Office for National Statistics

Compendium

Regional firm-level productivity analysis for the non-financial business economy, Great Britain: April 2018

Analysis on the sources of regional differences in labour productivity in the non-financial business economy.

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1 . Main points

- Aggregate average productivity level of the non-financial economy varies by NUTS1 (Nomenclature of Territorial Units for Statistics) regions and by NUTS2 subregions in Great Britain.
- All NUTS1 regions and NUTS2 subregions in Great Britain have a mix of high and low labour productivity (as measured by gross value added (GVA) per worker) firms; however, in the South East, and particularly in London, there is a greater share of high productivity firms in comparison with other regions and countries of Great Britain.
- The analysis of the non-financial business economy suggests that with occasional exceptions, a region's industry structure appears to only play a relatively small role in productivity differences between regions.
- Instead, it is the differences between average firms' productivity within industries that has the most significant effect on aggregate regional productivity differences; for example, firms in London have higher median levels of productivity in most industry sectors when compared with other regions and it is these differences that are the larger factor in its higher overall labour productivity.
- In general, labour productivity in knowledge intensive services sectors is twice as large as productivity in less knowledge-intensive services sectors; however, in most regions, employment in less knowledge-intensive services sectors is over three times larger than employment in the knowledge-intensive services sectors.
- Local plants in the less knowledge-intensive services sectors accounted for the majority of the plants in the bottom 20% of the productivity distribution; while the top end was generally dominated by local plants in the knowledge-intensive services, manufacturing and non-manufacturing production and construction sectors.
- Local plants that are attached to micro enterprises (1 to 9 employees) and young enterprises (less than five years old) are more likely to be in knowledge-intensive services sectors than is the case for local plants that are attached to enterprises that are larger (over 250 employees) and older (over 20 years old), with most of the local plants in the latter categories falling in less knowledge-intensive services sectors.
- In considering these results, it should be noted that the analysis in this article uses a special version of the Annual Business Survey (ABS) that apportions firms' output to their various sites (also known as plants or local units) across geographic locations where the economic activities take place.
- The results are based on nominal terms such that any local variation in price level has not been considered; additionally, the analysis does not include the finance or agriculture sectors and also excludes the public sector.

2 . Things you need to know about this release

Background

Understanding the economic performance of different areas is important to developing policies aimed at economic growth and welfare improvement. The aggregate productivity data in our regional and subregional productivity article shows labour productivity varies both within a region and between regions.

These differences can reflect differences in both relative firm performance within industries (where firms in a given industry and region are more productive than firms in the same industry located elsewhere), or in the industries which are found in different locations (industry composition). In January 2017, we published an article, Regional firm-level productivity analysis for the non-financial business economy: January 2017 , providing experimental analysis on the sources of regional differences in labour productivity in the non-financial business economy. An important conclusion of the report was:

“With an occasional exception (for example, Aberdeen, which has a large oil and gas production sector), a region’s industry structure appears to only play a relatively small role in productivity differences between regions. Instead, it is the differences between firms’ productivity within industries that has the most significant effect on aggregate regional productivity differences. For example, firms in London have higher median levels of productivity in most industry sectors when compared with other regions and it is these differences that are the larger factor in its higher overall labour productivity.”

A subsequent article in April 2017 then explored similar data comparing rural and urban areas and different sized urban centres.

The aim of this article is to update the analysis using the latest available Annual Business Survey (ABS) data and to provide additional analysis to expand on the existing work.

Data sources: use of the ABS local unit dataset

The calculations in this article make use of a tailored micro-dataset constructed from the Annual Business Survey (ABS)[1] that provides coverage of Great Britain. It includes all the local units of the firms and their plants registered in the Inter-Departmental Business Register (IDBR), the postcode of their location and the approximate gross value added (aGVA)[2] they have produced over a period of 12 months[3]. A firm or enterprise may have more than one plant in different locations. These are referred to as local units. Local units of an enterprise may be engaged in different parts of the business such as production, accounting or head office. Therefore, each local unit is assigned its own Standard Industrial Classification 2007: SIC 2007 code, which corresponds to the local unit’s principal activity. Note that this dataset apportions aGVA across the "LU universe" rather than the ABS LU sample.

The survey excludes the agricultural and financial sectors as well as some small firms, the self-employed and the public sector. As such, the ABS results represent approximately two-thirds of the UK economy in terms of gross value added.

Employment is used as the measure of labour input in calculating labour productivity. Employment includes employees and working proprietors and was obtained from the IDBR at the time of sample selection of the ABS. It should be noted that employment from the IDBR is derived from several different sources (such as the Business Register Employment Survey (BRES), HM Revenue and Customs (HMRC) records or imputed), and some of the employment information, especially for small businesses, may be several years old. Despite this limitation, the IDBR is at present the most comprehensive source of employment information for firm-level analysis due to its coverage.

For the analysis of firm characteristics – size and age – the local unit ABS dataset is linked with the enterprise dataset in IDBR. Therefore, the size and the age of the local unit reflects the size and the age of the enterprise to which the local unit is attached.

Note that the use of the local unit version of the ABS means this analysis may produce different results from analysis carried out using the reporting unit version of the ABS more commonly used for investigating national productivity issues. The advantage of using the local unit version of the dataset is that this is the dataset used for compiling regional accounts data by ONS as it allocates output to the site of each local plant or site (unit) operated by an enterprise, rather than simply allocating output to the location of the head office of the enterprise or to its reporting unit. The local unit version of the dataset should therefore provide better geographical accuracy for analysis.

It should be noted, however, that a degree of modelling of output data is necessary to produce the local unit version of the ABS. For this, reporting unit data are apportioned amongst the constituent local units in line with a regression model. The covariates used in this model are industry, geography and employment size bands. The model parameter estimates are obtained by fitting the model that best predicts the data gathered from reporting units with very few local units. More information can be found under regional apportionment in section 5.8.2 of the ABS Technical Report. A recently published article also provides related information on the issue by exploring the impact of modelling in the production of ONS regional GVA estimates.

In considering the results in this article, it should be noted that these data are based on nominal terms such that any local variation in price level has not been considered.

Industry mix

This analysis uses an aggregated industry structure[4] classification, which aggregates Standard Industrial Classification (SIC) 2007 two-digit level industries according to their technological or knowledge intensity. In our previous analysis, industry composition for each area is calculated as the employment share of 85 groups of two-digit SIC industries in each region's or subregion's employment. In this analysis, manufacturing sectors are aggregated according to technological intensity (research and development (R&D) expenditure and value added) and based on the Statistical classification of economic activities in the European Community (NACE) at two-digit level. The level of R&D intensity served as a criterion of classification of economic sectors into high-technology, medium high-technology, medium low-technology and low-technology industries.

Services are mainly aggregated into knowledge-intensive services (KIS) and less knowledge-intensive services (LKIS) based on the share of tertiary educated persons at NACE two-digit level. The sectoral approach is used for all indicators except data on high-tech trade and patents. Knowledge-intensive services include high-tech knowledge-intensive sectors such as telecommunication or information service activities; market services such as architectural and engineering activities, technical testing and analysis; or legal and accounting activities and other services such as veterinary activities. Less knowledge-intensive services sectors include accommodation and food service activities or wholesale and retail trade sectors. For more detailed information, please visit the Eurostat website.

Notes for: Things you need to know about this release

1. The Annual Business Survey (ABS), formerly the Annual Business Inquiry part 2 (ABI/2) is the main structural business survey conducted by Office for National Statistics (ONS), which collects business and financial information of firms in the production, construction, distribution and services industries, representing approximately two-thirds of the UK economy. More information on ABS quality and methods including a technical report is available.

2. aGVA from ABS is known as approximate gross value added (aGVA). The ABS provides detailed information on the turnover and intermediate consumption of firms in the non-financial business economy and turnover minus intermediate consumption is called approximate value added. The ABS is also the main source for GVA data in national accounts. However, several other data sources are added and some adjustments performed to obtain the final published regional and national accounts GVA numbers.

3. ABS allows firms to report data for different 12-month periods. Most of them report for the calendar year. However, some firms report for the financial year and a few for other 12-month periods.

4. There are two widely-accepted methods of defining industry composition. These are either using output such as shares of gross value added or inputs such as the shares of employment of each industry. The focus of this article is on labour productivity in industry. Defining the industry structure in terms of the inputs such as employment, therefore, appears to be more appropriate than using the output definition.

3 . Results: sources of labour productivity in the Great Britain regions and countries and subregions

Observed average aggregate productivity in an area derives from two main sources:

- firm productivities within the industries in the area
- industry mix in the area

Therefore, differences in average labour productivity between regions can reflect differences in both firm characteristics in the areas and industry composition of an area. This section uses a decomposition technique to investigate these sources of productivity and how they relate to differences in aggregate productivity between regions. The full technique is explained in the methodology section in the Annex. In brief, the technique allows the decomposition of aggregate average labour productivity in each region into three indices, of which the following two are particularly relevant:

- the Firm Productivity Index, which shows the average level of productivity in a region (relative to the national average) assuming the industry composition in that region is the same as for the economy as a whole; this is designed to demonstrate the effect of the firm level productivities on the region's estimated average aggregate productivity

- the Industry Composition Index, which shows the average level of productivity in a region (relative to national average) assuming the productivity of each industry in that region equals nationwide average productivity for that industry; this is designed to demonstrate the effect of the industry composition on the region's estimated average aggregate productivity

Therefore, a higher value of the Firm Productivity Index in a given region shows that productivity of the firms (hence industries in general) in that region are higher than firms in equivalent industries elsewhere. A higher value of Industry Composition Index implies that the more productive industries in Great Britain have larger industry shares in that region.

The third index – the residual covariance term – provides a link between industry shares and industry productivity in an area. As an example, if an area has a high share of industry employment relative to Great Britain in the industries to which it has productivity advantages, then it would likely have a large positive residual covariance. In reality, the residual covariance column is relatively small in most regions and subregions.

Table 1 shows the firm productivity, industry composition and residual covariance indices for Great Britain regions and countries. Each cell in the table has been divided by the average aggregate productivity level for Great Britain in 2015 to provide results on a Great Britain equals 100 basis. Note that in the following analysis firms are defined as the local plants of a business enterprise and not the enterprise overall.

This analysis uses an aggregated industry structure classification, which aggregates Standard Industrial Classification 2007: SIC 2007 two-digit level industries according to their technological or knowledge intensity (see Things you need to know about this release section for more information). In our previous article, industry composition for each area was calculated as the employment share of 85 groups of two-digit SIC industries in each region’s or subregion’s employment.

Table 1: Sources of aggregate labour productivity (gross value added (GVA) per worker)

Great Britain regions and countries, 2015, Great Britain=100

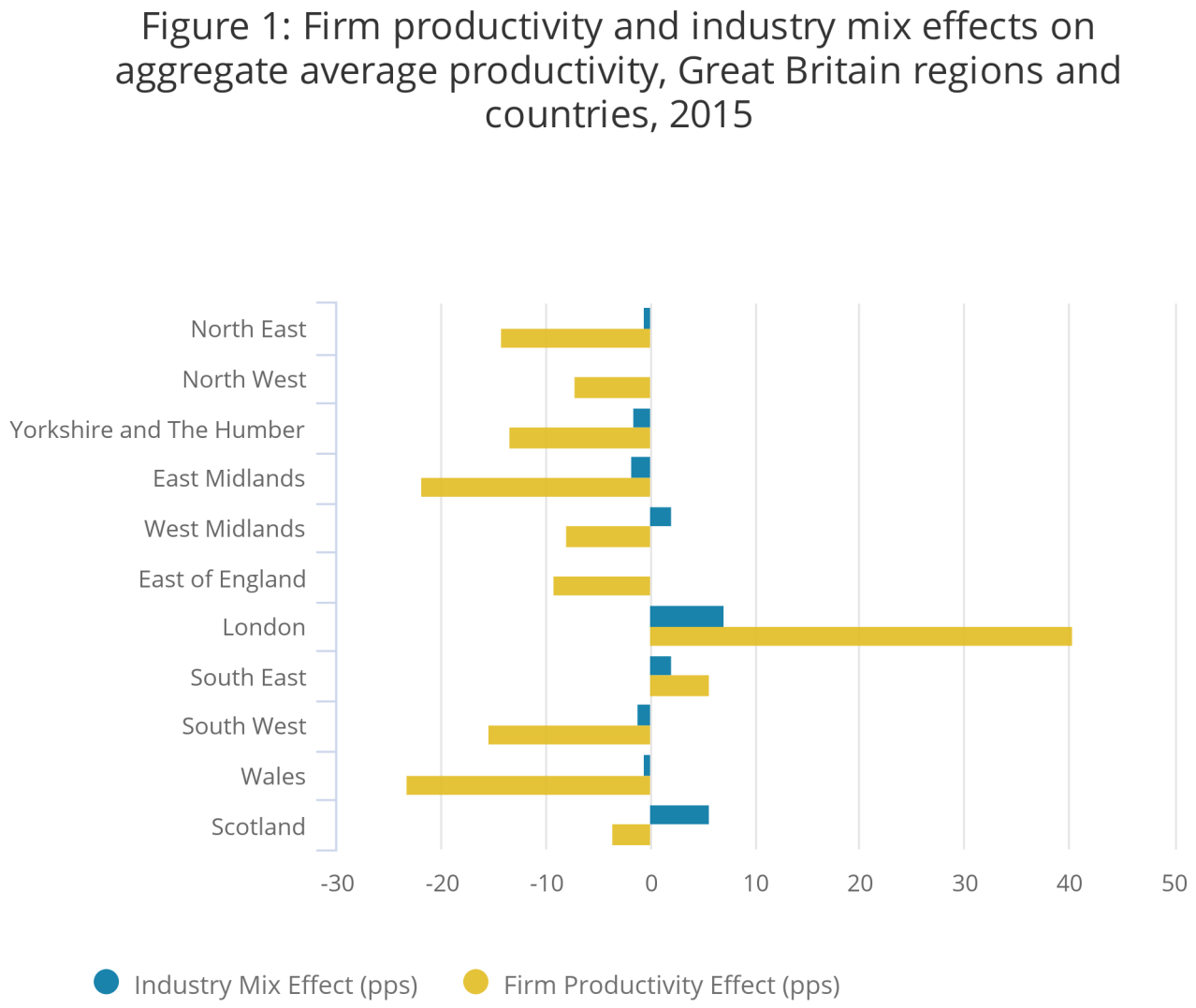
	Aggregate Average Labour Productivity Index	Firm Productivity Index	Industry Composition Index	Aggregate Average Labour Productivity, Great Britain	Residual Covariance
North East	85	85	99	100	1
North West	91	91	99	100	1
Yorkshire and The Humber	84	85	97	100	1
East Midlands	78	80	100	100	-1
West Midlands	91	89	99	100	3
East of England	91	91	100	100	0
London	143	136	102	100	5
South East	107	105	101	100	1
South West	82	83	98	100	1
Wales	74	75	98	100	2
Scotland	99	93	103	100	3

Source: Annual Business Survey

This change in industry categorisation has not affected the overall results obtained. The indices show that the differences in aggregate labour productivity for the non-financial business economy (shown in the first column of the tables) in most NUTS1 regions appear to be more closely related to individual firm productivities than to the industry composition in the regions. For example, in the North East region, the Firm Productivity Index equals 85 (on a Great Britain equals 100 basis). This is the productivity (15 percentage points below the Great Britain average) that would exist if the North East had a Great Britain industry structure whilst maintaining local average industry productivities. By contrast, the Industry Composition Index for the North East is 99 (a 1 percentage point difference from Great Britain). This is the productivity that would exist if we kept the North East industry structure, but applied average UK industry productivities within each industry.

Figure 1 shows the contribution of average firm productivity in industries and the industry mix to the regions' productivity gap with Great Britain.

Figure 1: Firm productivity and industry mix effects on aggregate average productivity, Great Britain regions and countries, 2015



Source: Annual Business Survey, Office for National Statistics

Both Table 1 and Figure 1 illustrate that a low average aggregate productivity level in most of the regions is due mostly to low firm productivities within industries relative to the Great Britain average and only slightly impacted by local industry structure. For example, the case of the North East is typical of most of Great Britain regions, in that the average aggregate productivity level is most closely related with the level of the Firm Productivity Index. This reflects that differences in productivity across the regions are more closely related to different firm-level productivities within industries and less impacted by the local industry structure.

Table 1 shows Scotland to be the one clear exception to this pattern. For Scotland, its industrial composition is shown to be the major source of its relatively strong overall labour productivity performance. Industry structures of London and the South East also have a positive impact on their overall average productivity levels; however, the higher average productivity of the firms in these regions play a more significant role than their industry structures on their overall average aggregate productivity levels. In the West Midlands, the industry structure also plays a positive role, however, it is not large enough to compensate for the effect of the relatively low average productivity levels of the firms located in this region.

The foregoing analysis suggests that changes to the Firm Productivity Index have a much larger scope than changes to industry mix for improving a region's average productivity.

Sources of productivity in NUTS2 regions

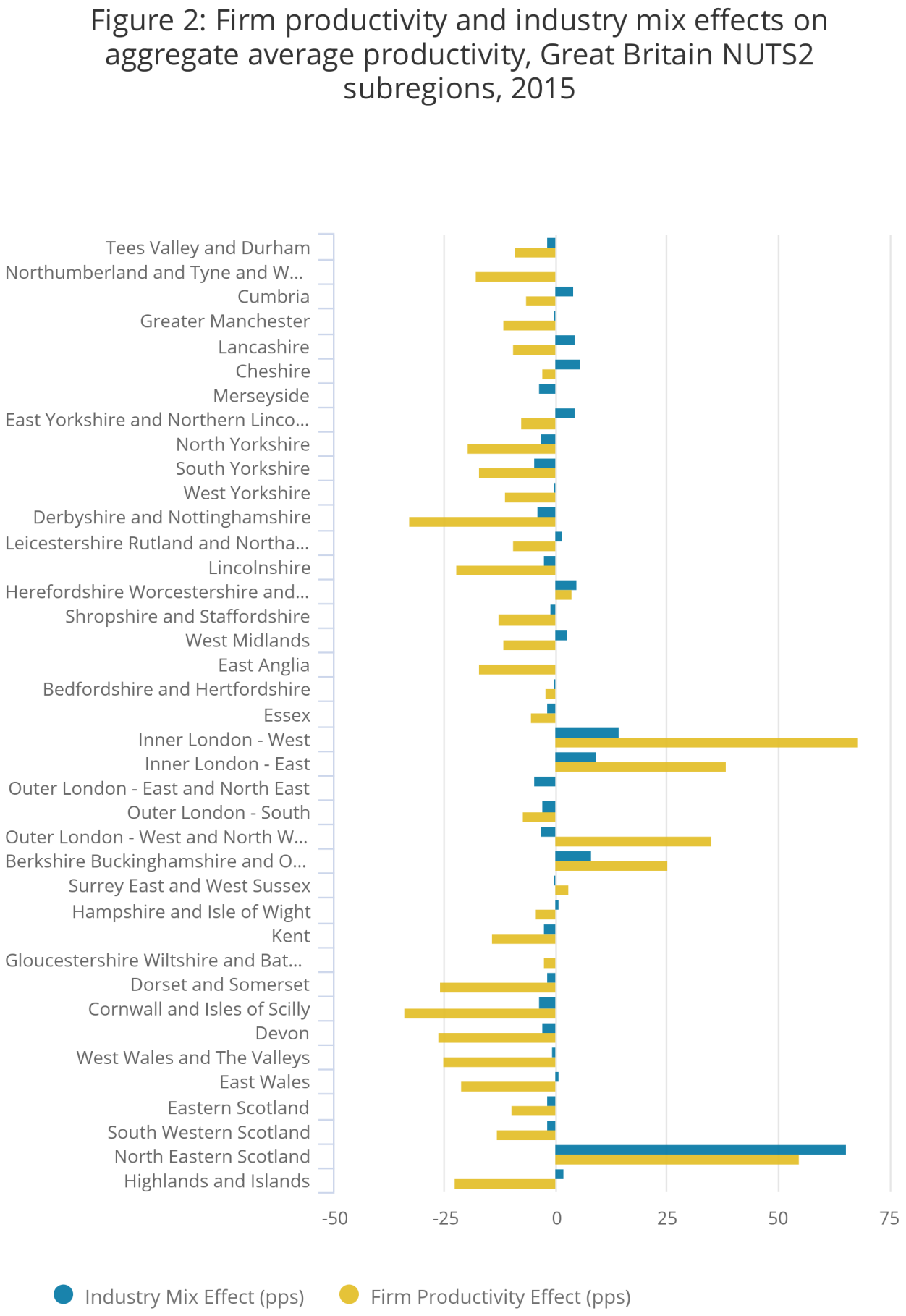
Our regional and subregional productivity article shows that differences in economic performance among regions mask significant variations within regions. In this section, the decomposition analysis is carried out to explore the sources of productivity differences between NUTS2 regions.

Figure 2 shows the firm productivity and industry composition indices for NUTS2 regions in Great Britain. Each cell in the table has been divided by the average aggregate productivity level for Great Britain in 2015 to provide results on a Great Britain equals 100 basis.

Figure 2 shows the contribution of average firm productivity in industries and the industry mix to the NUTS2 regions' productivity gap with Great Britain. It shows that differences in aggregate labour productivity for the non-financial business economy within the NUTS2 regions also appear to be more closely related to individual firm productivities within the industries in that region than to their industry composition.

There was only a small number of NUTS2 regions where the industry structure had a more significant effect on aggregate productivity than the firm productivities: North Eastern Scotland, Herefordshire, Worcestershire and Warwickshire, Cheshire (all with a positive effect) and Outer London – East and North East subregions (with a negative effect). In these subregions, industry mix appears to play a more prominent role in explaining the region' s average aggregate productivity.

Figure 2: Firm productivity and industry mix effects on aggregate average productivity, Great Britain NUTS2 subregions, 2015



Source: Annual Business Survey, Office for National Statistics

4 . Results: distribution of firms (local plants) by productivity

This section explores the distribution of the firm productivities in the Great Britain regions and countries to investigate further the average firm productivity levels obtained in the previous section.

Figure 3: Distribution of firm-level (local plant) productivity (gross value added (GVA) per worker), Great Britain regions and countries, 2015

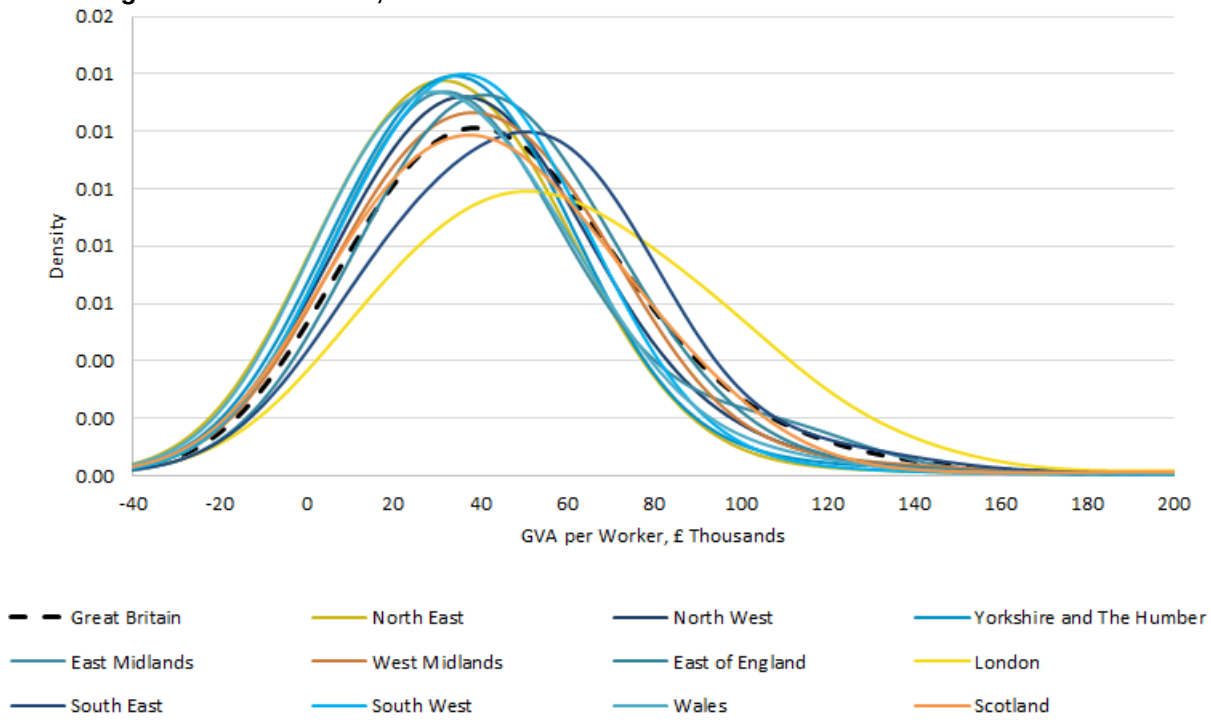


Figure 3 displays the distribution of firms (local plants) by their productivity (gross value added (GVA) per worker) for all the regions and countries in Great Britain. In 2015, most regions and city regions in Great Britain had a large proportion of the firms with GVA per worker around £20,000 to £50,000. However, South East England and London had a larger proportion of firms with higher levels of GVA per worker compared with the rest of the Great Britain countries and regions. This can be seen particularly in the very different shape of the distribution for London compared with other regions and countries in Figure 3.

In every region there are firms with very low and very high productivity performance. However, the skewed distributions illustrate that there are more firms in all the regions with productivity clustered at lower levels and few with productivity clustered at higher levels. However, in some regions such as London and the South East, the average firms have higher productivity than in other regions and there are more firms at the top tail of the distribution.

5 . Results: firm-level (local plant) productivity by industry groups

Figure 4 shows firm-level (local plant) productivity distributions within selected aggregated industry groups in Great Britain regions and countries. It shows the median level of gross value added (GVA) per worker (the dot) and the inter-quartile range (the bars) and the 10th and 90th deciles (the lines). Note that each local plant is assigned a single Standard Industrial Classification 2007: SIC 2007 code, which corresponds to the plant's principal activity.

Firms in manufacturing sectors and knowledge-intensive services sectors have generally higher productivity levels than firms in less-knowledge intensive services sectors throughout the Great Britain regions. In London, firms generally have higher GVA per worker in all the services sectors compared with their counterparts in Great Britain. This figure illustrates the importance of firm-level productivity within industries in explaining the differences in aggregate labour productivity between the regions.

Figure 4: Distribution of local plant productivity (gross value added (GVA) per worker) by industry groups, Great Britain regions and countries, 2015

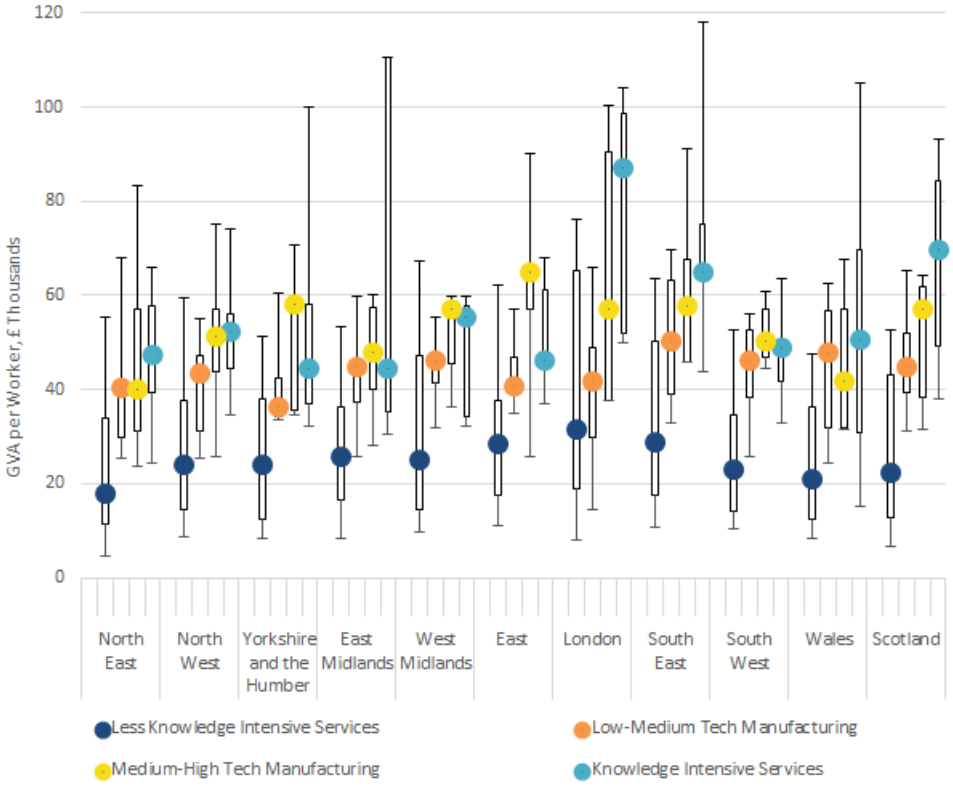


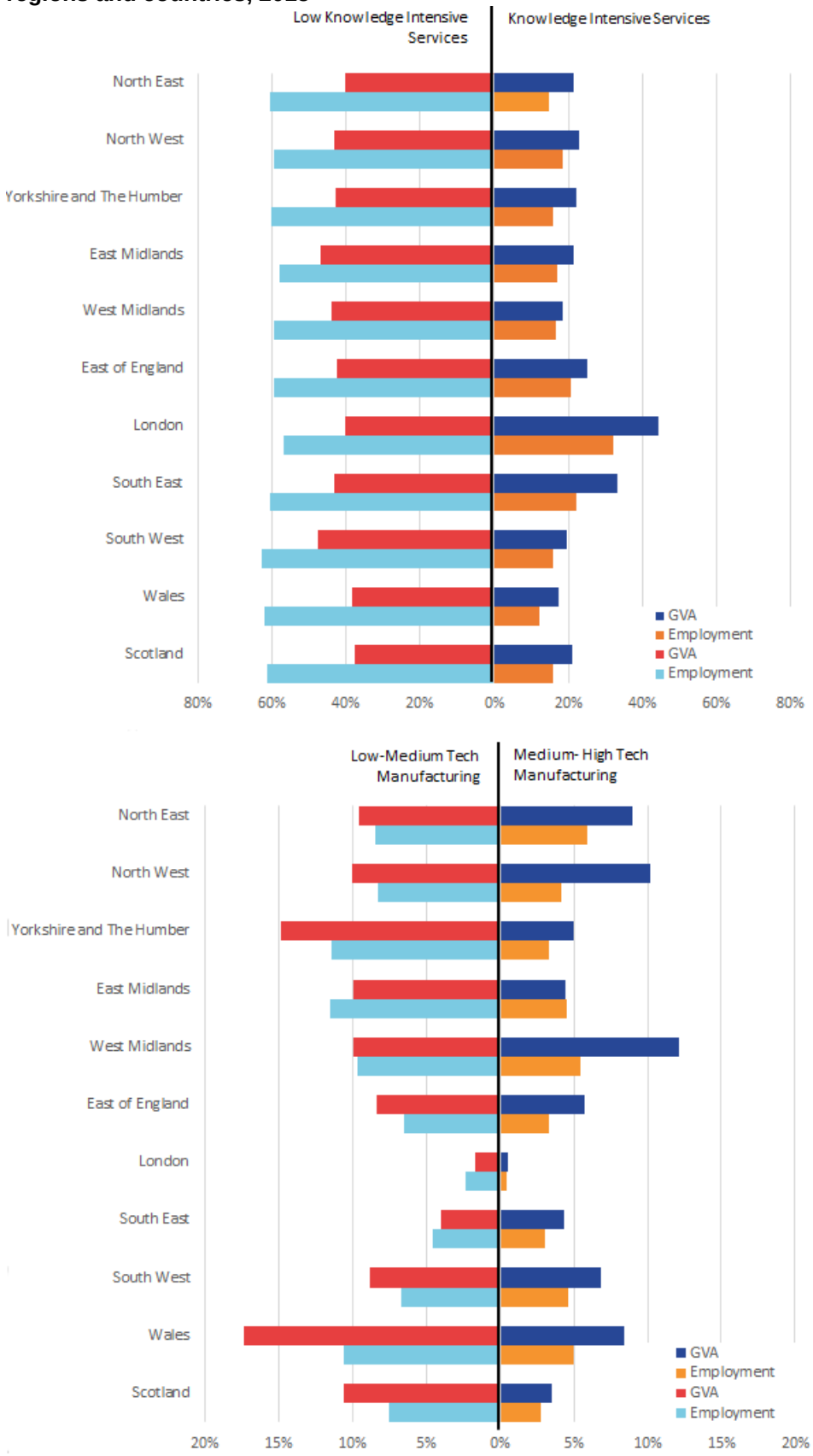
Figure 5 shows that in 2015, less knowledge-intensive services sectors generated around 60% of the employment and 42% of the GVA; while knowledge-intensive services sectors generated 20% of the employment and 29% of the GVA in the non-financial business economy across the Great Britain regions and countries. The distribution of employment in these sectors is similar in most of the regions. The notable exceptions are that London has a higher than average share of employment in knowledge-intensive services and high-tech services.

Both manufacturing sectors accounted for a smaller share of employment in Great Britain regions and countries than services; however, their impacts on GVA, particularly the high-tech manufacturing sectors, were among the highest of all the sectors in the non-financial business economy in 2015. It can be seen in Figure 4 that these sectors had generally the highest GVA per worker in most of the regions. Note that, the capital intensive non-manufacturing production sector (not shown in Figure 5) also had very high labour productivity, however, except for North Eastern Scotland, the share of employment of these sectors in the business economy is small.

Figure 4 also indicates that average GVA per worker in the knowledge-intensive services sectors is twice as large as the GVA per worker in less knowledge-intensive services sectors. However, across the regions, around two-thirds of the employment in the non-financial business economy is in relatively low productivity and less knowledge-intensive services sectors.

The aggregate average productivity of the less knowledge-intensive services sectors in London is around 40% more than the national aggregate average productivity of these sectors. This contributes significantly to the overall productivity gap between London and other regions. The large share of employment that exists in these relatively low productivity services, and the spatial productivity differences within them, present an important policy challenge for improving regional economic performance and reducing the regional economic disparities in Great Britain.

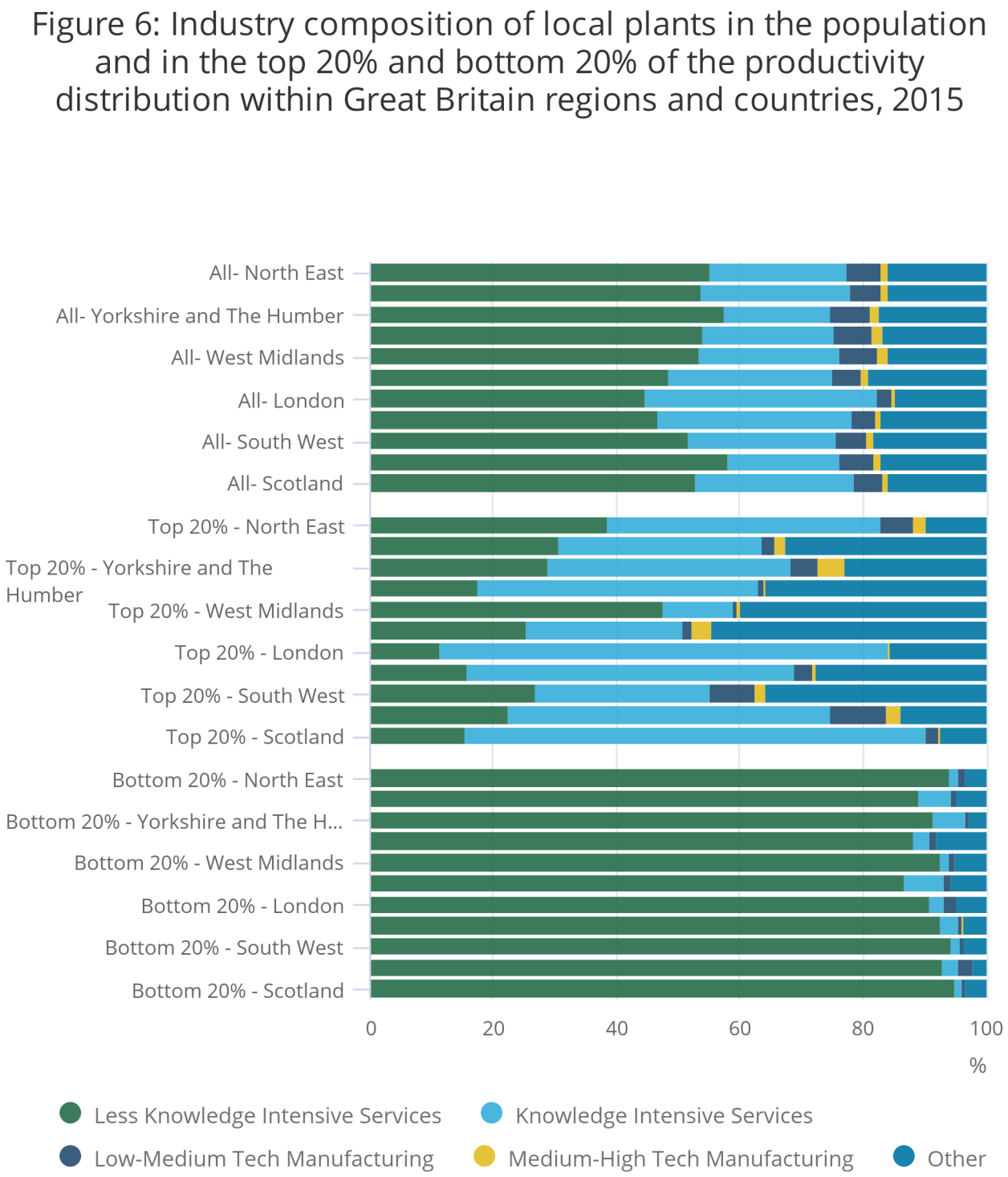
Figure 5: Share of employment and gross value added (GVA) by selected industry groups, Great Britain regions and countries, 2015



Analysis of firms (local plants) by industry at the bottom 20% and top 20% of the productivity distribution

Figure 6 shows that firms (local plants) in the top 20% and bottom 20% of the productivity distribution can be found in a broad range of industry sectors. However, throughout the Great Britain regions and countries, local plants in the less knowledge-intensive services accounted for the majority of firms in the bottom 20%. The top end was generally dominated by local plants in the knowledge-intensive services, manufacturing and non-manufacturing production and construction sectors.

Figure 6: Industry composition of local plants in the population and in the top 20% and bottom 20% of the productivity distribution within Great Britain regions and countries, 2015



Source: Annual Business Survey, Office for National Statistics

Notes:

1. Knowledge-intensive services includes Knowledge-intensive high-tech services, Knowledge-intensive market services and Other knowledge-intensive services.

2. Medium-high tech manufacturing includes Medium-high tech manufacturing and High-tech manufacturing.

3. Low-medium tech manufacturing includes Low-tech manufacturing and Medium-low tech manufacturing.

4. Other include Construction, Real estate and Non-manufacturing production.

6 . Results: firm demography and aggregate average productivity in the regions

Firm productivity can reflect characteristics of the firms such as production technology, capital intensity, investment, firm size, firm age, innovation, foreign ownership, managerial capability, extent of market power, as well as characteristics of product and factor markets they operate in or consumer tastes and preferences for the firms' products. Firm productivity may also be influenced by local factors such as infrastructure, agglomeration and pricing.

To explore the relationship between firm characteristics and productivity, the following analysis focuses on two firm characteristics[1] – size and age – with an emphasis on the "best" and "worst" performing firms [2] and the role of these characteristics on productivity.

This analysis has been carried out by linking the local unit ABS dataset with the Inter-Departmental Business Register (IDBR), which includes several firm characteristics. It should be noted that due to the potential lag in updating employment data, especially for small firms on the IDBR, the firms (local plants) may not have been allocated to correct size groups. Developments in the use of timelier administrative data will help improve this allocation.

The productivity analysis in this article uses nominal gross value added (GVA), which does not by definition take account of any regional or local price difference or different factor prices faced by the firms.

Distribution of local plants by firm size and productivity

Previous Office for National Statistics (ONS) analyses (for more information see Labour productivity measures from the Annual Business Survey: 2006 to 2015 and Understanding firms in the bottom 10% of the labour productivity distribution in Great Britain: "the laggards", 2003 to 2015) of firm-level productivity in Great Britain have explored GVA per worker by (employment) size of firms and found that in general, larger firms have higher productivity levels on average compared with smaller firms. These analyses were undertaken at the level of the reporting unit of a firm. However, there are other levels at which it is possible to analyse the firm size and productivity, such as at the enterprise level or local plant level. These differences in measuring the firm size need to be borne in mind when comparing results across studies.

For the remainder of the article, analysis continues to be carried out on a local plant basis, but the size category each plant is allocated to is taken as the size of the enterprise to which the local plant is attached. This can be helpful for analysis because being a part of a large business enterprise may have different effects on productivity levels for a small plant compared with a similar size single plant establishment. For example, a small store of a large supermarket chain may benefit from more efficient administrative systems or supply chains (hence a cost advantage) compared with their single plant counterparts.

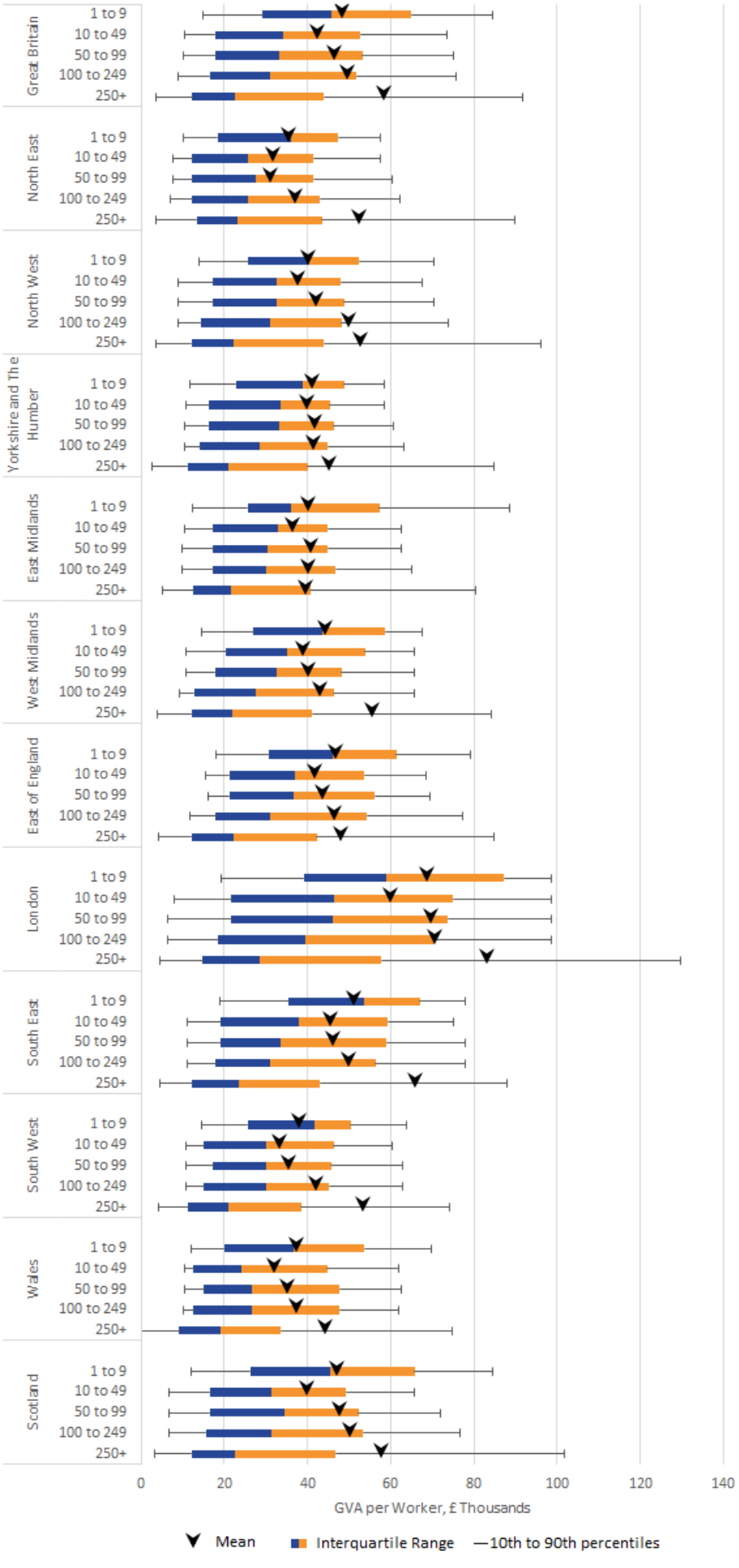
In most cases, local plants, reporting units and enterprises are one and the same. On average, around one-quarter of the local plants across the regions belonged to a multi-plant enterprise in 2015, with the North East having the highest (31%) and London having the lowest (21%) proportions. The larger the enterprise, the more likely they are to have more than one plant. In the dataset, over 95% of the enterprises with 250 or more employment were multi-plant enterprises and over 90% of the micro-plants were single establishments across the regions and countries in Great Britain.

Figure 7 shows that the median GVA per worker in micro-plants (1 to 9 employment) is generally higher than in local plants of larger firms. However, Figure 10 also shows that the top tail of the distribution of the local plants, which are part of the largest firms (250 or more employees), is very long suggesting on average there are productivity advantages of large firms.

Note that this finding partly reflects the fact that the local plants of large firms are counted as “large” if they belong to a large multi-plant enterprise. A multi-plant enterprise may have local plants that are engaged in different types of activities ranging from low to high productivity. Equally, it should be noted that each local plant is included when compiling these distributions – so the local units within the 250 or more employment section will include some very large local plants belonging to large enterprises with only one or a few sites, but will also include the many smaller local units belonging to some large enterprises, for example, the many different retail sites belonging to large retail chains.

Figure 7 also shows that, except for micro-plants, average GVA per worker in a region generally appears to increase with the size of the enterprise. Further analysis suggests that this result holds in each of the industry groups being considered. As mentioned in other ONS articles, such as Labour productivity measures from the Annual Business Survey: 2006 to 2015, this finding is consistent with the expectations that the large businesses may have more scope to benefit from specialisation of functions and economies of scope and scale.

Figure 7: Distribution of local plant productivity (gross value added (GVA) per worker) by firm size, Great Britain regions and countries, 2015



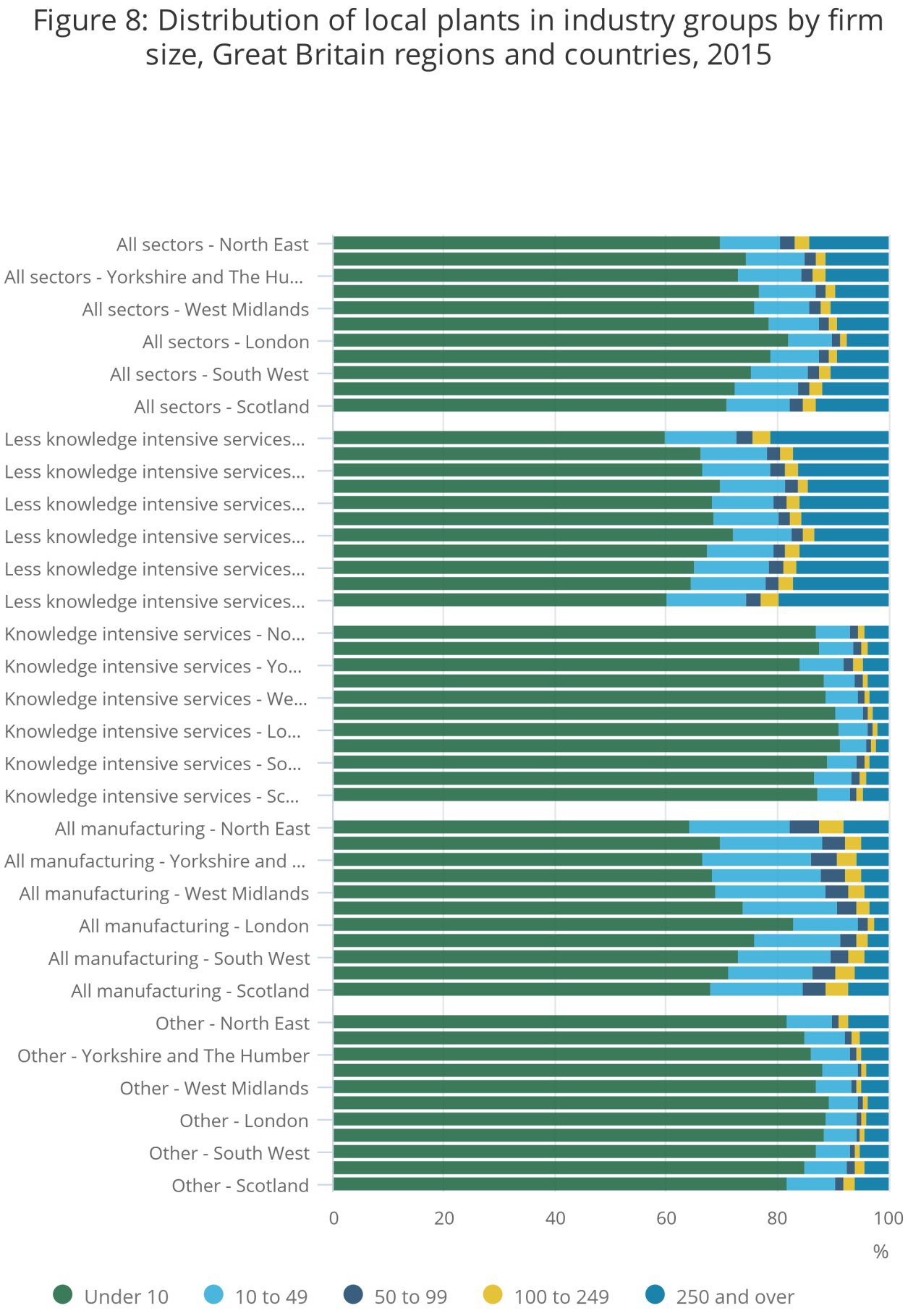
Industry groups by firm size

This section explores whether the relationship between productivity and firm size partly reflects the industry composition of the local plants. The upper panel of Figure 8 shows that micro-plants (1 to 9 employment) generally accounted for more than 70% of the non-financial business population as a whole in 2015. London had the highest share of micro-plants amongst its local units (around 80%), while Scotland and the North East region of England had the highest share of their local unit business population made up of plants associated with the largest enterprises (250 or more employment).

The lower panels show that all the industries have a mix of plants attached to both small and large enterprises, however, there are notable differences in different industries. For example, across the regions there was a higher proportion of knowledge-intensive services firms among the micro-plants (1 to 9 employment) compared with the distribution of micro-plants in the business population. However, there was a higher proportion of plants belonging to large firms (250 or more employment) in the less knowledge-intensive services compared with their distribution in the business population.

The relatively high median productivity level of the plants that are attached to micro-plants (shown in Figure 7) can be explained partly by their heavier representation in the knowledge-intensive sectors than in the rest of the non-financial business economy as a whole, as shown in Figure 8.

Figure 8: Distribution of local plants in industry groups by firm size, Great Britain regions and countries, 2015



Source: Annual Business Survey (ABS), Office for National Statistics and Inter-Departmental Business Register (IDBR)

Notes:

1. Knowledge-intensive services includes Knowledge-intensive high-tech services, Knowledge-intensive market services and Other knowledge-intensive services.

2. Other include Construction, Real estate and Non-manufacturing production.

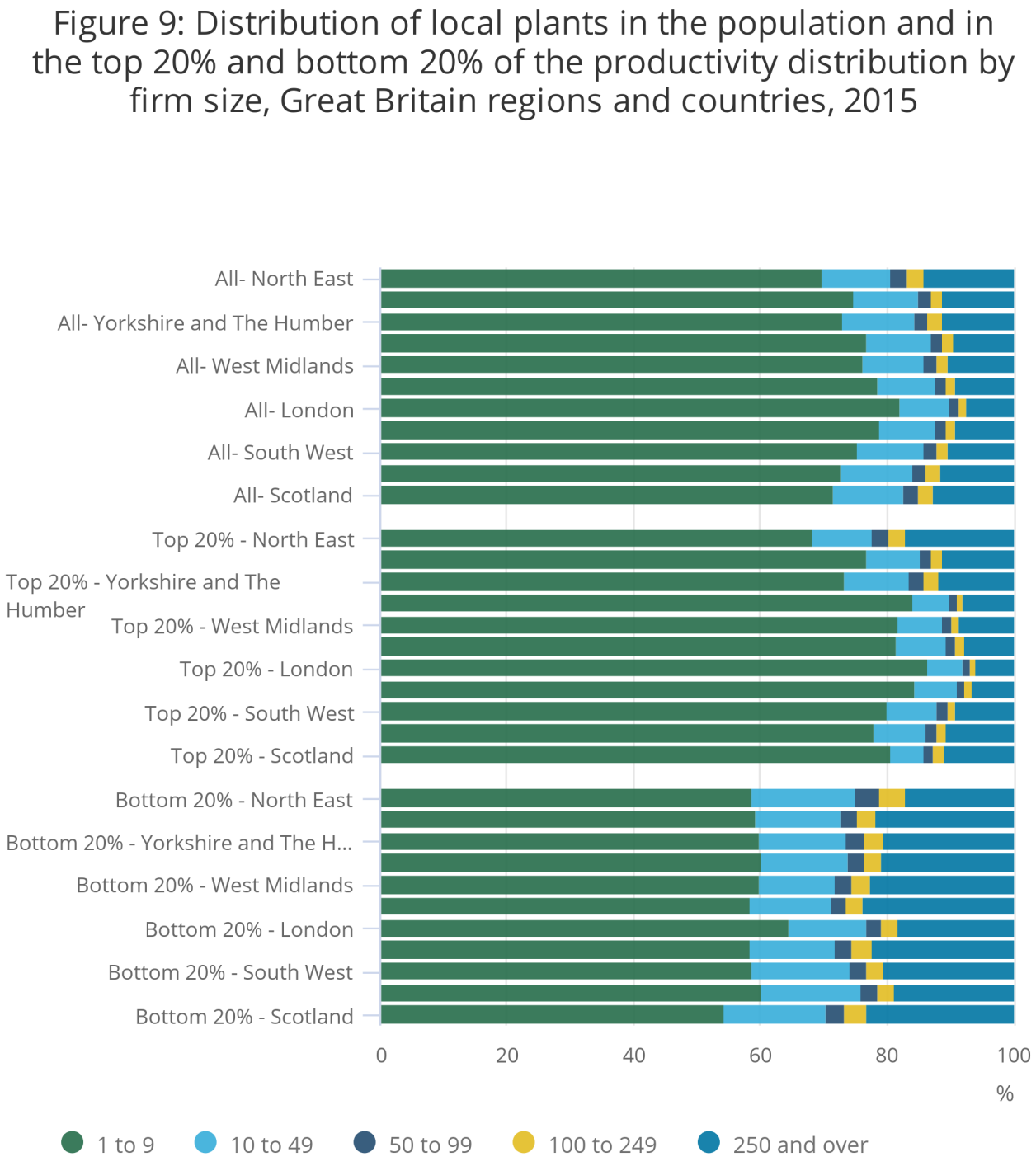
Analysis of local plants by firm size at the bottom 20% and top 20% of the productivity distribution

To explore the role of the firm size in regional average aggregate productivity further, the upper panel of Figure 9 shows the distribution of local plants by size of the enterprise to which they are attached in regions; whereas the bottom panels show the distribution of local plants by enterprise size among the top 20% and the bottom 20% of the productivity distribution.

The bottom panels of Figure 9 show that, throughout the regions, there were proportionately more plants that are attached to micro-firms (1 to 9 employment) among the top 20% compared with their population in the business economy in 2015. For example, in the South East region, the share of the plants in the best performing group accounted for by small firm size was around 6 percentage points larger than in the business population as a whole.

On the other hand, the plants associated with small- to medium-sized enterprises (10 to 49 employment) and with the largest enterprises (250 or more employment) appeared to account for a larger share of the plants in the bottom 20% of the labour productivity distribution than in the business population as a whole.

Figure 9: Distribution of local plants in the population and in the top 20% and bottom 20% of the productivity distribution by firm size, Great Britain regions and countries, 2015



Source: Annual Business Survey (ABS), Office for National Statistics and Inter-Departmental Business Register (IDBR)

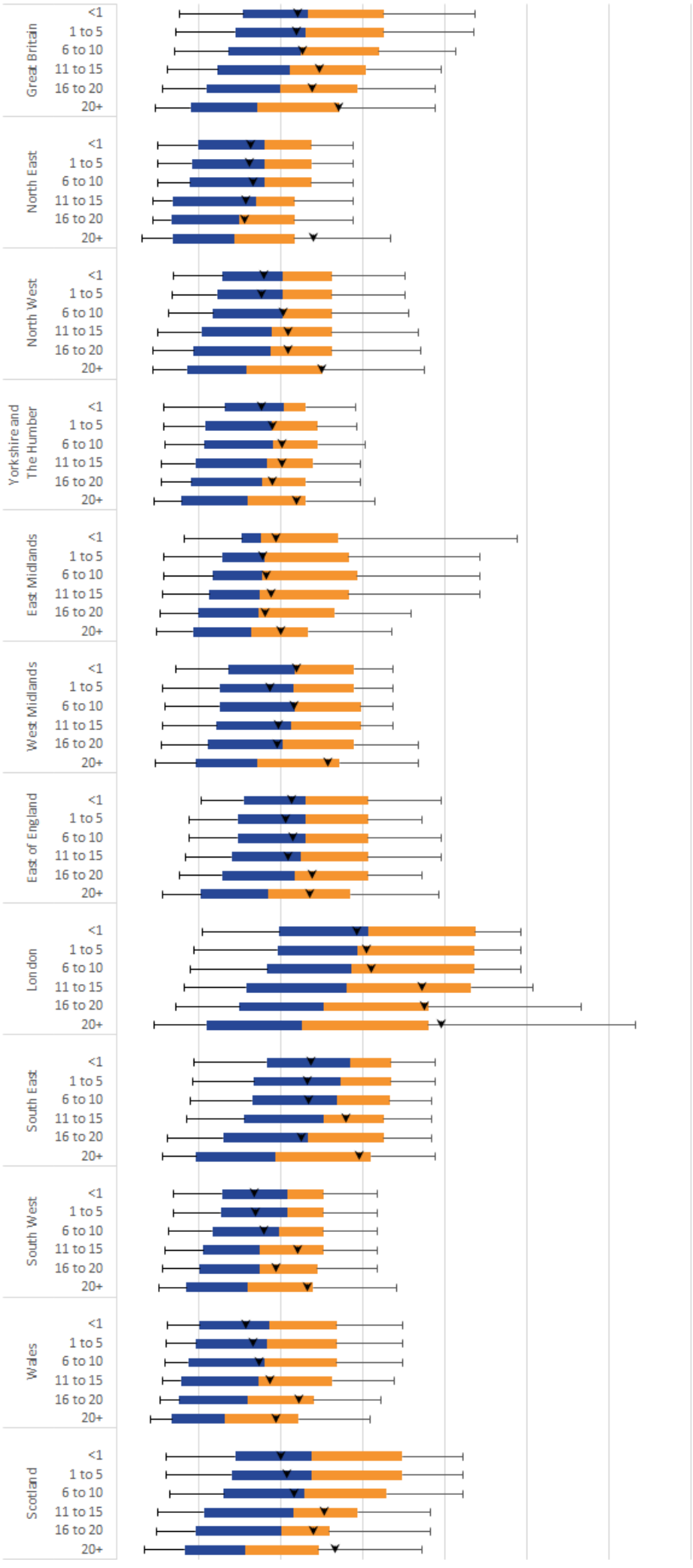
Distribution of local plants by enterprise age and productivity

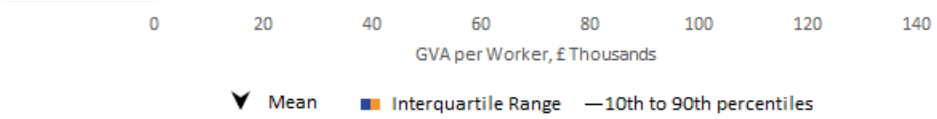
One of our previous publications analysing the characteristics of firms at the bottom of the productivity distribution in Great Britain suggests that the productivity of a firm can also be related to its age.

To examine the relationship between productivity and firm age, the local plant dataset is linked with the IDBR, which includes the birth date of the enterprises. Therefore, in this analysis the age of the local plant reflects the age of the enterprise that the local plant is attached to. As previously, for over three-quarters of the cases the local plants, reporting units and enterprises are one and the same.

Figure 10 shows that median GVA per worker in local plants which are associated with younger enterprises is generally higher than in local plants which are associated with older firms. However, the long top tail of the distributions of the local plants which are attached to enterprises aged 21 years or older makes the average GVA per worker in this group the highest among the age groups analysed.

Figure 10: Distribution of local plant productivity (gross value added (GVA) per worker) by firm age, Great Britain regions and countries, 2015


Great Britain
North East
North West
Yorkshire and The Humber
East Midlands
West Midlands
East of England
London
South East
South West
Wales
Scotland
<1
1 to 5
6 to 10
11 to 15
16 to 20
20+



Industry groups by firm age

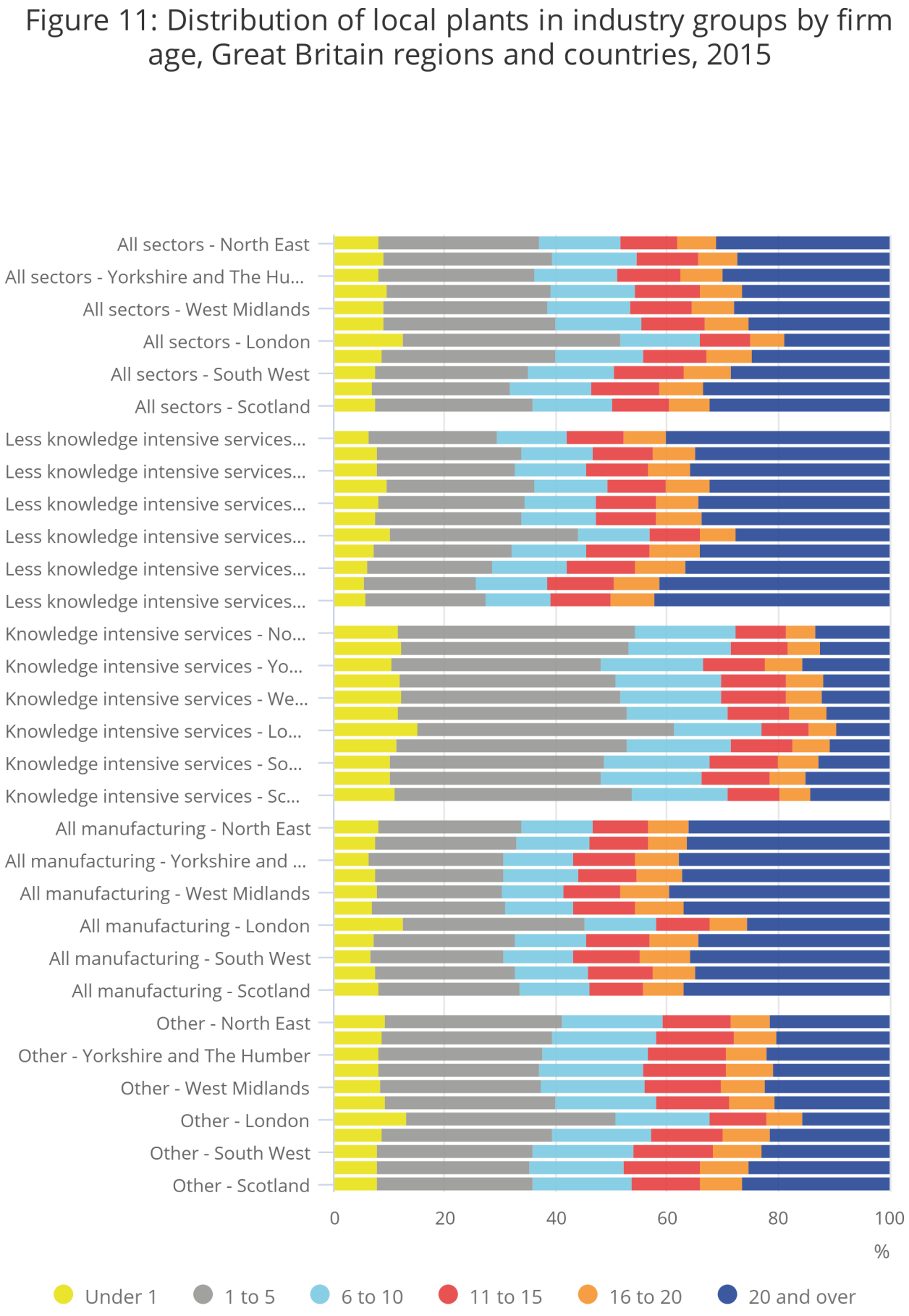
This section explores whether the relationship between productivity and firm age partly reflects the industry composition of the local plants.

The upper panel of Figure 11 shows that in most of the regions, local plants that are attached to young firms (five years old or less) accounted for typically around 40% of the business population as a whole in 2015, with London having the highest share of younger firms compared with other regions.

The lower panels of Figure 11 display the distribution of local plants by the age of enterprise to which they are attached in different industry groups. It shows that all the industries have a mix of local plants belonging to both young and old firms, however, there are notable differences in different industries. It suggests that across the Great Britain regions and countries, knowledge-intensive services sectors tended to have more local plants that are associated with younger firms (less than five years old) compared with the distribution of the similar plants in the business population. However, local plants that are attached to older firms, particularly firms 20 years or older, had a larger representation in the less knowledge-intensive services sectors compared with their distribution in the business economy as a whole.

Figure 11 also suggests that the relatively high median productivity level of the local plants that are associated with young firms (shown in Figure 10) can be partly explained by their heavier representation in the knowledge-intensive sectors than their distribution in the non-financial business economy as a whole.

Figure 11: Distribution of local plants in industry groups by firm age, Great Britain regions and countries, 2015



Source: Annual Business Survey (ABS), Office for National Statistics and Inter-Departmental Business Register (IDBR)

Notes:

1. Knowledge-intensive services includes Knowledge-intensive high-tech services, Knowledge-intensive market services and Other knowledge-intensive services.

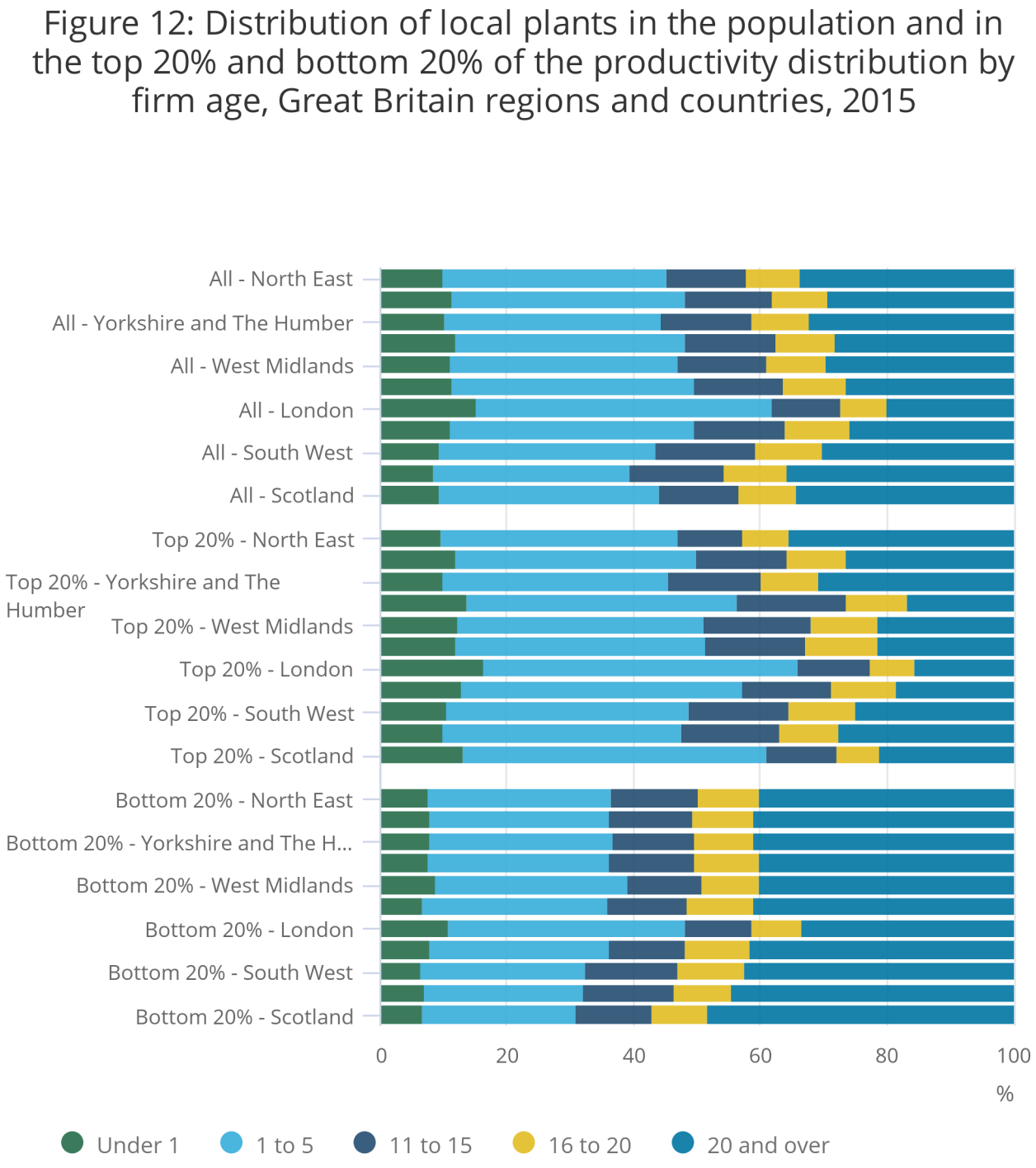
2. Other include Construction, Real estate and Non-manufacturing production.

Analysis of local plants by firm age at the bottom 20% and top 20% of the productivity distribution

To explore the role of firm age in regional average aggregate productivity further, the upper panel of Figure 12 displays the distribution of local plants by firm age in Great Britain regions and countries. The bottom panels show the distribution of local plants by age groups among the top 20% and the bottom 20% of the productivity distribution.

It suggests that throughout the Great Britain regions and countries in the top 20% of the productivity distribution, there were proportionately more local plants that are attached to enterprises less than 15 years old, with the majority being in the one- to five-year-old age group compared with their distribution in the business population as a whole. The least productive (bottom 20%) plants tended to be in the older age group enterprises.

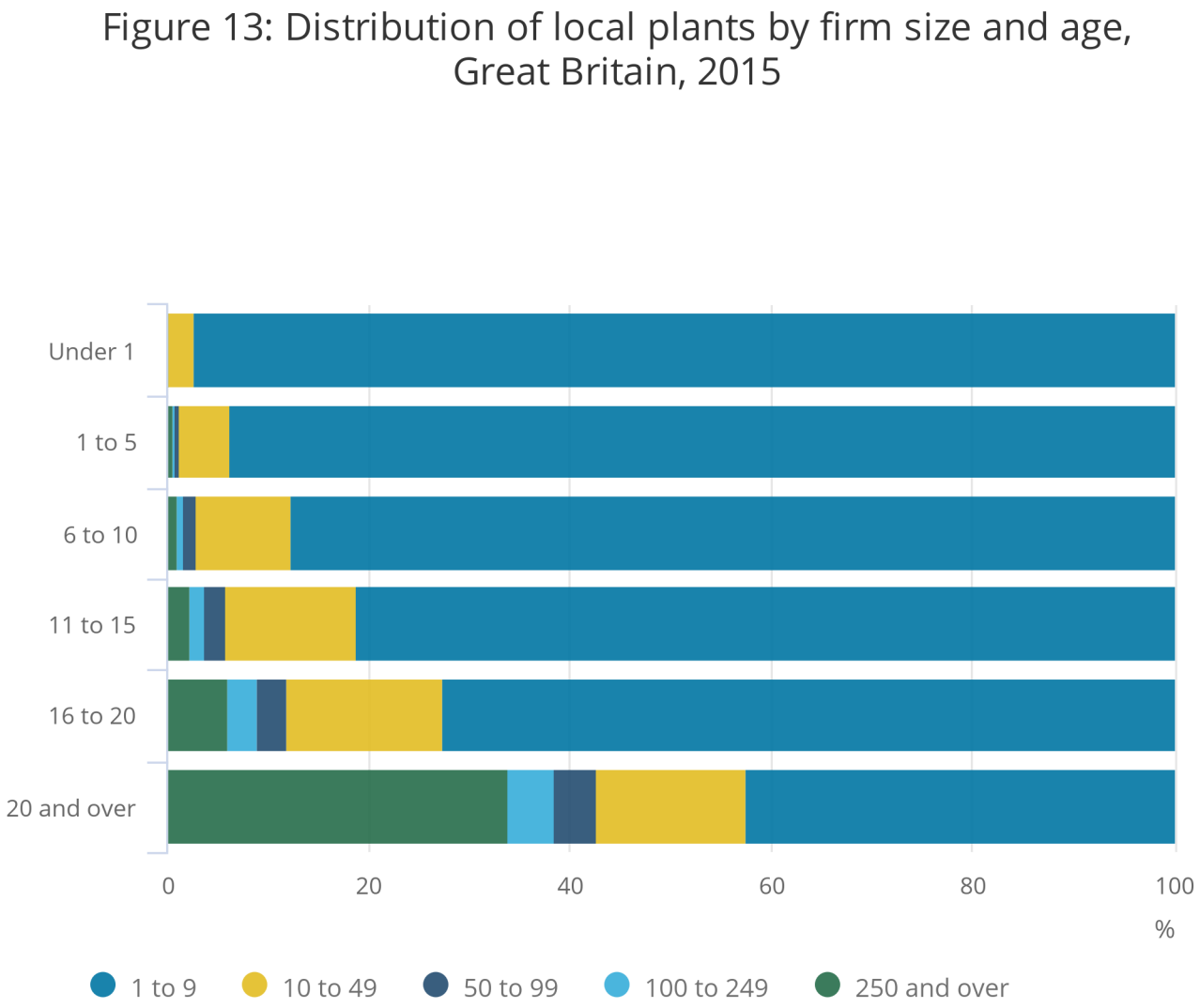
Figure 12: Distribution of local plants in the population and in the top 20% and bottom 20% of the productivity distribution by firm age, Great Britain regions and countries, 2015



Source: Annual Business Survey (ABS), Office for National Statistics and Inter-Departmental Business Register (IDBR)

Finally, Figure 13 shows that most of the plants that are attached to younger firms do also belong to micro-firms (1 to 9 employment) and there is a positive relationship between age and size, that is, older firms tended to be larger firms. The relationship between firm size and age follows the same pattern in all the regions. The findings in Figures 7 and 10 show that the relatively high median productivity of plants that are attached to small firms and young firms are partly reflecting this relationship.

Figure 13: Distribution of local plants by firm size and age, Great Britain, 2015



Source: Annual Business Survey (ABS), Office for National Statistics and Inter-Departmental Business Register (IDBR)

This analysis by size and age in the latter half of the article has shown some interesting results based on analysis of the local plants. For example, median productivity was highest amongst local plants associated with young and small enterprises, most likely due to the higher than average share of such plants found in the knowledge-intensive services sectors. By contrast, except for micro-plants, average GVA per worker in a region generally appeared to increase with the size or the age of the enterprise, suggesting that very high productivity plants must exist within the top tail of the productivity distribution for these size and age groups.

Overall, therefore, the local unit analysis has provided an interesting extra dimension to consideration of these topics. However, further analysis will be required to more fully understand the results from the local unit analysis and how the results compare with, and add to, productivity analysis carried out on a reporting unit basis.

Notes for: Results: firm demography and aggregate average productivity in the regions

1. The Annual Business Survey (ABS) includes other factors that can affect firm productivity such as foreign ownership and whether the firm is an exporting business or not, however, data on other factors were either not complete or not available at the enterprise level for linking with the local unit dataset.

2. Definition: firms in the bottom 20% and in the top 20% of the labour productivity distribution in 2015.

7 . Discussion

The main aim of the article is to provide some information on the sources of spatial differences in labour productivity.

The main finding of the analysis is that in nominal terms, labour productivity differs considerably between and within different industries. Productivity differences within industries appears to play a more prominent role than the industry structure in explaining overall spatial differences in productivity in the non-financial business economy in Great Britain. For example, the data in this article have highlighted that London's labour productivity advantage over other regions is not just about having more firms in certain industries. Rather, they reflect that within certain industries (and particularly in the services industries), London firms display a significantly higher level of labour productivity on average than firms in equivalent industries elsewhere in the country.

Therefore, this question of why are firm-level productivities different within a particular industry between the regions is a vital one to consider. One explanation may be the firm characteristics affecting firm-level labour productivity such as production technology, capital intensity, investment, firm size, firm age, innovation, foreign ownership, managerial capability, extent of market power, as well as characteristics of product and factor markets they are operating in, or consumer tastes and preferences for the firms' products.

This article does not aim to provide a full analysis of all the drivers of firm productivity. The analysis explored two firm characteristics – firm size and age – which previous Office for National Statistics (ONS) articles have found to be correlated with firm productivity. The findings in this article also suggest that there is some correlation between firm size, firm age and productivity. However, their role on the productivity of the firm is at best a partial one and these characteristics do not appear to have a large effect on the spatial differences in aggregate average productivity, as the distributions of local plants by these two characteristics are very similar across the regions.

Based on this analysis, however, it is possible to make a few observations on the factors behind the observed differences between the local plants located in different regions. For example, across the Great Britain regions and countries, local plants that are attached to micro-plants (1 to 9 employment) have relatively high median productivity levels. This can be explained partly by their heavier representation in the knowledge-intensive services sectors than their distribution in the non-financial business economy as a whole. It is important to note that the analyses of productivity and firm size and/or age cannot be compared directly with other ONS analyses (such as Labour productivity measures from the Annual Business Survey: 2006 to 2015 and Understanding firms in the bottom 10% of the labour productivity distribution in Great Britain: "the laggards", 2003 to 2015), which were undertaken at the reporting unit level of an enterprise.

Another factor is that firm-level productivity may be influenced by agglomeration effects. There is a body of evidence that clustering economic activity (agglomeration) makes a city or region more productive. For example, businesses have access to a larger pool of potential customers, suppliers and workers in the same city. Similarly, knowledge spillovers are likely to occur when many similar firms are located close to each other. This can either be because firms collaborate or because workers move from one company to another, bringing their knowledge with them.

However, some sectors benefit more than others from knowledge spillovers with knowledge-intensive services businesses having the most to gain from a central location. Firm-level productivity may also be influenced by local factors such as infrastructure, economic mass or distance to economic mass. Some of these factors were discussed in last year's rural urban productivity analysis.

Another point to note is that even within a narrow industry sector, this article used broad industry groupings for the Industry Mix Index, however, they are based on 85 two-digit industry groupings. They could still cover a range of slightly different types of firms. More broadly, the results in this section are likely to reflect the fact that even within a particular industry sector, there can be differences in the types of outputs and the skills of workers involved, which may explain productivity differences. For example, a multinational law firm in London may have a different specialisation (hence different labour productivity levels) to a small local law firm elsewhere, but both will have the same two-digit industry grouping.

Finally, productivity indicators also depend on pricing. The productivity analysis in this article uses nominal gross value added (GVA), which does not by definition take account of any regional or local price difference [1] or different factor prices faced by the firms. Therefore, there is a possibility that if we were to control for regional price differences, this may either strengthen or weaken these findings.

Further analysis on the sources and determinants of labour productivity differences between regions and city regions will follow in our subsequent productivity bulletins.

Notes for: Discussion

1. Local price effects may be particularly significant if the goods and services are not tradeable (that is, they are produced and consumed locally).

8 . Annex: Calculation of the productivity and industry composition indices

This decomposition analysis technique is based on the original work of Olley and Pakes (1996) [1].

Equation 1 shows the calculation of the indices that break down the aggregate productivity into two components. This can be calculated as follows:

$$qr \equiv \sum_r q_r^i \lambda_r^i = \sum_r q_r^i \bar{\lambda}^i + \sum_r \bar{q}^i \lambda_r^i - \sum_r \bar{q}^i \lambda_r^i + \sum_r (q_r^i - \bar{q}^i)(\lambda_r^i - \bar{\lambda}^i)$$

where :
$\text{r} = \text{region}$
$\text{i} = \text{industry}$
$\lambda = \text{share of industries in the region (defined as share of industry i employment in the total employment of the region)}$
$\bar{\lambda} = \text{share of industries in Great Britain (defined as the national share of industry i employment in the total nation employment)}$
$\text{qr} = \text{aggregate productivity in the region, that is weighted average of industry productivities in region r, using lab share of the firm as weight}$
$\bar{q} = \text{aggregate productivity in Great Britain}$

First term = Productivity Index, which shows the average level of productivity in region r assuming the industry composition in that region is the same as for the economy as a whole.

Second term = Industry Composition Index, which shows the average level of productivity in region r assuming the productivity of each industry in that region equals nationwide average productivity for that industry.

Term 3 = average labour productivity in Great Britain.

Term 4 = Residual covariance between industry productivities and industry shares in region r. It shows the link between industry shares and productivity.

Notes for: Annex: Calculation of the productivity and industry composition indices

1. For more information see Olley GS and Pakes A (1996), ‘The Dynamics of Productivity in the Telecommunications Equipment Industry’, Econometrica, Volume 64, Issue 6, pages 1,263 to 1,297.