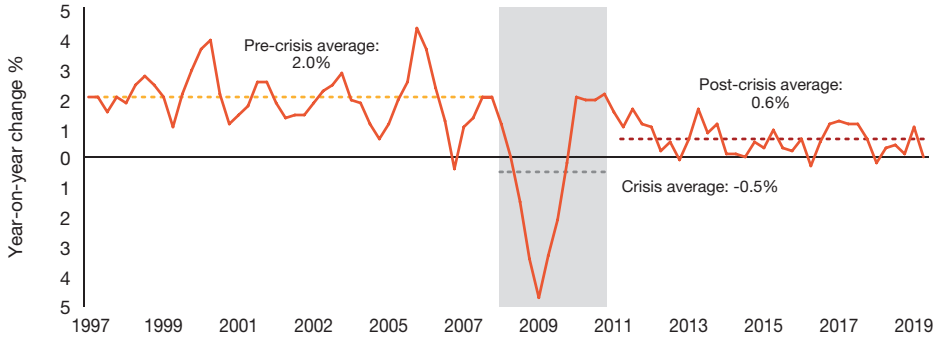
3. The Productivity Puzzle revisited: why has UK productivity lagged behind other advanced economies?[1]

Key points

- Labour productivity in the UK has consistently lagged behind a number of other advanced economies including France, Germany, Sweden and the US.
- Our analysis shows that this cannot be explained by the UK having too small a manufacturing sector, with the partial exception of comparisons with Germany.
- Instead it seems to reflect lower average UK productivity levels within a number of major industry sectors, including retail and wholesale, where it may have made sense for UK companies to pursue a more labour-intensive business model than in other advanced economies.
- This is partially offset by sectors where UK productivity is higher than most other advanced economies, such as financial services.
- Higher investment levels, a stronger education and skills strategy and improved adoption of existing technologies could all help the UK to close the productivity gap with other leading economies.

Figure 3.1 – Growth in UK output per worker



Source: ONS

Introduction

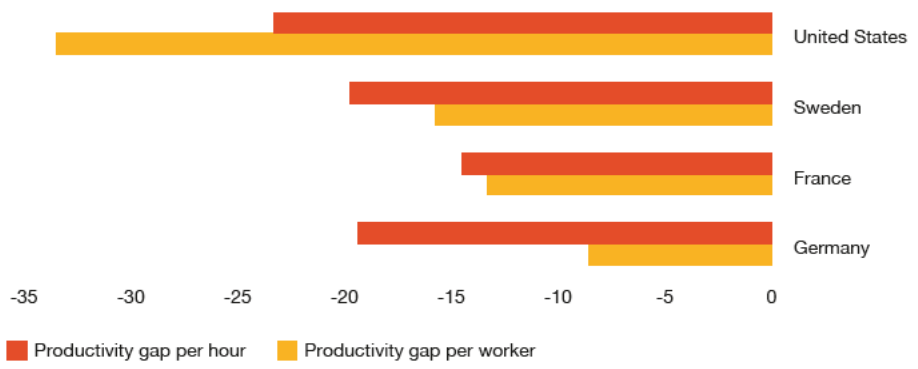
Over the last ten years the UK has seen much discussion of the 'Productivity Puzzle'. But really, there are two such Productivity Puzzles: a 'growth' puzzle and a 'levels' puzzle. These puzzles could equally be called a 'slowdown puzzle' and a 'gap puzzle'.

The first 'puzzle' is that UK productivity has grown more slowly since the crisis than before. Figure 3.1 shows that in the ten years prior to 2008, output per worker in the UK grew at an average annual rate of 2%[2]. In the crisis years (2008-10), productivity actually fell. But more importantly, it has grown only slowly in the recovery, averaging just 0.6% growth since 2011. Although the extent of this differs, most advanced economies have experienced a similar slowdown relative to pre-crisis growth rates.

> "Increasing output per worker to German levels would boost UK GDP by £180bn a year.
>
> **Alex Tuckett**
> Senior Economist, PwC

1 This article was written by Alex Tuckett and Thanh Dinh.
2 We use output per worker as the measure of productivity in this article. Other measures are available; for instance, Total Factor Productivity (TFP) takes account of how effectively both capital and labour are used. However, comparing TFP across countries is very difficult, and for many questions – such as how an economy delivers living standards – output per worker is more relevant.

Figure 3.2 – The UK productivity shortfall (% difference)



Note: Productivity is measured here by GVA per hour and GVA per worker at PPP exchange rates, 2017 data. PPP exchange rates take account of differences in prices between countries and are generally acknowledged as the most appropriate measure when making international comparisons of output or productivity. Data excludes the real estate sector as differences in measurement of imputed rents can distort the figures.

Source: Eurostat

The second 'puzzle' is that the average level of productivity in the UK has been persistently lower than in a number of other 'leading' advanced economies. Figure 3.2 shows the shortfall that the UK faces in comparison to a number of other advanced economies. Output per hour in the UK is around 14% lower than in France, and around 23% lower than in the US.

Calculations of productivity per hour take account of both Gross Value Added (GVA) per worker – the economic output of the economy relative to the number of workers – and the average number of hours worked.

Average hours can vary substantially across countries, reflecting cultural differences as well as labour market factors such as the balance between part-time and full-time work. More importantly, there are problems with measuring hours in a way that is consistent across countries, as highlighted in recent work by the OECD[3]. For this reason, in the rest of this article we focus on output per worker. Although the shortfall to other European countries is smaller on a per worker basis (also shown in Figure 3.2), the gap relative to the US is even larger (since US working hours are significantly longer on average).

This 'productivity levels gap' has existed since the 1970s and shows little or no sign of closing. If the UK were to increase output per worker to, for example, German levels, the economy could be more than £180bn per year larger; or £5,800 higher for each worker in the UK. In this article, we examine some possible explanations for the gap and discuss ways in which the UK could try and close this gap. Section 3.1 investigates the role of industrial structure in explaining differences in productivity. Section 3.2 goes on to look at the underlying drivers of relatively low productivity in the UK. Section 3.3 concludes and draws out the implications for public policy and for businesses.

3 https://oecdecoscope.blog/2019/01/21/statistical-insights-are-international-productivity-gaps-as-large-as-we-thought/

3.1 – How much does industrial structure matter?

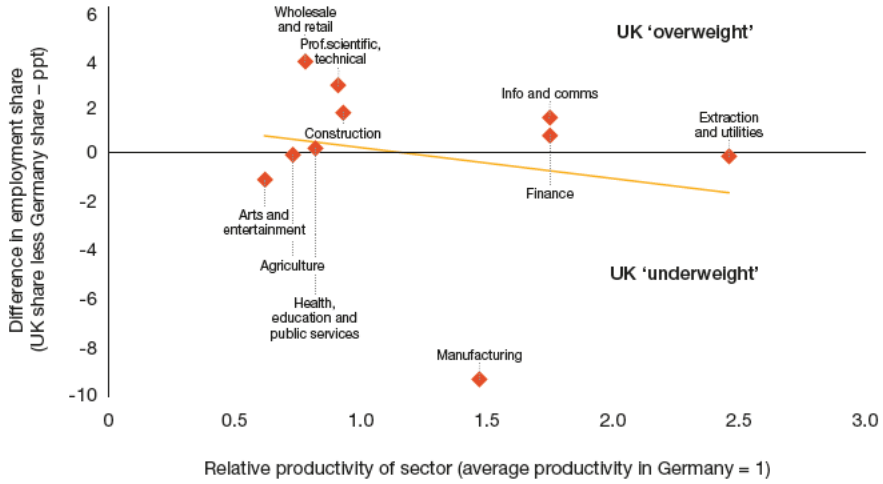
One way in which a country can increase productivity is by transferring resources from low productivity to high productivity sectors. This process is sometimes referred to as the 'Lewis Model', after the economist Arthur Lewis. In the 1960s, Lewis described a simple stylised model of economic development, where a country can increase total productivity by transferring labour from low productivity agriculture to high productivity manufacturing[4]. Much of the debate around the UK's productivity gap is rooted in similar logic: namely that the problem has been a 'reverse Lewis shift' from manufacturing to lower productivity services sectors[5].

Shifting resources from one sector to another is, however, not easy. Different sectors need workers with different skills and they also need very different forms of capital. A high street shop, for example, cannot easily be turned into a factory making solar panels, nor can retail workers easily shift to high tech engineering or design work. But, setting that aside, is it even true that the sectoral mix of the UK economy is the fundamental problem?

To analyse this systematically, it is useful first to note that the difference in productivity between any two countries can be attributed – in a purely mathematical sense – to a combination of two factors:

- **a 'between-industry' or 'compositional' effect**, where one country has a greater share of workers in industries which have higher productivity (in both countries); in the Lewis example, country A (e.g. China) has higher productivity because it has a greater share of workers in manufacturing than country B (e.g. India), which still has a larger agricultural sector; and
- **'within-industry' effects**, where one country has higher productivity within the same industries - in the Lewis example, country A has higher productivity than B in both manufacturing and agriculture.

Figure 3.3 – Differences in industrial structure between the UK and Germany



Note: X-axis shows productivity in each industry in Germany, relative to the average for the German economy as a whole. Real estate sector is excluded as this is principally imputed rents.

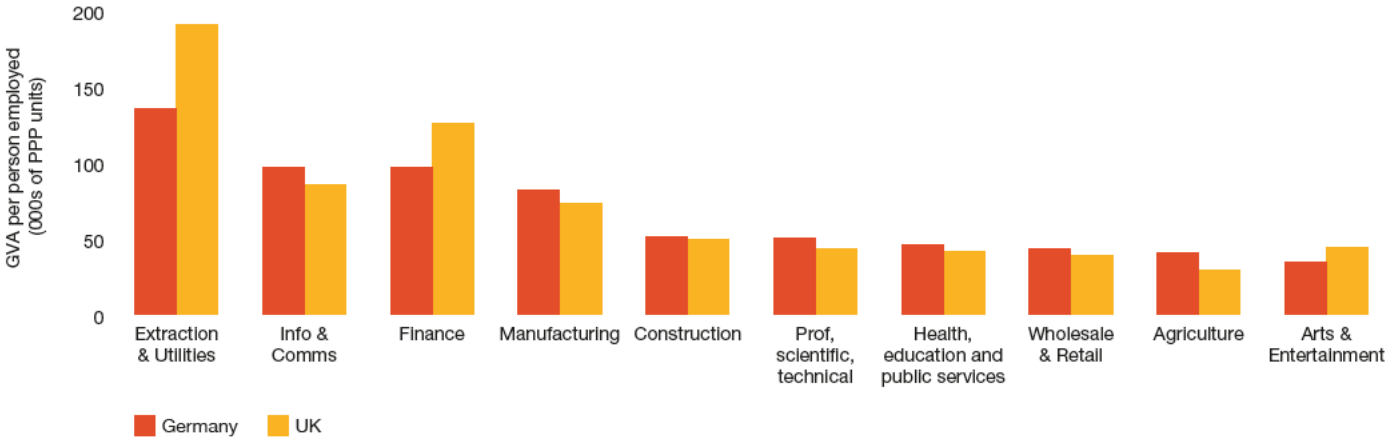
Source: PwC analysis of Eurostat data

These concepts can be used to help us understand the productivity gap between the UK and a country with higher productivity, such as Germany. Beginning with the compositional effect, Figure 3.3 shows the differences in industrial structure between the two countries. Each industry sector is represented by a dot: dots above the x-axis are where the UK has a larger employment share than Germany, dots below the axis where the UK has a lower share. The sectors are ordered by their relative productivity: the further to the right they are in the chart, the more productive an industry is[6].

The starkest difference in structure is that Germany has a much larger share of employment in manufacturing, which has productivity 45-50% higher than the economy as a whole in both countries. The UK has correspondingly higher shares of employment in construction and across a number of service sector industries. Some of these are sectors, such as wholesale and retail, that have lower productivity than manufacturing, but some are sectors such as finance or communications that have higher productivity. The downward sloping line of best fit indicates, however, that the overall net effect of industrial composition is to boost German productivity relative to the UK.

4 Lewis (1954), Economic Development with Unlimited Supplies of Labour, http://faculty.smu.edu/tosang/pdf/Lewis_1954.pdf
5 See, for example, Froud et al (2012), Rebalancing the Economy (or Buyer's Remorse), http://hummedia.manchester.ac.uk/institutes/cresc/workingpapers/wp87.pdf
6 The sectors are ordered by their relative productivity in Germany, but using UK relative productivities would not dramatically change the picture.

Figure 3.4 – Productivity per worker at industry level, Germany and UK



Note: Productivity has been calculated using whole economy PPP exchange rates (both for this chart and later ones in this article). This can theoretically lead to some distortion of relative productivity between industries, but it was judged to be preferable given the large potential for error in industry-specific PPP rates. PPP figures are based on the average price level of EU27 countries.

Source: Eurostat

Figure 3.4 shows the 'within-industry' picture. The UK has substantially higher productivity than Germany in the extraction and utilities sectors, and in finance. It also has somewhat higher productivity in the arts and entertainment sector. In every other sector, productivity per worker in the UK is below German levels.

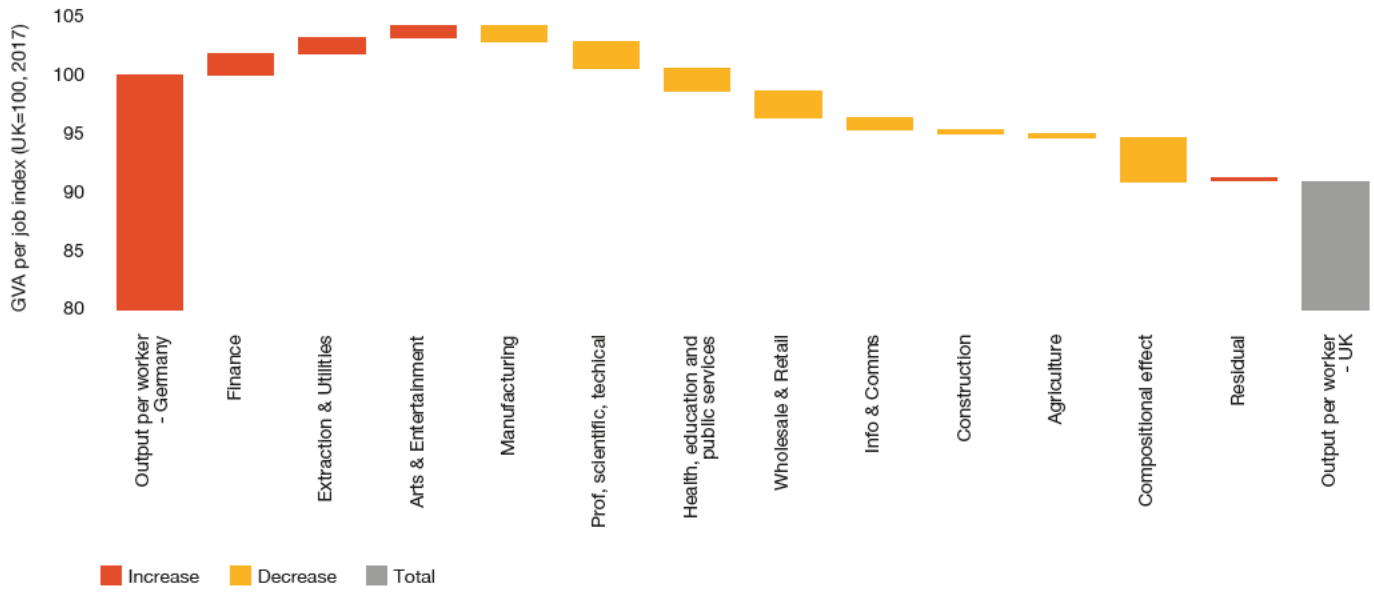
Figure 3.5 shows a decomposition of the per-worker[7] productivity gap between the UK and Germany, splitting the gap into what is attributable to the UK having lower or higher productivity in each sector, which is a function of the size of the gap and the size of the sector; and finally a composition effect showing the net effect of the UK's industrial structure relative to Germany's.

The red bars on the left show the three sectors that make a positive contribution; that is, in which the UK has higher productivity than Germany:

- **Extraction and utilities:** a large part of the extraction sector in the UK consists of North Sea oil and gas, a far higher productivity activity than coal mining, which is the dominant extraction activity in Germany.
- **Finance:** London's role as a major global financial hub means that the UK has a relatively large number of highly remunerated jobs[8] in this sector[9].
- **Arts and entertainment:** the UK is recognised as an international centre of excellence in film, music, TV production and other creative industries[10].

7 For consistency, we have used output per worker, as measurement issues for hours at an industry level are probably even more substantial than for cross-country comparisons.
8 There is a close link between wages and productivity. The most commonly used measure of productivity is Gross Value Added (GVA) per worker. As GVA is by definition the sum of compensation of workers and the operating surplus (a measure of profits) of firms, firms with high average wages tend to have high GVA per head, and so high productivity per head.
9 For more information on the importance of the City to the UK Economy, see https://www.thecityuk.com/research/a-vision-for-a-transformed-world-leading-industry/
10 Recognising the high productivity jobs it can bring, since 2007 the UK Government has operated a Tax Relief scheme for films made in the UK. This was expanded in 2013 to cover high-end TV and animation, and in 2016 to cover video games and children's programming.

Figure 3.5 – Sector decomposition of the gap between UK and German productivity per worker



Note: 'Increase' bars show the contribution of sectors where the UK has a productivity advantage, 'decrease' where Germany has a productivity advantage. Composition effect is calculated by altering German sector employment shares to UK shares, holding productivity in each sector at German levels. The residual is due to convexity.

Source: PwC analysis of Eurostat data

The orange bars in Figure 3.5 show the contribution of the sectors where the UK has a productivity advantage, whilst the yellow bars show the contribution of sectors where Germany has a productivity advantage. Finally, the bar capturing the compositional effect on the right shows the net effect of the differences in industrial structure shown in Figure 3.3. This compositional effect explains around half of the overall gap in productivity between the UK and Germany. The other half can be explained by superior German productivity performance across a range of sectors, outweighing sectors (such as finance) where the UK outperforms.

In comparing UK productivity to Germany, therefore, industrial structure does seem to be an issue. If manufacturing became as important to the UK economy as it is to Germany, then that could raise UK productivity. However, it would depend on what sectors workers relocated from. If workers were moved from relatively low productivity sectors such as retail, there would be a clear productivity gain, but that would be far from easy given the very different skills sets required for workers in high productivity manufacturing sectors like aerospace or pharmaceuticals.

Furthermore, if workers were relocated to manufacturing from high productivity parts of the UK service sector – such as finance or communications (where some workers could have appropriate scientific academic backgrounds) - it is not clear there would be any net productivity gain at all.

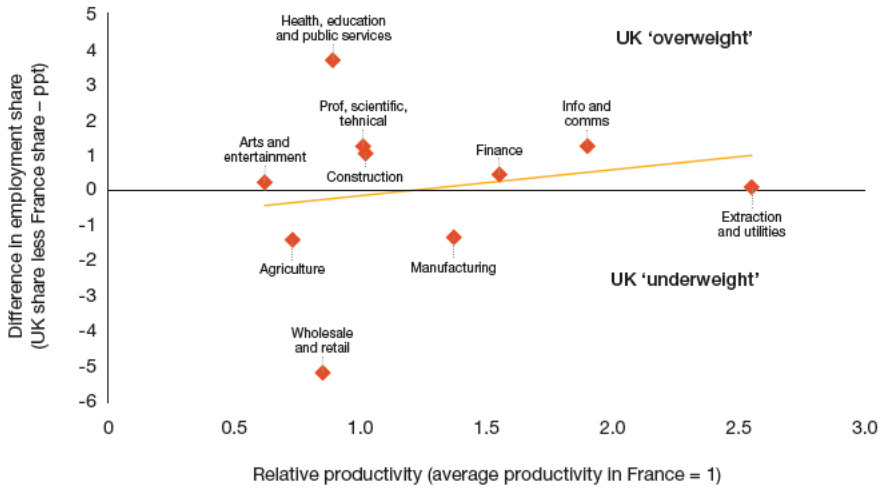
11 This point is explored further in Section 3.2 below.

What about the other countries shown in Figure 3.2? The US has a vastly domestic market, and its leading firms – in technology, aerospace and pharmaceuticals amongst other sectors – produce and bring to market many globally transformative innovations[11]. However, France and Sweden are more similar in size to the UK, and as members of the EU they are more closely aligned on regulation. What explains the productivity gap between the UK and these other two EU countries?

Figures 3.6 and 3.7 show how UK industrial structure differs to, respectively, France and Sweden. Some themes emerge:

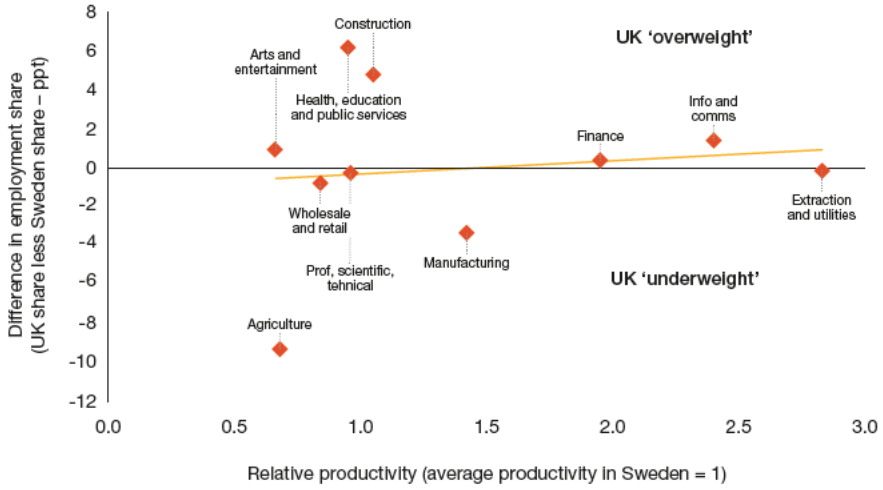
- The UK has a lower share of employment in **manufacturing**; however, the gap is nowhere near as large as with Germany. The effect on productivity is counterbalanced by the UK having a smaller **public sector**, which has below average productivity in each of these countries.
- Compared to France and Sweden, the UK has more employment in **finance and communications**, which are high productivity service industries. However, this is balanced by also having a larger share of employment in **retail and wholesale**, a relatively low productivity industry.

Figure 3.6 – Differences in industrial structure between the UK and France



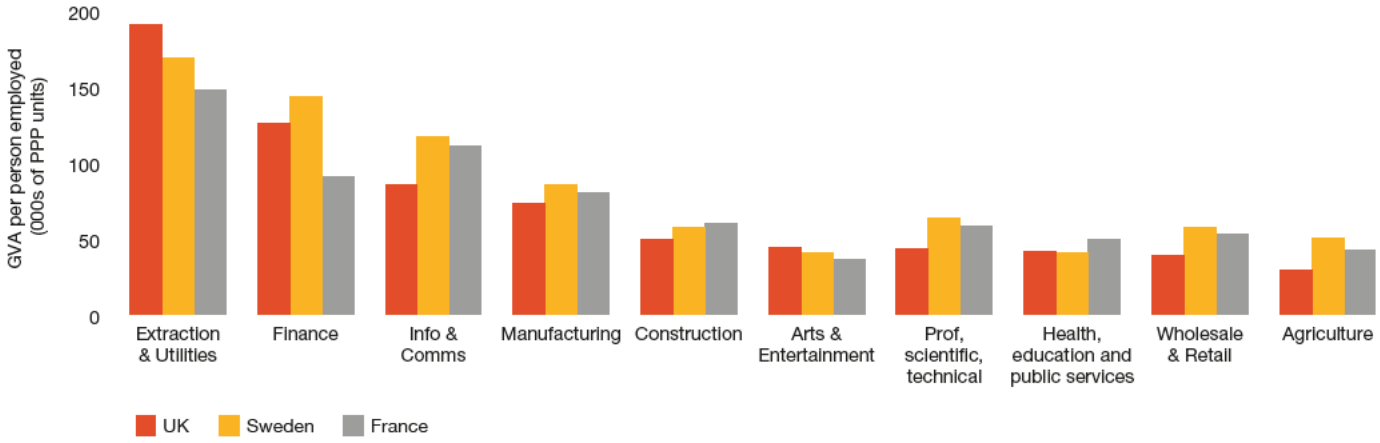
Source: PwC analysis of Eurostat data

Figure 3.7 – Differences in industrial structure between the UK and Sweden



Source: PwC analysis of Eurostat data

Figure 3.8 – Industry level differences in productivity between the UK, France and Sweden



Source: Eurostat

Overall, as suggested by the downward sloping lines in these three charts, industrial composition cannot explain lower aggregate productivity in the UK compared to these countries. If anything, the UK's industrial composition gives it some limited productivity benefit relative to France. Lower UK productivity relative to these economies – which are highly service based economies like the UK – is down to within-industry differences in productivity, as shown in Figure 3.8. The UK does better in extractive industries and arts and entertainment, but across a range of service sector industries it lags behind.

The UK is even outperformed in finance by Sweden, despite having in London a major world financial centre. Sweden scores well on financial innovation, being home to an estimated 400 Fintech firms[12]. However, more than anything Sweden's performance illustrates the power of adoption: widespread adoption of cashless payments and other digital technologies has allowed Sweden to reduce its reliance on labour-intensive branch networks[13].

12 See https://www.investstockholm.com/globalassets/invest/reports/stockholm-fintech-guide.pdf
13 See https://www.swedishbankers.se/en-us/the-swedish-bankers-association-in-english/the-swedish-banking-market/the-swedish-financial-market/ and https://www.mckinsey.com/industries/financial-services/our-insights/disruption-in-european-consumer-finance-lessons-from-sweden

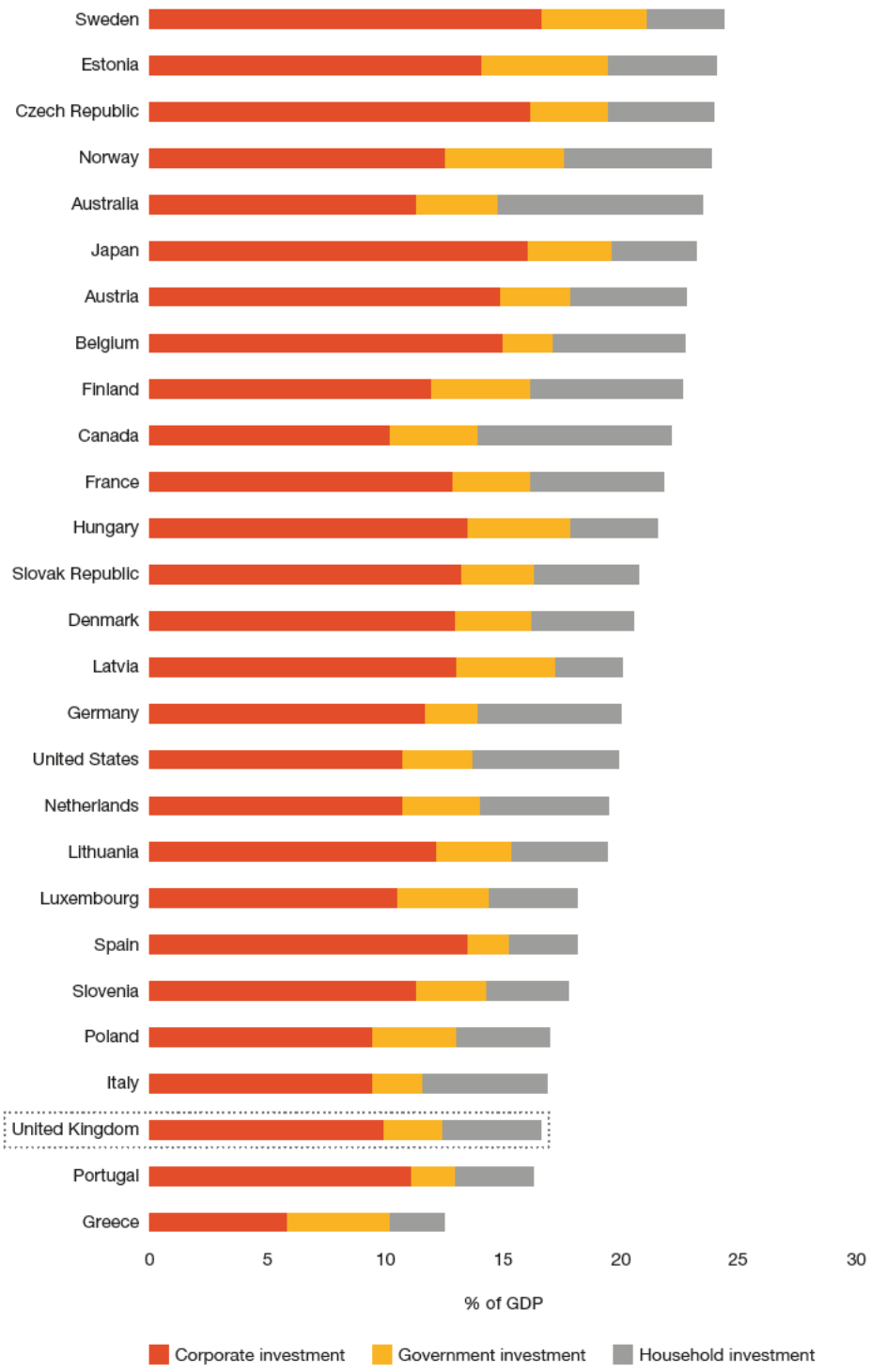
3.2 – What are the underlying drivers of lower productivity levels in the UK?

The analysis above makes clear that within-sector productivity differences are generally the most important factors behind the UK's relatively low overall level of productivity. But what underlies these differences? The first obvious place to look is at differences in capital investment rates.

Investment and capital stock

Figure 3.9 shows the UK's total investment rate – by business, government and households – as a % of GDP, relative to other OECD countries. The UK has the 3rd lowest investment rate in the entire OECD. Part of this is explained by low housing investment; whilst important from a broader social well-being perspective, this has less impact on productivity than corporate or infrastructure investment. However, even judged on business investment alone, the UK ranks close to the bottom of the OECD. National saving rates have been even lower in the UK, such that even with a low investment rate the UK has run persistent current account deficits. National savings rates are correlated with investment rates, so policies that increase UK saving rates could have positive pay off over time. Any increase in saving needs to be balanced against the need to maintain macroeconomic stability and strong employment, so it should be a gradual process over time.

Figure 3.9 – Investment rates for OECD countries

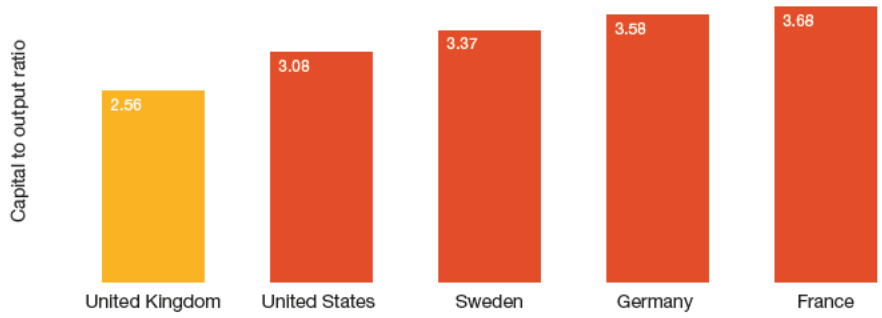


Source: OECD

Investment rates in the UK have been low for a long time, and this has translated into a capital-output ratio that is lower than in many of its peers, as shown in Figure 3.10. Like the productivity gap itself, this is not just the result of differences in industrial structure; the UK has a lower capital-output ratio even than other services-based economies such as France and the US.

In a mechanical sense, this lower capital-output ratio could plausibly explain much of the UK productivity gap. However, rather than being a fundamental explanation in itself, this gap in capital really just brings us back to the question of why UK firms seem to invest less. At a time when innovations such as AI have the potential to transform how goods and services are provided, it is more important than ever for firms and countries to be making the investments necessary to drive improvements in productivity[14]. In this respect, the UK's poor showing in R&D spending is particularly worrying. At just 1.7% of GDP it lags behind the EU average of 2.1%, is lower than Germany and France and barely half the level of Sweden[15].

Figure 3.10 – Capital-output ratios for selected countries



Sources: Eurostat, EUKLEMS

14 PwC research on The Impact of Artificial Intelligence on the Economy has highlighted the transformation new technologies could bring to the way we work: https://www.pwc.co.uk/economic-services/assets/macroeconomic-impact-of-ai-technical-report-feb-18.pdf

15 https://www.ons.gov.uk/economy/governmentpublicsectorandtaxes/researchanddevelopmentexpenditure/bulletins/ukgrossdomesticexpenditureonresearchanddevelopment/2017

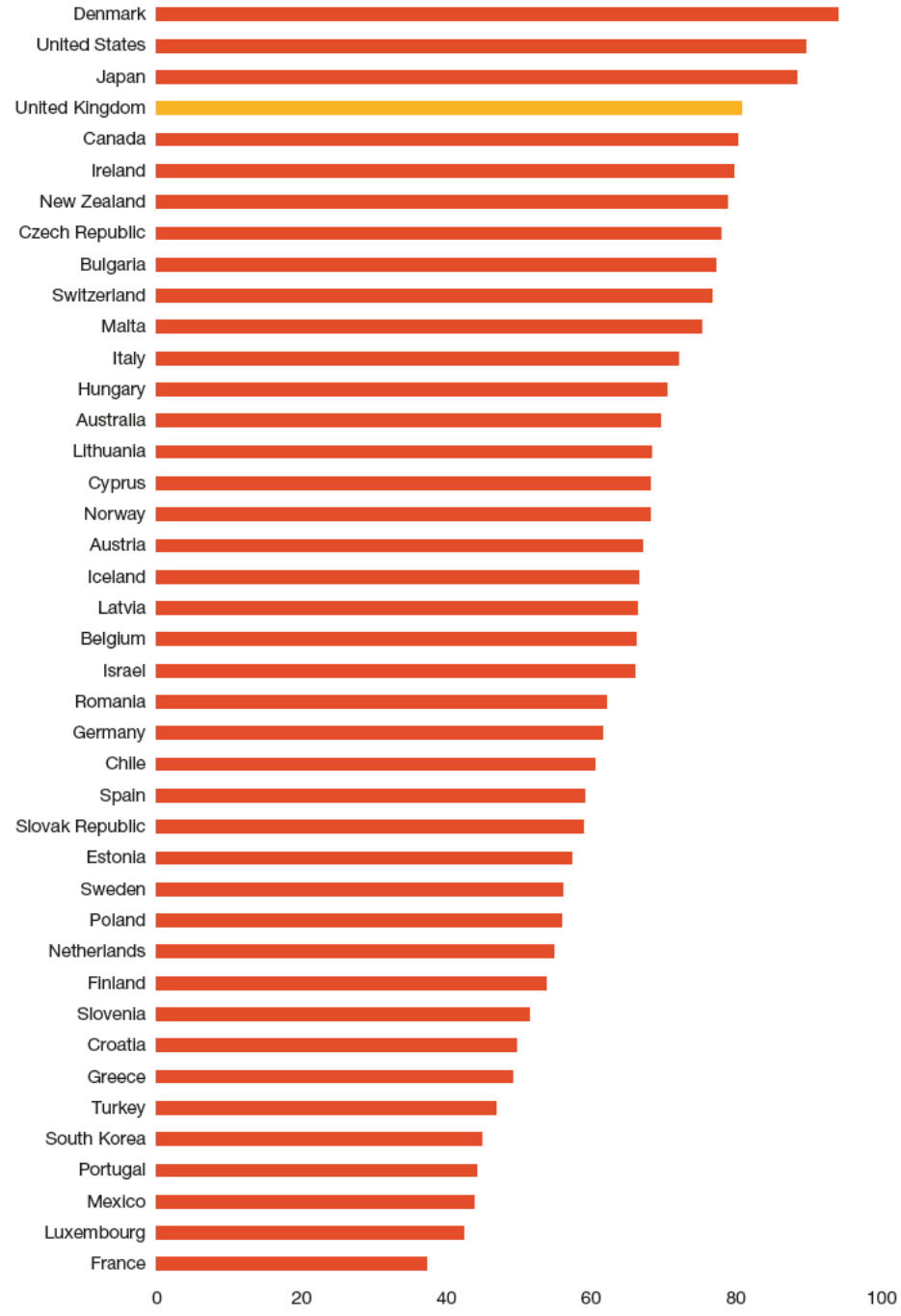
Does UK plc have a labour-intensive business model?

In the long run, growth in labour productivity (driven by investment and innovation) underpins growth in real wages. However, some have argued that the causation runs in both directions. If firms have access to plenty of cheap, flexible labour, then they may have less reason to invest in labour-saving technology that increases productivity. Indeed, at the industry level, it is not clear empirically whether it is productivity or wages that drives the other[16].

The UK certainly has a highly flexible labour market, according to comparative OECD analysis (see Figure 3.11). Although slightly behind the US and Japan, the UK is rated as having the fourth most flexible labour market in the OECD. Together with other factors that have underpinned labour supply[17] – such as increases in the participation rate for older workers[18], higher levels of educational attainment and strong inward migration since the early 2000s – this may have encouraged a relatively labour-intensive business model in the UK. It is certainly true that the years since the crisis have seen a combination of disappointing real wage growth and unexpectedly strong employment growth, consistent with a boost to labour supply.

However, it is not clear that labour market flexibility necessarily leads to low productivity outcomes. Economies such as Denmark and the US combine very high ratings for labour market flexibility with high productivity. Indeed, the overall correlation across OECD countries between labour market flexibility and labour productivity is actually positive. Furthermore, the UK's productivity gap long predates some of the trends – such as higher inward migration and increased participation rates by older workers – which have boosted UK labour supply over the past decade.

Figure 3.11 – OECD index of labour market flexibility, 2019



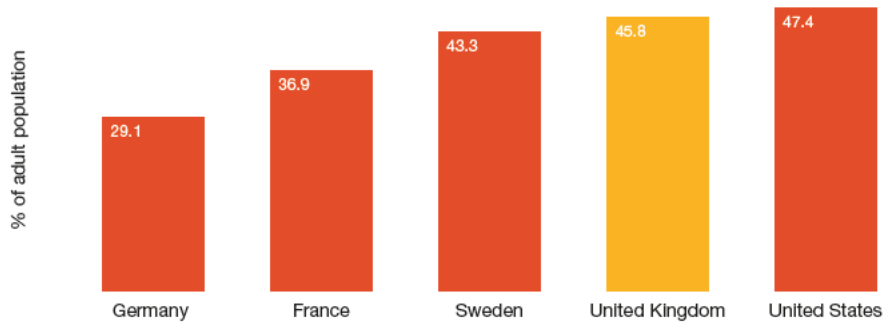
Source: OECD

16 See 'Does productivity drive wages? Evidence from sectoral data'. https://bankunderground.co.uk/2017/03/30/does-productivity-drive-wages-evidence-from-sectoral-data/
17 For example see the speech by Michael Saunders 'The Labour Market'. https://www.bankofengland.co.uk/speech/2017/the-labour-market
18 Although PwC's Golden Worker Index highlights how much further scope for improvement the UK has relative to countries such as Iceland, New Zealand or Israel. https://www.pwc.co.uk/services/economics-policy/insights/golden-age-index.html

Skills and education

Perhaps the key issue is therefore not with quantities of labour relative to capital, but with the quality of labour, particularly the knowledge and skills that workers are able to bring to their jobs. Evidence here is mixed. The UK now has a relatively high share of graduates in the adult population, ahead of other major EU countries and almost matching the US, as shown in Figure 3.12. However, degree level qualifications may not necessarily give workers the skills required for the most productive jobs, and it may be more important how qualified non-graduates are for such jobs. Section 4 includes data on skills gaps which suggests that the workers with the right skills are often in the 'wrong' parts of the UK.

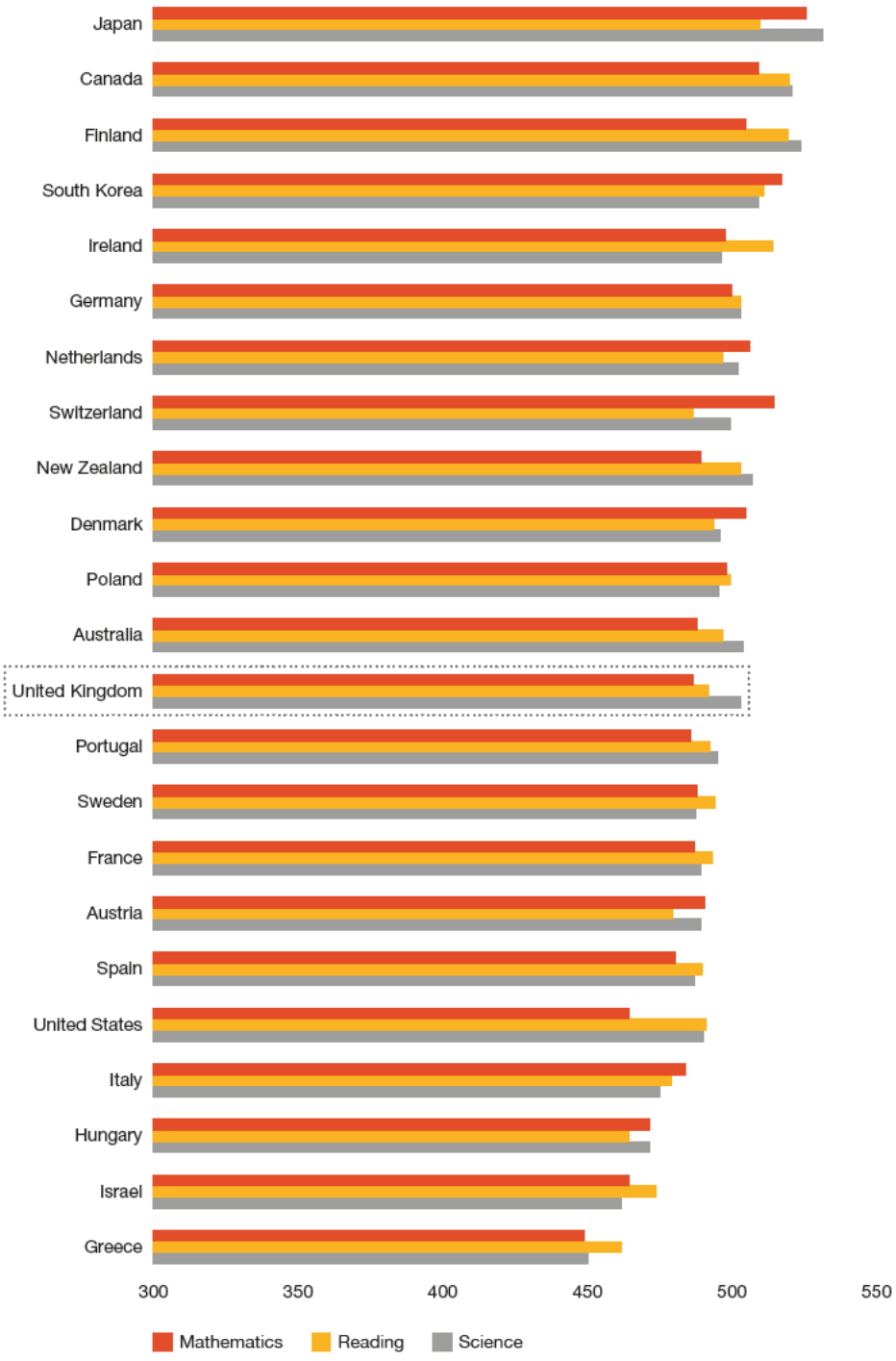
Figure 3.12 – Proportion of adults with tertiary education, 2018



Source: OECD

Another possible measure of interest here is the OECD's PISA exercise, which evaluates school age educational standards in reading, maths and science based on standardised assessments. On these measures, the UK is less impressive, coming mid-table in reading and maths (see Figure 3.13). It scores lower in reading and maths than most of the countries with higher productivity shown in Figure 3.2. However the UK does do better in science, and it should be noted that the US performs worse than the UK in all three subjects and still has high productivity. The US's middling performance also does not appear to prevent it from creating leading innovations in the technology sector, as well as in aerospace, pharmaceuticals and other industries, and – equally importantly – bringing these innovations to market. It may be that the educational performance of the median school student, rather than the top of the distribution, is most important in how it enables diffusion of new technology through the economy. The median student or worker is unlikely to develop a new innovation, but they will need to adapt to using new technologies over the course of their careers. Better educational standards give workers a stronger platform to be able to learn new skills. This point – about the importance of diffusion relative to innovation – is explored in more detail in the following sub-section.

Figure 3.13 – PISA scores in reading, maths and science



Note: Countries are ordered by their average score across Reading, Maths and Science, although this average is not shown on the chart.

Source: OECD

Long tail of relatively low productivity businesses

The importance of diffusion of ideas and techniques for productivity has been highlighted by analysis from the OECD[19] and the Bank of England[20]. In this narrative, the problem with UK productivity is not the lack of high productivity firms: the UK is home to many world-beating companies in sectors like finance, technology, aerospace, pharmaceuticals and business services that have high levels of productivity. Rather, the problem is that the diffusion of ideas, technology and best practice from these 'frontier' firms to the rest of the private sector (and arguably also parts of the public sector, such as the NHS) is too slow. The result is a 'long-tail' of firms with relatively low productivity, which drags down the UK average. This 'long-tail' exists in every economy, but based on analysis of firm-level data, Haldane (2017)[21] finds it to be more acute in the UK than in France or Germany.

In this analysis, the problem is not so much that firms lack the capabilities to create new innovations, but that firms are not effective enough at adopting innovations created by others. R&D spending and innovation tend to be concentrated in a few firms, while most companies undertake little or no R&D activity. The importance of diffusion for productivity can also be seen at the country level; a small country of 10 million people or less is unlikely to account for a very large share of global innovation, but there are small countries – for example Switzerland or Denmark – which have very high levels of productivity. Productivity growth at a global level |must ultimately rely on technological innovation; but the relative level of productivity between firms (or countries) may be driven more by who is better at adopting these innovations.

What would help UK firms adopt technologies and best practice more quickly? Workforce skills are an important factor. Part of this is about educational standards, which give workers the core skills they need to adapt to new technologies. But it is at least as important to have a system that supports and encourages workers to gain new skills throughout their career. School and university age education is important, but 80% of the workers who will be in employment in ten years' time are already in the workforce.

Professor John van Reenen and other researchers have drawn attention to the importance here of **management practices**, and how much these can vary across firms and countries[22]. On their measures, UK firms in manufacturing lag behind their counterparts in the US, Germany, Sweden and Canada. They also find that management practices are positively correlated with worker skill levels, suggesting that improvements in these areas can be mutually reinforcing. If managers can make better use of information to target efficiency gains, and adopt new techniques and technologies, the benefits in productivity for their firms – and the wider economy – can be substantial. Many important new technologies also cut across sectors, and the UK lags behind adoption of technology for enterprise resource planning, supply chain and customer relationship management[23].

Regional disparities

The UK's aggregate productivity gap can be re-cast in regional terms. Productivity in London is around 40% higher than for the UK as a whole, making it more productive on average than any of the comparator countries examined in this article. In contrast, productivity in Yorkshire and Humberside is around 16% below the UK average. Differences at the regional level become even greater at lower levels of disaggregation. The next section of this report explores these differences in regional productivity and what causes them, concluding that if areas with productivity below the UK average could close half of that gap, this could boost UK productivity by almost 4%, closing around half the gap in aggregate output per worker with Germany.

19 For example Andrews, Criscuolo and Gal (2015), Frontier Firms, Technology Diffusion and Public Policy. http://www.oecd.org/economy/Frontier-firms-technology-diffusion-and-public-policy-OECD-productivity-working-papers.pdf
20 Haldane (2017) 'Productivity Puzzles'. https://www.bankofengland.co.uk/speech/2017/productivity-puzzles
21 Ibid.
22 Bloom et al (2012), 'Management practices across firms and countries', NBER Working Paper 17850. https://www.nber.org/papers/w17850.pdf
23 See https://www.kcl.ac.uk/ifis/assets/gearing-up-for-digital-transformation-web.pdf

3.3 – Conclusions and implications for policy and business

The UK has a persistent productivity shortfall relative to other leading advanced economies such as the US, Germany, France and Sweden. Our analysis shows that the industrial structure of the UK is not the primary reason for this shortfall, and strategies that seek to close this gap by promoting any one sector are unlikely to be successful.

A horizontal strategy, which attempts to improve productivity performance across a range of sectors, is a more promising approach. This needs to have a number of elements:

- Higher standards in the formal education system, and a lifelong upskilling strategy that supports workers to acquire new skills – particularly digital skills – throughout their career, both in and out of employment. AI and other new technologies are likely to transform the workplace in coming decades and having an adaptable workforce will be key if UK firms are to reap the potential productivity rewards of these technologies.
- Firms themselves can upskill, investing in digital transformation and making greater use of data to improve management practices, allowing them to adopt new methods more quickly and bring their products to market more effectively.
- A better investment environment, with government ensuring the country has the modern infrastructure it needs, and a financial system which supports private investment by firms of all sizes.

Together with more regionally balanced growth, these could all help the UK reduce or close the gap with other advanced economies. In the next section, we look further at how this could be achieved through policies aimed at closing regional productivity gaps across the UK.

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