Music, London Royal Holloway, University of London Sheffield Hallam University SOAS, University of London Solent University St George's, University of London Staffordshire University Swansea University Teesside University The Glasgow School of Art The London School of Economics and Political Science The Open University The Royal Central School of Speech & Drama The Royal Veterinary College The University of Buckingham The University of Manchester The University of Nottingham	The University of Sheffield The University of West London Trinity Laban Conservatoire of Music and Dance Ulster University University College London University of Aberdeen University of Bath University of Bedfordshire University of Birmingham University of Bolton University of Bradford University of Brighton University of Bristol University of Cambridge University of Central Lancashire University of Chester University of Chichester University of Cumbria University of Derby University of Dundee University of East Anglia University of East London University of Edinburgh University of Essex University of Exeter University of Glasgow University of Gloucestershire University of Greenwich University of Hertfordshire University of Huddersfield	University of Hull University of Kent University of Leeds University of Leicester University of Lincoln University of Liverpool University of London University of Northampton University of Oxford University of Portsmouth University of Reading University of Roehampton University of Salford University of South Wales University of Southampton University of St Andrews University of Stirling University of Strathclyde University of Suffolk University of Sunderland University of Surrey University of Sussex University of the Arts London University of the Highlands and Islands University of the West of England, Bristol University of the West of Scotland	University of Wales University of Wales Trinity Saint David University of Warwick University of Westminster University of Winchester University of Wolverhampton University of Worcester University of York Wrexham Glyndwr University York St John University