The UK Productivity Slowdown: A Review of Timing, Magnitude, and Drivers

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Abstract

Labour productivity growth in the UK has been historically slow since around the time of the 2008 global financial crisis. This slowdown has prompted extensive policy interest and research effort, with still little consensus. This article reviews the literature on the UK productivity slowdown, and presents new evidence on its timing, magnitude and drivers. On timing, I argue that underlying productivity growth began slowing before 2008. Aggregate productivity growth in 2007 was propped up by unusually fast growth in the finance and insurance industry, and absent this effect would have flatlined from mid-2006. On magnitude, I suggest the slowdown was a little smaller than typical estimates. Using a pre-slowdown period covering multiple full business cycles gives a better pre-slowdown trend growth rate. Excluding particular industries does not materially alter the trends. On drivers, I suggest that the UK may be more affected by some measurement issues and macroeconomic trends than other advanced economies. Notably the UK has decarbonised quicker than most other advanced economies, which may drag on measured productivity more in the UK than elsewhere. I also update growth accounting analyses using the latest data, broadly confirming findings in recent studies. I conclude with recommendations for UK productivity measurement.

There is a large and long literature on UK productivity, and in particular its perceived weakness. Studies of weak UK productivity relate to at least three different notions: a low level of UK productivity relative to other countries; slow

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growth in UK productivity relative to other countries; and a slowdown in productivity growth relative to previous UK experience. Mason *et al.* (2018) document research over many decades on the UK productivity performance, notably on the lower level of UK productivity relative to other advanced economies. Fisher (2024 and 2025) argues that productivity growth has been slowing across advanced economies, including the United Kingdom, for several decades.

This article is concerned with the apparent sharp slowdown in productivity growth in the United Kingdom in the 2000s and 2010s, which is often interpreted to have started with the 2008 global financial crisis and associated economic downturn. This slowdown has been known as the "productivity puzzle" and has garnered significant research and policy attention in the United Kingdom ever since. The Royal Statistical Society labelled the 0.3 per cent average annual increase in UK productivity in the decade or so since the financial crisis as its "UK Statistic of the Decade" in 2019.

Despite the considerable attention paid to this productivity growth slowdown, there is no consensus on its causes. Perhaps more surprising, there is also disagreement on when the slowdown started, and how big it has been. Data revisions over time have altered findings and perceptions, and some views prevail despite new and improved data that suggest otherwise. There are also limitations to current UK economic measurement that hamper productivity analysis.

This article provides a review of the literature on the UK productivity slowdown, with a focus on empirical studies, presents evidence on the timing, size, and drivers of the slowdown, using the latest data, and suggests fruitful avenues to develop UK productivity analyses.

The main findings are as follows.

Timing – The slowdown started before the global financial crisis (GFC), contrary to common perception. Aggregate productivity growth was driven predominantly by the finance and insurance industry in 2007, and absent this contribution it would have already clearly begun slowing in 2006. While it seems likely that the global financial crisis and associated downturn exacerbated the productivity slowdown, underlying productivity growth had already slowed before then.

Magnitude – As the data have evolved over time, notably following the introduction of double deflation in the official UK data in 2021, estimates of the UK productivity slowdown have been revised downward. Using a pre-slowdown period covering multiple full business cycles (e.g. 1976-2006), rather than a shorter period dictated by data availability, a reasonable pre-slowdown rate of trend growth in output per hour worked is 1.9-2.1 per cent for the whole economy and 2.2-2.4 per cent for the market sector – a little lower than typical estimates in the current literature. On this basis, I find a slowdown of roughly 1.5 percentage points per year for the whole economy and 2.0 percentage points per year for the market sector.

Drivers – Based on the latest data and other studies using the post-2021 UK data, the productivity slowdown looks less exceptional relative to other advanced countries. The UK labour productivity slowdown appears to be: (i) mainly driven by a slowdown in TFP, (ii) also partly driven

by a slowdown in capital accumulation, especially of tangible assets, (iii) widespread across industries, and (iv) with a particularly large slowdown in manufacturing. These features are broadly in common with other advanced economies. Other macro trends, notably environmental and industrial, may drag on UK productivity more than in other economies.

This article does not consider the impact of the coronavirus pandemic or the period since. At the time of writing, official data suggest declines in UK productivity in 2023-24, potentially consistent with a further slowdown in productivity growth. However, significant uncertainties exist with official labour market data due to a sharp decline in response rates to the UK Labour Force Survey, a key data source. Given that the true trends in productivity are unclear, and data uncertainties abound, this period is left to future studies.

The article proceeds as follows. Section 1 reviews the literature on the UK productivity slowdown, starting with cyclical and short-term explanations, before turning to structural and global explanations. Section 2 considers whether the UK productivity growth slowdown started before 2007, as often argued for the United States and other countries, drawing especially on industry-level data. Section 3 estimates the magnitude of the slowdown, by first establishing a pre-slowdown rate of trend productivity growth using a time period determined by economic arguments rather than data availability. This section also considers whether the exclusion of any "unusual" industries would alter the findings. Section 4 explores the drivers of the slowdown by first analyzing the latest data, then considering UK-specific measurement issues, and then considering macroeconomic drivers. Section 5 concludes with some suggestions for measurement to enhance UK productivity analysis.

Literature Review

In reviewing the literature on the UK productivity growth slowdown, it seems that the focus and understanding evolved over time. This section is structured roughly chronologically: first, studies exploring cyclical and short-term drivers and narratives; second, studies considering structural drivers (in the United Kingdom and internationally); and finally, more recent studies which consider the UK slowdown in the context of a global slowdown.[2]

Cyclical and Short-Term Explanations

The productivity growth slowdown became apparent somewhat after the 2008-2009 economic downturn precipitated by the global financial crisis. The outcome for productivity from the 2008-2009 downturn could have been: (i) a one-off hit to the level, with subsequent catch-up growth and return to trend; (ii) a one-off hit to the level, with no catch-up but return to

2 For overviews of a range of arguments for the UK productivity slowdown written at different times, see Grice (2012), Patterson (2012), Disney *et al.* (2013), Barnett *et al.* (2014), Bryson and Forth (2015), Haldane (2017), McCann (2018), Heys (2020), and Chadha and Samiri (2024).

trend growth; or (iii) a permanent impact on trend productivity growth. Most observers at the time expected the first possibility.

Given rigidities in the labour market (especially in Europe) and normal labour hoarding (given costs of hiring and firing for firms), economic activity typically falls faster than employment in recessions. As such, measured labour productivity tends to fall at the start of recessions in the United Kingdom (and Europe, though less so in the United States), before recovering as activity recovers and employment adjusts with a lag. As such, the initial fall in UK labour productivity in 2008 was not a puzzle.

However, the hit to real output in 2008 was larger and more persistent than in previous recessions, while the response of employment was slower and smaller (Disney *et al.*, 2013: Chart 3.2), and similarly the rise in unemployment was less than might have been expected. Taken together, this led labour productivity to begin to look unusually weak from around the start of 2009.[3]

In the early literature on this productivity slowdown, cyclical explanations were predominant, in line with the expectation of a return to trend productivity growth. Three common lines of enquiry were: (i) mismeasurement, notably of output; (ii) labour hoarding and capacity utilization; and (iii) reallocation effects across industries.

Measurement is always a challenge, but economic turning points may be harder to measure well, so mismeasurement was a concern shortly after the 2008-2009 economic downturn. Dale (2011) noted that the Monetary Policy Committee at the time expected GDP to be revised up over 2008-2011, which would raise measured productivity and reduce the productivity growth slowdown somewhat.[4]

Goodridge *et al.* (2013) considered another aspect of mismeasurement: the revision to the National Accounts guidelines to treat research and development (R&D) expenditure as capital investment.[5] They suggested that if a wider set of intangibles (beyond just R&D) were treated as investments, cumulative GDP growth between 2008 and 2012 would be revised up by 1.6 percentage points (roughly 0.3 percentage points per year), since the omitted intangibles component was less weak than measured GDP. However, this adjustment is small in the context of the productivity slowdown, is based on a much wider set of intangible assets than are currently included in GDP, and measurement of intangibles remains challenging.

Data revisions over time have increased post-GFC labour productivity growth somewhat, and decreased pre-GFC labour productivity growth a little, both con-

3 The Bank of England's August 2009 Inflation Report was the first to note that productivity was unusually weak relative to previous recessions.

4 Grice (2012) and Patterson (2012) provide reviews of the data underpinning productivity statistics at the time, including comparisons of nominal GDP growth with tax revenues.

5 The UK annual national accounts update in 2014 (Blue Book 2014) was the first to be consistent with the European System of Accounts (ESA) 2010, which capitalized R&D.

tributing to reducing the magnitude of the estimated productivity growth slowdown. Table 1 shows successive data vintages of average annual growth in UK output per hour worked, before and after the 2008-09 downturn and the slowdown as the difference between them (an equivalent table using output per worker is in the Appendix[6]). By Blue Book 2015 the data had settled down to a picture similar to what we have today, in part due to data revisions (mostly to GDP) and in part due to a longer post-GFC period. But even with improved measurement, the productivity growth slowdown clearly remains (UK measurement is discussed further in Section 4).

On labour hoarding and capacity utilization, Blundell *et al.* (2014) and Pessoa and van Reenen (2014) argue for the role of real wage flexibility in the productivity slowdown. If real wages are flexible, then firms can adjust to the decline in demand by reducing real wages rather than reducing hours or headcount. Thus, more real wage flexibility could have enabled firms to retain their workforce to a greater extent without excessively damaging their profitability, but with the result of lower labour productivity. This could explain relatively strong employment, weak productivity, and weak wage growth. In turn, cheaper labour relative to capital might reduce business investment and lead to capital shallowing, further reducing labour productivity.

Composition and reallocation effects act on aggregate productivity growth at all times, but may be particularly important during and after economic downturns. Broadbent (2012) notes that resources (notably capital, but also labour) are slow to reallocate across industries, leaving the economy temporarily mismatched, resulting in lower output per unit of input, and higher price pressures in some industries. A related narrative of "zombie firms" emerges here: historically low interest rates and bank forbearance allow unproductive firms to remain in business for longer than they otherwise would (or should), which hampers the productivity-enhancing effects of firm exit and reallocation of resources to more productive firms.

All these arguments likely played some role in the early years of the slowdown. But the longer that weak productivity growth continued, the clearer it became that trend growth had slowed, rather than just a one-off impact.[7] Business surveys on capacity utilization returned to normal around 2013-14, suggesting firms no longer had too much labour, and business investment was back towards trend in 2015. In light of this, it seems the early literature searching for cyclical drivers was overtaken, and so attention turned to structural drivers of the persistent weak growth rates.

Structural Explanations

From around 2014, the failure of productivity growth to recover motivated a transition from cyclical to structural explana-

6 Online Appendix for this article can be found at csls.ca/ipm/48/UK_productivity_slowdown_appendix.pdf

7 Resources will eventually be reallocated to their most profitable uses; Broadbent (2012) notes that could even lead to a period of above-trend productivity growth, something which has not occurred.

Table 1: UK Output per Hour Worked Growth Estimates, by Data Vintages

Vintage	Release	Last Year of Post-GFC Period	Pre-GFC (1997–2007)	Post-GFC (2010–latest/2019)	Slowdown (Post-GFC minus Pre-GFC)	Memo: Latest Estimate of Post-GFC Period
BB12	Jul-12	2011	2.5	1.1	1.4	0.9
BB13	Jul-13	2012	2.4	-0.5	2.9	0.3
BB14	Oct-14	2013	2.2	-0.1	2.3	0.1
BB15	Oct-15	2014	2.2	0.3	2.0	0.2
BB16	Jul-16	2015	2.2	0.2	2.0	0.2
BB17	Oct-17	2016	2.1	0.3	1.8	0.3
BB18	Jul-18	2017	2.2	0.4	1.8	0.5
BB19	Oct-19	2018	2.3	0.5	1.9	0.5
BB20	Oct-20	2019	2.2	0.4	1.9	0.5
BB21	Oct-21	2019	2.0	0.6	1.4	0.5
BB22	Oct-22	2019	2.0	0.5	1.5	0.5
BB23	Oct-23	2019	2.2	0.5	1.7	0.5
BB24	Oct-24	2019	2.2	0.5	1.7	0.5

Source: ONS (various vintages), author's calculations.
Notes: Update and modification of Table 1 from Martin and Mackenzie (2021), which went up to BB21. In this version the post-GFC period is adjusted to be growth from 2010 (i.e. first year of growth is 2011) to the latest year available or 2019. "Latest estimate of post-GFC period" uses ONS data from May 2025. An equivalent table for output per worker is Table A1 in the Appendix. Growth rates are compound annual averages.

tions. Barnett *et al.* (2014) provide a comprehensive assessment of a range of explanations up to that point, distinguishing between cyclical and more persistent factors. This experience was common across developed countries, so the literature on structural explanations for the productivity slowdown is less UK-specific (see Goldin *et al.* 2024, for an international review). Williams *et al.* (2025) present results of a survey of UK productivity experts on the explanations for the slowdown in question.

Another motivation for the change in course was the availability, from around this time, of data allowing more comprehensive assessment of productivity growth in the post-GFC period in the United Kingdom: growth accounting, and firm-level microdata.

Growth accounting decomposes growth in output (usually GVA) into growth of appropriately weighted inputs of labour and capital, and total factor productivity (TFP) as the residual. Labour inputs are usually measured as compositionally adjusted measures of hours worked (accounting for the changing mix of workers across education, age, and sex groups), and capital inputs are usually measured as capital services (accounting for the changing mix of the capital stock across assets and industries). This framework can be re-arranged to decompose growth in output per hour worked into the contributions of labour composition, capital services per hour worked (capital deepening, or capital shallowing), and TFP. In theory, TFP aims to measure efficiency and technology, though in practice it can also capture anything else that goes unmeasured, and mismeasurement.

As early as 2014, the prevailing view has been that the slowdown in UK labour productivity growth was caused by a slowdown in TFP growth. Goodridge *et al.* (2014) found that the shortfall in labour produc-

8 This paper is appropriately titled "The UK productivity puzzle is a TFP puzzle", which has become a stylised

tivity between 2007 and 2011, relative to the 2000-2007 trend, could be fully 'explained' by a slowdown in TFP growth.[8] More accurately, since TFP is a residual rather than an explanation, they found that labour composition and capital shallowing did not explain the labour productivity growth slowdown. Almost all growth accounting analyses of the United Kingdom since then have made a similar finding. Goldin *et al.* (2024:Table 14) provide a useful summary of the sign and magnitude of contributions to the labour productivity slowdown of ICT and non-ICT capital inputs, labour composition, and TFP across a range of studies. They report a large contribution of TFP in all the UK studies they consider, typically a small contribution from capital (more so non-ICT capital), and no clear contribution from labour composition.

Table A4 in the Appendix summarizes a range of estimates of TFP growth resulting from growth accounting studies of the UK productivity slowdown. Average growth rates of TFP in the pre-slowdown period (variously defined) are typically around 1–1.2 per cent per year for the whole economy, or 1.2–1.5 per cent per year for the market sector. In the slowdown period, TFP growth is typically found to be around zero, or slightly negative, for both the market sector and whole economy. Thus, a considerable slowdown in TFP growth is a consistent finding.

Labour composition (LC) is usually found to continue to grow at much the same pace in the slowdown and pre-slowdown periods, consequently contributing nothing to the slowdown in labour productivity growth. Indeed, some measures find an improvement in LC after 2007, which 'worsens' the productivity puzzle (an improvement in LC should, other factors equal, increase labour productivity growth). That said, there are many labour-relevant factors that LC measures do not account for, such as on-the-job training. Rincon-Aznar *et al.* (2015) find a very small role for a slowdown in training in explaining the labour productivity slowdown.[9]

By contrast, the role of capital is more debated. First, ONS measures of capital stocks and capital services were significantly revised in 2019 following a substantial review of the methods and assumptions and an improved statistical processing system (ONS, 2019). These revisions made capital services for the market sector appear weaker around 2009-2013 than in previous estimates, adding to the estimated role of capital shallowing in explaining the productivity slowdown. Several more recent studies have found that a slowdown in capital deepening (or in the extreme capital shallowing) capital shallowing can explain around a third of the labour productivity growth slowdown (Martin and Mackenzie, 2021; Goodridge and Haskel, 2023).

Second, the scope of capital varies across studies, notably by whether a broader set of intangible assets (beyond those included as assets in the National Accounts) are included. Studies that include these addi-

fact.

9 It is also worth noting inconsistencies in LC measures across datasets and vintages of datasets.

tional intangibles as capital assets (such as Goodridge *et al.* 2014, 2018; and studies using data from EUKLEMS) can be seen to be moving some sources of TFP growth into the contribution of capital and therefore out of TFP. Studies in Table A4 that adjust for additional intangibles tend to find slightly lower pre-slowdown growth in TFP (and slightly larger contributions from capital deepening accordingly), but a negligible effect in the slowdown period. Where studies split capital into different types (e.g. Van Reenen and Yang, 2024; Bontadini *et al.* 2024); van Ark *et al.,* 2024), they tend to find a larger role for capital shallowing of tangible assets than intangible assets.

Finally, the interpretation of capital deepening as an independent driver of labour productivity growth has been challenged by Fernald and Inklaar (2022). They argue that the capital stock is endogenous to TFP, and so the slowdown in TFP growth endogenously slows capital accumulation. They re-arrange the growth accounting framework such that capital is expressed not relative to labour (hours worked), but relative to output, such that it is changes in the capital-output ratio that determine the contribution of capital to labour productivity growth. In this formulation, capital contributes little (independently of TFP) to labour productivity growth or the productivity slowdown in the United Kingdom.

To shed more light on the slowdown in TFP growth, some articles turned to growth accounting by industry. Riley *et al.* (2018) is a thorough example of this approach (see also Tenreyro, 2018, and Kierzenkowski *et al.*, 2018). Based on growth accounting analysis across 15- and 59-industry breakdowns in the market sector, Riley *et al.* (2018) confirmed that the labour productivity slowdown was widespread and driven by TFP across most industries, suggesting macroeconomic drivers. Of the more detailed industries, they identified the financial services and telecommunications services industries as the two largest contributors to the slowdown, followed by retail, mining and quarrying, electricity supply, and manufacturing of pharmaceuticals. In all of these (and indeed most other detailed industries), they found TFP to be the main driver. They note that several of the industries contributing most to the aggregate slowdown are subject to particular measurement challenges.

Industry data also permits the decomposition of aggregate productivity growth into contributions from within-industry growth and changes in industry composition (known as reallocation effects, or between-effects). There are several decomposition methods, and the results depend also on the level of industry aggregation used; for instance, growth within manufacturing includes the contribution of reallocation between detailed manufacturing industries. However, across a range of studies using different aggregation levels and decomposition methods, reallocation effects across industries have consistently been found to play a minor role in the UK productivity slowdown (Riley *et al.* 2018; Goodridge *et al.* 2018; Goodridge and Haskel, 2023; Coyle and Mei, 2023).

The second key data source was firm-level microdata, which became available covering the post-GFC period around 2014,

leading to a range of firm-level analyses of the productivity slowdown. An important data source for this sort of analysis in the UK is the Annual Business Survey (ABS).[10] The cross-sectional ABS data were combined together into a panel dataset known as the Annual Respondents Database (ARD) which has been extensively used for UK firm-level productivity analysis. A major benefit of firm-level analysis is the ability to explore the role of firm entry and firm exit, and re-allocation effects across incumbent firms.

As with industry-level analysis, there are several different decompositions and approaches possible in firm-level data. Riley *et al.*, (2015) implement several decomposition methods, with varying results. Their preferred approach finds that the slowdown in productivity growth across 2007-2013 (both the 2008-09 fall and subsequent partial recovery) relative to earlier years is driven primarily by a within-firm slowdown, while the contribution of external effects (net entry, and re-allocation between incumbents) was somewhat smaller than pre-GFC. Given that economic downturns might be expected to lead to an increase in creative destruction and reallocation of resources, the lack of increase in the external effects is tentative evidence for impairment in the re-allocation process.

Black *et al.* (forthcoming) updates and extends Riley *et al.*, (2015) with ABS data up to 2022, and improved historical data. The longer post-GFC period enables analysis of productivity change over longer windows (e.g. five-year changes in productivity) which can improve the results given that firm-level data can be noisy. Findings in this study suggest a larger role for reduced between-firm re-allocation effects in explaining the post-GFC productivity growth slowdown, with within-firm and between-firm effects each explaining roughly half of the slowdown, and net entry effects explaining relatively little. That said, they also find considerable variation cross decomposition methods, consistent with Riley *et al.*, (2015), which makes these findings uncertain. Black (2022: Figure 3) suggests that much of the strong pre-GFC growth in manufacturing labour productivity was through a reduction in the number of workers in relatively low productivity firms as manufacturing declined in the UK up to 2008, a pattern that could not be repeated. The Bank of England (2023) notes that manufacturing productivity growth between 1997 and 2007 was unusually strong relative to the period before or after.

Other studies explored which parts of the firm-level productivity distribution saw the largest slowdowns. Here the evidence is mixed. Haldane (2017, 2018) emphasized the "long tail" of low productivity firms in the UK, linked to management practices, technology adoption, and international exposure. While potentially significant for the level of UK productivity, it is not clear that these low productivity firms contributed materially to the slowdown in aggregate productivity growth. While nu-

10 The ABS is conducted with a year's lag, and becomes available to researchers a year after that (e.g. data for 2010 was collected in 2011 and available in 2012).

merous, low productivity firms tend to be small, and thus account for a relatively small share of the UK economy, and so likely contributed little to aggregate productivity growth either before or after the GFC. By contrast, Dacic and Melolinna (2022) show that productivity growth of the 100 largest firms in the UK is significant for aggregate UK productivity outcomes.

Schneider (2018) argued that it was a slowdown among UK frontier firms that contributed most to the aggregate productivity slowdown, using a novel decomposition method and data up to 2014. The findings in Schneider (2018) should be interpreted cautiously for two main reasons. First, firms in the extremes of the productivity distribution (both top and bottom) are more likely the subject of measurement error – firms with extremely high or low measured productivity may have erroneously high or low values for turnover or employment. Especially at the top of the distribution, and when working with sample survey data, these firms can have outsized effects on results. Second, Schneider appears to use a version of the ARD that is missing a large part of the services sector, namely the retail and accommodation and food services industries. This omission is likely the result of errors in the construction of early iterations of the ARD, and may influence the results.

The latest analysis of firm-level productivity using the ABS (as in Black, 2022; ONS, 2024) suggest that it is the 'middle' of the productivity distribution that drove the productivity slowdown (van Ark and O'Mahony, 2023). Contributions to aggregate labour productivity growth from firms in the top 10 per cent of the employment-weighted firm productivity distribution was 0.7 percentage points per year on average between 1998 and 2007, and 0.8 percentage points per year on average between 2011 and 2019. The bottom 50 per cent of the productivity distribution contributed just 0.1 percentage points per year on average in both periods. Firms between the 50th and 90th percentiles contributed 0.6 percentage points per year on average pre-GFC, falling to 0.3 percentage points per year afterwards. However, even at this level of aggregation the year-to-year patterns are noisy (Figure A1 in the Appendix), and the implied productivity growth slowdown in the ABS is much less than that in National Accounts data. Wales (2019) documents a range of other findings on UK productivity from firm-level data.

The UK in a Global Slowdown

Literature in more recent years has sought to put the UK productivity slowdown in a global perspective, motivated by data developments and international events.

Until 2021, official UK GVA and GDP estimates were based on "single deflation" methods, making them inconsistent with international best practice and measures in other countries, and so hampering international productivity comparisons. The ONS implemented "double deflation" for the first time in 2021, leading to major revisions to UK National Accounts and industry GVA data, and improving consistency with other countries. Another major change at the same time was the introduction of a new deflator for telecommunications services (Abdirahman *et al.*

2022). Martin (2021) documents the impact of both changes on UK productivity trends and finds notable changes, with revisions varying substantially by industry. The telecommunications industry saw substantial upward revisions to productivity growth, reducing the degree of slowdown considerably. Many manufacturing industries saw productivity growth revised up in years before the financial crisis, but much less in years after, leading to a larger productivity growth slowdown. Findings in studies using earlier UK industry data therefore may no longer hold.

More recent articles using the latest UK industry data (e.g. Martin and Mackenzie, 2021; Coyle and Mei, 2023; Goodridge and Haskel, 2023) tend to find the largest contributions to the productivity slowdown from manufacturing, ICT, and finance industries. Goodridge and Haskel (2023) suggest that the TFP slowdown is mostly explained by intangible-intensive industries, including the aforementioned selection. These industry patterns are mirrored for the United Kingdom in international datasets.

A range of recent studies compare productivity trends across countries, facilitated by advances in cross-country data, including the EUKLEMS-INTANProd database (see Bontadini *et al.* 2024 for details). Van Reenen and Yang (2024) compare the United Kingdom with the United States, Germany, and France using the 2023-vintage of EUKLEMS-INTANProd. They find a 1.2 percentage point slowdown in annual TFP growth for the UK market sector in 2007–2019 compared with 1995–2007, broadly similar to that for the comparator countries; but a larger slowdown in capital deepening and labour composition than others. Bontadini *et al.* (2024) use the same data, including also an adjustment for the capitalization of additional intangible assets, and find the UK productivity slowdown driven by TFP and capital deepening.[11] Goldin *et al.* (2024) use the 2019-vintage of EUKLEMS and define the slowdown as 2006–2017 relative to 1996–2005. They similarly find a large (albeit common) slowdown in TFP growth and capital deepening, but an unusual slowdown in labour composition in the United Kingdom. It is noteworthy that studies using EUKLEMS datasets have markedly different findings from studies using ONS data (e.g. Goodridge and Haskel, 2024) on the role of labour composition; any differences in labour composition have equivalent differences of the opposite sign for TFP.

These studies tend to find the labour productivity growth slowdown (variously defined) to be larger in the United Kingdom than comparator countries, which is also a common theme in commentary on productivity in UK policy circles. By contrast, Fernald and Inklaar (2022) suggest that the UK productivity slowdown was

11 However, they also offer an alternative interpretation: using an adjusted (lower) pre-slowdown baseline for TFP growth, a more recent comparison period of 2014-2019, and adjusting for "mismeasurement of prices for consumer digital services", they find that the TFP slowdown is much milder at just 0.15 percentage points per year for the UK, and near zero for the United States. The relevance of the mismeasurement adjustment for the UK is unclear, given that these UK data already include the substantially revised telecommunications deflator described in Abdirahman *et al.* (2022).

very similar to that in the United States and northern European countries and that the United Kingdom does not appear unusual in this regard. They argue that the slowdown, common across countries, should be viewed through the lens of conditional convergence, and since the frontier (taken to be the United States) slowed, so too would countries near the frontier (such as the United Kingdom).[12] They argue that any (small) additional slowing in the United Kingdom relative to the slowing at the frontier can be explained by industry-specific issues (e.g. mining) and a small difference in industry structure across countries. Fisher (2024: Figure 5) similarly notes the parallel trends of whole economy labour productivity in the United Kingdom and United States between 2009 and 2019.

Timing of the Slowdown

Many studies assume that the UK productivity slowdown in question started with the Global Financial Crisis (GFC) and the associated economic downturn. The United Kingdom entered recession in 2008 Q2 and saw annual falls in measured labour productivity in 2008 and 2009. It is intuitive and common, therefore, to interpret 2008 as the start of the slowdown and thus the period up to 2007 as the period before the slowdown.

Table A3 provides a summary of growth accounting studies that analyze the UK productivity slowdown. The vast majority use a pre-slowdown period that ends in 2007, in line with the view that the slowdown happened after 2007. The choice of "before" period and "after" period matters for the estimated size of the slowdown, but for now we focus on the timing.

There is a broad consensus that the slowdown in the United States started around 2005 (e.g. Cette *et al.*, 2016; Fernald *et al.*, 2025), and so slowdowns are often defined between pre-2005 and post-2005. This is the case, for instance, in Gordon and Sayed (2019) and Goldin *et al.* (2024). A key motivation here seems to be the end of the ICT-related productivity boom in the United States which ran from the mid-1990s to the mid-2000s (roughly 1995–2005). Gordon and Sayed (2019) note that Europe did not see such a productivity boom pre-2005. Cette *et al.* (2016) argue that productivity slowdown in question happened before the "Great Recession" of 2008–09 both in the United States and Europe, but observe a "sharp break with the [Global Financial] Crisis" for the United Kingdom.

Given the view that US productivity slowed before the GFC, it is worth considering if that might also hold for the United Kingdom. Chart 1 explores the industry contributions to annual growth in aggregate UK output per hour worked in each year between 1998 and 2007. Some remarkable patterns emerge. First, the contribution from the finance and insurance industry (dark brown) alone can almost explain aggregate productivity growth in 2007. From the underlying industry de-

12 Philippon (2022) argues that TFP actually evolves linearly rather than exponentially. In this view, there has been no slowdown in the true additive TFP process, but rather TFP in most advanced economies is now so high that new innovations make only a small additive contribution.

tail, it is the insurance industry which drives this, bouncing back from a particularly weak year in 2006 (note the negative contribution of finance and insurance in 2006); though the other two finance industries also contribute positively in 2007. Second, manufacturing (light green), which had been the engine of productivity growth up to 2006, contributes very little in 2007. At a more detailed level within manufacturing, the drop in contributions is widespread, but due especially to manufacturing of other transport equipment (division 30), e.g. aircraft; manufacturing of computer, electronic, and optical products (26); and manufacturing of food products (10). Third, the remaining "other" industries (dark green) collectively contribute negatively in 2007.

Chart 1 suggests that apparently strong productivity growth in 2007 is something of a mirage, driven by unusually fast growth in the finance and insurance industries, and not matched elsewhere. Table A2 in the Appendix presents some descriptive statistics that attempt to capture the breadth of productivity growth across the economy. Across most metrics, 2007 appears a year of relatively narrow productivity growth—for instance, the unweighted median annual growth in output per hour worked across 78 industries was just 0.1 per cent in 2007, having been near 2 per cent in previous years.

The unusually fast productivity growth in the finance and insurance industries in 2007 may have been driven by mismeasurement, which is notoriously difficult, and perhaps especially so in the run-up to the GFC. Alternatively, measurement may have been appropriate but capturing "bad outputs" associated with unsustainable risk-taking and socially damaging activities that led to the GFC. Better or alternative measures of finance and insurance output and productivity might therefore give an alternative perspective of aggregate productivity growth in the years before the GFC (note the large contribution of the finance and insurance industries in 2005 in Chart 1 as well).

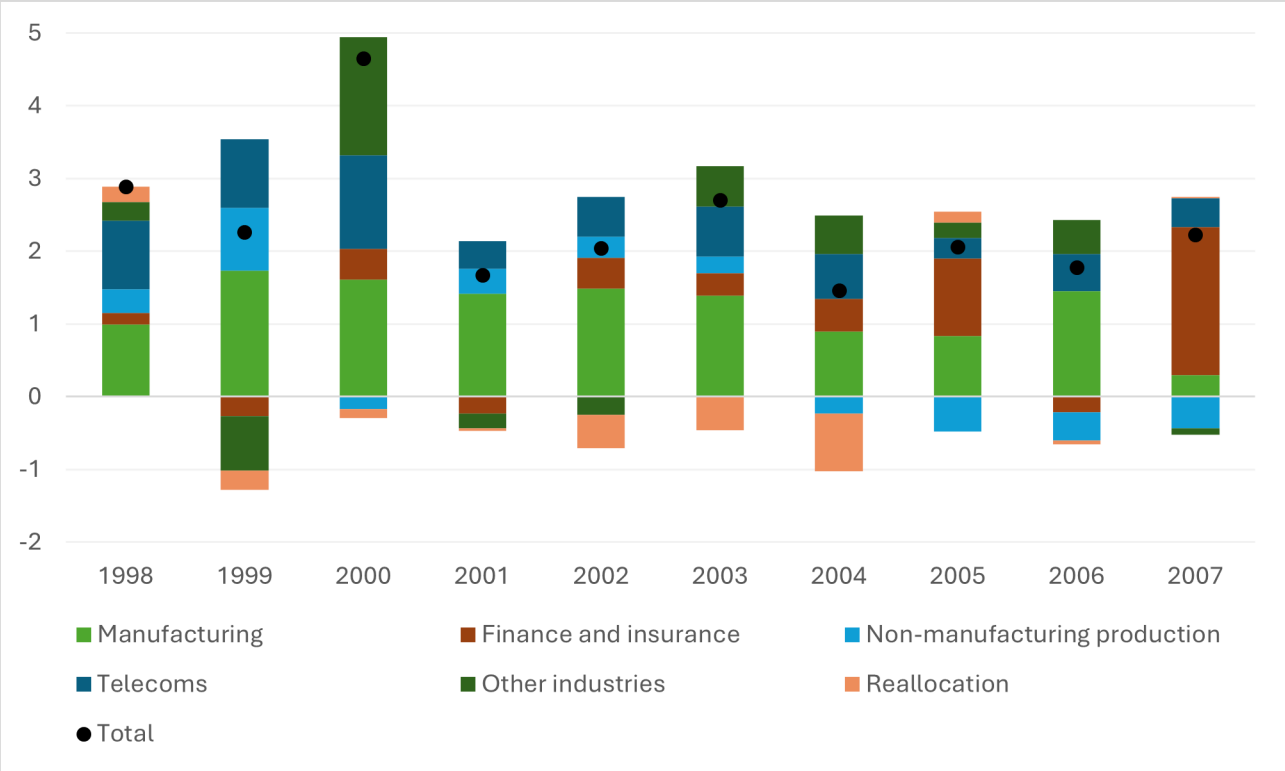
Chart 2 shows output per hour worked for the whole economy including and excluding the finance and insurance industry, indexed to 100 in 1997, to explore the potential impact of alternative measurement of this industry. Consistent with Chart 1, measured productivity peaks in 2006 and falls in 2007 for the series excluding finance and insurance, and goes on to fall in 2008 and 2009, before recovering. By about 2013 the series had more or less re-converged. Using quarterly data (not shown), output per hour worked peaks in 2006 Q2–Q3 for the series excluding the finance and insurance industry, essentially flatlines through to 2008 Q2, before falling. Section 2 considers measures that exclude other industries for various reasons.

Taking the evidence from this section together, the productivity slowdown in the United Kingdom probably started before the GFC, with productivity already having slowed in 2007 (before the recession in 2008). However, measurement challenges mean that we should perhaps be cautious not to over-interpret any individual year of data.

Size of the Slowdown

A slowdown in productivity growth is,

Chart 1: Industry Contributions to Annual Growth in Whole Economy Output Per Hour Worked, 1998–2007



Source: ONS (2025), author's calculations.
Notes: Contributions use the Tang and Wang (2004) decomposition, with each industry weighted by its share of nominal GVA in the previous year; the reallocation effect is the residual after subtracting all the within-industry contributions from whole economy growth. Whole economy and real estate industry exclude imputed rental from GVA. Contributions are calculated across 78 industries using ONS data and aggregated. Non-manufacturing production is agriculture, mining and quarrying, energy, and water and waste. Telecoms is industry division 61.

by definition, the difference between some slower rate of growth in a later period relative to some faster rate of growth in an earlier period. We would prefer those "before" and "after" growth rates to be representative of the trend rate of growth, rather than distorted by volatility or idiosyncratic events. Which periods are most suitable for such a calculation?

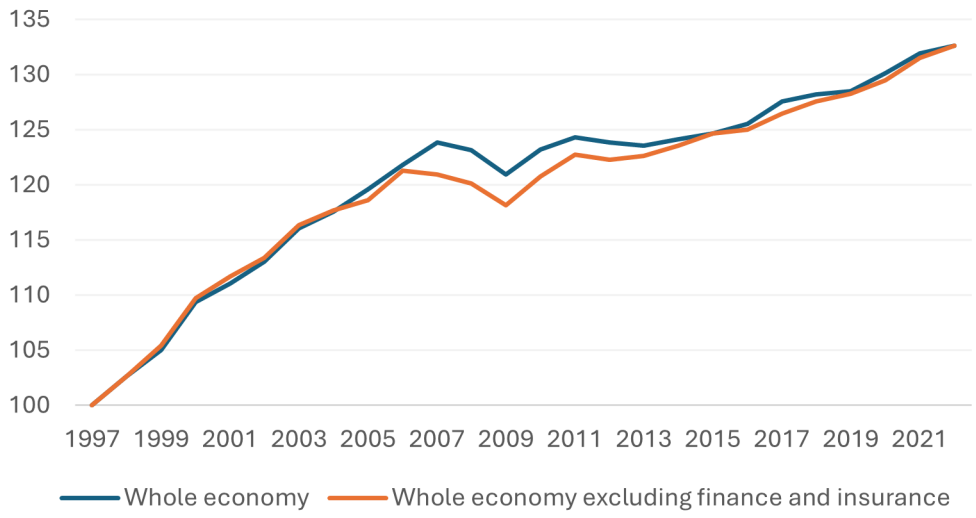
The Pre-Slowdown Trend – The "Before" Period

The choice of period for the trend rate of productivity growth "before" the slowdown should be informed by economic arguments, but has often been dictated instead by data availability and convenience.

Many studies use a "before" period that ends in 2007, aligned with the perceived pre-GFC peak in UK labour productivity. It was mentioned in the previous section that the slowdown likely started just before the 2008 financial crisis and economic downturn, and so the "before" period would be better ended in 2006 than 2007. But the impact on the trend pre-slowdown rate of productivity growth from such a choice will be slight.

Of more significance to the trend rate

Chart 2: Output Per Hour Worked, Whole Economy With and Without the Finance and Insurance Industry, Index 1997=100



Source: ONS (2025), author's calculations.
Notes: "Whole economy excluding finance and insurance" is whole economy GVA minus the GVA of the finance and insurance industry (section K), correctly chain-linked, divided by hours worked with a similar adjustment.

of pre-slowdown productivity growth is the choice of where to start the period. The start of the "before" period is often taken as 1997 (first growth rate in 1998), likely because various official UK data published by the ONS start in 1997, which makes this an easy choice.[13] Tables A3 and A4 in the Appendix show a range of studies on the UK productivity slowdown, many of which use a "before" period that starts in 1997. Other convenient years to start the "before" period include 1995 (the start of UK data in some international datasets)[14], 1990 (the start of some ONS industry GVA data, and a decennial year), and 1970 (the start of the current ONS growth accounting estimates).

However, it would be preferable to choose a period that best establishes the trend rate of productivity growth based on economic principles. Given the known pro-cyclicality of labour productivity estimates (Basu and Fernald, 2001), the trend is likely best measured over a period that

13 For instance, ONS industry productivity estimates start in 1997, which follows because the annual supply and use tables are currently published for years since 1997, and this has been true since 2011 when the ONS moved the National Accounts to the Standard Industrial Classification (SIC) 2007 for the first time. GDP and GVA estimates for years prior to 1997 are given less scrutiny, and so are likely to be less consistent with post-1997 data.

14 For transmission to Eurostat (while the United Kingdom was still a member of the EU), data since 1995 was required for some variables under EU regulations. For the United Kingdom, these were typically compiled as an 'extension' to more comprehensive estimates that started in 1997. As such, many international datasets contain UK data since 1995, though the quality of the 1995 and 1996 data is likely lower than the data from 1997 onwards.

15 An alternative approach would be to use a series that is already adjusted for variations in capacity utilization, such as Fernald (2014) for the United States. There is not such a series for the United Kingdom given challenges measuring capital utilization (see Martin and Jones, 2022, for a discussion).

Table 2: Average Annual Growth of Output per Hour Worked, Various Ranges Prior to Slowdown

Range	Whole Economy		Market Sector	
	Compound Annual Average Growth	Median Annual Growth	Compound Annual Average Growth	Median Annual Growth
Preferred ranges				
1976-2006	2.3	2.3	2.2	2.4
1985-2006	2.1	2.1	2.2	2.2
1994-2006	2.1	2.0	2.4	2.2
2002-2006	1.9	1.8	2.4	2.2
Preferred start dates with ending in 2007				
1976-2007	2.2	2.3	2.2	2.2
1985-2007	2.1	2.0	2.2	2.2
1994-2007	2.1	1.9	2.4	2.1
2002-2007	1.8	1.7	2.3	2.1
Typical ranges				
1995-2005	2.2	2.2	2.7	2.4
1995-2007	2.2	2.0	2.5	2.2
1997-2007	2.2	1.8	2.7	2.4
2000-2007	1.8	1.7	2.3	2.1

Source: ONS (May 2025), author's calculations.
Notes: Year ranges are from the level of productivity in the first year, e.g. 1976–2006 is the growth from 1976 to 2006, with the first growth rate being between 1976 and 1977 (the growth between 1975 and 1976 is not included). Whole economy data from latest labour productivity statistics at time of writing, published May 2025, consistent with Blue Book 2024; market sector data from latest ONS growth accounting estimates at time of writing, published May 2025, consistent with Blue Book 2024.

spans one or more whole business cycles.[15] This could be done peak-to-peak or trough-to-trough, though deviations at peaks and troughs are not always comparable, and may be subject to increased measurement error. Therefore, a period starting and ending at a point where the economy is near balance (i.e. the output gap is near zero and capacity utilization is near normal) is preferable. Additionally, longer periods are likely preferable since the effects of any short-term volatility or measurement error are diluted with longer time periods.

To identify periods when the economy was near balance and so judge a reasonable period to establish trend productivity growth, estimates of the historical output gap and capacity utilization from a range of sources are used, summarized in Pybus (2011). Periods at which the output gap seems near closed include roughly 1976–77, 1985–86, 1994–95, 2002–2003, and 2006.

Table 2 shows average annual growth of output per hour worked between each of these earlier periods and 2006 (taken to be the end period and start of the slowdown, as discussed earlier), for both the whole economy and market sector. For the whole economy, the preferred ranges give similar averages to the typical ranges; but for the market sector, the average growth rates over the preferred ranges are lower than the typical pre-slowdown growth rates used in studies of the UK slowdown, as detailed in Table A3 (some of which are also shown in Table 2). The difference between ending in 2006 and 2007 is slight, but starting in 1995 or 1997 seems to give a trend rate that is too high for the market sector. There are three years of fast labour productivity growth in the late 1990s, which likely cause the pre-slowdown period to be overstated if a short window is used.

An alternative approach, also shown in Table 2, is to take the median annual growth rate across the period. This reduces

the influence of unusually fast (or slow) years of productivity growth and gives a better sense of the central tendency of annual growth over the period. These medians accord better with the means over the periods proposed in this article. Taken together, a reasonable pre-slowdown rate of trend growth in output per hour worked is 2.2–2.4 per cent for the market sector and 1.9–2.1 per cent for the whole economy. This is similar to, though slightly lower than, the estimate from Crafts and Mills (2020), who find a trend rate of whole economy output per hour worked growth of 2.3 per cent immediately pre-GFC (and a range from 0.9 per cent to 3.3 per cent per year over the preceding 150 years).

The Slowdown Trend – The "After" Period

For the "after" period, we again wish to choose a period that best represents the trend rate of growth in this slowdown period, rather than being distorted by where we choose to measure it. For this second period in the before–after comparison, it is the start date that is most significant. Some studies start this second period immediately after the end of the "before" period—for instance, 1997–2007 and then 2007–2019. However, given the procyclicality of labour productivity measures, this suffers the same issues as described above. Labour productivity fell in 2008 and fell further in 2009 before recovering strongly in 2010. Taking those three years together gives a reasonable average of 0.3 per cent annual growth, but taking only one or two of those years (e.g. starting in 2008 or 2009) risks biasing the results.

Even starting in 2006, however, causes problems. The GFC caused a large recession by recent historical standards, so even including the whole GFC and downturn period (2008–2010) is arguably not a good reflection of the trend rate of growth in this slowdown period. This is particularly true for TFP, given challenges measuring capital during downturns (see Section 5). It might be preferable, therefore, to start in 2010 (i.e. growth in 2011) and miss the GFC period entirely.

After the 2008–09 downturn there were a series of other shocks that complicate the assessment of trends, especially across countries. The Eurozone debt crisis of 2012–13 likely had some impact on the United Kingdom, but causes particular issues for European country comparisons, leading some authors to split the post-GFC period in two parts (e.g. Bontadini *et al.*, 2024, use 2010–2014 and 2015–2019). The United Kingdom's vote to leave the European Union in 2016 is a UK-specific shock. Impacts on the UK economy likely began immediately given the sharp depreciation of Sterling and stagnation of business investment (Haskel and Martin, 2023). The impacts of Brexit likely built over time, especially so when border controls came into effect in 2020, though the assessment of this is hampered by the concurrent coronavirus pandemic. The pandemic and associated recession in 2020, followed by the Russian invasion of Ukraine in 2022 and surge in inflation in 2022–23, complicate this period further. Data issues also increased during and after the pandemic.

The post-GFC period in the United Kingdom has been marked by substantial growth in employment and hours worked,

Table 3: Average Annual Growth of Output per Hour Worked, Various Ranges for the Slowdown

Range	Whole Economy		Market Sector	
	Compound Annual Average Growth	Median Annual Growth	Compound Annual Average Growth	Median Annual Growth
Preferred ranges				
2006-2019	0.41	0.44	0.37	0.12
2010-2019	0.47	0.44	0.24	0.12
Other ranges				
2007-2019	0.31	0.43	0.25	0.09
2008-2019	0.39	0.44	0.31	0.12
2009-2019	0.60	0.46	0.47	0.15
2010-2016	0.31	0.43	0.13	0.09
2010-2017	0.50	0.44	0.28	0.12

Source: ONS (May 2025), author's calculations.
Notes: Year ranges are from the level of productivity in the first year, e.g. 2006–2019 is the growth from 2006 to 2019, with the first growth rate being between 2006 and 2007 (the growth between 2005 and 2006 is not included). Whole economy data from latest labour productivity statistics at time of writing, published May 2025, consistent with Blue Book 2024; market sector data from latest ONS growth accounting estimates at time of writing, published May 2025, consistent with Blue Book 2024.

driven in part by inward migration. Hours worked in the market sector grew at an average annual rate of 1.8 per cent between 2010 and 2019, faster than any individual year since 1997 and more than twice as fast as the average over any of the pre-slowdown year ranges discussed. Some of this strength in market sector labour input is offset by declining employment in the public sector between 2010 and 2019, such that whole economy labour input growth is somewhat less strong.

Table 3 reports a range of average annual growth rates for the "after" period, in a similar style to Table 2. The unusually strong growth rates in 2010 (recovery from the GFC) and 2017 (footnote 16) drag up the means when included, while periods that start with the low levels of productivity during the financial crisis appear too low (for the whole economy at least). The medians give a better sense of the typical year over this period, which for the market sector is a paltry 0.1 per cent.[16]

Taking the estimates in Table 3 together, a reasonable rate of trend growth in output per hour worked since the slowdown is 0.2–0.3 per cent for the market sector and 0.4–0.5 per cent for the whole economy. It is noteworthy that the market sector has seen slower growth than the economy as a whole, implying yet faster growth for the non-market sector.

Measuring the Trend – Which Industries to Include

There are several industries (sectors) which might be considered peculiar and so omitted from measures of trend productivity growth. Some of these overlap with industries identified by Coyle (2024)

16 The pattern of annual growth in output and hours gives rise to the peculiar result that output per hour worked in 2017 grows by 1.2 per cent in the market sector and 1.7 per cent for the whole economy, while other years in the post-GFC decade do not come close to this. Similarly, MFP is estimated to grow by 1.1 per cent in 2017, while estimated MFP growth in the adjacent four years is negative (in the latest ONS data). This leads the mean to be much higher than the median. However, measurement is never so accurate as to over-interpret a single year, and timing inconsistencies in labour, capital and output data could play a role.

as "hard to measure" in the modern economy, though my choices are dictated not only by measurement. This section discusses the arguments for such exclusions and presents estimates that omit various combinations of these industries.

Government. The most obvious candidate industries for exclusion are perhaps those industries in which the public sector (government) dominates—both because these industries are much less the subject of market forces and because their measurement is challenging. In the National Accounts, non-market output is usually measured by its inputs, which prohibits any measured productivity growth. The ONS is a world leader in measuring government output, using output measures based on activities rather than inputs to a large extent, which allows for change in measured productivity. But measures in the National Accounts do not account for quality change, in the United Kingdom or internationally, making these measures limited (see Heys, 2025, in this issue for discussion of UK public service productivity measures).

In the United Kingdom context, the relevant industries are public administration and defense (section O), education (section P), and health and social care (section Q).[17] Some studies and datasets, for convenience, equate the activities of industries O, P, and Q (henceforth "OPQ") to government activities, and refer to a measure that excludes OPQ as the market sector. This is a reasonable approximation but an imprecise one. An alternative (used primarily in this paper) is measures of the market sector, based on National Accounts data by institutional sector—nonmarket sectors, namely government and the non-profit institutions serving households (NPISH) sector, are omitted, leaving the "market sectors" comprising the nonfinancial and financial corporations and households sectors. One drawback of the market sector measures (when defined by institutional sector) is that it includes imputed rental since it is output of the households sector.

Real Estate. Output of the real estate industry includes imputed rent—the imputed income that households who own their own homes pay to themselves instead of paying a landlord for a rental property. This is rightly included in estimates of GDP for the purposes of cross-country comparability. However, for productivity analysis, imputed rent is unhelpful—it is income (and thus output and GVA) without corresponding labour input, since there is no equivalent imputation of owner-occupier hours worked. As such, many studies prefer to exclude imputed rent or, indeed, for convenience exclude the real estate industry entirely. ONS publishes series of labour productivity for the whole economy excluding imputed rent.

Imputed rent causes further challenges in industry-level analysis, including of reallocation effects. Given the additional imputed GVA without associated labour, labour productivity in the real estate indus-

17 The UK public sector also operates in other industries, including waste disposal (part of section E), libraries and other cultural activities (part of section R), and financial services (section K) given the operation of the central bank and the effective nationalization of some financial institutions after the GFC.

try appears to be very high. As such, it has an outsized effect on within-between decompositions of productivity growth across industries. The real estate industry has relatively little employment, and as a result, the estimates of hours worked can be noisy, since they rely on small samples of workers. Small (often erratic) moves in hours worked of the real estate industry can dominate reallocation effects. Using measures for the real estate industry excluding imputed rent is preferable (this is the approach used in Chart 1). Even this residual part of the real estate industry can cause issues—much of the income of the real estate industry is generated by capital (dwellings and other buildings), so the industry has a very low labour share and a high level of labour productivity. It can therefore be preferable to calculate within-between decompositions excluding the real estate industry entirely.

Agriculture. Another often-excluded industry is agriculture—notably in the United States, where "non-farm" measures are standard. The reason for the exclusion in the United States relates to the seasonality of agricultural labour and the potential for weather-induced volatility in output measures, which could cause challenges in interpreting the data (though in other countries, the seasonality may be different). Most data on the UK agriculture industry comes from the relevant central government department rather than ONS-run business surveys, but the data are thought to be robust. Agriculture is a small part of the UK economy in recent decades, so its exclusion will have little effect on aggregate productivity estimates.

Mining and Quarrying. In the UK context, the mining and quarrying industry (notably oil and gas extraction) might also be excluded. United Kingdom North Sea oil production peaked in the mid-1980s and again in the late-1990s-to-early-2000s and has been in fairly continuous decline ever since. Measured labour productivity in the mining and quarrying industry was in near continuous decline between 1997 and 2013, before recovering somewhat up to 2016 and then leveling off. This pattern is in contrast to the United States, which has seen sharp increases in mining productivity due to fracking (Gordon and Sayed, 2019), and also in contrast to major European countries, which mostly have little mining activity. The secular decline of UK mining and quarrying since around the turn of the century is a good argument to exclude it from aggregate measures.

Utilities. The utilities industries of energy generation and distribution and water supply are an interesting case. Similar to the mining industry, though to a lesser extent, these industries have also seen a decline in (measured) labour productivity since the early 2000s. The output of both industries is in large part measured directly by the volume of energy and water, respectively, transmitted to households. Over recent decades, there has been considerable effort in many countries to reduce consumption of energy and water for environmental reasons, leading to weak growth in (measured) output and a decline in (measured) productivity. We might therefore prefer to exclude these industries too.

Finance and Insurance. As discussed earlier, measured productivity of the finance and insurance industry may have been growing at unsustainable rates pre-

GFC and so might not be appropriate to include in the pre-slowdown "trend" rate. This is a similar argument as for the exclusion of the mining industry, but in reverse—while the mining industry is in secular decline, which is not representative of the economy as a whole, the finance industry was in a temporary boom, which is also not representative. There are also well-known challenges with the measurement of financial services output.

If one were to exclude, for one reason or another, all of the industries discussed in this section, what would that leave? Roughly 55 per cent of the economy by nominal GVA and roughly 70 per cent by hours worked, consisting of manufacturing, construction, retail and wholesale, transportation, accommodation and food services, ICT services, professional services, admin and support services, arts and recreation, and other services. We might call this remainder the "core market sector." (One could easily make an argument to exclude any of these remaining industries as well, but in order to retain a reasonably-sized aggregate, we will proceed with this group.)

Table 4 summarizes average annual growth of output per hour worked for a selection of aggregates that exclude one or more of the industries discussed in this section, with more alternatives in Table A5 in the Appendix. The slowdown is not much altered by excluding agriculture, mining, utilities, or finance. Excluding real estate makes the slowdown larger, since it notably increases average annual growth before 2006. Excluding government services makes the slowdown even larger. The full set of exclusions discussed here inflates pre-slowdown average annual growth to 3.6 per cent per year, and while it increases post-slowdown growth to 0.8 per cent per year, that still constitutes a very significant slowdown (2.8 percentage points).

What then to conclude on the size of the slowdown in the United Kingdom? The preferred "before" and "after" periods suggest slowdowns of around 1.5–1.6 percentage points for the whole economy and around 2.0 percentage points (1.9–2.3 percentage points) for the market sector. The range of industry groupings explored in Table 4 do not materially affect the results, though note these do not use the preferred pre-slowdown period. While any of these estimates clearly represent a very significant slowdown, that for the market sector are modestly smaller than the reported slowdowns in most of the articles in Table A3.

Drivers of the Slowdown

As described in Section 1, the literature on the UK productivity slowdown suggests that there are structural rather than cyclical drivers. Despite a wide range of suggested explanations and extensive research, none have been found to fully explain the slowdown. The recent literature, using the latest official data, typically finds the productivity slowdown in the United Kingdom slightly larger than in other developed economies, though with similar attributes: largely a slowdown in TFP, with some slowdown also in capital accumulation, and fairly widespread across industries with a particularly large role for a slowdown in manufacturing.

This section briefly reviews the drivers of

Table 4: Average Annual Growth in Output per Hour Worked, Different Industry Groupings and Restrictions, Before and After Slowdown and Difference

Industry Group	1997–2006	2010–2019	Difference
Whole economy	2.2	0.5	-1.7
x Agriculture (A)	2.1	0.4	-1.7
x Mining and quarrying (B)	2.3	0.6	-1.8
x Utilities (DE)	2.2	0.5	-1.7
x Finance and insurance (K)	2.1	0.7	-1.5
x Real estate (L)	2.5	0.4	-2.1
x Imputed rental (part of L)	2.4	0.5	-1.9
x Government services (OPQ)	2.9	0.4	-2.4
"Core market sector"	3.6	0.8	-2.8
Market sector (by institutional sector)	2.6	0.3	-2.2

Source: ONS, author's calculations.
Notes: The pre-slowdown period uses data for 1997–2006 since data on hours worked for detailed industries are not available prior to 1997. Industry sections from SIC 2007 given in brackets. "Core market sector" excludes all other listed industries, as defined in text. Period averages calculated as simple averages of annual natural log changes.

the UK productivity slowdown, both in an empirical and economic sense. First, updated growth accounting decompositions for the United Kingdom using the latest ONS and international data are presented. Second, UK-specific measurement issues that might "explain" (or give caution to) the UK productivity slowdown are considered. Third, some economic arguments to explain the UK slowdown are discussed.

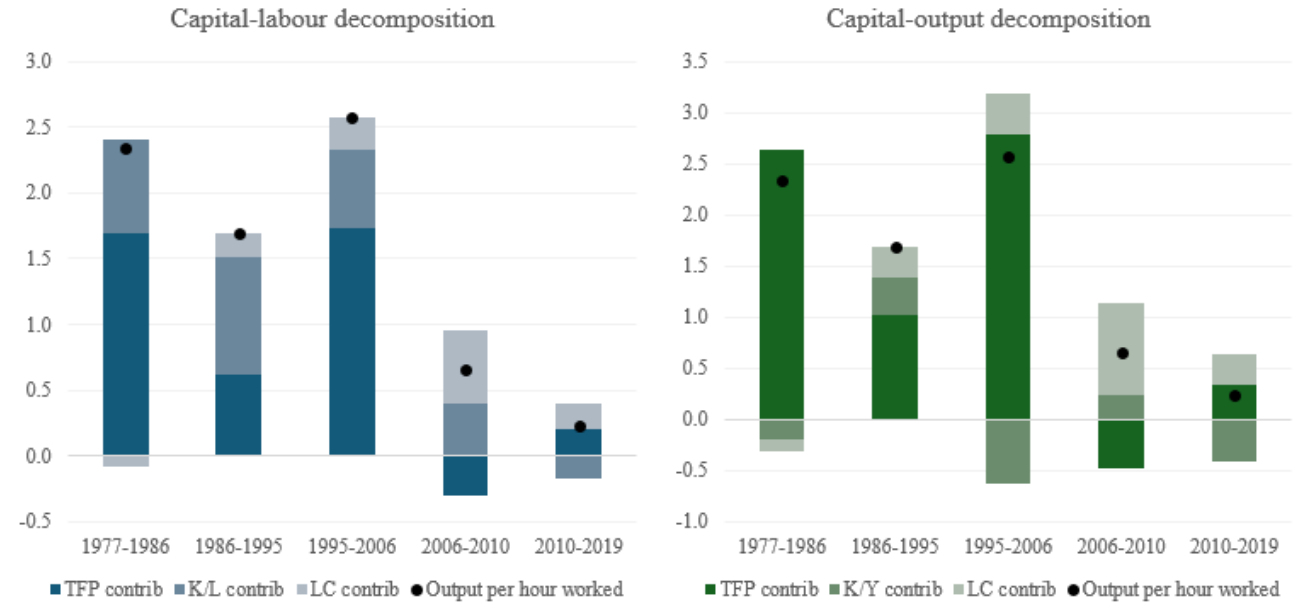
Growth Accounting Decompositions

Chart 3 shows two decompositions of growth in output per hour worked in the UK market sector, in various time periods over the past half century, using the latest ONS growth accounting estimates. The left panel contains the typical growth accounting decomposition, with the contribution of capital expressed relative to hours worked. On this basis, the slowdown in labour productivity growth in 2010–2019 relative to 1995–2006 is driven roughly two-thirds by TFP and one-third by capital deepening.

The right panel contains the decomposition proposed by Fernald and Inklaar (2022), which shows capital relative to output, with the contributions of TFP and labour composition rescaled (see Section 2). On this basis, the slowdown is due almost entirely to a TFP slowdown. The change in the capital-output ratio drags on labour productivity somewhat, but by much the same degree as before the slowdown.

Chart 4 shows the typical capital-labour decomposition of labour productivity growth for the non-agriculture market sector across 12 countries (those for which complete data are available), for two time periods, from the 2025-vintage of EUKLEMS-INTANProd. The bars in both the pre-slowdown (1995–2006) and slowdown (2010–2019) periods are sorted by the level of average annual labour productivity growth in the second period. In the second period, the United Kingdom has the lowest average growth rate of labour productivity growth and the largest estimated decline in TFP. In the pre-slowdown period, the United Kingdom has among the highest labour productivity and TFP growth. These data therefore suggest an unusually

Chart 3: Decompositions of Growth in Output Per Hour Worked, UK Market Sector



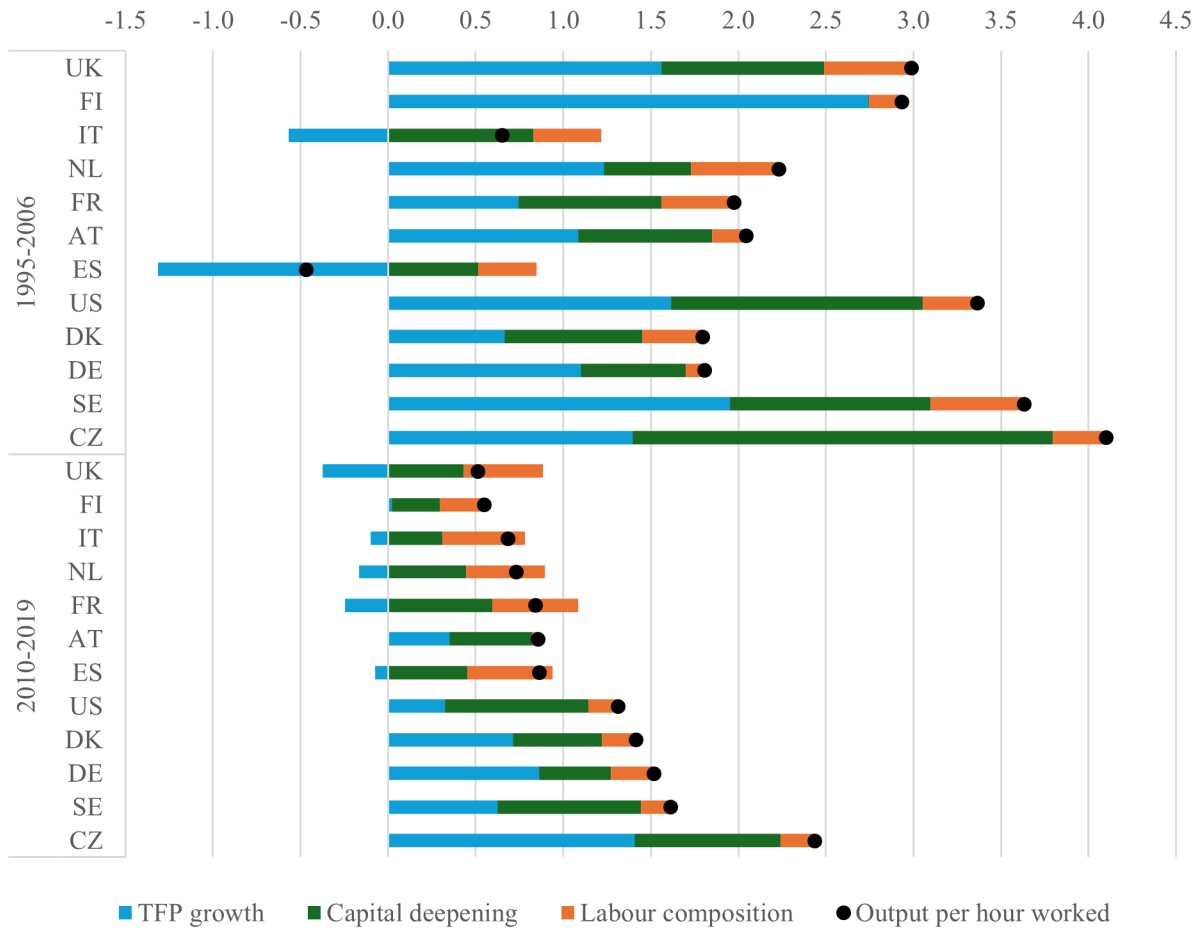
Source: ONS (2025), author's calculations.
Notes: Left panel uses "traditional" growth accounting decomposition, with capital per hour worked (K/L) weighted by the capital share of income (α), and labour composition (LC) weighted by the labour share of income (1–α). Right panel uses decomposition proposed by Fernald and Inklaar (2022), using the capital-output ratio (K/Y) weighted by $\alpha/(1–\alpha)$, TFP weighted by $1/(1–\alpha)$, and labour composition (LC). Scales differ. Both decompositions derived from ONS growth accounting estimates published May 2025. Year ranges are from the level of productivity in the first year, e.g., 1977–1986 is the growth from 1977 to 1986, with the first growth rate being between 1977 and 1978 (the growth between 1976 and 1977 is not included). Periods based on discussion in Section 3.

large slowdown in productivity growth in the United Kingdom.

However, these data for the United Kingdom should be interpreted cautiously. First, the estimates of labour composition (LC) growth for the United Kingdom are consistently larger than estimates produced by ONS. Higher LC growth implies lower TFP growth in the EUKLEMS dataset. The ONS LC estimates make use of more detailed and comprehensive UK-specific data sources, while the EUKLEMS estimates rely on cross-European data sources, so the ONS estimates (which show slower growth) are to be preferred. Second, the capital estimates are also different from ONS estimates, especially in the "extended" module which includes additional intangibles and alters the deflator for ICT equipment, and results in substantially faster capital growth. With stronger labour composition and capital services growth in EUKLEMS than in ONS estimates, the TFP residual is mechanically much weaker. Third, the market sector definition is by the exclusion of industries, rather than by institutional sector, making it inconsistent with ONS growth accounting estimates in Chart 3.

That said, the pattern of the slowdown is similar in the United Kingdom as in other countries. In most of the countries in Chart 4 experiencing a slowdown in labour productivity growth, the slowdown is explained roughly three-quarters by TFP and one-quarter by capital shallowing. This confirms findings in the recent literature.

Chart 4: Decomposition of Growth in Output Per Hour Worked Across Countries, Non-Agriculture Market Sector



Source: EUKLEMS-INTANProd (2025-vintage), author's calculations.
Notes: Dots show average annual growth rates of output per hour worked, and bars show average annual contributions to OpH growth in percentage points. Bars in both time periods sorted low-high by OpH growth in the second period. See Appendix for country codes.

UK Measurement Issues

Much has been written on the potential impact of measurement issues on productivity statistics (Syverson, 2017; Goldin *et al.*, 2024; see also Martin and Riley, 2025, on advances in productivity measurement). In this section, some UK-specific measurement issues are considered. More pervasive measurement issues, including free digital goods and services, the challenges of quality-adjusting deflators, measuring public sector output (especially in healthcare), and the role of intangible assets, are largely not discussed here, except where they relate specifically to UK measurement practice.

Research and Development. In the 2025 annual national accounts update, the ONS will substantially increase estimates of investment in research and development (ONS, 2025), which will likely increase the level of GDP. This follows major changes to the business R&D survey in recent years (ONS, 2023), after it was identified that the previous sample design

substantially underestimated the number of firms (especially small firms) conducting R&D, and thus the total value of R&D expenditure. These revisions will increase the level of R&D Gross fixed capital formation (GFCF) across the entire time series, though the precise revisions are unknown at the time of writing. This will make the R&D share of GDP in the United Kingdom more in line with other advanced economies and increase the level of UK GDP (and investment) relative to other countries slightly. This change is unlikely to materially alter the growth of GDP; rather this is likely to be a fairly uniform increase in the level of GDP over time. However, a concurrent change to the deflator for R&D investment (ONS, 2025) may have effects on real GDP growth.

Profit Shifting. Multi-national enterprises are increasingly able to shift the reporting of their profits across subsidiaries in different countries, which may be for tax or accounting purposes. Many MNEs have a presence in the United Kingdom, meaning that UK GDP could be under- or over-stated due to profit shifting relative to the value associated with production activities in the United Kingdom. Mion and Tong (2022) find that in 2017 more profit is recorded in the United Kingdom than would have been expected relative to a counterfactual activity-based measure. In 2007, less profit had been recorded in the United Kingdom than the counterfactual. This suggests that "true" GDP should be higher than measured in 2007 and lower than measured in 2017, which would accentuate the productivity slowdown slightly relative to current measurement.

Output Deflators. The deflation of services output is challenging, and is especially important in a services-dominated economy such as the United Kingdom. The preferred services output deflators in the United Kingdom are Services Producer Price Indices (SPPIs). O'Mahony and Samek (2021) found that UK SPPIs were not materially different to those for other countries; however, some UK SPPIs were only created around 2010 (especially those for professional services industries), with deflators for earlier years based on an alternative series which may not be consistent. In cases where no SPPI exists, ONS often use a wage-based deflator which likely does not account for quality change and may therefore overstate price growth and understate real output growth.

In addition, ONS use a "productivity adjustment" in the calculation of real GVA estimates for approximately 8.7 per cent of nominal GVA across a range of services industries.[18] This is usually the case when the industry output volume measure is based on the number of workers (rather than deflated turnover), or where the deflator is wage-based. It is unclear what measure of productivity ONS uses for these productivity adjustments. If it is based on

18 Author's calculation based on ONS methods information, see Appendix for details. The use of productivity adjustments is not recommended by Eurostat in their Price and Volume Handbook, because any adjustment in the absence of appropriate evidence is arbitrary. Of course, making no adjustment is also an assumption of no productivity growth, which is just as arbitrary. The preferred solution then must be to identify or construct suitable independent price indices that can be used as deflators, or direct volume estimates that are not based on production inputs (e.g. labour).

a measure of productivity that has seen a slowdown (and most have), then this adjustment may be reinforcing this slowdown by spreading it into other industries. For instance, if ONS is using whole economy output per hour worked as the productivity adjustment measure, then the slowdown in manufacturing productivity will be "spread" to other industries.

Hours Worked. Official UK productivity statistics published by the ONS use estimates of hours worked from the Labour Force Survey (LFS), using the so-called "direct method." That is, hours worked for the whole economy are based solely on the aggregation of reported hours actually worked by individuals on the LFS. Many other countries use a so-called "component method" to estimate hours worked, which instead uses a series of components derived from different sources.[19] Ward *et al.* (2018) found that estimates of hours worked in OECD countries that used a direct method were systematically higher than those using a component method, suggesting that the direct method was biased upward. Ward *et al.* (2018) construct a "simplified component method" for countries that use the direct method in their productivity statistics, which in the case of the United Kingdom is around 10 per cent lower.

A lower estimate of hours worked would, other things equal, increase estimates of output per hour worked by an equivalent amount. It is likely that the primary effect of this measurement issue is to alter the level of UK labour productivity, and particularly the level relative to other countries (the United States and major European economies use the component method in their official productivity statistics). Indeed, the OECD simplified component method estimate is a roughly constant 8 per cent below the ONS direct estimate. However, it is plausible that the bias from the LFS has been changing over time. Response rates to the UK LFS declined almost continuously from around 70 per cent in the late 1990s, to around 50 per cent in 2019, falling as low as 14 per cent in mid-2023. Declining response rates reduce the achieved sample, but also increase the scope for non-response bias. Any bias onto the growth of hours worked is unclear. Impacts by industry are also unclear and may not be uniform.

Capital Stocks. Measuring capital stocks consistently across countries is well-known to be challenging, but some issues may impact UK estimates more than other countries. First, major changes to ONS capital stocks methods in 2019 (ONS, 2019) included reducing assumed asset service lives and so increasing depreciation rates. Thus, ONS estimates of capital stocks are considerably lower than previously, which naturally means that the capital-to-output ratio is lower than previously. However, ONS did not adjust historical service life assumptions uniformly through time, instead maintaining previous assumptions from the 1960s and transitioning to the new assumptions between 1970 and 1997. As

19 Typically, one would start with an estimate of paid, usual or contractual hours worked from a high-quality source, perhaps administrative data, and then adjust it for deviations such as sickness, holiday, overtime, strikes, and so forth.

such, for a given volume of investment, estimated capital stocks will be larger historically than over recent decades. This has contributed to a falling measured capital-to-output ratio in the United Kingdom, which challenges the assumptions in some growth accounting decompositions. To the extent that these practices vary across countries, it could lead UK capital stocks to appear to be growing slower than other countries. The EUKLEMS-INTANProd database provides "harmonized" estimates of capital stocks and capital services which use the same depreciation assumptions across countries. While there are good reasons to think that economic depreciation rates do vary across countries (due to compositional, behavioral, or environmental reasons), harmonized assumptions may improve comparability.

Second, alongside normal depreciation, some capital assets are scrapped/retired before the end of their useful service life. This might be especially common during economic downturns. If this is not adequately adjusted in capital stock measures, it could lead countries with larger downturns to have their capital stock relatively over-stated, which would lead TFP to be relatively understated, following downturns in those economies. The United Kingdom experienced a relatively large economic downturn in 2008–09, so may be relatively more affected by this mismeasurement since then.

Intangibles. Following international guidance, only some intangibles are treated as produced assets in the UK National Accounts. The broader set of intangibles described in Corrado *et al.* (2005) and Bontadini *et al.* (2024), among others, may be more important in the United Kingdom than in some other countries given the importance of services to the UK economy. Indeed, Corrado *et al.* (2018) find that the United Kingdom and United States invest relatively more in these uncapitalized intangibles than many major European economies, so their exclusion from GDP may be more consequential to the United Kingdom than to many other countries. Similarly, data will be treated as a produced asset under SNA 2025, which will increase the level of GDP by roughly the value of the newly capitalized investment. Corrado *et al.* (2022) find that the United Kingdom invests relatively more in data assets than some other advanced European economies, so the revision to United Kingdom GDP and capital input may be larger in the United Kingdom than elsewhere. This suggests the importance of considering measures that account for additional intangibles to ensure fairer comparisons between the United Kingdom and other countries.

The United Kingdom In A Global Slowdown

It is beyond the scope of this UK-focused article to review explanations for the global productivity slowdown, which are well reviewed elsewhere. Instead, the United Kingdom is considered in the context of two of those proposed global drivers.

Environmental Factors. Many countries have attempted to reduce environmental damage over recent decades by reducing emissions of greenhouse gases, transitioning toward renewable energy sources, reducing use of materials, increasing recy-

cling, and so forth. The United Kingdom has been making more progress than most countries: greenhouse gas emissions have fallen faster in the United Kingdom than in the United States and most major European economies, especially since about 2005. A similar pattern exists for water use.[20]

There are at least two potential impacts on aggregate productivity. First, growth of "traditional" (measured) output and productivity will be constrained in some industries, most notably the energy and water industries, but potentially also the transportation, mining, manufacturing, and construction industries. For energy and water industries, where output is measured (and defined, in a National Accounts sense) by the volume of energy and water transmitted, efforts to reduce usage directly constrain industry output and so productivity. Using data from the 2025-vintage of EUKLEMS-INTANProd (see Table A7 in the Appendix for details), the United Kingdom has the fourth slowest labour productivity growth of 19 countries in the period 1995–2019 for the energy industry (section D), and third slowest for the water (section E) industry. Thus, these industries appear to be dragging on aggregate UK productivity more than in other countries.

The second potential mechanism is a slowing in innovation more broadly. A country likely has a relatively fixed and limited supply of scientists, innovators, and researchers, and a limited supply of funding to support those people. A country that prioritizes environmental goals may have to do so at the expense of innovations in other fields. Similarly, businesses might have capacity to invest either to increase the efficiency of their operations (e.g. through business process improvements) or to reduce their environmental impact (and meet associated regulation). The latter may be socially desirable, but goes unmeasured in traditional economic statistics. Activity to reduce environmental damage can also be seen as an intertemporal trade-off—it may reduce productivity or profitability in the present but may be profit-maximizing in the long run.

Agarwala and Martin (2023) propose to add "unmeasured environmental protection output" to GDP, with an estimate that it could account for around 5 per cent of United Kingdom GDP—that may be larger than in other countries. De Ridder and Rachel (2025) construct emissions-adjusted TFP measures for a range of countries and find a significant increase in the adjusted measure of TFP (TFPE) growth for the United Kingdom. Indeed, they suggest that the United Kingdom did not experience a TFP slowdown once the decline in carbon dioxide emissions is accounted for.[21]

To the extent that the United Kingdom is a world leader in reducing its environmental footprint, this could have implications for the level and growth of measured productivity. If the United Kingdom

20 Based on data as presented by Our World in Data and AQUASTAT. See Appendix for details.

21 Agarwala and Martin (2022) make a similar adjustment for UK industries, but account for a wider range of emissions and pollutants than just carbon dioxide. They find substantially higher labour productivity growth with this adjustment, but still a slowdown from around 2007 onwards.

has a lower level of environmental damage per unit of "traditional" output than other countries, then its level of "true" (environmentally adjusted) productivity would be most mismeasured. Thus, accounting for environmental damage would raise the level of UK productivity relative to other countries. Similarly, if the United Kingdom has reduced its emissions and environmental damage faster than other countries, the bias on measured productivity would also be greatest. Indeed, Cárdenas Rodríguez *et al.* (2023) find that the United Kingdom has the second largest positive adjustment to TFP growth when accounting for pollution abatement (behind Belgium), at nearly 0.4 percentage points per year, compared to less than 0.2 percentage points per year for the United States and OECD average.

Services and Intangibles. Another global trend, at least among advanced economies, is a shift from manufacturing to services. It is argued that this will inevitably lead to a slowing in productivity growth, since the potential for productivity gains in labour-intensive services industries is lower than in capital-intensive production industries (Baumol's cost disease). If so, that might apply to the United Kingdom more so than in many other advanced economies. The manufacturing share of total value added in the United Kingdom is around 10 per cent—well below the average of other advanced economies. By contrast, the share of predominantly public services industries (public administration, education, health and social care) is around 20 per cent of total value added in the United Kingdom—a little above the average of other advanced economies. Given the aging and demographic change that has already been experienced and is expected to continue over coming decades, this trend is only likely to continue, both in the United Kingdom and other advanced economies. This has consequences both for measurement of productivity, since measuring the output and productivity of services is clearly challenging, but also for actual productivity growth.

As well as a services-oriented economy, the United Kingdom is also an economy for which intangible assets are especially important. The intangible share of investment is higher in the United Kingdom than in most other advanced economies, based on estimates that include a broader definition of intangible investment (Corrado *et al.*, 2022). Again, there is a measurement effect and a real effect. Measuring intangible assets remains difficult despite considerable efforts by the research community. National Accounts measures which include only a subset of intangibles as produced assets may understate UK GDP and labour productivity to a greater extent than in many other economies. International databases which account for additional intangible assets, such as the EUKLEMS-INTANProd, may therefore be especially important for the United Kingdom.

There are also important implications of an intangible-intensive economy for "true" productivity. Haskel and Westlake (2022) argue that the properties of intangible assets are not necessarily positive for aggregate productivity, at least not without the right institutions. Through their synergies and sunk costs, intangibles favour winner-takes-all dynamics which can hin-

der competition and the spread of ideas. Intangible-intensive firms may also struggle to obtain debt capital to expand, since intangibles can rarely be used as collateral. Studies have observed a decline in business dynamism and an increase in productivity dispersion, which are found to be associated with intangible-intensive firms and industries.

These issues may be more pervasive in the United Kingdom, as an intangible-intensive economy, than in many others. The obvious counterargument to this line of thinking is the United States, which is clearly also an intangible-intensive economy but has seen a better productivity performance than the United Kingdom over recent decades, despite a slowdown in productivity growth of broadly similar shape. However, the United States is a unique case in many respects (market size, dominant currency, venture capital, Silicon Valley), and so may not be a good comparator here. Alternatively, the United States may have more appropriate institutions (as per Haskel and Westlake) to enable an intangible-intensive economy to succeed.

Conclusion: Evidence Gaps For UK Productivity

I conclude by suggesting three avenues for measurement to enhance our understanding of UK productivity and its growth slowdown.

First, measures of labour input in the United Kingdom should be improved. labour is arguably the most important input in the production process and should be the easiest to measure. But UK measures of hours worked are well behind the international methodological frontier. As described in Section 4, official UK productivity statistics use a "direct method" to estimate hours worked, rather than the international best-practice "component method." The implications for the level of UK productivity, especially relative to other countries, are clearly set out in Ward *et al.* (2018). Declining response rates for the UK Labour Force Survey, to as low as 14 per cent in 2023, have increased the scope for non-response bias—if the large non-responding cohort has different employment rates or hours worked than the responding cohort, this could be biasing the estimates. If that bias is changing over time, this could matter for the growth of hours worked, as well as the level. The size of any effect is unclear, but it has the potential to materially affect the recent history of measured UK productivity.

Labour composition estimates, which typically account for changes in the age and education composition of the workforce, may not capture other important worker characteristics. For instance, the role of on-the-job training, work experience (general, industry-specific, and firm-specific), and age mixes within firms are all understudied in the United Kingdom due to lack of suitable data.

Second, more research is needed on the role of worker-firm interactions. The United Kingdom lacks a linked employee-employer dataset (LEED), which is a powerful dataset of workers and firms, enabling rich analysis of the drivers of firm-level productivity. Development has been hampered by restrictions on accessing individual-level income tax data, though progress is (at the time of writing) be-

ginning. Among many other things, this would allow research into the importance for productivity of movements of workers across firms (spreading ideas, improving matches) and within firms (building firm-specific human capital).

Third, the United Kingdom does not have current estimates of TFP constructed in a KLEMS framework.[22] Unlike GVA-based growth accounting, KLEMS-type accounting decomposes total output into the contributions of labour, capital, and intermediate inputs. This is only possible with separate estimates of the volumes of output and intermediate inputs, which is now available following the introduction of double deflation in official data in 2021. KLEMS measures relax some of the assumptions imposed by GVA-based productivity measures and better attribute productivity gains along supply chains. In an era of changing trade relationships and supply chain disruption (e.g. Brexit, deglobalization), a blurring of the boundary between capital and intermediate inputs (e.g. cloud computing), and digital advances enabling rapid changes in production functions (e.g. homeworking, food deliveries), KLEMS is the ideal framework.

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