Office for
Budget Responsibility

Briefing paper No.9

Forecasting productivity

November 2025

Contents

Supplementary information and charts and tables data are available on our website

Executive summary

1.1 In our November 2025 *Economic and fiscal outlook* (*EFO*), we have revised down our central forecast for underlying productivity growth – that is the medium-term growth in trend output per hour worked – from 1.3 to 1.0 per cent. This comprises a revised total factor productivity (TFP) growth contribution of 0.8 percentage points – down from 1.1 percentage points in our March 2025 *EFO* – and an unchanged contribution from capital deepening of 0.2 percentage points. Trend productivity growth is now forecast to rise from 0.3 per cent in 2024 and 0.7 per cent in 2025 to reach 1.0 per cent in 2030. Combining this with our unchanged forecast for potential labour supply growth of 0.5 per cent yields a revised estimate of medium-term potential output growth of 1.5 per cent, down from 1.8 per cent in our March forecast.

1.2 While the outlook for productivity growth is one of our most important variables in terms of its impact on the public finances, it is also one of the most uncertain. To illustrate the uncertainty around this central forecast, we present an upside scenario where more of the recent weakness in productivity growth was due to temporary shocks, the fading of which alongside a larger boost from artificial intelligence (AI) pushes potential productivity growth up to 1.5 per cent. We also present a downside scenario where potential productivity growth stays around its post-financial crisis average of 0.5 per cent over the forecast period.

1.3 Our revised productivity judgement is not prompted by any particular government policy decisions. Rather, we have based it on assessments of:

- the evidence on the UK's productivity performance over long periods and comparisons with other major advanced economies;
- the changing picture painted by successive vintages of official data regarding the underlying productivity of the economy and the impact of successive shocks in the form of the financial crisis, Brexit, Covid, and the energy crisis; and
- the underlying structural changes which have a bearing on the past and future productive potential of the UK economy, including global trade policy, demographic trends, the changing sectoral composition of UK output, and the rise of AI.

1.4 Looking at the long sweep of history, it is evident that there are points when the trajectory of productivity growth changes. Sudden sharp rises or falls in productivity growth, often associated with shocks, are typically followed by some reversion to that era's productivity trajectory. Between these eras, productivity performance can be very different. But it is much easier to identify these eras and turning points looking backward than it is to know where the UK economy stands now and where it is headed in future. There has clearly been much

lower growth in productivity in the UK since the financial crisis in 2008. Further shocks have hit the UK economy since then. Productivity growth averaged 2.1 per cent in the decade before the financial crisis (1998 to 2007), 0.6 per cent in the decade after the financial crisis (2010 to 2019), and 0.4 per cent between 2020 and 2024.

1.5 We have made several previous downward revisions to our trend productivity forecast in response to shocks and the growing period of weak productivity growth since 2008. The 0.3 percentage point revision we have made to medium-term productivity growth is significant, but not as large as the 0.5 percentage point revision we made in November 2017. Comparing the forecast change in five-year cumulative trend productivity growth, there are five other EFOs where we have made downward revisions of a similar or larger magnitude.

1.6 Our central forecast for medium-term productivity growth in March 2025 of 1.3 per cent assumed that recent weak productivity growth was partly due to the temporary impact of shocks over this period. As the impact of those shocks waned, we thought that TFP growth would pick up to roughly halfway between its pre- and post-financial crisis averages.

1.7 The limited further downward revision in this forecast partly reflects the latest official estimates of productivity growth. Based on earlier vintages of data, measured productivity growth appeared to be picking up towards our previous medium-term forecast assumption, with relatively strong growth in output per hour worked of 0.6 per cent in 2020, 1.5 per cent in 2021, and 0.9 per cent in 2022 at the time of our March 2025 forecast. But the productivity picture has become clearer and weaker more recently. In particular:

- Problems with the quality of Office for National Statistics (ONS) data, especially the Labour Force Survey (LFS), previously clouded the picture on the performance of UK productivity since Covid. LFS sample sizes have now partially recovered, and the survey's labour supply estimates have converged with those from other sources, such as payroll data. We therefore have a more consistent picture of developments in hours worked, output, and productivity since 2020.

- The latest ONS data indicate that productivity fell by 0.5 per cent in 2023 and a further 0.8 per cent in 2024.[1] This means that measured productivity growth has remained extremely weak several years on from the major shocks of Covid and the energy crisis and a decade-and-a-half on from the financial crisis. Alternative measures of productivity, adjusted to account for the issues with the LFS mentioned above, indicates productivity growth over the past two years has been no higher than the average following the financial crisis – a period during which the effect of recent shocks should have mostly faded.

1.8 With the passage of time, and several years after the Covid and energy price shocks, this continued weakness of productivity means it becomes less and less likely that the kind of substantial and rapid bounce back in productivity growth rates that the UK has witnessed in the wake of previous shocks is going to materialise over the medium term. In addition to

[1] Unless otherwise specified, in this paper we define productivity as GDP per hour worked. There have been significant downward revisions to data over this period compared to earlier estimates. At the time of our October 2024 forecast, based on data up until the second quarter of 2024, productivity in 2023 was estimated to be flat on a year earlier and we expected it to also be flat in 2024.

recent data on economy-wide productivity, a number of underlying structural changes in the UK and global economy point to more persistent weakness in productivity growth relative to the period before the financial crisis:

- UK and global productivity growth between the early 1990s and mid-2000s was likely boosted by increases in **trade** as a share of GDP, or 'trade intensity.' Recent geopolitical developments mean this is unlikely to continue. We expect UK and global trade intensity to fall in the coming years, as a result of the recent resurgence in global protectionism on top of the enduring effects of Brexit, and for this to weigh on productivity growth. We have not changed our assessment that Brexit will reduce the level of UK productivity by around 4 per cent after 15 years.

- Other **structural shifts** within the UK economy, some linked to the reversal in global economic integration mentioned above, are also likely to act as a continued drag on productivity growth into the future. Specifically, there has been a slowdown and falling contribution to productivity growth from the financial, manufacturing, and information and communications technologies (ICT) sectors since the mid-2000s which is unlikely to fully reverse or be offset by accelerating growth in other sectors.

- Finally, there are a set of **underlying trends** whose combined effect should weigh on productivity growth. Population ageing is likely to increase employment in the health and social work sectors, which have relatively low levels of productivity. Our analysis suggests that AI will make a smaller contribution to productivity growth over the next five years than the ICT revolution did before the financial crisis. Finally, climate change may have significant negative impacts on productivity growth. Relatedly, the transition to net zero may weigh on productivity in the short-to-medium term before potentially becoming a more positive factor over the longer term.

1.9 But we still expect productivity growth to pick up from its recently depressed rate over the forecast period. This acceleration over the medium term reflects our judgement that:

- Part of the recent weakness in productivity growth reflects temporary, though persistent, factors arising from the series of major **shocks** that the UK economy has experienced over the past 15 years. As the lingering effects of these shocks continue to fade, we still expect this to lead to a pick-up in productivity growth but, for the reasons set out above, we expect this bounce-back to be less sharp than previously judged.

- We also expect **artificial intelligence** to begin having a positive effect on productivity growth within the forecast period. There is significant uncertainty around both the size and timing of this effect – our central estimate is that it will build over time as adoption grows to reach an estimated 0.2 percentage points by our forecast horizon.

1.10 The downward revision to our medium-term productivity growth forecast takes us closer to other UK external forecasts and other official forecasters in comparable countries. Our November 2025 forecast of 1.0 per cent is at the top end of the range of external forecasts for the UK. It is in the middle of the range of official forecasts for comparator countries.

2 Introduction

2.1 Our judgement about the growth rate in the potential output of the UK economy is one of the most important drivers of our medium- and long-term economic and fiscal forecasts. *Briefing paper 8: Forecasting potential output – the supply side of the economy* described how we divide our potential output forecast into three components:

- **Labour supply:** the total amount of hours that can be sustainably worked in the economy. This is a function of the 16+ population, the potential participation rate, the equilibrium unemployment rate, and trend average hours worked.[1]

- **Capital deepening:** this is a function of past levels of investment in tangible and intangible productive assets, the rate at which investment depreciates or is retired, plus the flow of new investment that adds to the stock.[2]

- **Total factor productivity (TFP)**: a measure of the efficiency with which labour and capital can be combined in the production process. It is a function of the state of global technology and knowledge, and the degree to which that technology and knowledge is effectively used domestically. TFP is the focus of this paper.

2.2 For ease in making historical and international comparisons (as capital stock data is not available for all countries and all time periods), the capital deepening and TFP components are often combined into a single **labour productivity** measure, which can be thought of as the amount of output produced per unit of labour. Productivity itself can be measured in several ways:

- **output per worker**: total output produced in a given period divided by the average number of workers;

- **output per hour**: the total output produced in a given period divided by the total number of hours worked by those workers; and

- **output per quality-adjusted hour of labour input**: total output divided by the average number of hours worked adjusted for changes in workforce skills and experience.

2.3 We concentrate on output per hour in our economy forecast and in this paper. It is important to distinguish between measured output per hour and potential output per hour. Measured output per hour can be influenced by short-term fluctuations in how intensively

[1] See Box 2.3 and 4.5 of our March 2024 *Economic and fiscal outlook*, and Rawlings, J., *Forecasting participation trends: the cohort model*, 2025.
[2] See Suresh, N., R. Ghaw, R. Obeng-Osei, and T. Wickstead, *OBR Discussion paper No. 5: Public investment and potential output*, 2024 for our analysis on the impact of government investment on capital deepening.

labour and capital are used – that is for changes in capacity utilisation. For example, during downturns, firms may retain staff but operate below full capacity, temporarily lowering output per hour. Our estimate of potential output per hour aims to capture underlying productivity trends after accounting for cyclical fluctuations in output per hour.

2.4 We derive our estimate of TFP growth by subtracting capital deepening (proxied by growth in the gross capital stock per hour worked multiplied by the capital share of income) from potential output per hour worked growth. TFP accounts for the bulk of productivity growth in most advanced economies, making up around two-thirds of total growth in productivity in the UK over the past quarter century. The remaining third comes from an increase in capital per worker (capital deepening). We do not explicitly adjust output per hour for labour quality due to significant challenges in directly measuring labour quality and to its relative lack of variation over our standard five-year forecast period.

2.5 While TFP is the most important driver of productivity, it is also the hardest to forecast. This is partly because it can be measured only indirectly, as the residual after subtracting the change in the inputs of labour and capital from the change in the output they produce. It is also because growth in TFP depends on the pace of technological advances and their diffusion across and within countries, which are inherently unpredictable.

2.6 The remainder of this paper provides our latest assessment of the outlook for potential productivity of the UK economy.

- **Section 3** reviews the UK's **post-2008 productivity performance** from historical and international perspectives.
- **Section 4** discusses, in the light of these trends, the UK **productivity outlook** from three perspectives: time series modelling, structural drivers, and the sectoral composition of future productivity growth.
- **Section 5** describes how this has informed the **potential productivity central forecast and alternative scenarios** in our November 2025 *Economic and fiscal outlook*. It also considers how our central forecast compares to our previous forecasts, other UK forecasters, and official forecasts for other advanced economies.
- **Annexes A, B, and C** provide more detail on the **time series models** used in Section 4, and on the impact of **AI** and **trade** on productivity.

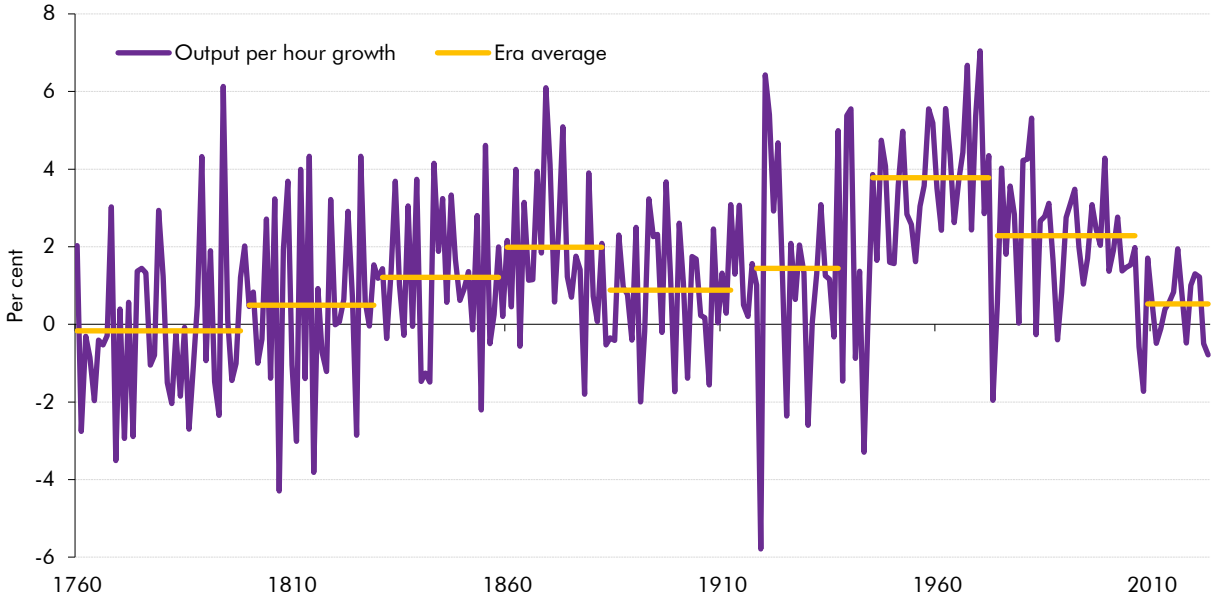
2.7 *Briefing paper 10: Accounting for the supply-side effects of policy* has been published alongside this paper. It reviews the lessons from recent experience with the application of our more transparent approach to accounting for the impact of government policies on potential output (including productivity) and proposes refinements to our approach in the light of this experience.

3 The UK's productivity performance

Long-run UK productivity growth

3.1 UK output per hour growth over the past 250 years displays successive cycles of both rapid productivity growth and prolonged slowdowns (Chart 3.1).[1] While long-run data are subject to limitations and should be interpreted with caution, this history provides context for the persistent weakness in productivity observed since 2008 and illustrates the inherent challenges in forecasting these cycles.

Chart 3.1: Output per hour worked growth over two-and-a-half centuries



Note: Data up to 1971 are from the Bank of England. Data after this point are from the ONS.
Source: Bank of England, ONS, OBR

3.2 In Chart 3.1, we have divided the history of UK productivity growth into broad eras to reflect these cycles, during which average annual productivity growth has ranged from as low as zero to as high as 3¾ per cent:

- Productivity growth averaged around zero from the 1760s until around 1800.
- Between 1800 and 1830, productivity growth picked up a little to average ½ a per cent a year, but accelerated more significantly after 1830, averaging nearly 1¼ per cent until 1860.

[1] Crafts, N., and T. C. Mills, *Is the UK productivity slowdown unprecedented?*, National Institute Economic Review, 2020.

- This was followed by the peak impact of the First Industrial Revolution, where productivity growth averaged 2 per cent a year from around 1860 into the 1880s.

- The next era was the 'Long Depression' of the late 19th century, which saw a prolonged slump in productivity growth until World War I, during which growth averaged under 1 per cent a year.

- Following World War I, annual productivity growth recovered to 1½ per cent a year, despite sharp falls in output per hour during the Great Depression in 1931.

- In the period after World War II, the UK experienced its 'golden age' of productivity growth – between 1946 and the early 1970s output per hour worked growth averaged 3¾ per cent, its highest sustained rate.

- This began to decline from the mid-1970s but still averaged around 2 per cent a year until the financial crisis in 2008.

- Following the financial crisis, productivity growth has averaged ½ a per cent a year, its slowest average rate since the 1830s.

3.3 The pace of technological innovation and its diffusion across and within economies has been the key driver of productivity growth in advanced economies.[2] And the eras described above tend to be closely related to these technological developments. But productivity growth has also been affected by other structural developments including changes in trade openness, large shocks, and sectoral shifts in the composition of the UK economy, the impacts of which are explored further the rest of this section and in Section 4.

3.4 High productivity growth from the 1830s into the 1880s was driven by the technological innovations associated with the First Industrial Revolution – in particular, the widespread adoption of steam power in manufacturing and transportation via railways.[3] However, growth rates slowed in the 1880s and 1890s, once the potential of these technologies had largely been realised. This coincided with the Long Depression, when deflation and stagnation across Europe and North America dampened investment and weighed on productivity growth.[4] These trends reversed when productivity picked up in the early 1900s and again following World War 1.[5] The acceleration in growth was driven by the technologies of the Second Industrial Revolution – notably, electrification, advances in chemicals, and the internal combustion engine which transformed production processes, transportation, and consumption.[6]

[2] Mokyr, J., *The Lever of Riches: Technological Creativity and Economic Progress*, Oxford, 1992.
[3] Crafts, N., *Steam as a General Purpose Technology: A Growth Accounting Perspective*, The Economic Journal, 2004.
[4] Musson, A. E., *The Great Depression in Britain, 1873-1896: a Reappraisal*, The Journal of Economic History, 1959.
[5] Broadberry, N., *The Productivity Race: British Manufacturing in International Perspective, 1850-1990*, New York: Cambridge University Press, 1997.
[6] Ibid.

3.5 The ensuing post-World War II boom of the 1950s and 1960s was driven by Britain's catch-up to the US productivity frontier through the increased adoption of technologies such as mass production techniques, petrochemicals, and automobiles.[7] It was helped by increases in global trade following World War II and a reversal of the protectionism of the 1930s.[8] Productivity growth briefly moderated in the 1970s as earlier technological gains were exhausted and macroeconomic shocks, such as the oil crises of the 1970s, constrained growth.[9] However, productivity growth remained relatively strong by historical standards, this time supported by the information and communication technology (ICT) revolution, including the widespread adoption of computers, the internet, and wireless mobile technologies which continued into the early 2000s.[10]

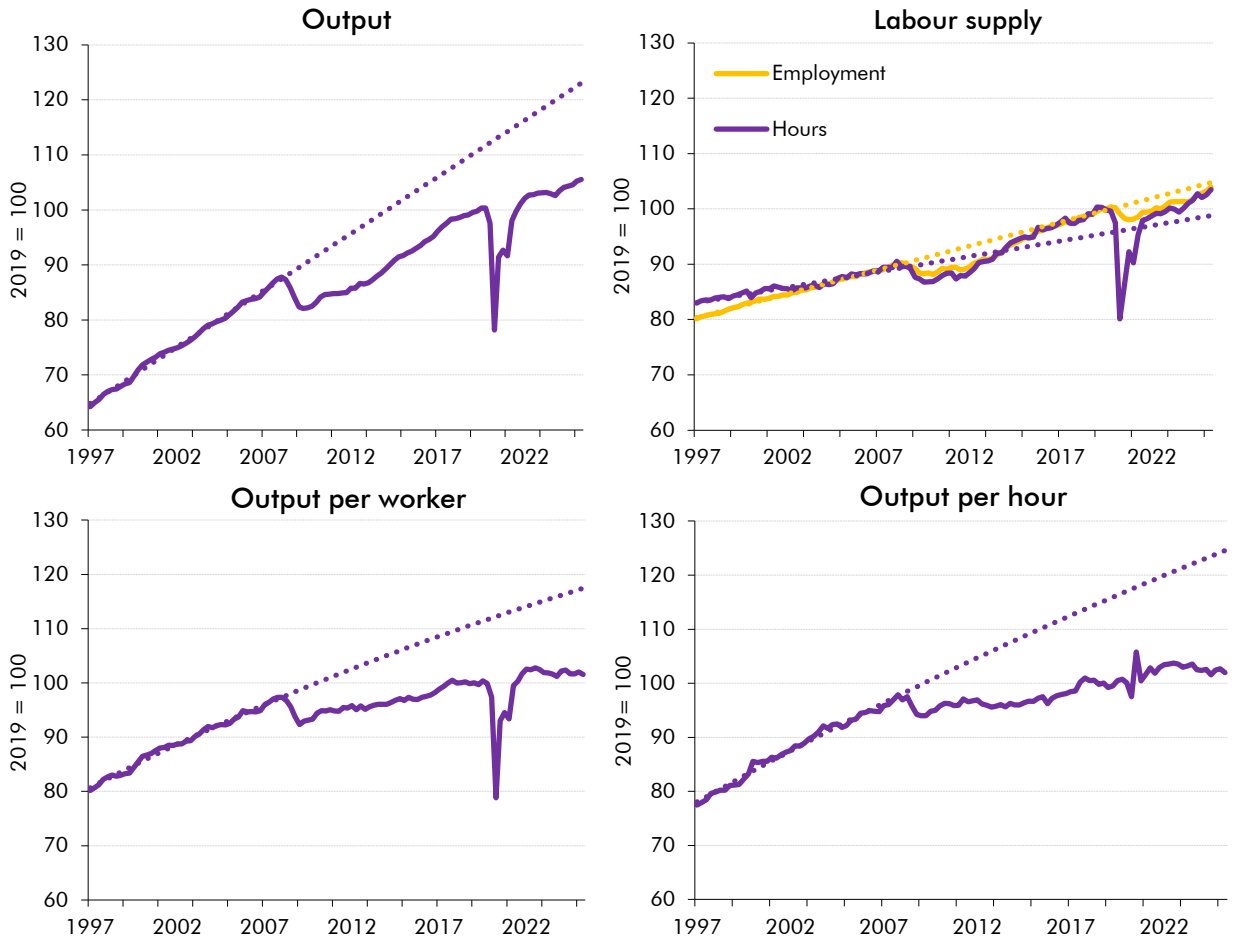
UK productivity growth since 2008

3.6 Since the 2008 financial crisis, the UK has experienced the largest slowdown in the growth of output per hour since the start of the First Industrial Revolution.[11] In the decade prior to the financial crisis (1998 to 2007), growth in output per hour worked averaged 2.1 per cent.[12] In the decade following the financial crisis, (2010 to 2019), productivity growth averaged 0.6 per cent. And since 2020, productivity growth has remained subdued, averaging only 0.4 per cent and falling in each of the last two years based on measured output per hour data from the ONS. While productivity data since the start of Covid has been affected by measurement difficulties, productivity growth over the past two years has been no higher than the average following the financial crisis after adjusting for these issues (see Box 3.1).

3.7 Taking the whole period since 2008, the level of output now sits around 14 per cent below its pre-crisis trend (Chart 3.2, top-left panel). While employment has only been slightly below its pre-crisis trend, average hours are above their pre-crisis trajectory, leaving growth in overall labour supply (total hours worked) around 5 per cent above its previous trend (Chart 3.2, top-right panel). As a result, the level of output per worker is now 14 per cent below, and the level of output per hour 18 per cent below, their respective pre-crisis trends (Chart 3.2, bottom panels).[13]

[7] Ibid.
[8] Crafts, N., *Britain's Relative Economic Performance, 1870-1999,* Institute of Economic Affairs, 2002.
[9] Crafts, N., and Toniolo, G., *European Economic Growth, 1950-2005: An Overview*, C.E.P.R. Discussion Papers, 2008.
[10] Van Ark, B., et al., *The Contribution of ICT-Producing and ICT-Using Industries to Productivity Growth: A Comparison of Canada, Europe, and the United States*, International Productivity Monitor, 2003.
[11] Crafts, N., and T. C. Mills, *Is the UK Productivity Slowdown Unprecedented?*, National Institute Economic Review, 2020.
[12] For consistency, through the rest of this paper we select 1998 to 2007 as the pre-financial crisis period, in order to compare the decade preceding and following the crisis. This also aligns with the availability of data for cross-country and sectoral comparisons.
[13] The last LFS reweighting exercise left a discontinuity in published total hours estimates in early 2019. To reduce this discrepancy, we have recalculated outturn for total hours using reweighted ONS estimates for employment which have been modelled back to the 2011 census point to remove the discontinuity.

Chart 3.2: Output, labour supply, and productivity



Note: Dashed series are 1997-2008 trend lines.
Source: ONS, OBR

Box 3.1: Interpreting productivity data since the pandemic

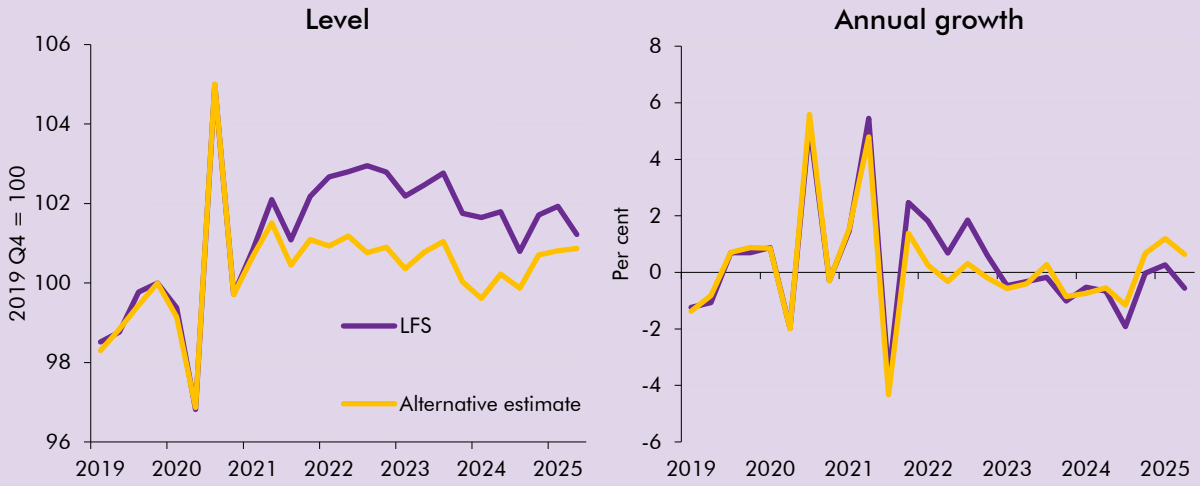
Problems with the quality of ONS data, especially with the Labour Force Survey (LFS), have clouded the picture on the recent performance of UK productivity. This is best illustrated by the revisions to the 2023 ONS measure of output per hour growth, which is based on the LFS. The first estimate of +0.2 per cent has been revised down to -0.5 per cent in the latest estimate, reflecting the incorporation of higher estimated growth in the labour force. Now that LFS response rates have partially recovered and its labour supply estimates have converged with those from other sources, such as payroll data, we now have a better understanding of developments in hours worked, employment and, in turn, productivity since 2020.

The latest official data indicate that productivity growth remains weak despite being several years on from the major shocks of Covid and the energy crisis, and a decade-and-a-half on from the financial crisis. The latest ONS data indicate that output per hour fell by a further 0.8 per cent in 2024.

While official data may overstate the weakness in 2023 and 2024, alternative data sources are consistent with continued recent subdued productivity growth.[a,b] According to LFS-based ONS data, average annual productivity growth between the second quarter of 2023 and the second quarter of 2025 averaged -0.5 per cent (Chart A). Alternative productivity estimates, which account for the sample bias issues with the LFS by using wider labour market evidence, suggests productivity growth over the same period has been no higher than the average following the financial crisis. This measure uses an estimate for employment based on the average of three sources: i) Resolution Foundation estimates which draw on real-time information (RTI) payroll employee and self-employment tax data, ii) the Bank of England's underlying employment measure, and iii) the workforce jobs survey. This is then multiplied by the LFS estimate of average hours worked, adjusted slightly to account for some known LFS-related biases, to derive total hours worked.[c] Regardless of the measure, productivity growth has remained weak over the last couple of years when the effects of Covid and the energy price spike should have mostly faded (Chart A). And cumulative productivity growth since the start of 2020 on this alternative measure is even slightly weaker than on the official measure.

Overall, both the official and alternative measures of productivity show the post-financial crisis weakness in productivity growth has continued in recent years. With the passage of time, this continued weakness means that a substantial and rapid rebound in UK productivity growth, such as those observed following previous shocks, appears less likely.

Chart A: Output per hour, official and alternative measures



Note: The alternative estimate uses employment based on three sources: i) HMRC RTI payrolls-based estimate used by the Resolution Foundation, ii) the Bank of England's underlying employment measure, which we have aligned to the level of LFS employment in the fourth quarter of 2019 and iii) the workforce jobs survey. This is then multiplied by the LFS estimate of average hours worked, adjusted to account for some potential LFS-related biases, to derive total hours worked.
Source: Bank of England, ONS, Resolution Foundation, OBR

[a] Bank of England, *Monetary Policy Report*, August 2025.
[b] Christensen, E., and G. Thwaites, *Trend setters: what is the OBR's forecast for trend productivity growth and why it matters so much for the Budget*, Resolution Foundation, 2025.
[c] Analysis on average hours worked by the Bank of England as noted in its August 2025 *Monetary Policy Report*.

3.8 Part of the reason for the UK's poor productivity growth since 2008 is a series of shocks – some global and some specific to the UK – which have weighed on productivity growth. These include:

- The **financial crisis** which reduced productivity growth across advanced economies, and had a larger impact in the UK than many other countries due to the relatively large size of our financial services sector.
- The UK's **exit from the European Union** in 2021, following the 2016 referendum, which we continue to estimate will reduce the level of productivity by around 4 per cent within 15 years from leaving.[14]
- The **Covid pandemic** which caused a sharp drop and then rise in measured productivity during 2020, although productivity returned to slightly above its pre-pandemic level in 2021.
- The 2022 **European energy crisis**, which reduced the productivity of energy-intensive sectors by raising their input costs while wholesale energy costs were high. The UK was likely harder hit by this than other G7 economies given its reliance on gas as its principal source of energy.[15]

3.9 Alongside these shocks, other factors have contributed to the productivity growth slowdown, though the precise causes are subject to ongoing debate. In Section 4, we explore some of the structural and sectoral drivers of the slowdown in the context of the productivity outlook. Box 3.2 summarises the academic literature on the post-2008 productivity slowdown, some of which appear less, and some more, plausible with the passage of time.

Box 3.2: Literature review – drivers of the post-2008 productivity slowdown

Many factors have been put forward as contributors to the post-2008 slowdown in productivity growth, on top of those detailed in this paper, and the debate around their relative importance is ongoing.[a] In this box we summarise some of these explanations.

Early explanations for the post-2008 productivity growth slowdown pointed to temporary factors, whose effects would fade, including:

- labour hoarding, where firms kept workers but used them less efficiently to avoid the cost of rehiring them when demand recovered;[b]
- the persistence of unproductive 'zombie firms', which were prevented from going bankrupt by very low interest rates, inhibiting the productivity-boosting process of creative destruction;[c] and

[14] See Box 2.4 in March 2024 *Economic and fiscal outlook*.
[15] See Box 2.1 in March 2023 *Economic and fiscal outlook* and Chapter 3 of July 2022 *Fiscal risks and sustainability* report.

- economic scarring, where productivity takes longer to recover after workers experience persistent unemployment or firms delay investment.[d, e]

Measurement issues were also examined as possible exaggerators of the slowdown – either by overestimating productivity growth prior to the financial crisis or underestimating it since – but can only account for part of the overall decline.[f, g, h]

As economic conditions normalised, these temporary factors and measurement difficulties could not plausibly account for the persistent weakness in productivity growth and other related indicators (such as average earnings and tax revenues). It now appears more likely that the slowdown was also underpinned by structural changes with impacts lasting into the medium term. The literature points to factors including long-term underinvestment by UK firms and reduced business dynamism, where lower business creation and firm turnover limits competition-driven growth.[i, j, k]

The uncertainty around the drivers of the slowdown makes it difficult to know the extent to which the weakness will persist. This means that there is great uncertainty around any central forecast for productivity. However, given that UK productivity growth remains subdued some 17 years on from the financial crisis, a strong rebound – like those seen after previous shocks – appears increasingly unlikely. The balance of evidence suggests that deep-rooted structural factors will continue to drag on growth over our forecast period.

[a] Martin, J., *The UK Productivity Slowdown: A Review of the Timing, Magnitude, and Drivers*, International Productivity Monitor, 2025.
[b] Pessoa, J., and J. Van Reenen, *The UK Productivity and Jobs Puzzle: Does the Answer Lie in Wage Flexibility?*, The Economic Journal, 2014.
[c] McGowan, M., et al., *The Walking Dead? Zombie firms and productivity performance in OECD countries*, Economic Policy, 2018.
[d] Aikman, D., et al., *The scarring effects of deep contractions*, Bank of International Settlements, October 2022.
[, e] Reinhart, C., and K. Rogoff, *This Time is Different: Eight Centuries of Financial Folly*, Princeton University Press, September 2009.
[f] Bean, C., *Independent review of UK economic statistics: final report*, HM Treasury, 2016.
[g] Coyle, D., *The Measure of Progress: Counting What Really Matters*, Princeton University Press, 2025.
[h] Goldin, I., et al., *Why is productivity slowing down?* Journal of Economic Literature, 2024.
[i] Van Reenen, J., and X. Yang, *Cracking the productivity code: an international comparison of UK productivity*, International Productivity Monitor, 2024.
[i] Fernald, J., and R. Inklaar, *The UK Productivity "Puzzle" in an International Comparative Perspective*, Oxford Bulletin of Economics and Statistics, 2025.
[k] Andrews, D., et al., *The Best versus the Rest: The Global Productivity Slowdown, Divergence across Firms and the Role of Public Policy*, OECD, 2016.

An international comparison of the post-2008 slowdown

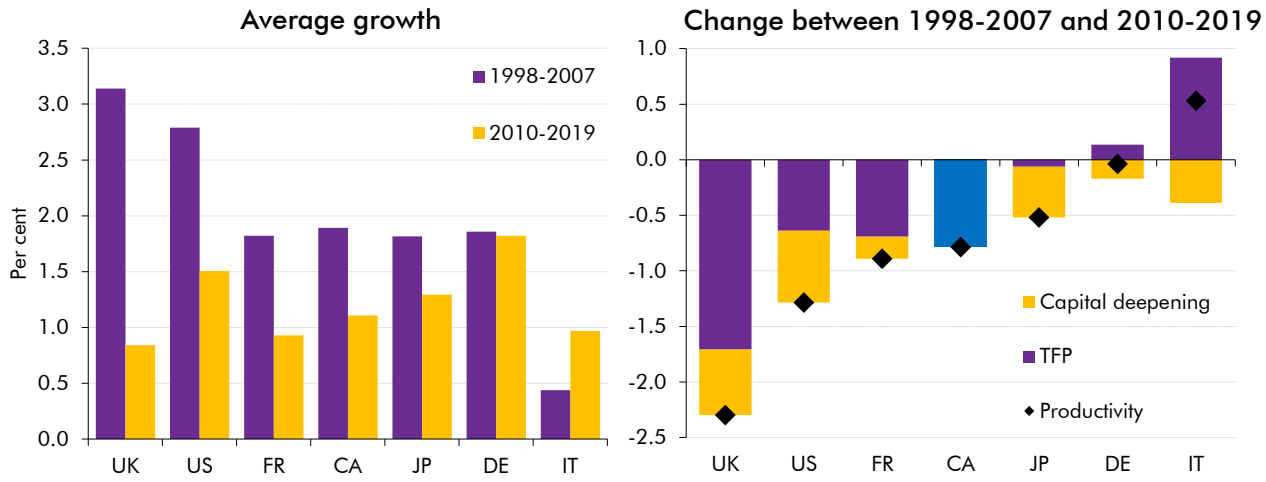
3.10 While most major advanced economies experienced a productivity slowdown following the financial crisis, the UK saw the biggest fall in productivity growth among G7 economies. Comparing productivity growth across G7 countries during the ten years before and after the crisis (Chart 3.3), average annual productivity growth in the UK fell by 2.3 percentage points from 3.1 per cent before the financial crisis to 0.8 per cent after.[16] On average, productivity growth among other G7 countries fell by 0.5 percentage points between these

[16] These comparisons are made using EUKLEMS & INTANProd data and so UK figures are not directly comparable to the ONS estimates used above due to methodological differences. 1998-2007 and 2010-2019 have been chosen to allow for a reasonable length of time before and after the financial crisis. The results are similar using different time periods, but it should be noted that most economies were still experiencing recovery growth in 2010, and so the post crisis slowdown is more pronounced and widespread if measured from 2011 instead of 2010. Alternative methodologies can yield varying estimates of the relative contribution of capital deepening and TFP.

two periods. As a result, the UK went from having the fastest productivity growth in the G7 in the period leading up to the financial crisis to the slowest productivity growth in its aftermath.

3.11 Looking at the composition of the post-financial crisis productivity slowdowns across the G7, a slowdown in TFP growth accounted for three-quarters of the post-financial crisis decline in UK productivity. The remainder was accounted for by a slowdown in capital deepening. The rest of the G7 experienced broadly similar declines in capital deepening, but smaller declines in TFP. In the cases of Italy and Germany, TFP growth actually increased in the period following the financial crisis. Labour quality has had only a small impact on the change in productivity growth over this period in all G7 countries, so for simplicity we incorporate labour quality into TFP. For a more detailed discussion of labour quality, see Section 4.

Chart 3.3: Growth in output per hour worked across the G7



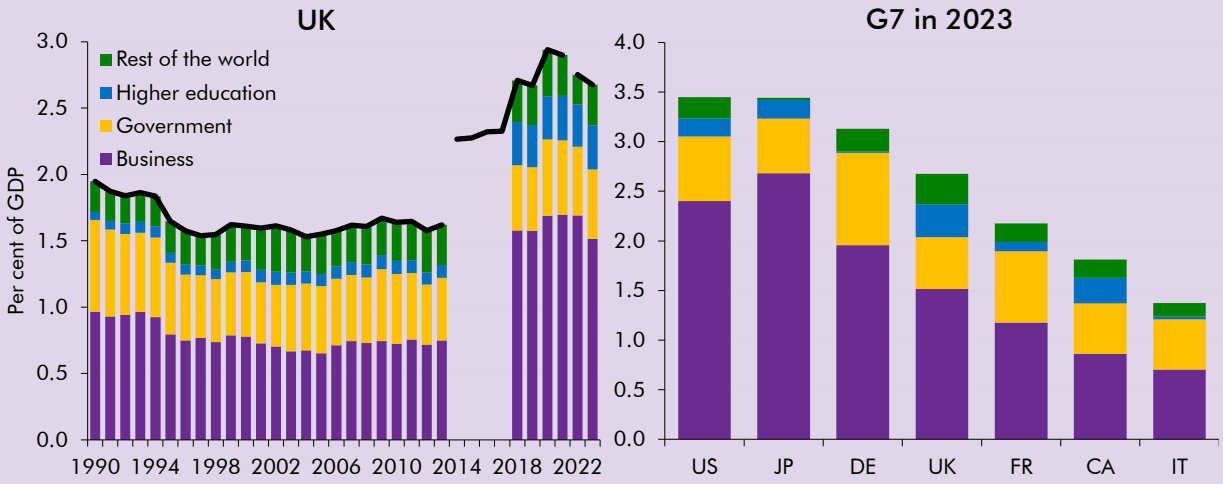
Note: Productivity is defined as output per hour worked and data is for the market sector excluding agriculture for all countries except Canada and Japan where the whole market sector has been used. A decomposition of the productivity slowdown is not available for Canada. TFP includes changes in labour quality.
Source: EUKLEMS & INTANProd, Statistics Canada

3.12 These data suggest that both global and domestic factors have contributed to the UK's weak productivity growth, though the precise drivers of its underperformance relative to other G7 economies remain subject to debate. Commonly cited explanations for the outsized hit to productivity growth experienced by the UK include underinvestment relative to other G7 economies, the relatively large share of low-productivity service sectors in the UK economy, and a series of shocks that have hit the UK harder than its peers (see paragraph 3.7 and Box 3.2 for more details). However, one area where the UK has performed relatively well is research and development investment, which has remained resilient since the financial crisis and is broadly in line with the G7 average (see Box 3.3).

Box 3.3: The impact of research and development on productivity

This box summarises our assessment of the impact of research and development (R&D) on productivity growth in the periods before and after the global financial crisis. Relatively low investment in R&D has been cited as a contributing factor to the UK's weak productivity growth in recent decades.[a] However, UK R&D investment as a share of GDP is near the G7 average of 2½ per cent and has increased modestly over the past decade from around 2¼ per cent (Chart A).[b]

Chart B: Research and development investment



Note: There are breaks in the UK R&D series in 2014 and 2022 reflecting methodological changes.[c]
Source: OECD

The businesses and government sectors together account for three-quarters of R&D investment in the UK (Chart A). At the Spending Review 2025, the Government committed £22.6 billion to R&D in 2029-30. This is a 13 per cent real-terms increase in expenditure compared to the £16.4 billion spent in 2022-23, a rise of around 0.2 per cent of GDP. Within the business sector, more than half of all UK R&D investment is in the health sector – this compares to around only 20 per cent at a global level.[d] Higher education also plays a notable role in the UK, including through the world-leading life sciences 'golden triangle' of London, Oxford, and Cambridge.

Domestic R&D spending can affect productivity through two channels. First, it makes it possible to produce new goods and services that make more effective use of existing resources. Second, it can boost productivity by making it easier to adopt foreign technologies.[e] While there is broad consensus that R&D contributes positively to productivity growth, estimating the precise magnitude and timing of its impact remains challenging. This is partly because increases in R&D spending alone are not sufficient to drive productivity gains. It needs to be complemented by intangible assets such as skills and intellectual property, and new technologies need to be adopted widely across the economy.[f] The productivity impact also depends on the historical accumulation of R&D, with gains typically materialising only after a critical mass is reached and often with long lags.[g] As a result, estimates of its impact vary. For example, the National Institute of Economic and Social Research (NIESR) finds that a 10 per cent increase in the UK R&D capital

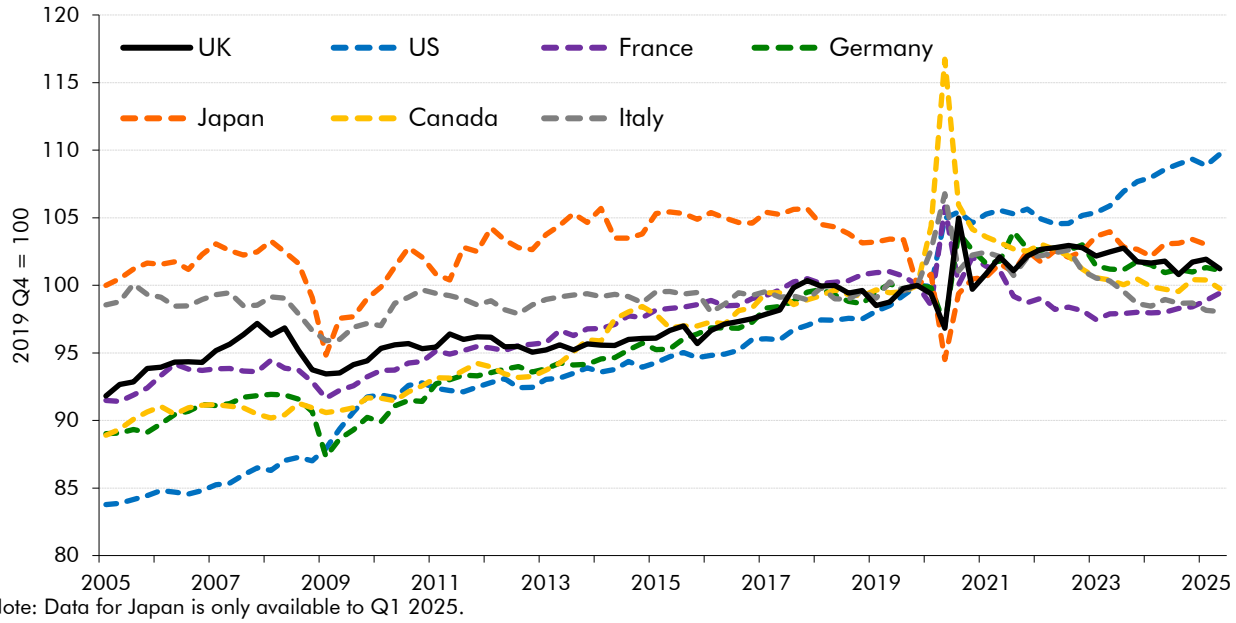
stock raises productivity by 0.4 per cent in the short run,[h] while others estimate a long-run effect of 1.9 per cent.[i]

According to an estimate from the 2025 release of EUKLEMS & INTANprod, average growth in the R&D capital stock was higher in the decade after the financial crisis at 1.8 per cent, than in the decade before at 1.2 per cent. Given this and the size of the estimated effects of changes in the capital stock on productivity, we believe it is unlikely that R&D has played a major role in the post-financial crisis slowdown in UK productivity. And given the broad outlook for R&D spending and the likely lags involved, we do not expect it to have a significantly different impact on productivity growth over the forecast than in recent years.

[a] Indraccolo, L., *Bridging the gap: Understanding the UK-US Productivity Decoupling*, IMF Selected Issues Paper, 2025.
[b] The ONS has revised its method for measuring R&D over time, including in the Blue Book 2025, which has resulted in breaks in the data series which limit the ability to analyse longer-term trends in the data.
[c] First series break refers to changes including extending coverage of small businesses and introducing a new data source to capture R&D performed in the higher education sector. These changes saw measured R&D increase significantly between 2013 and 2014. Sector-level data between 2014 and 2017 are not available. Second series break refers to Blue Book 2025 changes.
[d] European Commission, EU Industrial R&D Investment Scoreboard, 2024.
[e] Bravo-Ortega, C., and A. Garcia Marin, *R&D and Productivity: A Two Way Avenue?*, World Development, 2011.
[f] Rogers, M., *R&D and productivity: using UK firm-level data to inform policy*, Empirica 37, 2010; Coyle, D., B. van Ark, and J. Pendrill, *The Productivity Agenda*, The Productivity Institute, 2023.
[g] D'Artis, K. and S. Boriss, *R&D and Non-linear Productivity Growth of Heterogeneous Firms*, Swiss Federal Institute of Technology Zurich, 2012.
[h] Aitken, A., et al., *From ideas to growth - Understanding the drivers of innovation and productivity across firms, regions and industries in the UK*, National Institute of Economic and Social Research, 2021.
[i] Mamatzakis, E., et al., *Does R&D, human capital and FDI matter for TFP in OECD countries?*, Economics of Innovation and New Technology, 2019.

3.13 It is now 17 years on from the start of the financial crisis, most Covid-hit sectors are back to pre-pandemic levels of activity, and European gas prices have fallen significantly from their 2022 peak. Yet productivity growth has remained sluggish in most G7 economies, other than the US. Since 2019, the ONS estimates UK productivity – based on the LFS – to have grown by 1.2 per cent, compared to 9.7 per cent in the US and 0.3 per cent in other G7 economies excluding the US and UK. Box 3.1 discusses an alternative measure of UK productivity which account for LFS measurement issues – this alternative suggests UK productivity has grown by only 0.9 per cent over this period.

Chart 3.4: Output per hour worked in the G7



Note: Data for Japan is only available to Q1 2025.
Source: BEA, BLS, European Commission, OECD, ONS

Conclusion

3.14 Since the 2008 financial crisis, the UK has experienced its most significant and long-lasting slowdown in productivity growth since the Industrial Revolution. The UK's productivity slowdown has also been greater than in any other major advanced economy. The UK slowdown has been driven primarily by a decline in total factor productivity with a smaller contribution from capital deepening. Shocks from the financial crisis, Brexit, the pandemic, and the energy crisis seem likely to have had a disproportionate impact on the UK economy relative to other G7 economies and could help explain some of this slowdown.

3.15 Until recently, Covid, the energy price shock, and data measurement issues have all clouded the underlying productivity picture. As explained in Box 3.1, we think that there is now a clearer picture on the performance of productivity growth since 2020. Adjusting for measurement issues in the LFS, productivity growth has continued to be weak since the middle of 2023 – a period in which the effects of Covid and the energy price shock should have mostly faded. The evidence presented in this section highlights the scale and persistence of the UK's productivity slowdown since the financial crisis, and the extent to which it has diverged from historical and international patterns. The next section considers the UK's productivity outlook over the medium term, drawing on structural, sectoral, and time series modelling perspectives to inform our forecast.

4 The productivity outlook

4.1 In this section, we examine the prospects for UK productivity over our five-year forecast period. Since there is no single comprehensive model to explain the evolution of productivity growth, we look at different types of evidence to inform our forecast, considering the following questions in turn:

- What does **time series analysis** suggest about the potential trajectory of productivity growth and how can it help to disentangle the effects of short-term shocks from longer-term trends?
- What do recent evidence and projected developments in the **structural drivers of productivity** imply for the medium-term outlook?
- What might these trends and other factors mean for productivity growth given the past – and projections of the future – **sectoral composition** of the UK economy?

Time series modelling

4.2 One way to assess the past and potential future trajectories of productivity is to examine what statistical patterns of its past movement suggest about the future. Untangling the extent to which shocks have had temporary versus permanent effects is a longstanding challenge for forecasters. We use time series estimation techniques to help inform this by identifying the medium-term properties of productivity growth, allowing for structural breaks and mean-reverting autoregressive behaviour. Annex A provides a detailed explanation of the modelling framework and estimation methods used.

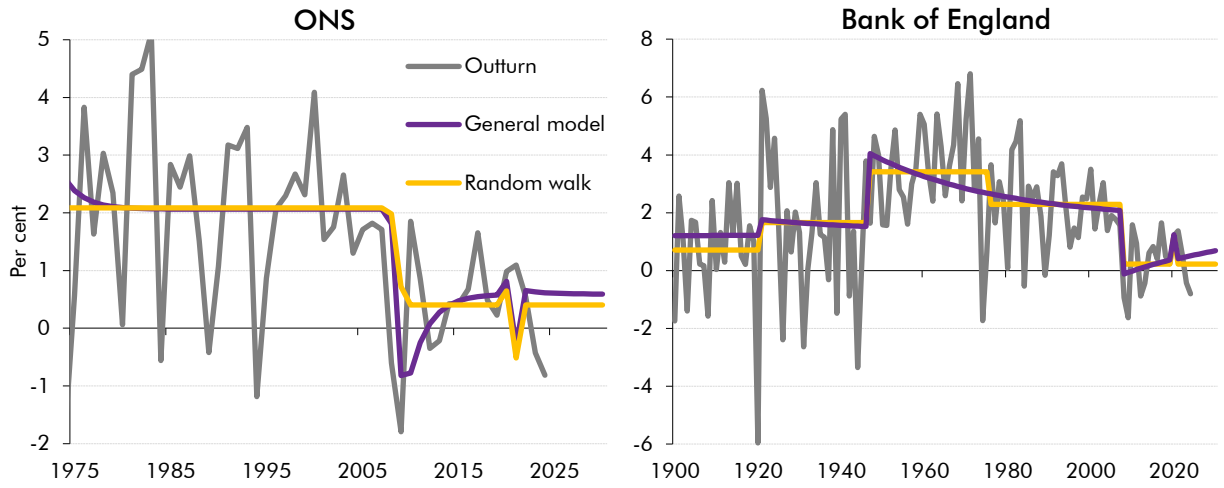
4.3 We defined productivity as output per hour, consistent with our forecasting framework. For robustness, we produced models using two datasets. First, we used quarterly ONS data from 1971 to 2024, where output is defined as real GDP, as it is in our forecasts. Separately, we estimated models using the Bank of England's 'A millennium of macroeconomic data' long-run dataset from 1760 to 2016 to assess whether capturing very long-run dynamics in productivity yields different results. Here, output is defined as GDP at basic prices, which measures the value of goods and services produced, excluding product taxes but including subsidies. To extend the Bank of England dataset to 2024, we assume that productivity growth matches the ONS measure over 2017 to 2024.

4.4 We specified two types of models. First, we specified a random walk with time-varying drift (referred to below as 'random walk'). This approach assumes productivity growth fluctuates around a rate – the drift – which is allowed to change at specific points in time. Importantly, this specification implies that the level of productivity remains permanently lower after a

negative shock, with no mean reversion to some pre-shock path. Second, we specified a trend stationary model, with a trend that can vary across sub periods but has mean reversion within sub periods (referred to below as 'general model'). This approach allows for mean reversion in the level of productivity, implying there is 'catch-up' following a negative shock. The general models outperform the random walk models, pointing to some mean reversion in the level of productivity (see Annex A for more detail).

4.5 The models can be used to produce forecasts of future levels of productivity. By 2030, the four models generate broadly consistent patterns with underlying annual productivity growth that ranges from 0.2 to 0.7 per cent, with a simple average of 0.5 per cent (Chart 4.1).

Chart 4.1: Time series models, output per hour growth forecasts



Note: The ONS series defines output as real GDP. The Bank of England series defines output as GDP at basic prices. The Bank of England data runs until 2016. To extend the Bank of England data to 2024, we assume growth matches the ONS measure over this period.
Source: Bank of England, ONS, OBR

4.6 The average result of 0.5 per cent is similar to the post-financial crisis period, and notably weaker than the 2.1 per cent seen in the preceding decade. All the models show a clear structural break around the 2008 financial crisis, highlighting a significant shift in productivity dynamics during this period (discussed in more detail in Annex A). Looking ahead over the next decade, these projections rest on the assumption that the post-financial crisis weakness in trend productivity growth persists indefinitely.[1] This means the 0.5 per cent figure is potentially at the pessimistic end of a plausible range of outcomes since it rests on the assumption that those factors that created a lower trend rate of growth of productivity since 2008 remain unchanged, even though it is clear from historical evidence that periods of unusually high or low levels of growth have not lasted forever.

4.7 The time series models also do not explicitly account for future technological breakthroughs such as the emergence of transformative technologies like AI which could also add to

[1] To generate this figure, we assume the financial crisis structural dummy remains active, or in the case of general model (4) as described in Annex A – the post-2008 trend remains unchanged. This is partly a simplifying choice, as switching the dummy during the forecast period would alter the relevant coefficient. However, it also mechanically implies that the post-2008 weakness in productivity persists across the forecast horizon. In turn, this arguably generates conservative forecasts for productivity and should not be considered in isolation.

productivity growth. In the next two sub-sections, we therefore examine whether the structural drivers of productivity and the sectoral composition of the UK economy are likely to mean productivity growth will continue around its post-financial crisis average or make a partial or full return to its pre-financial crisis rates.

Structural drivers of productivity

4.8 Structural drivers of productivity refer to long-term trends that shape the underlying capacity of an economy to produce output efficiently. Unlike cyclical influences – which reflect short-term fluctuations due to demand – or temporary shocks, structural drivers affect the economy's productive potential over extended periods. While AI is likely to provide a boost, we judge that other structural factors such as falling trade intensity, increasing demand for health services, climate change, and a slowdown in labour quality growth mean that productivity growth is unlikely to return to its pre-financial crisis rates. In the rest of this section, we analyse these and other factors that are likely to be among the most notable structural drivers of productivity growth in the UK in the coming years.

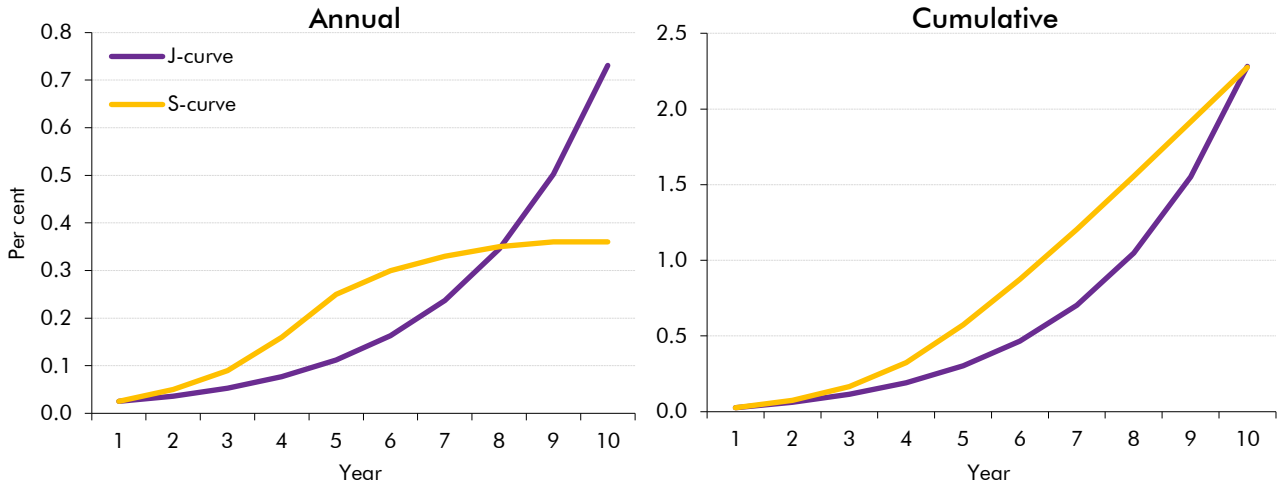
Technological innovation

4.9 Technological innovation is an important driver of long-term productivity growth, in particular, the development of general purpose technologies (GPTs). GPTs are innovations that have broad applicability across the economy and the potential to reshape production processes. Historical examples include the steam engine, electricity, and the internet. The diffusion and adoption of such technologies can raise efficiency and output, although the timing and scale of these gains are highly uncertain. The ICT revolution is generally regarded as the last GPT and having significantly boosted productivity growth in the decade before the financial crisis.

4.10 AI is increasingly recognised as the next GPT. While its impact is highly uncertain, our central estimate is that it will gradually boost annual productivity growth, reaching around 0.2 percentage points by the forecast horizon. Full methodological details, and scenarios around our central estimate, are provided in Annex B. This would mean that AI would not contribute as much to productivity growth over the next five years as the ICT revolution did in the period before the financial crisis. Our estimate of the impact of AI is derived using a task-based framework which assesses the extent to which productivity will be boosted by the automation of current work activities through the use of AI and is informed by the external literature. We project that around 40 per cent of UK occupations are exposed to AI, with most occupations to be complemented by AI rather than substituted.

4.11 To translate this exposure into a productivity impact, we apply a set of assumptions – including the feasibility of AI adoption and expected cost savings from automation – drawn from the literature. Our central estimate is for AI to boost the *level* of UK productivity by around 2½ per cent over the next decade. The exact contribution over our forecast period depends on the shape of the path to that 2½ per cent figure and where the UK currently sits on that path, both of which remain uncertain. It is likely that the impact would build gradually over time due to adoption lags and the need for complementary investments. Two potential paths for these gains are J- and S-curves, with illustrative effects shown in Chart 4.2. But overall, we expect that the effect on annual productivity growth will be around 0.2 percentage points by our forecast horizon, which lies between the J and S-curves.

Chart 4.2: Illustrative estimated impacts of AI on UK productivity

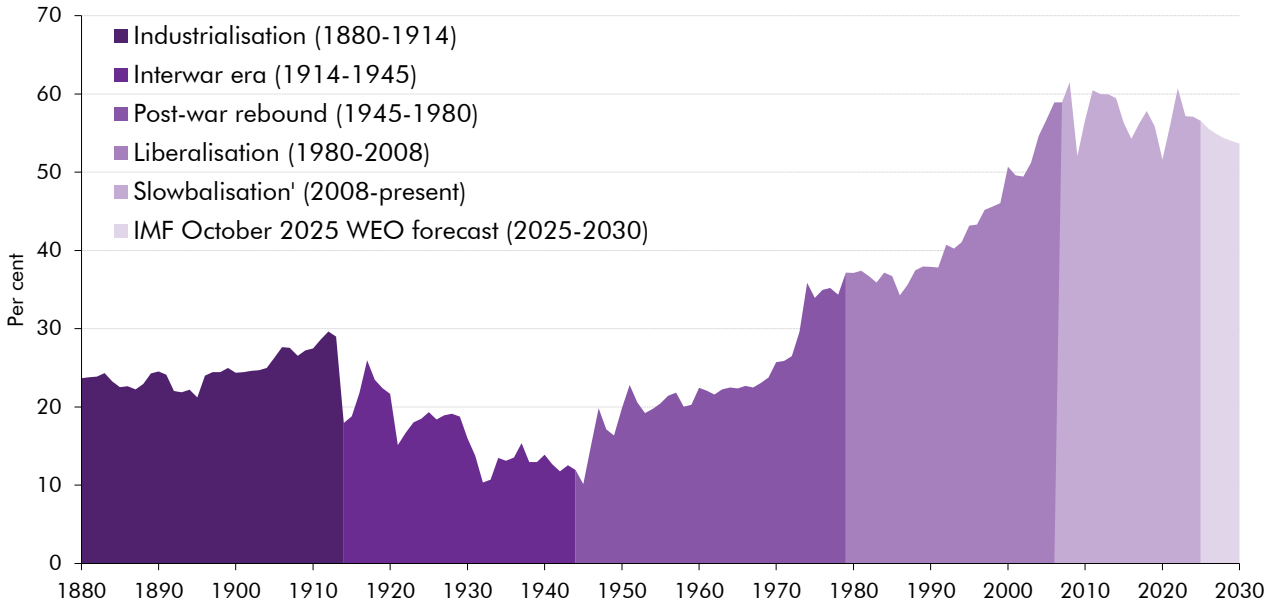


Source: OBR

Trade intensity

4.12 Higher trade intensity generally boosts productivity by fostering greater competition, allowing countries to specialise in production where they are relatively more efficient, enabling firms to realise economies of scale by selling into larger markets, and facilitating diffusion of technological innovations across borders. UK and global productivity growth between the early 1990s and mid-2000s was likely boosted by increases in trade as a share of GDP. However, it is likely that global and UK trade intensity will fall in the coming years as a result of the recent rise in global protectionism and the enduring effects of Brexit on the UK (Chart 4.3). We expect these factors will more than offset the impact of the post-Brexit trade deals that the UK has signed. Given recent global trade policy developments and the importance of the link between trade and productivity, we provide more detail in Annex C.

Chart 4.3: Global trade intensity (trade volumes as a per cent of GDP)

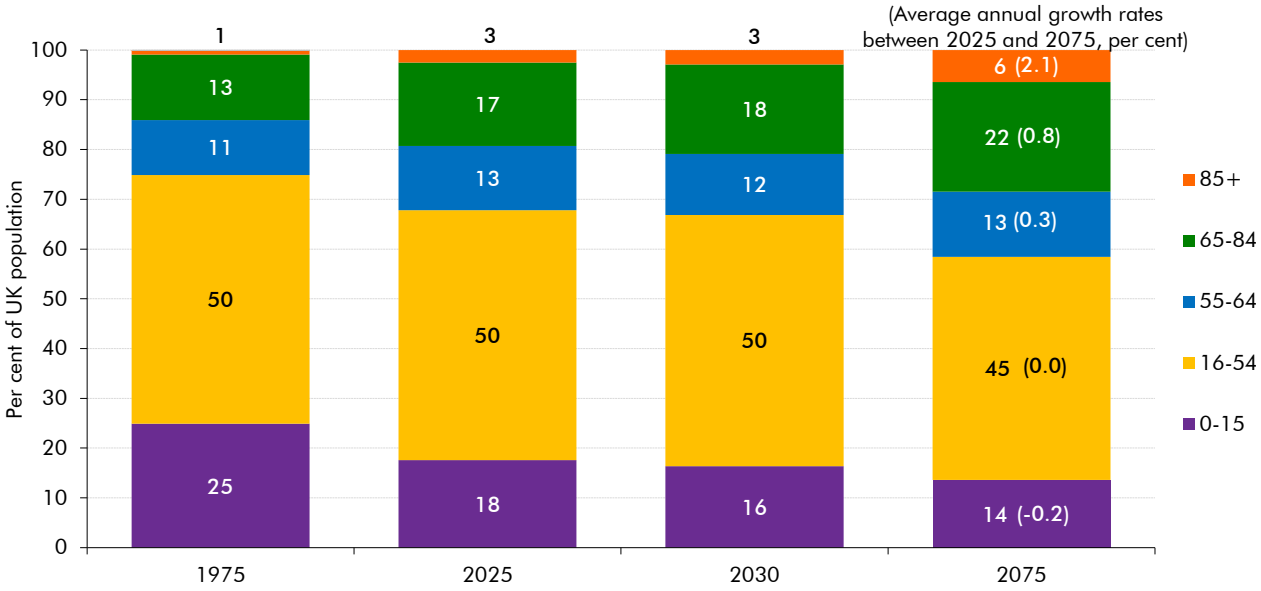


Source: IMF, PIIE

Population ageing and health & social care demand

4.13 A declining birth rate and a modest rise in life expectancy means that the UK population is set to age significantly over the next 50 years (Chart 4.4). The share of the population aged 65 and over has increased from 14 per cent in 1975 to 19 per cent in 2025. It is projected to reach 21 per cent in 2030 and 28 per cent by 2075. And while the proportion of the population of working age (16–64) has risen from 61 to 63 per cent between 1975 and 2025, the share of the working age population is projected to fall to 58 per cent in 2075.

Chart 4.4: Population age structure



Note: 2075 is from the *Fiscal Risks and Sustainability Report* 2024 population projection. Average annual growth rate is for the share of the population.
Source: ONS, OBR

4.14 There is the potential for both direct and indirect impacts from population ageing on productivity:

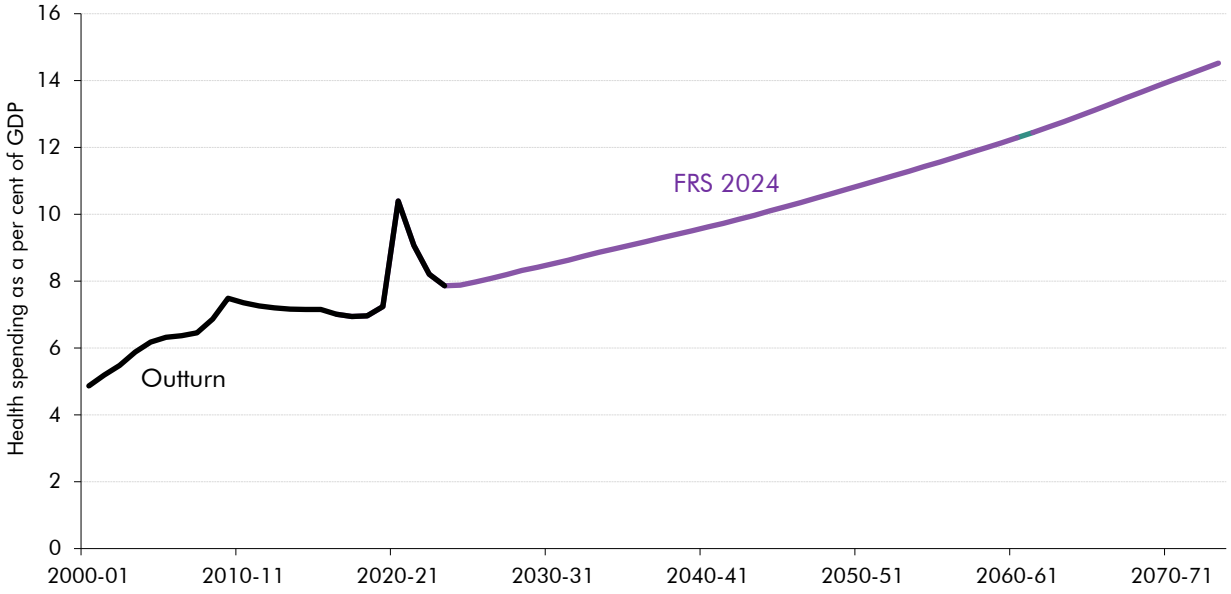
- The *direct* impact of **population ageing** on productivity growth is uncertain but unlikely to be significant in either direction over our five-year forecast period. The relationship between age and productivity can be characterised as an inverted U-shape, as worker productivity initially improves as they gain experience and skills before falling away as the skills and experience become dated.[2] Depending on the definition of ageing, the picture is mixed for the UK over medium term. The old-age dependency ratio (the proportion of those aged 65-and-over relative to those 16-to-64) is projected to rise by around 3 percentage points over the next five years. On the other hand, the share of the workforce aged 55-64 relative to the 16-64 workforce is projected to fall in coming years.[3] In addition, productivity is typically understood to peak between ages

[2] Daniele, F., T. Honiden, and A. Lembcke, *Ageing and productivity growth in OECD regions: Combatting the economic impact of ageing through productivity growth?*, OECD Regional Development Working Papers, 2019.
[3] The macroeconomic impact of ageing can be assessed using different metrics. One is the old-age dependency ratio, as discussed above; another is workforce ageing, measured by the proportion of workers aged 55–64 relative to the 16-64 population. See Aiyar, A., E. Christian, and X. Shao, *The Impact of Workforce Aging on European Productivity*, IMF Working Paper, 2016.

40-49, an age cohort which is set to rise as a share of the UK population over the next five years. Moreover, there is evidence that over the longer term a decline in productivity associated with ageing can be at least partly mitigated by sufficient healthcare and training.[4] Ultimately, we conclude that the *direct* impact of aging on productivity is ambiguous over the five-year forecast and likely to be small either way.

- However, population ageing is likely to *indirectly* weigh on productivity growth by **increasing demand for health and social care services**, in turn shifting economic activity towards sectors that typically lower in productivity. This shift is reflected in public spending on health which has risen from 5 to 8 per cent of GDP over the last 25 years, is expected to increase further to 9 per cent of GDP by the early 2030s, and is projected to reach 15 per cent of GDP by the mid-2070s in our long-term projections (Chart 4.5).[5] The next section discusses the relative underperformance of productivity growth in health relative to other sectors of the economy.

Chart 4.5: Public health spending



Source: ONS, OBR

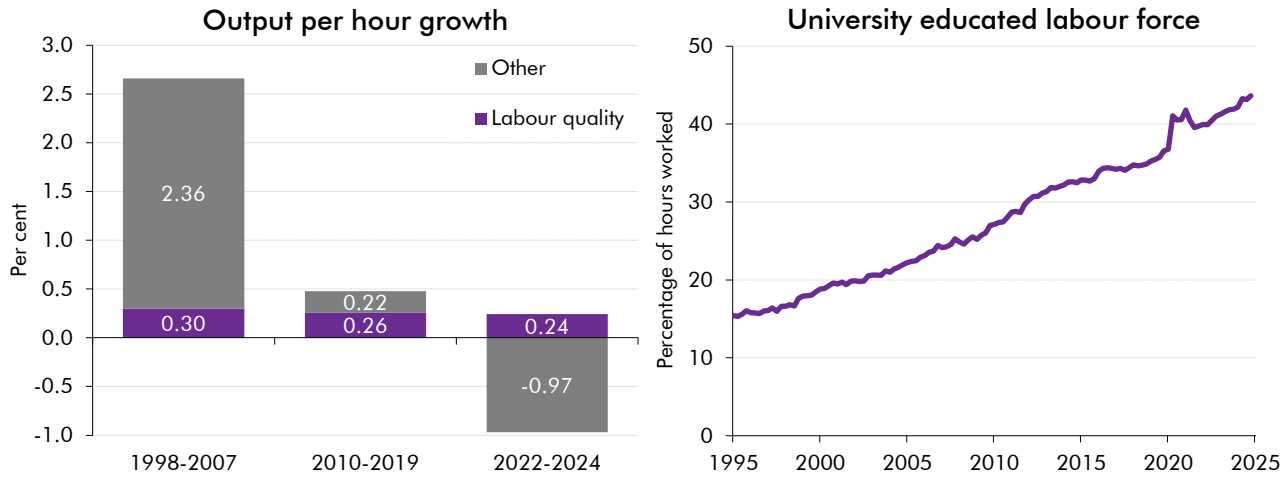
Labour quality

4.15 The sizeable increase in the share of hours worked by university educated people over the past quarter century will have contributed to a steady increase in the quality of labour, which is included in the OBR's estimate of TFP (Chart 4.6). The recent slowdown in the increase of the share of young people attending university will likely dampen the growth in labour quality in the future as these cohorts begin to make up a larger share of the labour force.[6] Over the forecast, we expect labour quality to continue to add to productivity growth at just

[4] See Asian Development Bank, *Aging Well in Asia,* 2024 and OECD, *Working Better with Age,* Ageing and Employment Policies, 2019.
[5] See Chapter 3 of the September 2024 *Fiscal risks and sustainability report*.
[6] The higher education entry rate among UK 18-year-olds increased from 24.7 per cent in 2006 to peak at 38.2 per cent in 2021. It fell back to 36.4 per cent in 2024. See Boulton, P., *Higher education student numbers*, House of Commons Research Briefing, 2025.

below its post-financial crisis rate, which is itself slightly below the rate seen before the financial crisis.

Chart 4.6: Labour quality and educational attainment



Note: University educated refers to undergraduate degrees, or equivalent, and higher degrees. Left hand side chart covers the market sector. Right hand side chart covers the whole economy.
Source: ONS

Climate change

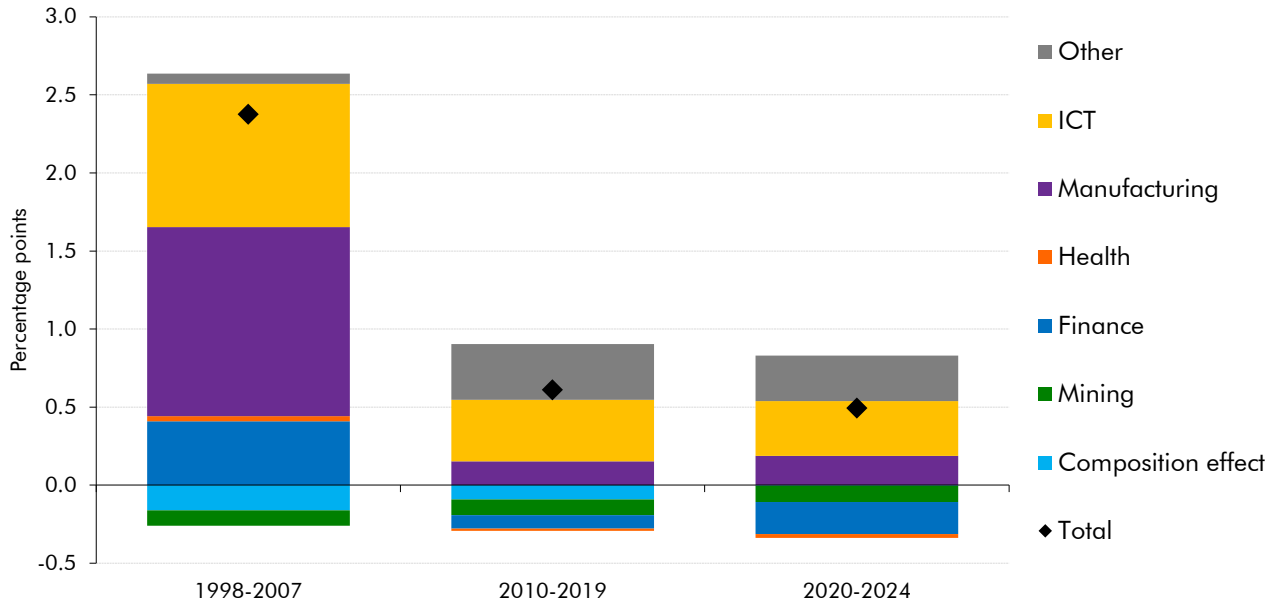
4.16 Climate change could have significant implications for productivity, though with differing impacts over different time horizons. In the short and medium term, the transition to net zero poses a downside risk to productivity, stemming from disruptions associated with phasing out carbon-intensive industries. However, over the longer term, there is potential for productivity gains from the transition to net zero. These may be driven by improved efficiency in resource use, enhanced energy security, and capital deepening from the significant additional investment required to reach net zero. Climate change itself poses material downside risks to the productive potential of the economy though the potential damage inflicted by rising temperatures and more severe weather on productive capital, agricultural outputs, and workforce health. These have been explored in our recent *Fiscal risks and sustainability* report.[7]

Sectoral composition of productivity growth

4.17 Looking at the sectoral composition of productivity growth over the past three decades helps to shed further light on some of the structural trends that may lie behind the post-2008 slowdown in economy-wide productivity and whether they are likely to persist into the future. Chart 4.7 examines the sectoral composition of productivity growth across three periods – pre-financial crisis (1998-2007), post-financial crisis (2010-2019), and the pandemic-era and aftermath (2020-2024). We separately consider the individual contributions from within-sector productivity growth and changes in the economy's composition (termed the composition effect).[8]

[7] See Chapter 2 of the September 2024 *Fiscal risks and sustainability* report.
[8] Sectoral comparisons are made using gross value added (GVA) per hour worked and so give slightly different totals from productivity figures used elsewhere that are based on GDP per hour worked.

Chart 4.7: Contribution to average output per hour growth, by industry



Note: Other includes agriculture and forestry, electricity, water supply and waste management, construction, transport and storage, wholesale and retail (including vehicle repair), accommodation and food, transportation and storage, real estate, professional scientific and technical, administrative and support services, public administration and defence, education, arts and entertainment, and other service activities including households as employers.
Source: ONS

4.18 The structural headwinds discussed in previous sections suggest that the slower productivity growth seen in some sectors since the financial crisis (Chart 4.7) is likely to continue over the next five years of our forecast period. In summary:

- **Manufacturing** was a major driver of productivity growth in the pre-financial crisis period, making the single largest contribution to economy-wide productivity growth. This strong pre-crisis productivity growth has been linked to rising UK trade intensity and integration into deepening European and global supply chains.[9] Manufacturing productivity growth has been much slower since the financial crisis, likely inhibited by stalling trade intensity and rising energy costs. Looking forward, the sector faces considerable structural challenges including higher and more volatile energy prices, new trade barriers from Brexit, and the general rise in global protectionism. This means that it is unlikely to replicate the previous strong rates of productivity growth.

- **ICT** was the second-largest contributor to productivity growth in the decade before the financial crisis due to the rapid adoption of personal computers, the internet, and mobile technologies. Productivity growth in the sector slowed in the post-financial crisis period as gains from the wave of information technology innovation had largely been realised. The slowdown in the ICT sector likely also had spillovers to the broader economy. ICT sector productivity has grown at a similar rate over the last five years as it had the previous ten. While AI may offer significant gains over the longer term, it is unlikely to deliver a similar productivity boost over the next five years (see Annex B for more detail).

[9] Tenreyro, S., *The fall in productivity growth: causes and implications*, Bank of England, 2018.

- **Finance and insurance** was the third-largest contributor to pre-financial crisis productivity growth, with strong productivity growth to some extent underpinned by excessive leveraging. The slowdown in productivity growth post-financial crisis likely reflects the deleveraging and increased regulation of the sector. Economic and policy uncertainty during this period, including the effects of Brexit, has also likely dampened productivity growth in the sector. With increased regulation and a re-appraisal of risk since the financial crisis fundamentally altering the operating environment, it is unlikely that the sector will contribute to productivity growth over our forecast period on the same scale as it did before 2008.

- **Mining** productivity has fallen in recent decades giving it a persistent negative within-sector contribution to economy-wide productivity growth (green bars in Chart 4.7). This reflects the maturation or exhaustion of the UK's resource deposits, which requires extraction from harder-to-reach locations or lower-quality reserves, coupled with reduced investment in the sector and stricter environmental regulations. In addition, mining has weighed on productivity growth through the 'composition effect' (light blue bars). Because mining's productivity *level* significantly exceeds the economy-wide average, its shrinking share of hours worked reduces aggregate productivity. We judge that these trends are likely continue and the declining output of the sector will, therefore, drag on whole-economy productivity over the forecast.

- **Health** (which includes social care) has made a persistently weak contribution to economy-wide productivity growth, consistent with stalling productivity in the National Health Service.[10] Health typically also has a relatively low *level* of productivity, reflecting that many activities are labour-intensive and less amenable to automation or standardisation than other sectors.[11] This means that the heath sector – which has also been growing rapidly as a share of total employment in recent years – has further depressed economy-wide productivity growth through the 'composition effect'. As discussed above, the sector will likely remain a headwind as an ageing population and rising ill-health boost demand for these services in the coming years. This will likely weigh on whole-economy productivity growth through further negative compositional effects.

- A group of 17 **other** sectors each contributed modestly to overall productivity growth, partly offsetting the slowdown in productivity growth since the financial crisis in the sectors mentioned above. They have continued to make a similar contribution since the pandemic.[12]

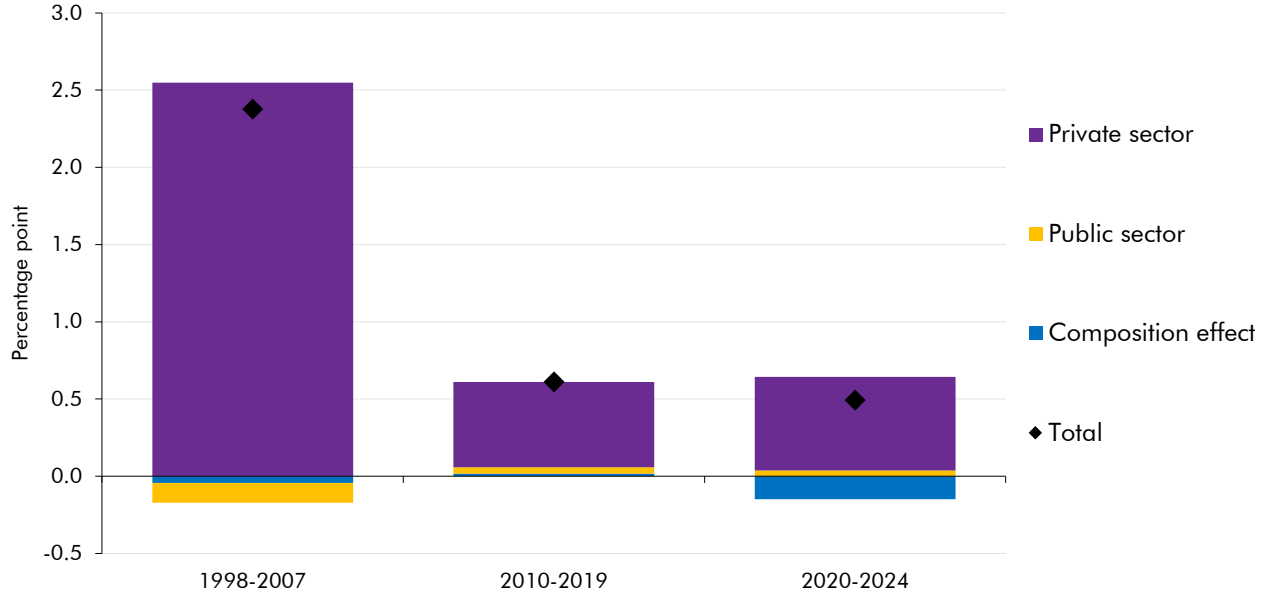
- Changes in the **sectoral composition** of the economy – the 'composition effect' – acted as a small drag on productivity growth in all periods, as the share of hours worked in

[10] Allas, T., Charlesworth, A., Chhoa-Howard, H., Fozzard, K., Moulds, A. and S Rocks, *From diagnosis to delivery: a framework for accelerating NHS productivity growth*, Health Foundation, 2025.
[11] The effectiveness of health and social care is not necessarily best reflected by conventional measures of output. A quality-adjusted measure of productivity can be a more accurate assessment, as it captures the quality of service delivered rather than simply the quantity.
[12] 'Other sectors' is agriculture and forestry, electricity, water supply and waste management, construction, transport and storage, wholesale and retail (including vehicle repair), accommodation and food, transportation and storage, real estate, professional scientific and technical, administrative and support services, public administration and defence, education, arts and entertainment, and other service activities including households as employers.

more productive sectors has grown more slowly than the share of hours in less productive sectors.[13] A significant portion of this effect has been driven by the decline of mining and the growth of the health sector. The declining share of employment in manufacturing – which has a relatively high level of productivity – has also contributed.

4.19 Chart 4.8 indicates the slowdown after the financial crisis was driven by a decline in **private sector** productivity growth. **Public sector** productivity growth dragged slightly on overall growth in the pre-financial crisis period but made a slight positive contribution to productivity growth over 2010-2019 and 2020-2024. The negative composition effect in 2020-2024 reflects an increase in the share of hours worked in the public sector where levels of productivity are lower than the private sector.

Chart 4.8: Contribution to average output per hour growth, public versus private



Note: The private sector is defined here as whole economy less public administration and defence, education, and human health and social activities which are considered public sector. This is an imperfect split as other sectors such as transport will have a public (or strongly regulated) component, while the health and education sectors also contain private sector activity.
Source: ONS, OBR

Conclusion

4.20 In Section 3, we analysed the post-financial crisis slowdown in productivity in historical and global contexts. In this section, we examined the prospects for UK productivity growth over the medium-term using three frameworks: time series analysis, structural drivers, and shifts in sectoral composition.

4.21 All the different types of evidence point to a significant degree of persistence in the factors that have created the recent era of slow productivity growth. Taken together, we judge that the weight of evidence points to a central forecast for medium-term productivity growth that

[13] The composition effect is calculated as the residual of total labour productivity growth minus the sum across sectors of 'within sector' productivity growth (where within sector growth is the change in labour productivity of the sector weighted by it's share of GVA in the previous period at current prices). This means that the composition effect includes both static reallocation of labour to higher productivity sectors and dynamic reallocation to higher productivity growth sectors, however of these effects the static is generally more significant.

is lower than we had previously assumed but still higher than average productivity growth in the period since the financial crisis.

4.22 The slowdown in average productivity growth from around 2 per cent in the decade before the financial crisis to ½ per cent in the 15 years after is likely to have two broad drivers, but it remains difficult to accurately judge the relative magnitude of the contribution each. First, temporary factors arising from a series of shocks – including the financial crisis, Brexit, Covid, and the energy crisis – which may unwind over time. Indeed, there have been several periods over the UK's history where subdued productivity growth has been followed by a relatively rapid bounce-back. Second, structural changes that represent a lasting shift in the growth of the productive potential of the economy.

4.23 The accumulation of evidence now places greater weight on the impact of structural, rather than temporary, drivers. And with the passage of time, the likelihood of a substantial and rapid rebound in productivity growth appears less likely. Analysis of the structural drivers of productivity growth and the sectoral composition of the economy supports the conclusion that productivity growth is likely to remain subdued. We expect that previous increases in trade intensity, which likely supported productivity growth, will go into reverse in the coming years. We also expect that there will be reduced contributions to output from sectors that previously had high growth in or levels of productivity and growing contributions from sectors that have historically seen relatively low productivity. Our analysis also suggests that AI will not contribute as much to productivity growth over the next five years as the ICT revolution did in the period before the financial crisis. And climate change may have a significant negative impact on productivity growth. Relatedly, the transition to net zero may weigh on productivity in the short-to-medium term before potentially becoming a more positive factor over the longer term.

4.24 The slowdown being seen across advanced economies, with average productivity growth in the G7 falling a ½ percentage point between the pre- and post-financial crisis decades, also supports the view that this is a widespread structural phenomenon. Similarly, our time series modelling suggests there was a structural break in productivity growth around the financial crisis. These projections conservatively assume that this weakness persists, leading to average productivity growth of only around 0.5 per cent across the four different statistical models we estimated in the medium term. This is likely to be at the pessimistic end of projections for future productivity growth because in using the models in forecasting mode it is assumed that the era of low post financial crisis productivity growth continues indefinitely.

4.25 So, while the evidence suggests that medium-term productivity growth will be lower than our previous central forecast, we do expect some pick up from the dismal rates of productivity growth seen in the post-financial crisis period. This is partly driven by the fading impact of recent shocks on productivity growth. It is also due to the growing impact of AI on the economy. While the AI impact is highly uncertain, our central estimate is that it could add around 0.2 percentage points to productivity growth by the forecast horizon. The implications for our November 2025 forecast are discussed in detail in the next section.

5 The OBR productivity forecast

History of OBR productivity forecast changes

5.1 The OBR's medium- and long-term productivity growth forecasts have been revised down several times as the UK economy has been hit by shocks and outturns over the past 15 years persistently undershot our forecasts. This is illustrated in Chart 5.1, which reflects how the OBR's forecast for growth in trend output per hour in the fifth year – or medium-term productivity growth – has changed over time, compared to the average productivity growth recorded in the preceding five years. Since the OBR was established in 2010:

- **Between 2010 and 2016**, we assumed the underlying growth rate would recover to its pre-financial crisis average of around 2.2 per cent over the longer term. But this rate was generally only reached slightly beyond our five-year forecast horizon.

- In **March 2016**, we downgraded this long-term underlying assumption to 2.0 per cent as the period of weak productivity growth following the financial crisis continued to lengthen, choosing to place more weight on recent trends as a guide to the coming years.[1] We assumed this rate would be reached by the forecast horizon.

- In **November 2016**, we downgraded our medium-term assumption to 1.8 per cent as the uncertainty created by the result of the Brexit referendum was expected to result in lower growth in business investment and less capital deepening over the forecast period. However, we still assumed productivity growth would reach 2.0 per cent in the long term.

- In **November 2017,** we revised down our medium-term forecast to 1.3 per cent, as the weakness in outturn continued.[2] This 0.5 percentage point downward adjustment was the largest single revision to our medium-term trend productivity growth forecast that we have made and significantly larger than the one we are making in this November 2025 forecast.

- In **March 2020**, we downgraded our forecast for long-run productivity growth from 2.0 per cent to 1.5 per cent, as we judged the pre-financial crisis period looked like a less convincing anchor for our long-term projections. However, this has little impact at the five-year forecast horizon.

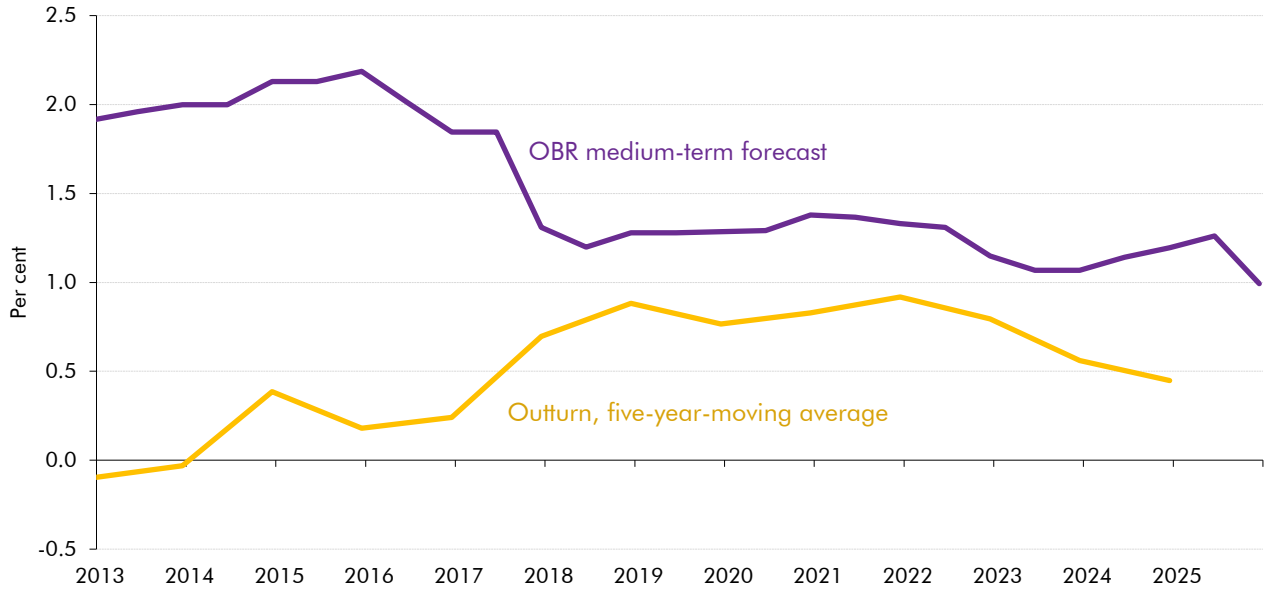
- **Between November 2020 and March 2025**, our medium-term productivity growth forecast has largely hovered around 1.3 per cent, with some fluctuations reflecting the

[1] March 2016 *Economic and fiscal outlook*.
[2] November 2017 *Economic and fiscal outlook*.

impact of shocks and changed in policy, including a downgrade in November 2022 linked to higher energy prices.[3] Over this period, we maintained our long-run assumption at 1.5 per cent.

5.2 In the three years before Covid and in its immediate aftermath, the five-year moving average of productivity growth appeared to be picking up towards our medium-term forecast assumption. But that pick-up stalled and has gone into reverse more recently (Chart 5.1).

Chart 5.1: Historical OBR output per hour forecasts and outturns



Note: Medium-term forecast refers to fifth-year trend productivity forecast.
Source: ONS, OBR

5.3 Since **November 2022**, we have split our productivity forecast into capital deepening and TFP components.[4] To estimate capital deepening, we project the gross capital stock, growing the historical data forward using our public and private investment forecasts and then adjusting for the rate at which capital is retired, known as the retirement rate. The retirement rate is assumed to increase gradually over time, reflecting the growing proportion of intangible assets – such as software – in the overall capital stock. Intangible assets generally have shorter lifespans than tangible assets such as buildings or machinery. We then adjust the growth in the gross capital stock for growth in total hours worked and multiply it by an assumed capital share of income of one-third to get our approximation for the contribution of capital deepening to productivity growth.

5.4 Splitting productivity into capital deepening and TFP has allowed for a closer examination of underling trends in the latter. In **March 2025**, our central forecast for medium-term underlying productivity growth was 1.3 per cent, reached at the then horizon of 2029. This

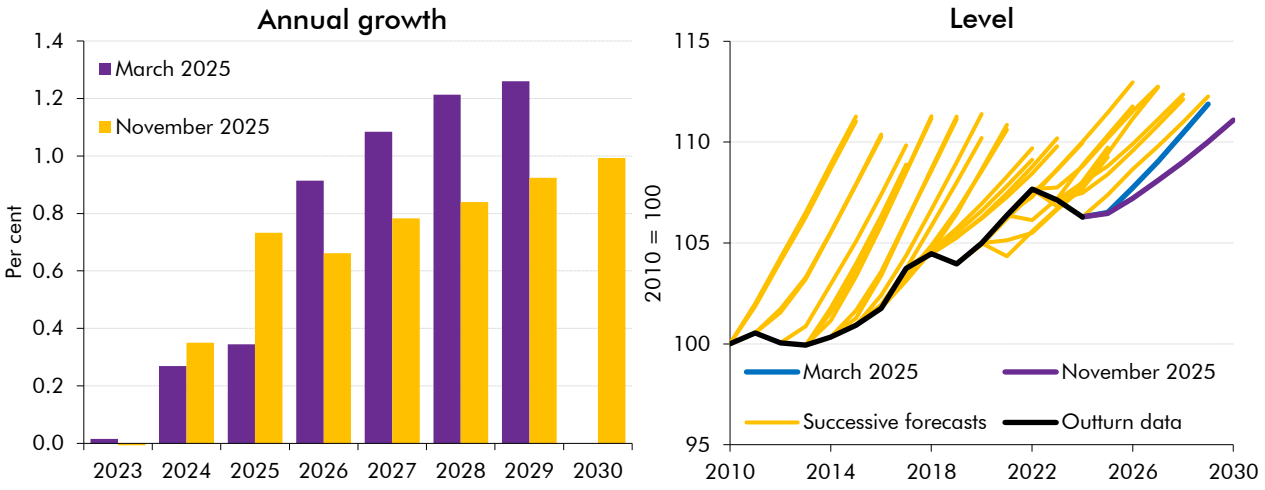
[3] This includes the fact that, since March 2020, we have assumed that additional trade barriers associated with leaving the EU will lower the UK's trade intensity and as a result will lower the level of productivity by around 4 per cent relative to remaining in the EU. For more information, see Box 2.1 in March 2020 *Economic and fiscal outlook*.
[4] November 2022 *Economic and fiscal outlook*.

comprised a 0.2 percentage point contribution from capital deepening and a 1.1 percentage point contribution from TFP growth – broadly the average of the higher growth in the decade before and lower growth in the decade after the financial crisis, with adjustments for policy including Brexit and planning reforms.

Autumn 2025 forecast

5.5 In our **November 2025** *EFO*, we have revised down our central forecast for medium-term productivity growth from 1.3 to 1.0 per cent. This comprises a revised TFP growth contribution of 0.8 percentage points and an unchanged contribution from capital deepening of 0.2 percentage points (Chart 5.2, left panel). As a result, productivity growth in the final year of our forecast (2030) is 0.3 percentage points lower than the final year of our March 2025 forecast (2029). Trend productivity growth is now forecast to rise gradually from 0.3 per cent in 2024 and 0.7 per cent in 2025 to reach our revised medium-term assumption of 1.0 per cent in 2030 (Chart 5.2, left panel). As a result, the level of productivity in 2029 is expected to be 1.7 per cent below our March forecast (Chart 5.2, right panel). To illustrate the uncertainty around this central forecast, we present scenarios reflecting how different judgements about the outlook for productivity would impact the forecast (see paragraph 5.9).

Chart 5.2: Output per hour forecast revisions



Note: The left-hand side chart compares trend forecasts, while the right-hand side compares forecasts for actual productivity growth (which can differ due to short-term cyclical factors) to measured outturn. Trend and actual productivity are expected to be equal in the fifth year of the forecast as the output gap is assumed to be closed.
Source: ONS, OBR

5.6 The 0.3 percentage point downward revision to medium-term productivity growth we have made in the November 2025 forecast is the second largest since the OBR was established in 2010, but only around half the size of the largest revision made in November 2017. An alternative way to assess the scale of the change is by examining the forecast change in five-year cumulative trend productivity growth, which more directly reflects the impact on the fiscal forecast. On this basis, the revision amounts to a 1.1 percentage points reduction in cumulative growth over the next five years – ranking as the third largest in the OBR's history and of similar magnitude to the downgrades made in November 2016 and November 2011. This downgrade is significantly smaller than the two largest downgrades to the forecast change in five-year cumulative growth of 2.0 percentage points in November 2022

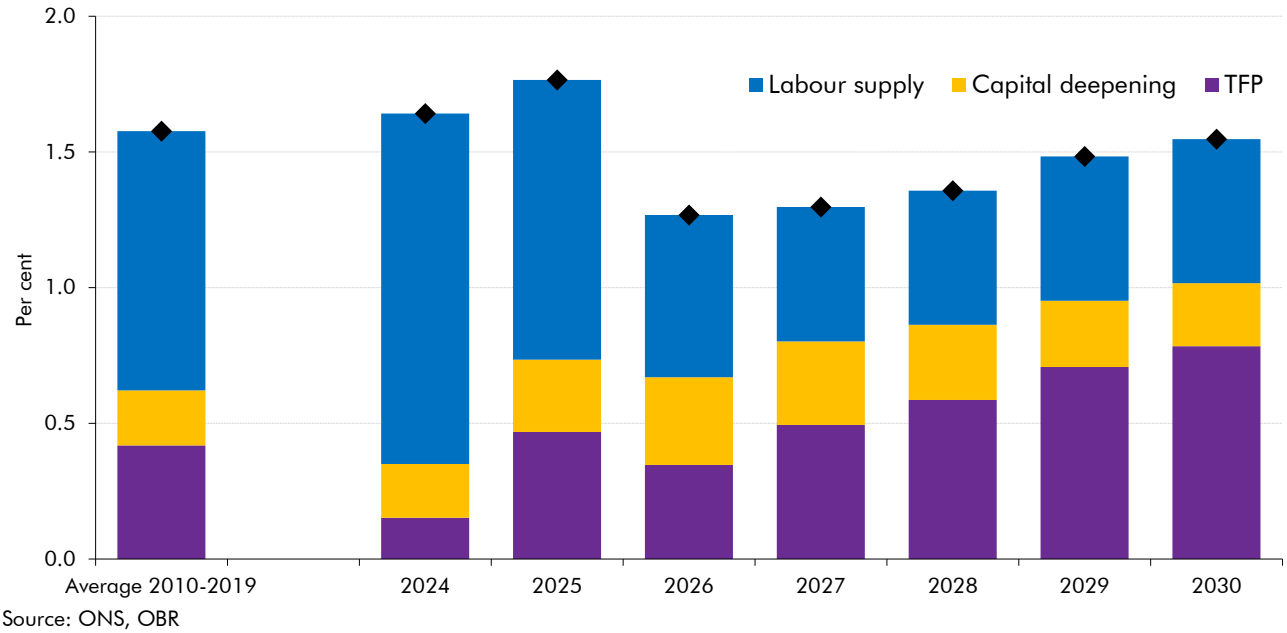
and 3.4 percentage points in November 2017. Separate from the revisions to medium-term growth discussed in paragraph 5.1, the November 2011 downgrade reflected the speed at which we expect growth to pick up to its longer-term rate, and the November 2022 revision mainly reflected the effect of higher energy prices and the effect of lower business investment on capital deepening.

5.7 Looking at the pick-up in productivity growth over our forecast by component, TFP is the main driver, while capital deepening remains broadly stable. The expected improvement in TFP reflects our assessment that:

- Part of the recent weakness in TFP growth in recent years is a result of temporary factors arising from the series of major **shocks** that the UK economy has experienced over the past 15 years, including the financial crisis, Brexit, Covid, and the energy crisis. As the lingering effects of these shocks continue to fade, we expect this to lead to improved TFP growth compared to the very weak recent outturns. But, for the reasons set out in Section 4, we expect this bounce-back to be less sharp than our previous judgement.
- We also expect **AI** to begin having a small positive effect on TFP growth within the forecast period. There is significant uncertainty around both the size and timing of this effect – our central estimate is that it will build over time as adoption grows to reach an estimated 0.2 percentage points by our forecast horizon.

5.8 Combining our revised forecast for potential productivity growth with our broadly unchanged labour supply forecast results in a new central estimate of potential output growth in the medium-term of 1.5 per cent (Chart 5.3). Potential output growth in 2024 and 2025 is boosted by strong growth in the labour supply from high net migration and a bounce-back in average hours worked, the effects of which fade in 2026. Over the rest of the forecast, labour supply growth is expected to moderate slightly further, reflecting the effect of population ageing on participation and on average hours. But this is more than offset by the expected rise in productivity growth driven by a recovery in TFP.

Chart 5.3: Potential output growth



Source: ONS, OBR

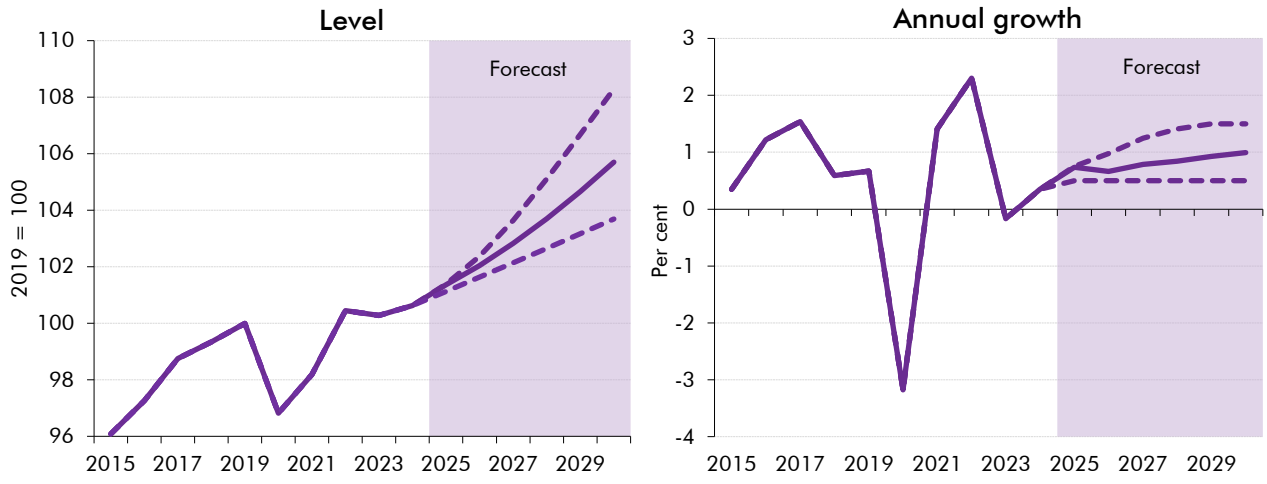
Scenarios

5.9 The outlook for productivity remains highly uncertain. To illustrate the extent of this uncertainty, the following scenarios set out how alternative judgements could impact the future path of productivity (Chart 5.4).

- **A plausible upside scenario is for TFP growth to reach 1.3 per cent by 2030**, leading to total labour productivity growth of around 1.5 per cent. This could be driven by a larger and/or faster boost from AI – aligning with the more optimistic estimates of AI's impact discussed in Annex B, where the uplift is closer to 0.5 percentage points, rather than around 0.2 percentage point assumed in our central case. Or it could be that more of the recent weakness in TFP growth was due to temporary factors than we have assumed. Faster TFP growth could also be supported by an easing of global trade tensions which would provide a boost through increased trade intensity.

- **A plausible downside scenario is for TFP growth to stagnate at 0.3 per cent until 2030**, with total labour productivity growth at around 0.5 per cent. This could be driven by global economic fragmentation weighing more heavily on productivity, disruptions associated with the transition to net zero, or economic damage caused by climate change. It is also possible that the weakness in TFP following the financial crisis has been more structural than assumed and that productivity growth over next five years will be similar to the last 15 years. It could also reflect our conservative scenario for AI, in which adoption is more limited and the impact negligible over the forecast period.

Chart 5.4: Trend productivity scenarios

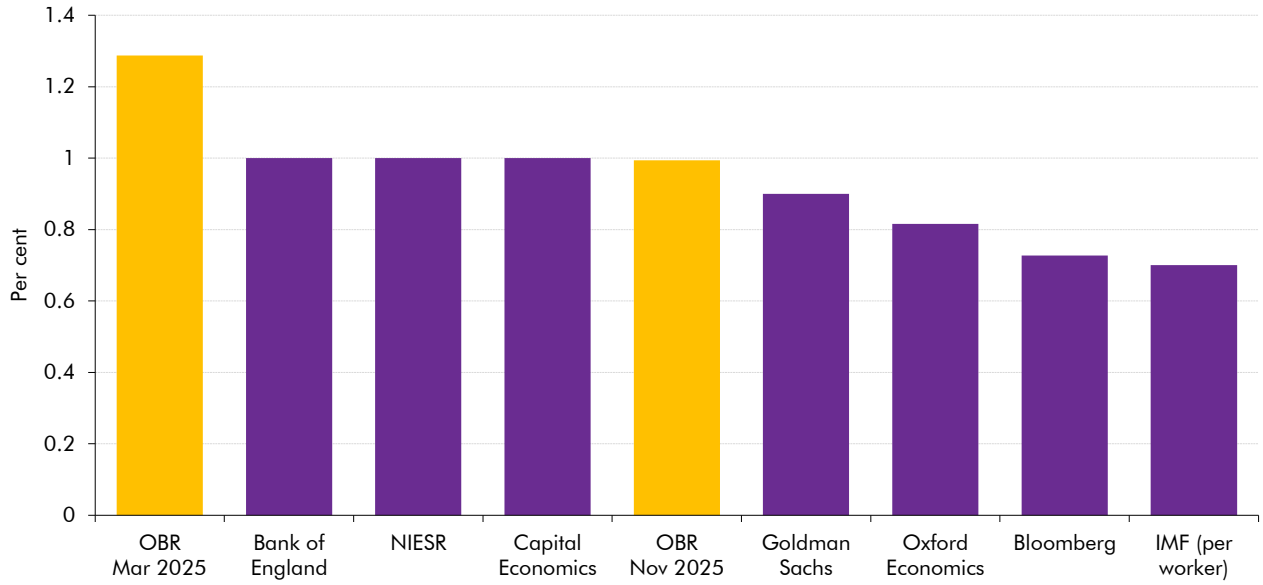


Source: ONS, OBR

Comparison to external forecasts

5.10 Following the downward revision, our November 2025 medium-term productivity forecast of 1.0 per cent is at the top end of the range of external forecasts for the UK, where several other forecasts cluster, including the Bank of England and the NIESR (Chart 5.5).

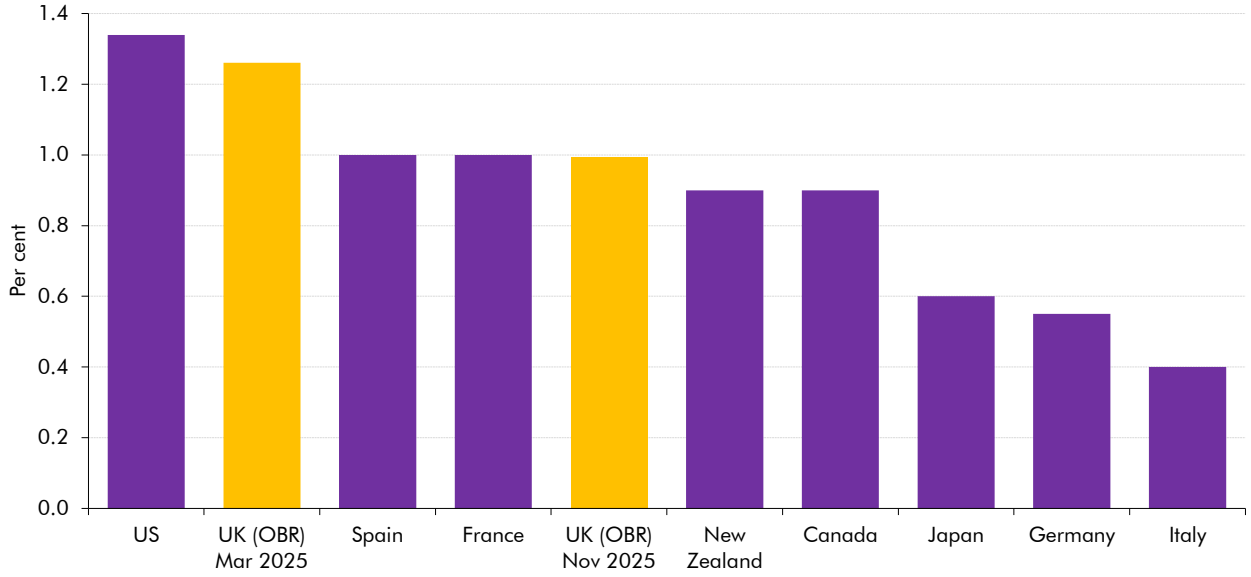
Chart 5.5: UK medium-term output per hour growth forecasts



Note: The November 2025, March 2025, IMF, Capital Economics, and Goldman Sachs forecasts are for medium term productivity. The Bank of England forecast is for long-run productivity. The Oxford Economics, and Bloomberg forecasts are for 2029.
Source: Bank of England, Bloomberg, Capital Economics, Goldman Sachs, IMF, NIESR, Oxford Economics

5.11 Our latest medium-term productivity forecast is in the middle of the range of official forecasts for comparator countries (Chart 5.6).[5] Within the G7, our forecast has moved from being the second strongest behind the US to around the middle of the pack, similar to France and Canada as well other comparable non-G7 nations like Spain and New Zealand. We continue to expect significantly stronger output per hour growth than official forecasters in Italy, Japan, and Germany.

Chart 5.6: Official international medium-term output per hour growth forecasts



Note: US: 2029, France: 2027, New Zealand: 2029, Germany: 2029, and Italy: 2028. Non-OBR forecasts for stated year except Spain, Canada, and Japan which are medium term.
Source: OBR, Canada Department of Finance, Congressional Budget Office, French Treasury, Germany Council of Economic Experts, Independent Authority for Fiscal Responsibility, Italian Ministry of Economy and Finance, Japanese Cabinet Office, New Zealand Treasury

[5] Comparator countries are the G7 plus Spain and New Zealand, developed, open economies for which recent official medium-term forecasts are available.

A Time series models of productivity

Models

A.1 We specified two types of models. First, a random walk with time-varying drift (referred to below as 'random walk'). This approach assumes productivity growth fluctuates around a rate – the drift – which is allowed to change at specific points in time. Importantly, this specification implies that the level of productivity remains permanently lower after a negative shock, with no mean reversion to some pre-shock path. Equation (1) is the specification used for the quarterly ONS data. $PROD$ denotes the level of productivity at time t. We regress the log difference of $PROD$ (approximately the percentage change) on a constant – or drift – term (β_0), a structural change dummy for the financial crisis (DFC), which takes the value zero up to the third quarter of 2008 and one thereafter, and an error term (ε_t). Dummy variables are used to exclude the volatility in the first, second and third, quarters of 2020 given distortions from Covid, and take the value of one for the quarter in question and zero otherwise. This specification allows a level change in the underlying growth rate (or drift) at each structural break.

$$(1)\ \Delta log(PROD)_t = \beta_0 + \beta_1 DFC_t + \beta_2 D_{2020Q2,t} + \beta_3 D_{2020Q3,t} + \beta_4 D_{2020Q4,t} + \varepsilon_t$$

Equation (2) is the random walk specification for the Bank of England data set, where we apply structural break dummies at 1921, 1947, 1976, and 2008, each representing a shift in the drift term. The rationale for selecting these break points is detailed in paragraph A.4. Each dummy takes the value of one from the specified year onward and zero beforehand. These variables capture how the drift changes at break points. A dummy is included to exclude 2020 given the pandemic-related volatility.

$$(2)\ \Delta log(PROD)_t = \beta_0 + \beta_1 DWW1_t + \beta_2 DWW2_t + \beta_3 Doilshock_t + \beta_3 DFC_t + \beta_2 D_{2020,t} + \varepsilon_t$$

A.2 Second, we specified a trend stationary model with a time-varying trend (referred to below as 'general model'). This approach allows for mean reversion in the level of productivity, implying there is 'catch-up' following a negative shock. As previously, the dependent variable is the log difference of $PROD$. This is regressed against a constant (β_0); a time trend (t); the lagged level of productivity, which combines with the time trend to produce the catchup effect; the structural change dummy for the financial crisis (DFC); and the interaction between the time trend and the structural change dummy. Again, pandemic dummy variables are included. Equation (3) is the specification for the ONS data, which allows for a shift in the level of productivity at the third quarter of 2008 and a change in the trend at the same point.

$$(3)\ \Delta log(PROD)_t = \beta_0 + \beta_1 t + \beta_2 log(PROD)_{t-1} + \beta_3 DFC_t + \beta_4 (t * DFC_t) + \beta_5 D_{2020Q2,t} + \beta_6 D_{2020Q3,t} + \beta_7 D_{2020Q4,t} + \varepsilon_t$$

A.3 Equation (4) is the specification of the general model for the Bank of England data. While in principle it would be possible to include both structural change dummy variables and their interactions with the time trend, this would be unnecessary duplication. Instead, we specify a time trend which varies over each period, where t_1 to t_5 are the respective time trends for periods 1761–1920, 1921–1946, 1947–1975, 1976–2007 and 2008–2024. This specification allows for a shift in the level of productivity and its growth trend at each break point.

$$(4)\ \Delta\, log(PROD)_t = \beta_0 + \beta_1\, log(PROD)_{t-1} + \beta_2 t_1 + \beta_3 t_2 + \beta_4 t_3 + \beta_5 t_4 + \beta_6 t_5 + \beta_7 D_{2020,t} + \varepsilon_t$$

Breaks

A.4 We identified structural breaks through a combination of visual inspection, running regressions with and without dummy variables, and formal structural break tests. In the ONS data, we find evidence of a single break at the financial crisis. In the longer Bank of England series, we detect breaks following the First and Second World Wars, as well as after the oil price shock in the 1970s.

Results

A.5 All models show a clear structural break around the 2008 financial crisis, highlighting a significant shift in productivity dynamics during this period (Table A.1). The random walk model (1) suggests that underlying quarterly productivity growth averaged 0.5 per cent (2.1 per cent annualised) prior to the financial crisis. The results indicate underlying quarterly productivity growth declined 0.4 percentage points to 0.1 per cent afterwards (0.4 per cent annualised). The random walk model (2) based on the Bank of England data similarly suggests underlying annual productivity growth declined following the financial crisis by 2.1 percentage points to 0.2 per cent. In both models, the dummy variables capturing the post-financial crisis decline in productivity growth are significant at the 1 per cent level. For the ONS data, the general model (3) has marginally better goodness of fit than the random walk model (1), while for the Bank of England data, the general model (4) clearly outperforms the random walk model (2). These results point to mean reversion in productivity levels (conditional on long-term growth trends), evidenced by the negative and highly significant coefficient on the lagged level of productivity. This implies that, following a temporary negative shock, productivity growth picks up in the short term in order to revert towards levels consistent with its underlying trend. The Durbin-Watson statistic is around 2 for each model, indicating autocorrelation has mostly been eliminated.

A.6 We employ these models to assess how effectively they capture historical trends and to project growth over the medium term (see Chart 4.1). Note these projections are constructed based on a conservative conditioning assumption – that the drift, or trend

growth term, stays at its lower post-financial crisis level indefinitely (see footnote 1 in Section 4 for more detail). The random walk models (1) and (3) allow only level shifts in underlying productivity growth at structural breaks. The general models (2) and (4) allow for more general adjustment processes, allowing not only for shifts in the level but also for a gradual adjustment towards a new long-run growth rate. This better reflects the fact that the economy does not instantly settle at a new rate of productivity growth following a major shock. Instead, businesses and workers adapt over time by changing processes, reallocating resources, and adopting new technologies over years, or even decades. We can approximate this by using the coefficient on the lagged level of productivity, which indicates how quickly deviations from equilibrium decay. Formally, the half-life is calculated as the natural log of 0.5 divided by the natural log of the persistence parameter. The ONS data, or model (3), indicate that adjustment to the post-financial crisis trend was half complete in just under 18 months. By contrast, the longer-run Bank of England data, or model (4), suggest half of the adjustment is only achieved after around 20 years. These wide-ranging estimates illustrate the considerable uncertainty over the persistence of shocks.

Table A.1: Estimation output

	ONS, 1971-Q1 2024 Q4			Bank of England, 1761-2024	
	Random walk (1)	General (3)		Random walk (2)	General (4)
Constant	0.0052***	0.4138***	Constant	0.0071***	0.0291***
t		0.0006***	$log(PROD)_{t-1}$		-0.0321***
$log(PROD)_{t-1}$		-0.1152***	$DWW1_t$	0.0095**	
$D_{2020Q2,t}$	-0.0302***	-0.0302***	$DWW2_t$	0.0175***	
$D_{2020Q3,t}$	0.0791***	0.0755***	$Doil_{shock_t}$	-0.0112**	
$D_{2020Q4,t}$	-0.0510***	-0.0455***	DFC_t	-0.0207***	
DFC_t	-0.0042***	0.0733***	$D_{2020,t}$	0.0098	0.0084
$t * DFC_t$		-0.0004***	t_1		0.0004***
			t_2		0.0004***
			t_3		0.0006***
			t_4		0.0006***
			t_5		0.0005***
Adjusted R-squared	0.39	0.41		0.17	0.25
AIC	-6.62	-6.66		-4.97	-5.03
BIC	-6.54	-6.53		-4.89	-4.92
Durbin-Watson statistic	2.06	1.95		2.19	2.30
RMSE	0.01	0.01		0.02	0.01

Note: Dependent variable is the log difference of output per hour. For the ONS dataset, output is defined as real GDP. For the Bank of England dataset, output is defined as GDP at basic prices. Note *, ** and *** indicate statistical significance at 10, 5, and 1 per cent levels respectively.
Source: OBR

B The impact of AI on productivity

B.1 Recent advances in AI, particularly generative AI, are widely viewed as transformative with the potential to materially increase global productivity growth. However, the impact of AI on UK productivity over the medium-term remains highly uncertain and estimates vary widely. This analysis summarises our current assessment based on the available evidence. External estimates suggest AI may increase annual productivity growth by between 0.1 and 3.4 percentage points in the long-term, although these estimates are tied to various time periods and regions (see paragraphs B.10-B.11).

Methodology

B.2 Daron Acemoglu's task-based framework has become the preferred method in the literature for evaluating AI's productivity impacts, initially for the US and more recently for a range of countries.[1,2] This framework first requires an estimate of the share of AI-exposed occupations in a given economy as a key input. We develop our own estimate of exposure by building a task-based model of the UK labour market. We use data from the O*NET database, a comprehensive and detailed source of occupational and task-level information for the United States labour market which we than adapted to reflect the occupational and task make-up of the UK labour market. Our methodology is similar to that used by Bergeaud, Gmyrek, et al., and the Tony Blair Institute. [3, 4, 5]

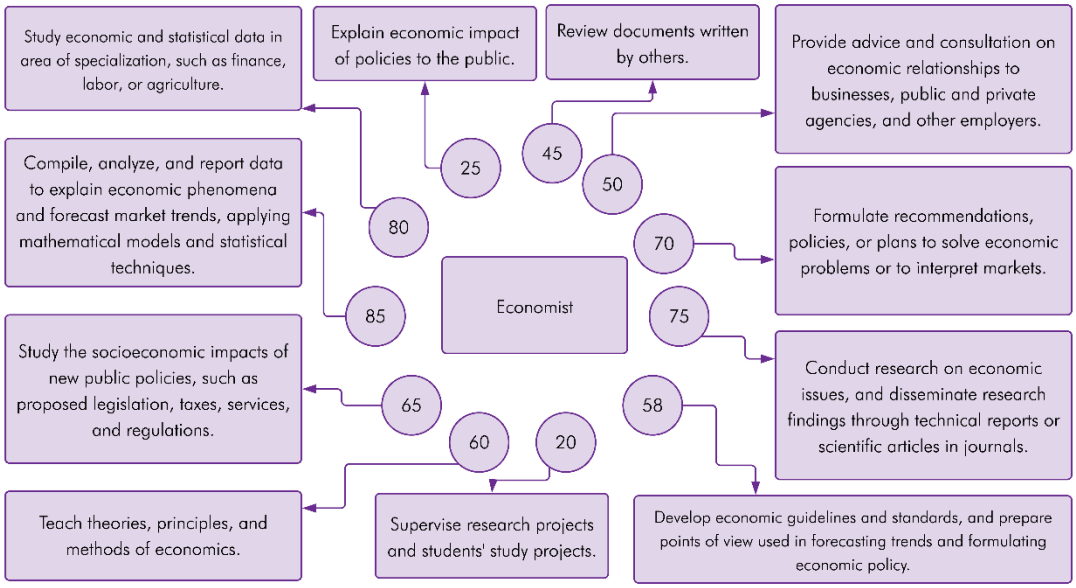
B.3 We evaluated the exposure of individual tasks to AI within the next 10 years using a large language model (LLM), allowing analysis of a large volume of tasks that would have been impractical through expert judgement alone. We used a series of prompts to guide the LLM on what to consider when judging each task, for example whether a task required human empathy. We reviewed a sample of 100 tasks and compared the LLM estimates with our own judgement to determine the thresholds over which a task was deemed as exposed. We also produced sensitivity analysis to see the effect of moving the thresholds up or down. AI exposure is then broken down into two categories: substitutes, meaning the task could be fully automated by AI without the need for human involvement, and complements, meaning AI will help people carry out these tasks more efficiently rather than replacing them. We then assessed exposure at the occupation level by aggregating the task-level findings. Since our initial analysis was based on US occupations, we used a publicly accessible crosswalk to map results for the UK.[6]

[1] Acemoglu, D., *The simple macroeconomics of AI,* Economic Policy, 2024.
[2] Acemoglu's task-based framework evaluates the productivity gain over the next 10 years by multiplying the following: the share of AI exposed occupations, the share of tasks that can be feasibly automated over next 10 years, the average cost saving at task level, and the average labour share.
[3] Bergeaud, A., *The Past, Present and Future of European Productivity*, European Central Bank, 2024.
[4] Gmyrek, P., J. Berg, and D. Bescond, *Generative AI and Jobs: A global analysis of potential effects on job quantity and quality*, International Labour Organization working paper, 2023.
[5] Sharps, S., et al., *The Impact of AI on the Labour Market*, Tony Blair Institute, 2024.
[6] The National Foundation for Educational Research, *Systematic Mapping of SOC 2020*, 2023.

Economist example

B.4 To illustrate our methodology, we provide an example using the economist occupation. Using our prompt, the LLM assigns each of the 11 important tasks for the economist occupation a score between 0 and 100 based on the task description (see Figure B.1), with tasks more amenable to automation through AI receiving a higher score. For example, explaining the economic impact of policies to the public is assigned a score of 25. This task is less likely to be exposed to AI as it requires audience-sensitive communication. On the other hand, studying economic and statistical data is assigned a score of 80. This task is more likely to be exposed to AI because it involves data analysis, a strength of the technology.

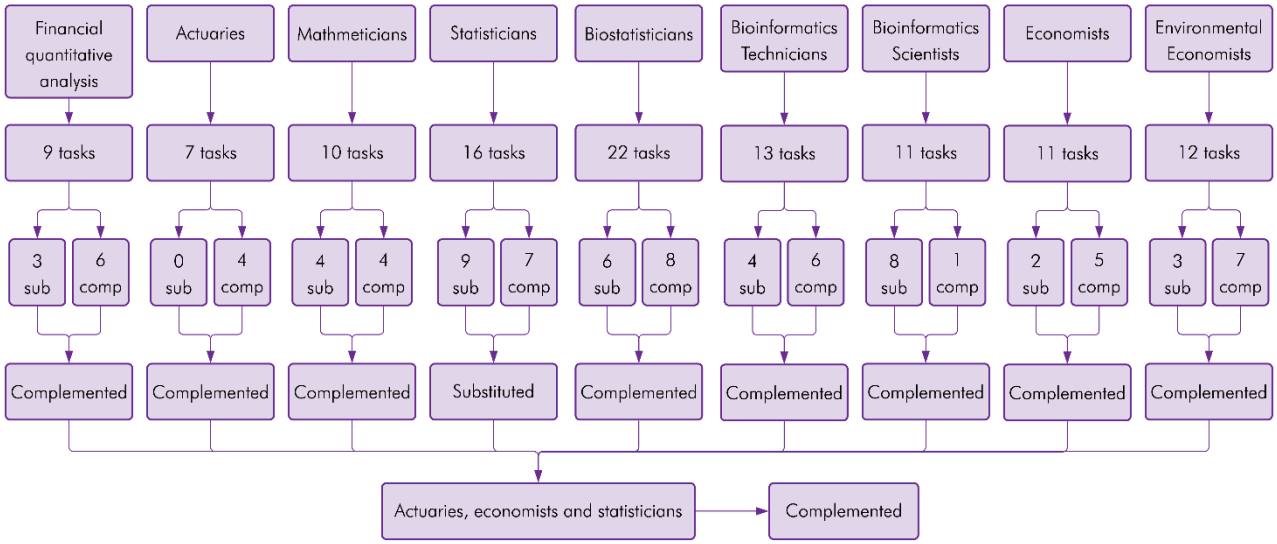
Figure B.1: Economist occupational tasks



Source: OBR

B.5 Based on our chosen thresholds, we estimate that, of the 11 important tasks carried out by an economist, five tasks could be complemented by AI whilst two tasks may be substituted. Given that over 50 per cent of tasks are exposed to AI and the majority are complemented, we classify the economist occupation as complemented. When mapping from US to UK occupations, the economist occupation forms part of the UK occupation category of actuaries, economists and statisticians. This UK occupation encompasses nine mapped US occupations (see Figure B.2). Eight of these nine occupations are classified as complemented, with one classified as substituted. Consequently, we classify the UK occupation of actuaries, economists and statisticians as potentially exposed to AI in a complemented manner.

Figure B.2: Actuaries, economists and statisticians' occupation



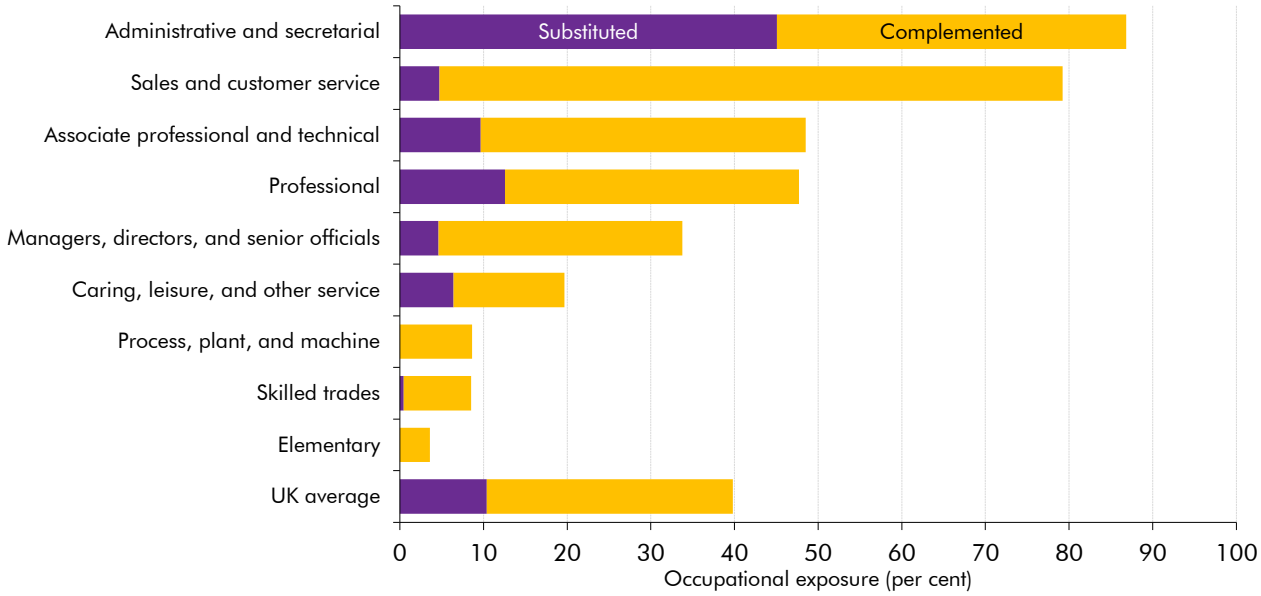
Source: OBR

Results

B.6 Using this approach, we estimate that AI could materially impact 40 per cent of the UK labour force over the next 10 years, with the majority of occupations expected to be complemented by AI rather than substituted. We find that administrative and secretarial occupations are the most exposed (87 per cent), followed by sales and customer service (79 per cent). This aligns with the fact that these occupations involve a higher proportion of tasks that are easily automated by AI, such as data entry, appointment scheduling, and basic customer inquiries. The least exposed to AI are elementary jobs (work mainly consisting of simple tasks requiring physical effort, such as cleaners and caretakers), skilled trades, and process, plant and machine occupations (less than 10 per cent).[7] This is consistent with these occupations relying more on physical labour and taking place in more unstructured settings. Our estimate is broadly in the middle of the very wide range of external estimates, which stretch from 19 to 68 per cent.[8]

[7] For more information on ONS occupations, see ONS, *SOC 2020*, 2023.
[8] External estimates include Gmyrek, P., J. Berg, and D. Bescond, *Generative AI and Jobs: A global analysis of potential effects on job quantity and quality*, International Labour Organization working paper, 2023; Pizzinelli, C., et al., *Labor Market Exposure to AI: Cross-country Differences and Distributional Implications,* IMF working papers, 2023; Acemoglu, D., *The simple macroeconomics of AI,* Economic Policy, 2024; Bergeaud, A., *The Past, Present and Future of European Productivity*, European Central Bank, 2024; Sharps, S., et al., *The Impact of AI on the Labour Market*, Tony Blair Institute, 2024; Jung, C. and Srinivasa Desikan, B., *Transformed by AI: How generative artificial intelligence could affect work in the UK – and how to manage it*, Institute for Public Policy Research, 2024 and Filippucci, F., et al., *Macroeconomic productivity gains from artificial intelligence in G7 economies,* OECD artificial intelligence papers, 2025.

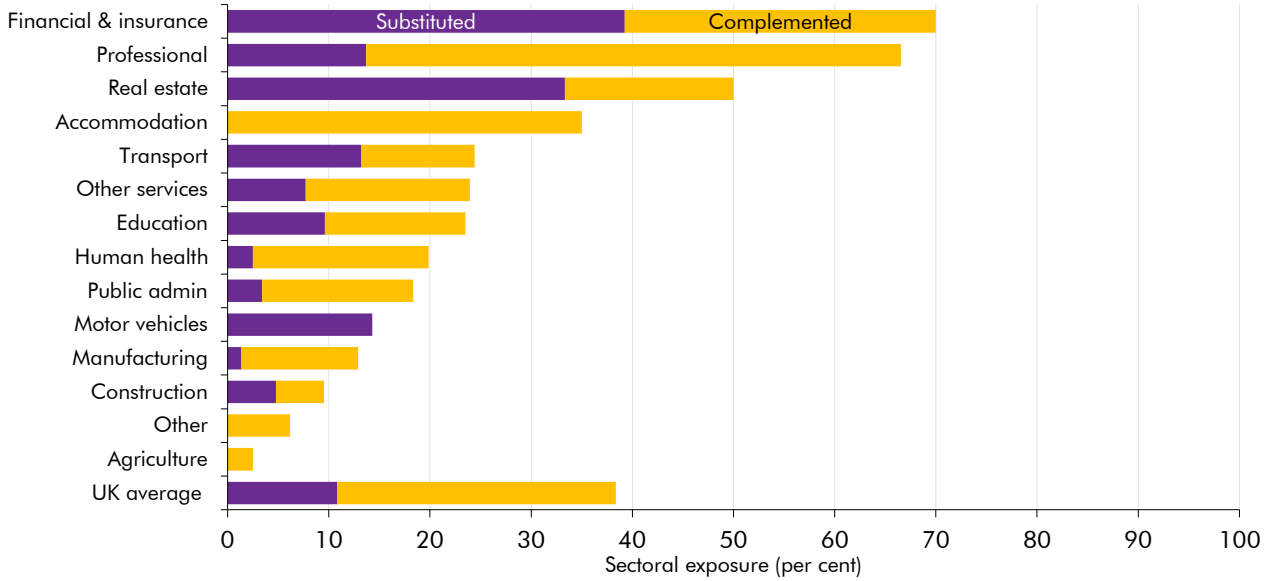
Chart B.1: AI exposure by occupation



Source: OBR

B.7 By share of employment in each sector, we find finance and insurance as the most exposed (70 per cent), followed by professional services (67 per cent) and real estate (50 per cent). The UK average (38 per cent) is heavily influenced by the relatively highly exposed professional services sector which accounts for nearly one-third of employment in the UK.[9] Construction and agriculture are some of the least exposed sectors, with less than 10 per cent of occupations exposed to AI.

Chart B.2: AI exposure by share of employment per sector

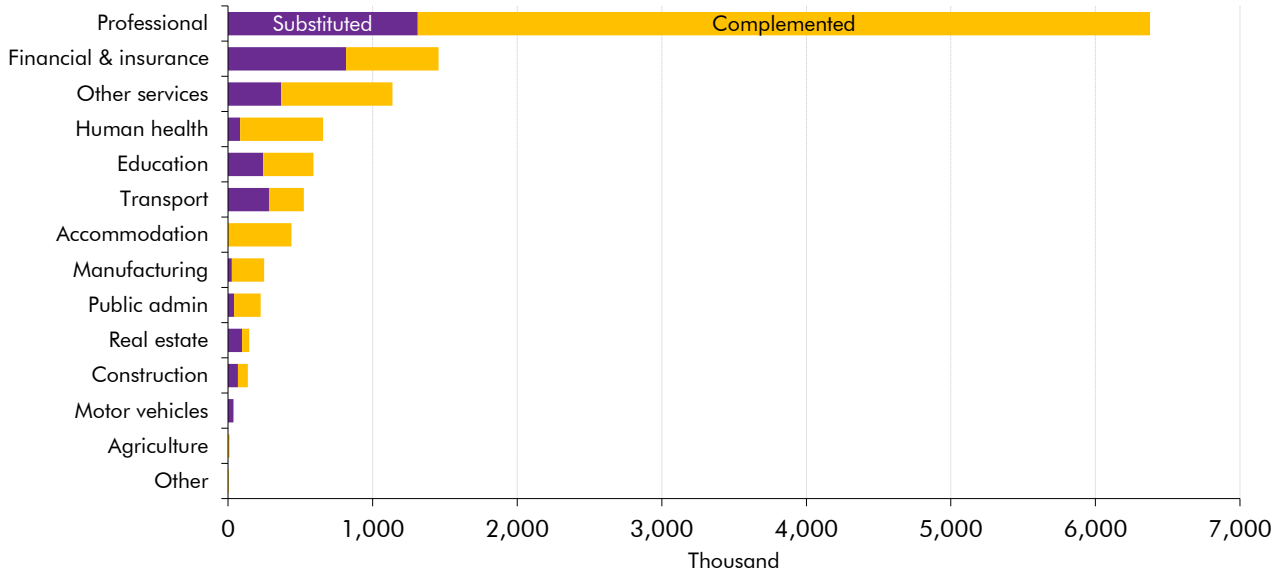


Note: Other includes mining, electricity and water sectors.
Source: OBR

[9] Our framework for mapping occupational results to sectors employs a simple approach, assigning each occupation to a single sector rather than accounting for the multi-sectoral nature of many occupations. As a result, the sector-based exposure estimate (38 per cent) is slightly below the occupation-based exposure estimate (40 per cent).

B.8 To find the impact on the level of employment by sector, we weight the exposure shares in Chart B.2 by their share of UK employment. The majority of workers exposed to AI work in the professional services sector (6.4 million), reflecting the sectors significant size and high exposure to AI. Financial & insurance (1.5 million) and other services (1.1 million) represent the next two most impacted sectors by employment exposure. By contrast, in nine of the 16 sectors, fewer than a ¼ of a million workers are exposed to AI.

Chart B.3: AI exposure by number of jobs exposed per sector



Note: Other includes mining, electricity and water sectors.
Source: OBR

Productivity estimate

B.9 We estimate the overall impact of AI on UK productivity using Acemoglu's framework, drawing on our estimate that 40 per cent of UK occupations are exposed to AI, and the UK's current labour share of approximately 57 per cent of GDP. We then take a simple average of recent external estimates for the feasibility of adoption and average cost savings at the task level.[10] This results in an assumption that 33 per cent of AI-exposed tasks could be feasibly automated in the next decade, with an average cost saving of 32 per cent for exposed tasks. Based on these inputs, we derive our central scenario which suggests AI could boost the level of economy-wide productivity by 2.3 per cent over the next decade. Our central estimate is within the range of external estimates and significantly higher than Acemoglu's estimate. It is broadly in line with estimates by Misch et al. and Bergeaud.[11] However, it is significantly lower than the estimates from Aghion and Bunel, and Filippucci et al. [12,13]

[10] Recent external estimates considered include Acemoglu, D., *The simple macroeconomics of AI,* Economic Policy, 2024; Aghion, P., and S. Bunel, *AI and Growth: Where do we stand?,* 2024; Bergeaud, A., *The Past, Present and Future of European Productivity*, European Central Bank, 2024; Filippucci, F., et al., *Macroeconomic productivity gains from artificial intelligence in G7 economies,* OECD artificial intelligence working paper, 2025. and Misch, F., et al., *AI and Productivity in Europe*. IMF working papers, 2025.
[11] Misch, F., et al., *AI and Productivity in Europe*. IMF working papers, 2025.
[12] Aghion, P., and S. Bunel, *AI and Growth: Where do we stand?,* 2024.
[13] Filippucci, F., et al., *Macroeconomic productivity gains from artificial intelligence in G7 economies,* OECD artificial intelligence papers, 2025.

B.10 Table B.1 shows our estimate of the impact of AI on the level of productivity with external estimates which vary considerably, demonstrating the uncertainty around its future impact. While all the studies referenced use Acemoglu's framework, each relies on different assumptions for key parameters. The literature underpinning these estimates remains limited, for example the average cost-saving estimates are often based on micro-level studies of specific tasks which are extrapolated to the wider economy.

Table B.1: Impact of AI on productivity from studies using Acemoglu's framework

Author	Region	Productivity gain over 10 years (per cent)
Acemoglu	US	0.7
Misch et al.[1]	UK	1.4
Bergeaud	Euro area	2.9
Filippucci et al.[2]	UK	4.0
Aghion and Bunel	US	6.8
OBR (central scenario)	UK	2.3

[1] Five-year forecast horizon.

[2] Scenario chosen is based on exposure given baseline AI capabilities.

Source: Authors listed above

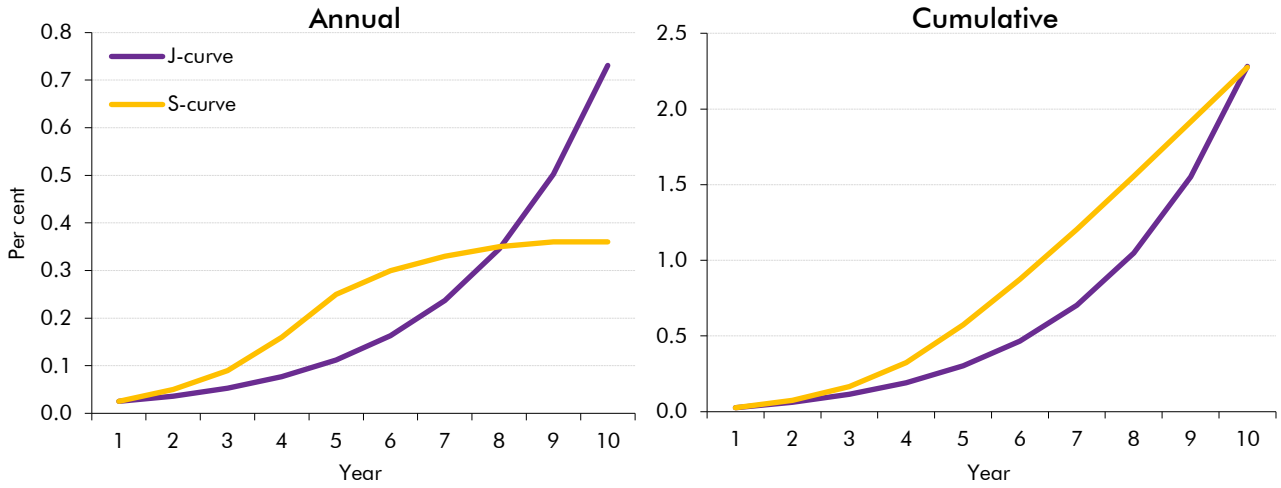
B.11 Studies adopting alternative frameworks also produce varying results. Haskel et al. estimates AI will increase annual labour productivity *growth* by 0.3 percentage points per year, through a production and use effect.[14] Goldman Sachs projects that AI could raise annual productivity growth in developed economies by around 1.5 percentage points during the decade following widespread adoption (at an unspecified time in the future)[15], while McKinsey estimates that AI could boost global annual productivity growth by between 0.5 and 3.4 percentage points up to 2040.[16]

B.12 On top of the uncertainty around the size of the effect of AI on productivity over the next decade, there is further uncertainty around its path, including exactly at what point on the path the UK economy currently sits. We think that the gains are unlikely to follow a linear trajectory. We model two scenarios to illustrate how these gains might materialise over a decade, and their implications for our medium-term forecast (Chart B.4):

- In the **J-curve scenario**, productivity gains build gradually, reaching 0.1 percentage points annually by year five.
- In the **S-curve scenario**, the productivity gains occur more quickly, reaching a ¼ of a percentage point in five years.

[14] Haskel, J., et al., *AI as an Innovation in the Method of Innovation: Implications for Productivity Growth in the US and Europe*, Working paper, 2025.
[15] Briggs, J., and D. Kodnani, *The Potentially Large Effects of Artificial Intelligence on Economic Growth*. Goldman Sachs, 2023.
[16] Chui, M., et al., *The economic potential of generative AI: The next productivity frontier*, McKinsey, 2023.

Chart B.4: Estimated impact of AI on UK productivity



Source: OBR

B.13 We expect the J-curve scenario to be more likely based on historical evidence. Previous general purpose technologies have typically followed this pattern, requiring significant complementary investments before delivering substantial gains.[17] Though the S-curve remains possible as some of the complementary technologies like computers and the internet are already widely used. The limited available data on AI adoption indicate that widespread, intensive adoption remains some way off. So while the exact current placement on the adoption curve is highly uncertain, we think the UK is still towards the start of it, even if not at year 0. The ONS business survey suggests around one-quarter of firms currently use at least one type of AI technology. But adoption at the firm level is different to our measure of exposure at the task-level. Firm-level adoption likely overstates economy-wide adoption as it does not capture the intensity of AI use within adopting firms. In addition, cost and lack of AI skills among existing employees remain barriers to adoption.

B.14 Overall, we think that that a central estimate is that AI will boost productivity growth by around 0.2 percentage point at our forecast horizon, somewhere between the J and S-curves. But given the high degree of uncertainty around our central estimate, we also constructed scenarios to illustrate the range of possible outcomes:

- The **conservative scenario** applies the lowest external estimates for exposure, feasibility, and cost savings. It projects the productivity gains will be equivalent to less than 0.1 percentage points annually on average over the next decade.

- The **transformative scenario** uses the highest external estimates for exposure, feasibility, and cost savings. It suggests the annual productivity gains from AI could be much more significant at around 0.8 percentage points on average.

- The **optimistic scenario** is identical to the transformative scenario except that it uses the average of the range for exposure. It suggests the annual productivity gains from AI could still be significant at around 0.5 percentage points on average.

[17] Brynjolfsson, E., Rock, D. and Syverson, C. *The Productivity J-Curve: How Intangibles Complement General Purpose Technologies*, 2020.

B.15 These **scenarios suggest AI could potentially increase annual productivity growth by anywhere between 0.0 and 0.8 percentage points over the next decade**. While the optimistic and transformative scenarios are possible, we consider the assumptions about exposure and feasibility elements to be fairly unlikely. And, even if achieved, most of the impact would likely occur in the latter half of the 10-years – beyond our medium-term forecast horizon – consistent with the J-curve described above.

B.16 In conclusion, these initial results suggest that AI will likely boost productivity growth over the next decade, including a small uplift over our five-year forecast. However, the timing and magnitude of this boost remains highly uncertain, and will hinge upon the evolution of AI technology, the pace of adoption, and the regulatory environment. For example, the framework we have used does not account for the new tasks that AI may create. AI could also accelerate idea generation, an effect Acemoglu acknowledges could have a substantial impact on productivity, but which is much more difficult to quantify and forecast. However, given the nature of this channel any such gains would likely occur beyond our five-year forecast horizon.

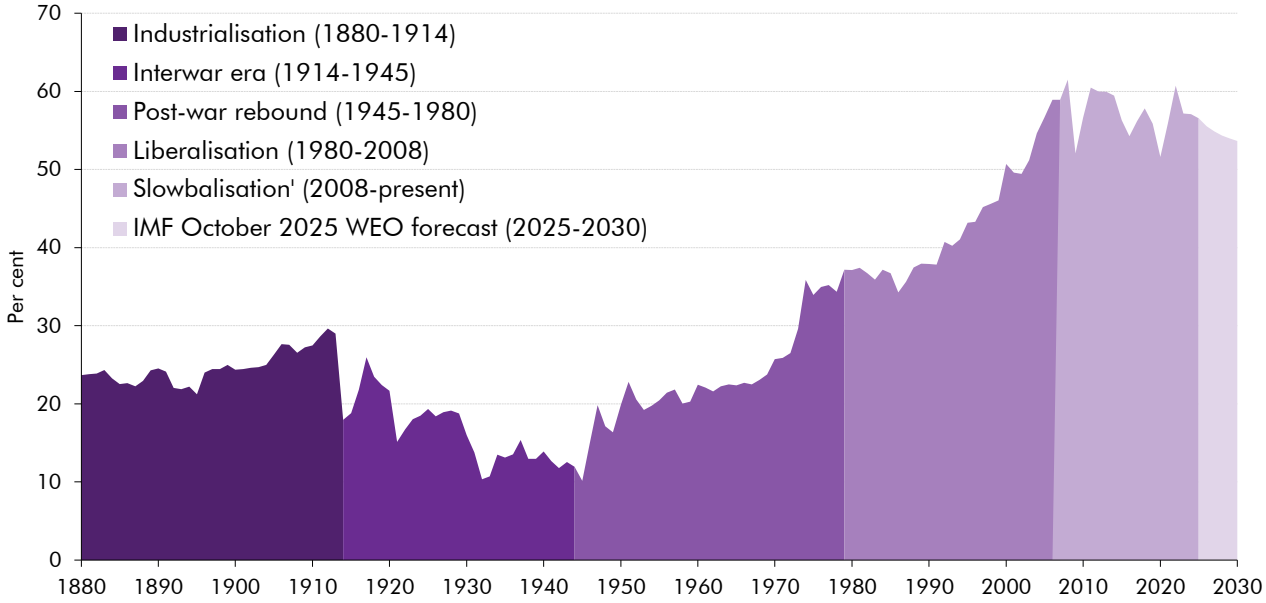
C Trade and productivity

C.1 Economic theory and empirical evidence suggest that greater trade intensity – increases in exports and imports as a share of GDP – leads to increases in productivity over the long run. The trade intensity of the global and UK economies grew rapidly between the early 1990s and mid-2000s which likely contributed to the strong productivity growth in the UK seen over that period, especially in the manufacturing sector. Since then, trade intensity has stalled globally. With recent increases in global protectionism and Brexit still weighing on UK trade performance, we expect global and UK trade intensity to fall slightly over our forecast period. We expect this to act as a drag on UK productivity growth over the forecast relative to the decade prior to the financial crisis.

Global and UK trade intensity

C.2 Global trade intensity rose steadily following the end of World War II but has plateaued since the global financial crisis. Recent rises in global protectionism means that the pre-financial crisis trend is unlikely to re-assert itself in the coming years. Indeed, the IMF expects global trade intensity to fall slightly over the next five years (Chart C.1).

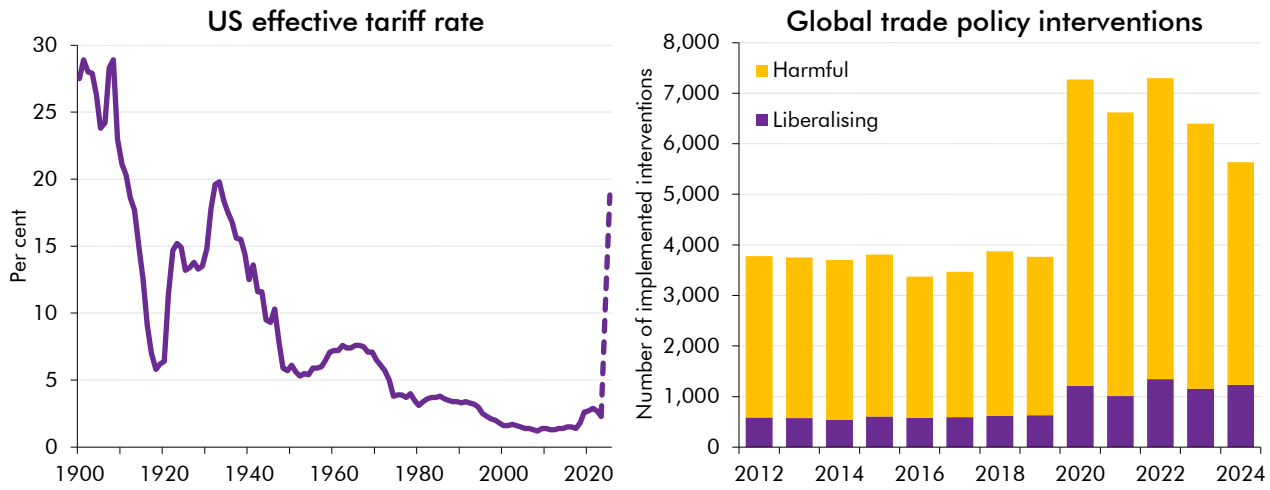
Chart C.1: Global trade intensity



Source: IMF, PIIE

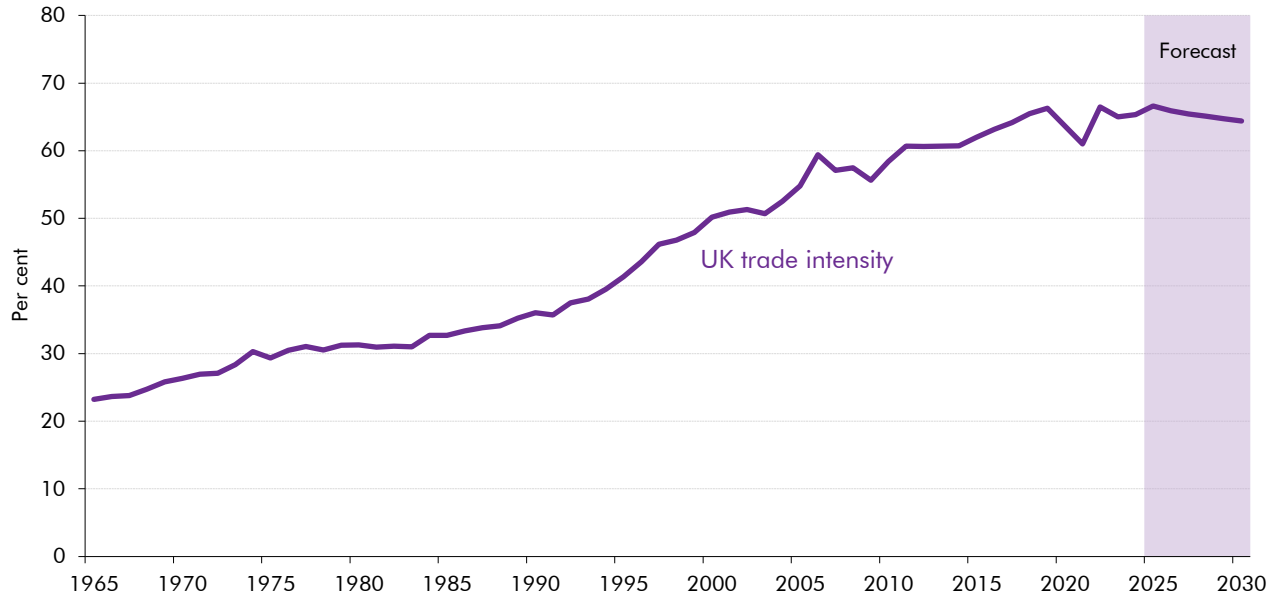
C.3 In line with global trends, the trade intensity of the UK economy increased significantly in the lead-up to the financial crisis, before flatlining. Given the recent rise in global trade barriers (Chart C.2) and the ongoing effects of Brexit, we think UK trade intensity will fall slightly over the next five years (Chart C.3), as covered in more detail below.

Chart C.2: US tariff rate and number of global trade policy interventions



Note: Dashed line indicates IMF estimate of average tariff rates used in October 2025 WEO forecast. No data exists for 2024.
Source: Global Trade Alert, IMF

Chart C.3: UK trade intensity



Source: ONS, OBR

Trade intensity and productivity

C.4 There is strong theoretical and empirical evidence supporting the link between trade intensity and productivity.[55] Increased trade can boost productivity due to:

- **Comparative advantage**: Trade enables countries to specialise in sectors where they are relatively more efficient, improving the allocation of labour and capital across the economy, raising aggregate productivity.

[55] See OBR, *Brexit and the OBR's forecasts*, October 2018 and Bank of England, *EU withdrawal scenarios and monetary and financial stability*, November 2018, for further details and evidence of the trade-productivity link.

- **Increases in scale of production**: Access to larger markets decreases production costs, leading to efficiency gains.[56] Consumers' and firms' generally place value on having a variety of products, and larger markets can support a greater variety of firms with each individual firm able to realise greater economies of scale.

- **Exposure to international competition and markets**: Increased trade exposes low productivity firms to global competition forcing them to improve or to exit the market. And trade gives higher productivity firms access to a larger market, allowing them to expand production.[57] In aggregate, more output in the economy is produced by higher productivity firms so overall productivity increases.

- **Dynamic effects**: Increases in trade can have longer-lasting effects on productivity growth by increasing the diffusion of technology and knowledge. While exposure to greater competition increases the incentive to innovate.[58]

C.5 Empirical evidence points to substantial causal links from trade openness to productivity. For instance, a 2004 review by Cline concluded that *"the uniformly positive estimates suggest that the relevant terms of the debate by now should be about the size of the positive influence of openness on growth, and probably also about how trade policy is related to observed openness, rather than about whether increased levels of trade relative to GDP have a positive effect on productivity and growth"*.[59] Feyrer provides an estimate of trade-productivity elasticities at the whole economy level, as lying between 0.15 and 0.25, using a natural experiment created by the closure of the Suez Canal.[60] Earlier studies often found higher elasticities.[61]

C.6 This is consistent with the firm-level evidence in the literature that exporters are about 20-40 per cent more productive than other firms.[62] Empirical work using administrative trade data from HMRC and the Annual Business Survey finds a positive correlation between trade and productivity in the UK. Businesses which report goods exports or imports were around 21 per cent and 20 per cent more productive, respectively, than businesses which do not trade after controlling for a range of business characteristics such as size.[63] Among traders, more productive businesses export more products and import from more destinations than less productive traders while the ONS found that firms experienced a 6.7 per cent increase in productivity when they engaged in any form of international trade.[64] The productivity effect of increases in trade intensity was likely particularly strong in the manufacturing sector.[65] Increased competition from overseas, lower cost producers may have led to increased investment and innovation. Meanwhile, lower import costs decrease the cost of production for importing firms and offshoring allowed up manufacturers to move up the value chain.

[56] Krugman, P., *Increasing Returns, Monopolistic Competition, and International Trade*, Journal of International Economics, 1979; Krugman, P., *Scale Economies, Product Differentiation, and the Pattern of Trade*, The American Economic Review, 1980.
[57] Melitz, M. J., *The Impact of Trade on Intra-Industry Reallocations and Aggregate Industry Productivity*, NBER Working Paper, 2003.
[58] For example: Kehoe, T., *An Evaluation of the Performance of Applied General Equilibrium Models on the Impact of NAFTA*, Federal Reserve Bank of Minneapolis Research Department Staff Report 320, 2003.
[59] Cline, W., *Trade Policy and Global Poverty*, 2004.
[60] Feyrer, J., *Distance, trade, and income — The 1967 to 1975 closing of the Suez canal as a natural experiment*, 2021.
[61] See for instance the 0.17 to 0.33 elasticities in Frankel, J., and A. Rose, *Estimating the Effect of Currency Unions on Trade and Output*, 2000 or the 0.5 to 0.75 elasticities found in Feyrer, J., *Trade and Income – Exploiting Time Series in Geography*, 2009.
[62] Evidence linking trade with the productivity of individual firms can be found in Section 3.1 of DBT, *The relationship between trade and productivity: a feasibility study*, 2023.
[63] ONS, *UK trade in goods and productivity: new findings*, 2018.
[64] ONS, *Trade and productivity in British firms: 2005 to 2022*, August 2025.
[65] Tenreyro, S., *A fall in productivity growth: causes and implication*, January 2018.

The UK outlook

C.7 While the UK has signed a number of trade deals in recent years, we still expect the trade intensity of the UK economy to decline over the forecast period. This is because the positive impact of these specific bilateral deals is likely to be outweighed by rising global protectionism and the continued impact of Brexit which we continue to assume will lower UK trade by 15 per cent and productivity by around 4 per cent in the long run (15 years). The Department for Business and Trade (DBT) estimate the effects that various trade deals signed and ratified by the UK since leaving the EU will have on the long-term level of GDP (Table C.1). Summing these effects suggests that these deals will have a positive effect of around 0.25 per cent.[66] The economic impact of all of these trade deals is already reflected in our baseline forecast. Our November 2025 forecast also incorporates the increase in US tariffs on the UK (including the partial offset from the deal signed so far between the UK and US) and rest of the world that were not incorporated in our March forecast. Assuming the tariffs are maintained, these are likely to decrease productivity by around 0.1 per cent over 15 years.

C.8 There are also trade deals that remain an upside risk our forecast, pending either ratification or negotiations being finalised. The UK-India Free Trade Agreement, if successfully ratified by both countries, could increase long-term GDP by 0.13 per cent according to DBT analysis. There are two deals with the EU where a Common Understanding has been signed, and details are yet to be negotiated. These could also have a positive impact on our forecast, with initial DBT analysis pointing to a combined impact of around 0.24 per cent on long-term GDP.[67] Once concluded, where these meet our refined criteria for making a supply-side adjustment, we will incorporate their effects into our forecasts.

[66] We make this summation to illustrate the potential size of the effects. This is an approximation as it fails to capture the potential impact of interactive effects between the deals.

Table C.1: Effects of recent trade developments on productivity

Trade deal	Signed	In effect	Estimated long-run GDP impact (per cent)
Included in November 2025 central forecast			
UK-Japan Comprehensive Economic Partnership Agreement	October 2020	January 2021	0.07
UK-Australia Free Trade Agreement	December 2021	May 2023	0.08
UK-New Zealand Free Trade Agreement	February 2022	May 2023	0.03
Joining Comprehensive and Progressive Agreement for Trans-Pacific Partnership whose members include Japan, Canada, Australia, Vietnam, Malaysia, Mexico, Chile, New Zealand, Singapore, Brunei, and Peru	July 2023	December 2024	0.07
UK-US Economic Prosperity Deal	May 2025	Ongoing	NA
Not included in November 2025 central forecast			
UK-India Free Trade Agreement [1]	July 2025	May 2026	0.13
Agreement linking the UK-EU Emissions Trading Schemes (ETS)[2]	May 2025	Subject to negotiation	0.10
UK-EU Sanitary and Phytosanitary Measures (SPS) Agreement [2,3]	May 2025	2027	0.14

Note: Estimated long-run GDP impact figures are sourced from impact assessments and do not necessarily constitute the OBR's central view of the effects of these trade deals. DBT typically assume the long run to be a period of around 10 to 15 years after implementation.

[1] The UK and India signed a free trade agreement in July 2025 with full details including implementation date yet to be confirmed.

[2] The UK and EU signed Common Understanding agreements in May 2025 with most details including implementation dates yet to be confirmed.

[3] DBT present this as an upper bound.

Source: Department for Business and Trade, Department for Envrionment, Food and Rural Affairs

Index of charts and tables