Economic Insight

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Economic Insight Ltd

FURTHER EVIDENCE ON FRONTIER SHIFT AT PR24

A report on behalf of a consortium of water companies

CONTENTS

1 Introduction and executive summary

This report contains further evidence on the frontier shift potential at PR24. We assess the extent to which any recent evidence (since our April 2023 report) in relation to productivity implies a material change to our recommended range for frontier shift at PR24. Additionally, we explore whether further evidence, including a survey of UK academic experts in productivity analysis, suggests that regulated industries (in particular, water) are not impacted (or to a lesser extent) by factors affecting low productivity in the UK. We find that, regarding the former, there is no indication that our recommended range should change. Regarding the latter, although there are reasons that some factors might affect certain industries more than others, we find that the factors most affecting the UK's productivity slowdown generally apply economy-wide, including to regulated industries.

1A. Context and background

In April 2023, we provided a consortium of water companies with a report on frontier shift potential at PR24 (henceforth, 'our April 2023 report').[1] In that report, our recommended (narrow or 'focused') range for frontier shift was 0.3%–0.7% pa, primarily based on EU KLEMS data. That range represents a relatively material reduction, when compared to Ofwat's frontier shift target of 1.1% pa at PR19. However, our April 2023 report highlighted that our recommended range was:

[1] *'Productivity and frontier shift at PR24: A report on behalf of a consortium of water companies,' Economic Insight (April 2023).*

- consistent with Ofwat's frontier shift targets up until the PR14 price control, at which time the regulator significantly increased its industry productivity targets;
- in line with the UK's persistent (near zero) productivity performance, observable since 2008; and
- reflective of the fact that low productivity appears pervasive across the UK economy and is not restricted to a small number of industries.

1B. Aims of our updated study

It is important that, within the PR24 determinations, the frontier shift targets are based on the most robust and complete evidence possible. Regarding this, there are two complicating factors that merit consideration:

- Firstly, by the time of the Draft Determinations (DDs) in June 2024, more than a year will have passed since our April 2023 report. As such, it is conceivable that more recent evidence might change our views regarding the appropriate range for frontier shift at PR24.
- Secondly, Ofwat and other sectoral regulators have previously suggested that the factors affecting low productivity in the UK do not apply (or apply to a lesser extent) to regulated industries (primarily because of mitigating effects of regulation). For example, Ofwat, in giving evidence to the CMA during the PR19 redeterminations, highlighted that, under economic regulation, water companies were shielded from demand reductions and reductions in investment.[2]

Following from the above, a consortium of water companies[3] have commissioned us to provide this follow-up report, setting out further evidence on the appropriate range for frontier shift at PR24. This report therefore addresses two key questions:

- **Does any recent data / evidence relating to productivity since our April 2023 report imply a change to our recommended range for frontier shift at PR24?**
- **Does any further evidence suggest that regulated industries (in particular, water) are not impacted (or are impacted to a lesser extent) by the underlying factors causing the UK's low productivity performance?**

[2] *'Additional Evidence on Some Points Relating to Frontier Shift.' Europe Economics (2020); page 16.*
[3] *Affinity Water; Anglian Water; Portsmouth Water; South East Water; South Staffordshire Water; Southern Water; Wessex Water; and Yorkshire Water.*

1C. Executive summary

Does any recent data / evidence relating to productivity since our April 2023 report imply a change to our recommended range for frontier shift at PR24?

Using a mixture of quantitative and qualitative evidence, we have examined whether (since the time of our April 2023 report) there have been any changes in:

(i) actual productivity ("**performance change**"); and / or

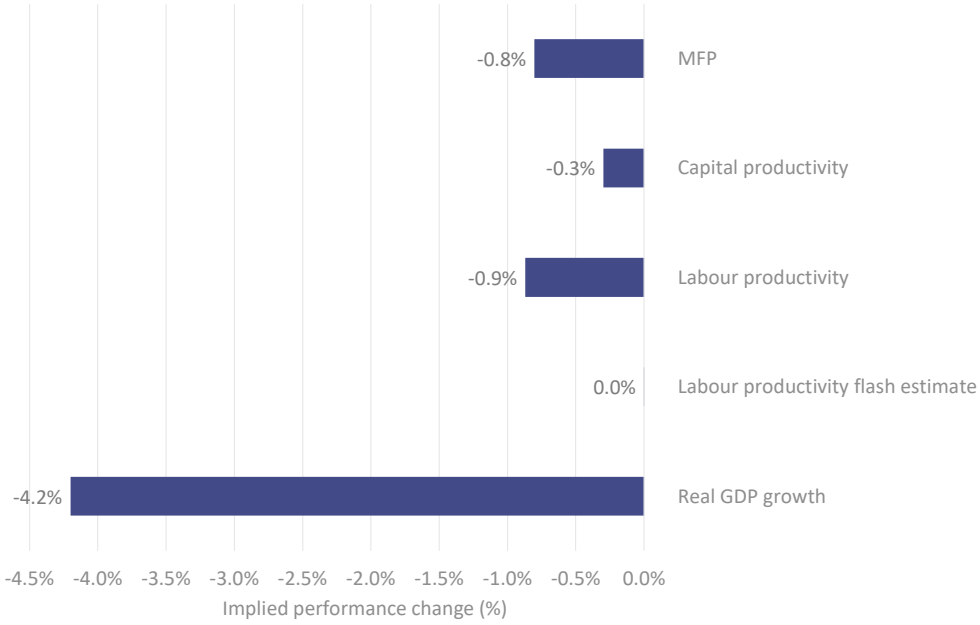
(ii) forecasts of productivity ("**future expectation change**").

RECENT EVIDENCE SUGGESTS THE PROSPECTS FOR PRODUCTIVITY GROWTH IN THE UK HAVE DECLINED SINCE OUR APRIL 2023 REPORT.

Recent evidence on actual productivity performance

We find that, drawing on a range of data sources, the UK's actual productivity performance has *declined* since our April 2023 report. Summarising, Figure 1 below shows the percentage point difference between the latest productivity estimate for each source available at the time of our April 2023 report; and that available now. As can be seen, each of these sources shows a reduction in productivity.

Figure 1: Productivity performance changes since our April 2023 frontier shift report



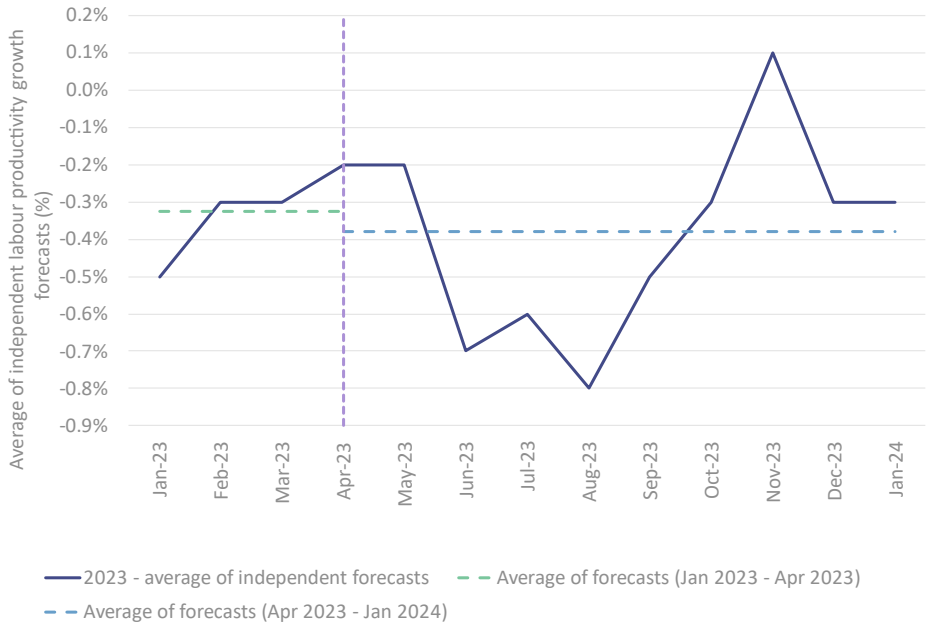
Source: Economic Insight analysis of ONS data

Note: the large negative change in relation to real GDP growth is largely driven by a (brief) 'rebound' in GDP immediately following the pandemic. We consider the productivity metrics above more relevant (with GDP included for completeness).

Recent productivity forecasts

We examine a range of productivity forecasts to understand how expectations of future performance may have changed since our April 2023 report. For example, Figure 2 below shows the average of independent forecasts for labour productivity growth, as reported by HM Treasury. As can be seen, the average forecasts made after our April 2023 report (dotted blue line) are lower than those made prior to then (dotted green line). Thus, as per actual productivity, we find the recent evidence suggests that a more pessimistic view on *future* performance now exists than prevailed at the time of our April 2023 report.

Figure 2: Average of independent forecasts of 2023 labour productivity growth



Source: Economic Insight analysis of HM Treasury consensus forecasts

More broadly, various credible institutions find no reasons to suppose the UK's productivity performance will materially change in the near term; and the outlook for the UK economy, at the time of this update report, remains poor.

In addition to the above, and as part of a wider academic research exercise in relation to UK productivity, we have conducted a survey of leading independent academic experts in productivity analysis in the UK.[4] The survey's results show that:

- 78% of respondents who provided an estimate expect UK productivity growth to be 0.50% pa or lower over the next five calendar years.
- 83% of respondents consider that the water sector will perform 'similarly' or will 'underperform' UK productivity, over the next five calendar years.

[4] *As summarised in our working paper 'The UK productivity puzzle: A survey of the literature and expert views.' Williams, S.; Glass, A.; Matos, M.; Elder, T.; and Arnett, D. (January 2024), and section 3C of this report. Note, this wider research exercise was not undertaken on behalf of (nor funded by) any clients. Participants in our research did so of their own volition and without any financial incentive. The research was not undertaken for the purpose of making regulatory submissions and was an academic endeavor on the part of the listed authors.*

Consequently, taking into account the most recent data and evidence, we find no reasons to depart from our recommended range for frontier shift, as per our April 2023 report (0.3% - 0.7% pa 'focused range'). That is to say, the most recent evidence would point to incorporating an additional year, in which productivity performance *has further declined.* This might provide some reason for considering values towards the lower end of our previously recommended range.

Does further evidence suggest that regulated industries are not impacted (or are impacted to a materially lesser degree) by the underlying factors causing low productivity in the UK?

Based on a range of quantitative and qualitative evidence, including a survey of academics in the field of productivity, we have sought to understand whether regulated industries might be less impacted by the factors causing the UK productivity slowdown.

To answer the above question, we have:

(i) identified and considered what the main factors causing the UK productivity slowdown are; and

(ii) for each of these factors considered the extent to which regulation might mitigate their impact on the water sector.

THE EVIDENCE IS NOT SUPPORTIVE OF REGULATION MATERIALLY MITIGATING THE IMPACT OF THE UK PRODUCTIVITY SLOWDOWN ON THE WATER INDUSTRY.

Evidence on the main factors causing the UK productivity slowdown

The UK's productivity growth has been low-to-stagnant since the 2008 financial crisis. The pattern of productivity shows that the slowdown is pervasive, being observable across the majority of sectors in the UK. This is consistent with its main causal factors being primarily economy-wide (thus, affecting *all* industries, to some degree). This is further supported in the academic literature.

The literature also identifies a range of factors that affect productivity. However, in and of itself, this literature does not point to a clear consensus as to the main causes of the post-2008 slowdown specifically. As such, within the above referenced survey of academics, we have sought to establish said main factors more robustly.

Surveyed academic experts consider that the five most important factors causing the productivity slowdown are the: (i) extent of **private investment**; (ii) **quality of infrastructure**; (iii) extent of **public investment**; (iv) quality of the **human capital stock**; and (v) quality of **firm management**.

Evidence on the extent to which regulation might mitigate the impact of these factors on the water sector

Whilst we consider that regulation may (in principle) mitigate the impact of the slowdown on the water industry through the 'certainty of investment' channel, data is not supportive of this occurring in practice. Moreover, in relation to the remaining drivers identified above (quality of infrastructure; human capital stock; and management quality), we find no reasons to believe regulation can materially impact water industry productivity. Furthermore, the proposition that innovation incentives

and funding can materially mitigate the productivity slowdown in regulated industries lacks a strong rationale and is also unsupported by the factual evidence.

Finally, the results of the survey of academic experts are consistent with the above finding, indicating that regulation and competition policy are not especially material drivers of productivity. Specifically:

- Only 4 out of 26 academics (15%) identified *'regulatory and competition policy'* as being an important driver of UK productivity growth since 2008 (see Table 2).
- Only 5 out of 26 academics (19%) identified differences in *'regulatory and competition policy'* as being an important driver of variation in productivity between industries (see Table 3).

1D. Structure for the remainder of the report

The remainder of this update report is structured as follows.

- **Chapter 2** answers our first question and provides an assessment of more recent evidence that has become available since our April 2023 report.
- **Chapter 3** sets out the findings from our review of further evidence, answering the second question raised above.
- **Chapter 4** concludes.

2 Does any recent data / evidence relating to productivity since our April 2023 report imply a change to our recommended range for frontier shift at PR24?

In order to answer this question, we have: (i) reviewed multiple sources of recent productivity data; and (ii) drawn on insights from other public sources and a survey of leading academic experts in the field of productivity. Overall, we find that both actual productivity and expectations around future productivity are lower than at the time of our April 2023 report. Overall, the more recent data does not imply any revision to our previously recommended range for frontier shift at PR24.

2A. Recap of the data on which our April 2023 report was based

The estimated range for frontier shift is sensitive to the time period over which it is measured (and data sets used). In our April 2023 report, our PR24 'focused range' drew on four time periods / data sets:

(i) 2010–2019 using EU KLEMS NACE II data;

(ii) 1995–2019 using EU KLEMS NACE II data;

(iii) 1970–2007, using EU KLEMS NACE I data; and

(iv) 1970–2019, which is a weighted average of the 1995–2019 EU KLEMS NACE II and 1970–2007 EU KLEMS NACE I periods.

At the time of our April 2023 report, the most recent year of EU KLEMS productivity data available was 2019. This means that, as we near the PR24 DDs, it is important to consider whether there is any more recent evidence that might affect our

recommended frontier shift range. This is particularly pertinent given recent macroeconomic events, such as COVID-19.

A range of evidence on recent UK productivity performance (economy-wide and, in some instances, by industry) has been published. For some of these sources, there have been publications both before and after our April 2023 report. This allows us to draw some insights around how the following measures have changed since the time of our previous study: (i) actual productivity ("**performance change**"); and (ii) forecasts of productivity ("**future expectation change**").

2B. Overview of method and key findings

Key evidence considered

In this update report, we have considered both recent quantitative and qualitative evidence. Regarding quantitative evidence, to examine any productivity *performance change,* we have used the following data sources:

- ONS multifactor productivity (MFP);
- ONS capital productivity;
- ONS labour productivity;
- ONS labour productivity *flash estimates* (providing an extra quarter of data, relative to the previous source); and
- ONS real GDP growth.

Of the above data sources, we examined ONS MFP data and real GDP growth data within our April 2023 report. Specifically:

- We used ONS MFP data to calculate implied productivity changes over time, but we did not use these estimates to directly calculate our frontier shift ranges (for the reasons discussed in section 3A of our April 2023 report). Nonetheless, we consider that the ONS MFP data provides a useful and credible source of information for the purpose of this update report.
- We demonstrated the high correlation between real GDP growth and productivity growth in section 4B of our April 2023 report.[5] Thus, changes in real GDP growth since our April 2023 report may also be *somewhat* informative of changes in productivity performance.

Regarding our more qualitative assessment, we have reviewed additional research and publications on UK productivity, and we also present results from a survey of leading

[5] *For example, this can be seen clearly in Figure 8, Figure 9, and Figure 10 of our April 2023 report.*

UK academic experts in productivity analysis, including academics from all five UK productivity research centres.[6]

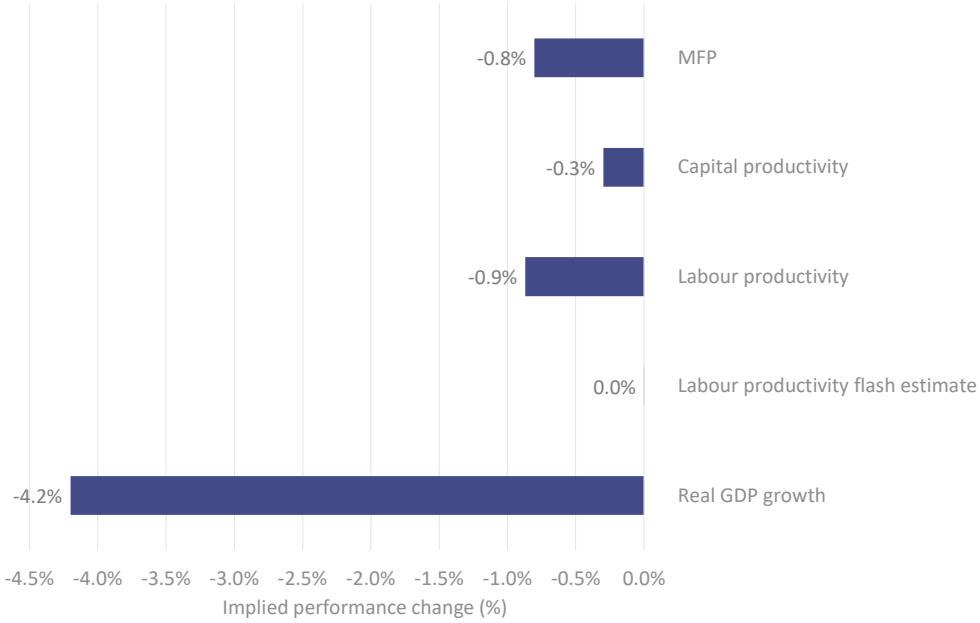
Key findings

Overall, our results suggest that the **UK's productivity performance has declined since our April 2023 report** (i.e., the performance change is negative).

FOR EACH DATA SOURCE, THE MOST RECENT DATA SHOWS REDUCED PRODUCTIVITY RELATIVE TO THE MOST RECENTLY AVAILABLE DATA AT THE TIME OF OUR APRIL 2023 REPORT.

Figure 3 below shows implied performance changes between our April 2023 report and the present, based on the sources of productivity data described above. Further information about the derivation of these figures is set out in section 2C (but, in summary, the chart shows the *percentage point* difference between the latest productivity estimate for each source available at the time of our April 2023 report and the latest estimate available now). As can be seen, each of these implied changes is negative.

Figure 3: Implied performance changes since our April 2023 report



Source: Economic Insight analysis of ONS data

Note: the large negative change in relation to real GDP growth is largely driven by a (brief) 'rebound' in GDP immediately following the pandemic. We therefore consider the other four metrics to be more accurate representations of productivity change.

In Figure 23 of our April 2023 report, we set out the range for our proposed frontier shift estimates. The above would seem to support the following inferences:

- maintaining a 'high' frontier shift challenge of >1.0% pa (as per Ofwat at PR19) is not any more supportable on the basis of the most recent evidence than it was at the time of our April 2023 report;

[6] *These are: the Productivity Institute; Loughborough University's Centre for Productivity and Efficiency; the Programme on Innovation and Diffusion (POID); the Productivity Insights Network; and Lancaster University's Centre for Productivity and Performance.*

- more broadly, it is hard to see a strong rationale for departing from the frontier shift estimates derived in our April 2023 report;
- however, to the extent that we would depart from our April 2023 report, a frontier shift challenge towards the lower end of our range is perhaps more consistent with near-term achievable productivity gains for the water industry.[7]

2C. Quantitative sources of data

As discussed in section 2A, the data source (EU KLEMS) that we primarily relied upon to calculate our frontier shift range has not been updated since the time of our April 2023 report. We are, therefore, unable to calculate a direct update to any range as implied by that data.

Helpfully, however, other sources of quantitative data on productivity are available, with some of these also having been updated between April 2023 and now. We have used these data sources to determine the magnitude of any performance change in productivity since our April 2023 report. This change represents the percentage point difference between the most recently realised annual productivity gains at the present day, and at the time of our April 2023 report. This analysis allows us to comment on the ongoing appropriateness of our previous recommended frontier shift range.

In addition, we have also obtained *forecasts* of productivity that we did not include in our April 2023 report. We use this data to further stress test the conclusions made in both this update report, and in our April 2023 report.

In the remainder of this section, we: (i) present the sources of information used to calculate the implied productivity performance changes; and (ii) present the data sources that we have used to derive implied changes in future productivity expectations.

Sources of data used for implied changes in productivity performance

To calculate implied performance changes, for each of the five data sources we have used, we calculate the differential between the most recently available realised annual productivity gains: (i) as of now; and (ii) at the time of our April 2023 report.

For each data source, where possible, we have sought to calculate the productivity performance change based on the industries in the *"preferred set"* of comparators detailed in our April 2023 report (please see section 5B of our April 2023 report for more details).[8] This is because this provides the best guide as to how our recommended

[7] *Our analysis suggests that taking into account one more year of data would slightly lower the range, given that this most recent data shows weaker productivity performance.*

[8] *These sectors are: (i) Total industries; (ii) Agriculture, forestry and fishing; (iii) Manufacturing; (iv) Chemicals; basic pharmaceutical products; (v) Manufacture of rubber and plastic products and other non-metallic mineral products; (vi) Manufacture of furniture; jewellery, musical instruments, toys; repair and installation of machinery and equipment; (vii) Wholesale and retail trade; repair of motor vehicles and motorcycles; and (viii) Transportation and storage.*

frontier shift range might change, purely as the result of updated performance data. Where data is not available at the industry-level of granularity, we have calculated a productivity performance change across the UK economy as a whole. Details of each of the five sources of data we have used to derive implied performance changes are given below.

- **ONS MFP**.[9] This data is available on both an aggregated level across the entire UK market economy, and at a more granular industry-level. The level of data available means that we can base the performance change for our comparator set on four of the eight industries in the *"preferred set"* detailed in our April 2023 report:[10]
  - total industries (A–S);
  - manufacturing;
  - wholesale and retail trade; repair of motor vehicles and motorcycles; and
  - transportation and storage.
- **Capital productivity**.[11] The second source of data we use is also taken from the ONS, and represents Gross Value Added per Volume Index of Capital Services.[12] Although it relates only to productivity growth in one primary input (i.e., capital), it is still a helpful source to include for the purpose of understanding how productivity performance may have changed, factoring in the most recently available data. As with MFP, data is available on both an aggregated and a more granular industry-level. Therefore, we have calculated an implied performance change for our comparator set, based on the same four industries as the MFP data (as listed above).
- **Labour productivity**.[13] The third source of data we have used is also obtained from the ONS and relates to labour productivity (output per hour worked). As with capital productivity, although this relates only to one primary input, we consider it to be informative of whether recent productivity performance implies any material changes in our views on frontier shift. Data availability means that we are able to base our implied performance change for our comparator set on five of the eight included industries in our *"preferred set"* (detailed in our April 2023 report). These are the same four as for MFP and capital productivity (as outlined above), plus *Agriculture, Forestry and Fishing*.

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9 *Please see: https://www.ons.gov.uk/file?uri=/economy/economicoutputandproductivity/productivitymeasures/datasets/growthaccountingannualuk/current/mfpannualpublish.xlsx (Table 7).*

10 *We are unable to include "Agriculture, Forestry and Fishing" as updated data has not been published for this industry.*

11 *Please see: https://www.ons.gov.uk/file?uri=/economy/economicoutputandproductivity/productivitymeasures/datasets/growthaccountingannualuk/current/mfpannualpublish.xlsx (Table 12).*

12 *The Volume Index of Capital Services is "a measure of flows of services that different types of assets provide to the production process." (Please see: https://www.ons.gov.uk/economy/economicoutputandproductivity/productivitymeasures/methodologies/volumeindexofcapitalservicesvicsqmi#:~:text=VICS%20is%20the%20measure%20of,report%20supports%20the%20MFP%20statistics.).*

13 *Please see: https://www.ons.gov.uk/file?uri=/economy/economicoutputandproductivity/productivitymeasures/datasets/growthaccountingannualuk/current/mfpannualpublish.xlsx (Table 7).*

- **Labour productivity flash estimate**.[14] The fourth source we have used is similar to the third, in that it measures output per hour worked. However, it is more up-to-date and allows us to obtain an estimate for a full year of productivity growth in 2023. The flash estimates are produced upon the release of Q4 GDP data, but prior to the release of Q4 Labour Force Survey data. This data is only available on an aggregated basis, so we cannot derive an implied performance change for our comparator set and calculate it on an economy-wide basis instead.

- **Real GDP growth**.[15] This data is only available on an aggregated basis (and so we have calculated the performance change for the UK economy as a whole).

In Table 1 below, we show the implied performance changes across each of our data sources and industries, in addition to the most recently realised annual productivity gains at the time of our April 2023 report. As can be seen, each of the implied performance changes is negative, with most ranging between 0.0% and –0.9%.

Table 1: Implied performance changes

Source	Latest available UK productivity estimate at time of April 2023 report (% pa)		Latest available UK productivity estimate now (% pa)		Performance change (% pa)
	Estimate	Date relates to	Estimate	Date relates to	
ONS MFP	1.4%	2021	0.6%	2022	–0.8%
Capital productivity	–1.2%	2021	–1.5%	2022	–0.3%
Labour productivity	2.4%	2021	1.5%	2022	–0.9%
Labour productivity flash estimate	0.1%	2022	0.1%	2023	0.0%
Real GDP	4.3%	2022	0.1%	2023	–4.2%

Source: Economic Insight analysis of publicly available ONS data

Note: the large negative change in relation to real GDP growth is largely driven by a (brief) 'rebound' in GDP immediately following the pandemic. We therefore consider the other four metrics to be more accurate representations of productivity change.

[14] *Please see: https://www.ons.gov.uk/generator?uri=/economy/economicoutputandproductivity/productivitymeasures/articles/gdpandthelabourmarket/julytoseptember2023/b89a8a88&format=xls*

[15] *Please see: https://www.ons.gov.uk/file?uri=/economy/grossdomesticproductgdp/datasets/realtimedatabaseforukgdpabmi/quarter4octtodec2023firstestimate/gdpinchainedvolumemeasuresrealtimedatabaseabmi.xlsx (tab "2018 –")*

Sources of data used for future expectation changes

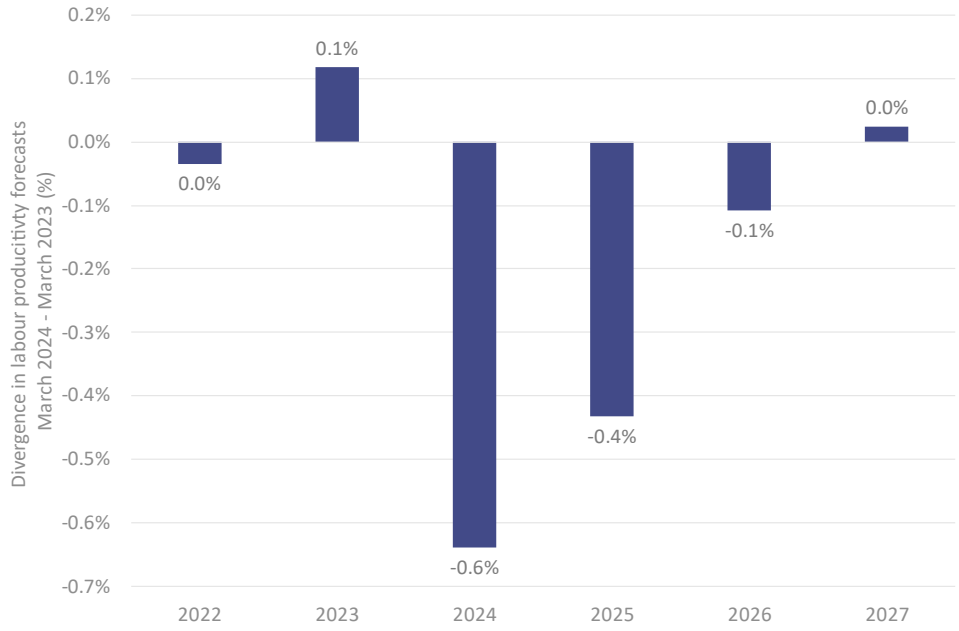
In addition to the data sources used above to calculate changes in outturn productivity performance, we have also analysed forecasts of productivity changes. These allow us to draw inferences as to how expectations of future productivity may have changed, since our April 2023 report. The sources we have used comprise: (i) forecasts made about UK productivity growth; and (ii) OECD data on productivity that allows us to compare recent trends in UK productivity to other Western European countries.

Forecasts of productivity

We firstly present data on forecasts of productivity. We consider forecasts made by: (i) the OBR; and (ii) other institutions, which have been collated by HM Treasury. The purpose of assessing these forecasts is to compare expectations about productivity growth in the UK at the time of writing our April 2023 report with more recent expectations.

In Figure 4 we show the divergence between OBR forecasts made in March 2024, as compared to March 2023.[16] As can be seen, for all forecasted years except 2023, the OBR's most recent (March 2024) forecasts are lower than (or the same as) they were in March 2023.[17] This suggests that expectations of the UK's productivity performance are slightly more pessimistic now than at the time of our April 2023 report.

Figure 4: OBR labour productivity growth forecasts: March 2024 vs March 2023



Source: Economic Insight analysis of OBR forecasted labour productivity growth

[16] *Please see https://obr.uk/docs/dlm_uploads/E03004355_November-Economic-and-Fiscal-Outlook_Web-Accessible.pdf (Table A.2).*

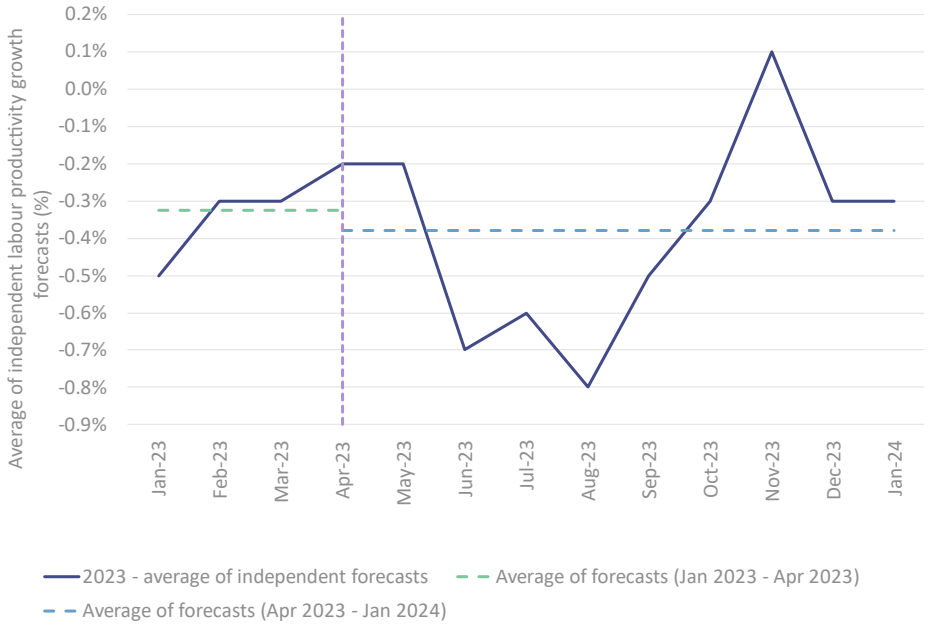
[17] *We note that the 2022 data is outturn in the March 2024 release, whilst it is forecasted in the March 2023 release.*

In addition, we have collected information from monthly HM Treasury publications that collate independent forecasts made by a range of different bodies.[18] Figure 5 below shows the average of the independent estimates available in each month between January 2023 and January 2024.

'Expectations of productivity are lower now than at the time of our April 2023 report.'

As can be seen, the average forecasts made after our April 2023 report (dotted blue line) are lower than those made prior to then (dotted green line). This again indicates that expectations of productivity are lower now than at the time of our April 2023 report – i.e., that the future expected change is negative.

Figure 5: Average of independent forecasts of 2023 labour productivity growth



Source: Economic Insight analysis HM Treasury consensus forecasts

OECD data

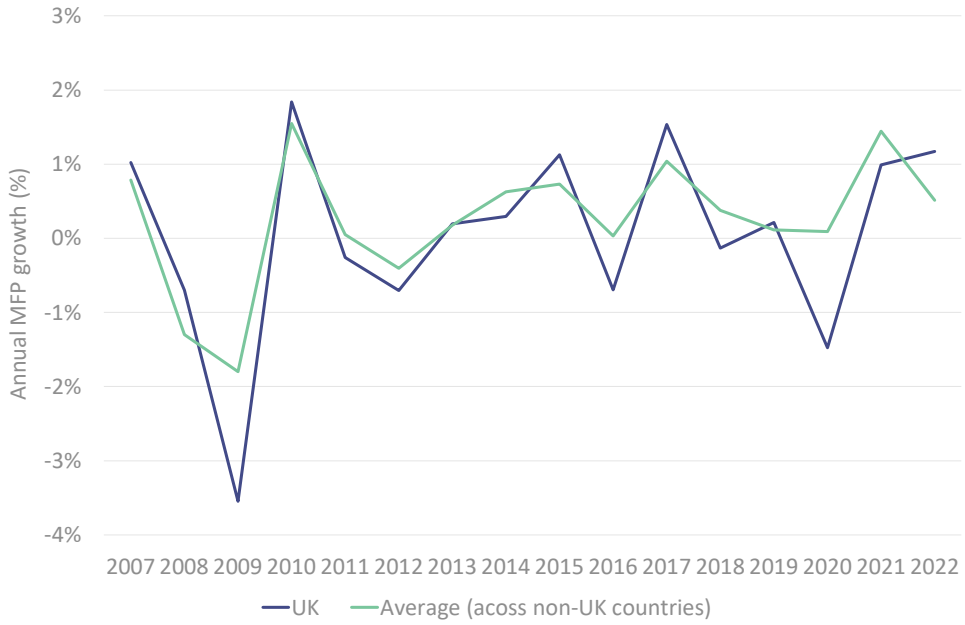
The final source of data we use comes from the OECD, specifically in relation to multifactor productivity.

In Figure 6, we show annual productivity growth over time in: (i) the UK; and (ii) all other countries included in the OECD data.[19] As can be seen, the flatlining of productivity since the financial crisis is not unique to the UK. This is important, as this observation is consistent with the main *drivers* of the productivity slowdown being common, as we discuss in more detail in the subsequent chapter. That is to say, the causal factors are therefore likely not unique, nor limited to certain industries or countries. Furthermore, we note that the UK seems to have poorer performance than other countries, with its productivity growth being below the OECD average.

[18] *These bodies are: Capital Economics; Pantheon; Société Générale; Beacon Economic Forecasting; Economic Perspectives; NIESR; and Oxford Economics.*

[19] *These countries are: Australia; Austria; Belgium; Canada; Denmark; Finland; France; Germany; Greece; Ireland; Israel; Italy; Japan; Korea; Luxembourg; the Netherlands; New Zealand; Norway; Portugal; Spain; Sweden; Switzerland; and the United States.*

Figure 6: OECD MFP growth over time



Source: Economic Insight analysis of OECD MFP data

2D. Additional sources of data

Additional public sources of data

We have also reviewed a wide range of additional evidence from various major financial institutions and independent bodies, and found that this also suggests lower future productivity growth for the UK (relative to the evidence available at the time of our April 2023 report). This includes information relating to: (i) labour productivity; (ii) overall productivity; and (iii) real GDP growth. In the following subsections, we expand on each in turn.

Recent labour productivity growth

In section 2C we showed that the latest ONS flash estimates imply reduced *overall* productivity performance (relative to what that same source implied at the time of our previous report). In addition, these estimates offer insights into the recent rate of *labour productivity* growth. Specifically, these estimates show that output per hour worked was 0.3% lower in Q4 2023 than a year before (Q4 2022); and 1% lower than in the previous quarter (Q3 2023).[20] This negative growth suggests that the outlook for labour productivity may be worse now than it was at the time of our April 2023 report.

A view of lower future labour productivity growth is also reflected in the OBR's downward adjustments to recent forecasts for labour productivity. As illustrated in section 2C, the OBR's latest (March 2024) forecasts of annual growth in labour

[20] *'UK productivity flash estimate: July to September 2023.' ONS (February 2024).*

productivity per hour are *lower* than its March 2023 forecasts for 2024 to 2026 by between 0.11 and 0.64 percentage points.[21]

Overall productivity growth

The OBR biannually releases "*Economic and fiscal outlook*" reports on the UK economy, which are typically published every March and November. At the time of our April 2023 report, the most recent release was the March 2023 edition. Since then, it has released two new editions in November 2023 and March 2024, providing updates on how new information has affected its view on the outlook for TFP.

- In its November 2023 edition,[22] the OBR stated: "*recent data and historical revisions point to a weaker near-term outlook for total factor productivity growth*"[23] in relation to new information since its March 2023 release. One of the reasons the OBR gave for this conclusion was that it considered that there had been a "*loss of momentum*"[24] as post-pandemic growth in TFP was lower than it had originally expected.

- In its March 2024 edition, the OBR's view on TFP growth remained weaker than in March 2023, with its average growth forecast over 2024 to 2028 unchanged from its November 2023 forecasts (which, as above, were themselves lower than in March 2023).[25]

'Whatever the latest productivity data say, it is unlikely to change the view that productivity growth in the United Kingdom has substantially slowed down in the last fifteen years. Improving productivity outcomes requires structural change that is sustained longer than the lifespan of any single government.'

Further to the above, in December 2023 (i.e., after our April 2023 report) both the extent of the UK's underlying weak productivity performance and likely continued challenges were highlighted by the National Institute of Economic and Social Research,[26] which commented:

  – "*The United Kingdom's poor productivity performance since the 2008 Global Financial Crisis has been well documented, and was illustrated again in the most recent productivity data published by the Office for National Statistics.*"[27]

  – "*Whatever the latest productivity data say, it is unlikely to change the view that productivity growth in the United Kingdom has substantially slowed down in the last fifteen years.* ***Improving productivity outcomes requires structural change that is sustained longer than the lifespan of any single government***" [emphasis added].

Again, this suggests that the outlook for productivity is no better now than it was at the time of our April 2023 report, and that this outlook is unlikely to improve without significant structural change.

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21 *'March 2023 Economic and fiscal outlook – charts and tables: Annex A.' OBR (November 2023); tab "TA.1"; 'March 2024 Economic and fiscal outlook – charts and tables: Annex A.' OBR (March 2024); tab "TA.2".*
22 *'Economic and fiscal outlook – November 2023.' OBR (November 2023).*
23 *'Economic and fiscal outlook – November 2023.' OBR (November 2023); para. 1.6.*
24 *'Economic and fiscal outlook – November 2023.' OBR (November 2023); para. 2.25.*
25 *'Economic and fiscal outlook – March 2024.' OBR (March 2024); para. 2.20.*
26 *'Exploring the Data on UK Productivity Performance.' NIESR (December 2023).*
27 *Note that this statement was in relation to the flash estimate of labour productivity for Q3 2023, the most recent estimate at the time of the post, which also indicated that output per worker was 0.3% lower than a year prior.*

Recent and forecast GDP growth

The broader economic outlook for the UK also remains poor, as we detail in the remainder of this section. Given that GDP growth is highly correlated with productivity growth over time, as discussed in section 4B of our April 2023 report,[28] this is further indicative that any significant improvement in UK productivity growth is unlikely to occur in the near future.

Firstly, the latest ONS GDP data (released in February 2024) shows that recent growth of the UK economy has been poor. In particular, it shows that over the last two years (from Q1 2022 to Q4 2023), the economy has failed to grow overall, with real GDP falling slightly.[29] Moreover, the latest data also shows that the UK experienced a recession at the end of 2023.[30] On a quarterly basis, there were two consecutive falls in GDP, with a fall of 0.3% in Q4 (October to December) 2023 following a fall of 0.1% in Q3 (July to September) 2023.[31]

Secondly, short-term forecasts for GDP growth also appear to be low, based on HM Treasury's latest review of forecasts for the UK economy.[32] This considered 19 new independent forecasts (all of which were made between 1–19 February 2024), as well as the IMF's latest forecasts. Of these, the average forecast annual GDP growth rate was just 0.4% for 2024.[33]

This pessimistic outlook with regards to the future of the UK economy appears to be shared by several other institutions. For example, in November 2023 the National Institute of Economic and Social Research commented:

- "*The outlook for UK GDP growth is bleak for the foreseeable future. Although we do not expect to see a recession in the United Kingdom, we see growth of only 0.6 per cent this year and 0.5 per cent next year as the rapid tightening in monetary policy we saw between December 2021 and August of this year continues to bear down on output.*"[34]

Similarly, the IFS stated in its October 2023 outlook for the UK economy:

- "*The economic experience of the last three years is a harbinger of the kinds of supply shocks that are likely to come.*"[35]
- "*We expect weak margins and policy headwinds to drive a moderate recession through the first half of 2024. We expect GDP will fall 0.7% by next year, followed by growth of 0.4% in 2025.*"[36]

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28 *For example, this can be seen clearly in Figure 8, Figure 9, and Figure 10 of our April 2023 report.*
29 *'GDP in chained volume measures – real-time database (AMBI).' ONS (February 2024).*
30 *Note that a technical recession is defined as two consecutive quarters of contracting GDP.*
31 *'GDP first quarterly estimate, UK: October to December 2023.' ONS (February 2024).*
32 *'Forecasts for the UK economy: February 2024.' HM Treasury (February 2024).*
33 *'Forecasts for the UK economy: February 2024.' HM Treasury (February 2024); page 3.*
34 *'The Outlook for the UK Economy.' NIESR (November 2023).*
35 *'UK Outlook: Fallout.' IFS (October 2023); page 3.*
36 *'UK Outlook: Fallout.' IFS (October 2023); page 5.*

Academic expert survey evidence

As noted in the introduction, as part of a piece of academic research, we conducted a survey of leading independent academic experts in productivity analysis in the UK.[37] 26 academic experts completed the survey, which asked them to give their views (and reasons for those views) in relation to:

(i) the factors driving the lower level of productivity growth for the UK since 2008;

(ii) the factors driving differences in historical productivity growth by sector;

(iii) the prospects for future UK productivity growth over three separate time periods, the next: (i) twelve months (2024); (ii) five calendar years (2024–2028); and (iii) ten calendar years (2024–2033); and

(iv) which sectors are expected to under or over perform the rest of the UK in the future.

Therefore, the survey helps us address both questions set out in this report. The academics' views on (iii) and (iv) provide additional evidence on the likely future productivity performance of both the UK in general, and individual sectors (including the water sector). Their views on (i) and (ii) above, help us understand what factors drive productivity growth, which we explore in the next chapter.

Below we set out our findings both in relation to the prospects for future UK productivity growth over the next five calendar years as well as the academics' expectations on which sectors will under or overperform.

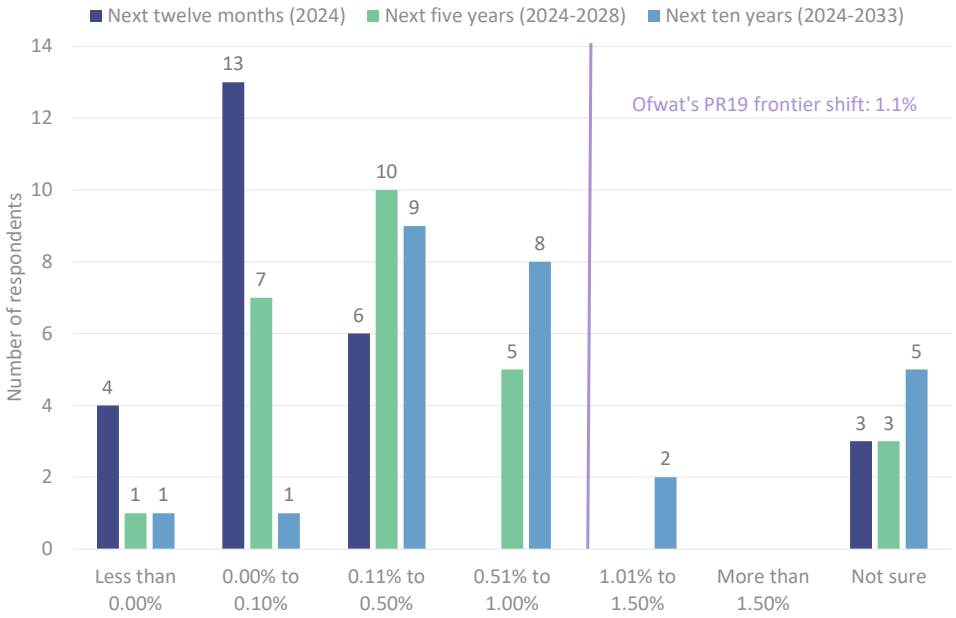
Leading academic experts expect UK productivity growth to be significantly below Ofwat's PR19 frontier shift challenge of 1.1% pa. Most predict it will be less than 0.5% pa over the next five calendar years (2024–2028).

Evidence from a survey of academic experts suggests that *most do not expect material changes in UK productivity performance over the next five years (2024–2028)*, compared to the current low productivity trend over the five most recent years (2016–2020).[38] This is illustrated in Figure 7 overleaf.

[37] *'The UK productivity puzzle: A survey of the literature and expert views.' Williams, S.; Glass, A.; Matos, M.; Elder, T.; and Arnett, D. (January 2024), and section 3C of this report. Note, this wider research exercise was not undertaken on behalf of (nor funded by) any clients. Participants in our research did so of their own volition and without any financial incentive. The research was not undertaken for the purpose of making regulatory submissions and was an academic endeavor on the part of the listed authors.*

[38] *So defined because these were the five most recent years for which data was available at the time the survey was run.*

Figure 7: Expectation of range of UK productivity growth (as measured by average annual % MFP) over the: (i) next twelve months (2024); (ii) next five calendar years (2024–2028); and (iii) next ten calendar years (2024–2033)



Source: survey of academic experts, N=26.

'Most academic experts (18 out of 23, or 78%, of those who provided an estimate) expect productivity performance to be 0.50% pa or lower' [over the next five calendar years].

As can be seen, over the next five calendar years (2024–2028):

- most academic experts (18 out of 23, or 78%, of those who provided an estimate) expect productivity performance to be 0.50% pa or lower;
- 5 academic experts believe it will fall between 0.51% pa and 1.00% pa; whilst
- no academic experts expect productivity performance to be above 1.00% pa (and 3 academic experts did not provide an estimate / were not sure).

Of the 18 academic experts who expect productivity performance to be 0.50% pa or lower:

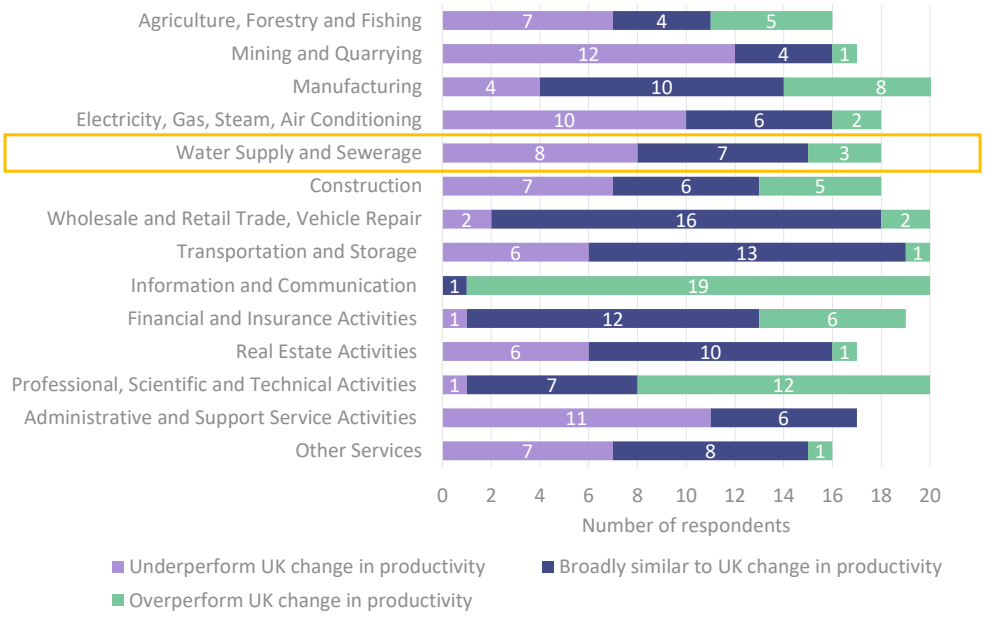
- 1 believes productivity performance will *reduce over the next five calendar years* (2024–2028), relative to its prevailing level of 0.0% pa over the most recent five calendar years for which data was available at the time of the survey (2016–2020).
- 7 believe productivity performance will *remain broadly similar over the next five calendar years* (2024–2028), relative to its prevailing level of 0.0% pa over the five most recent calendar years for which data was available (2016–2020). Reasons cited for this included that they consider there to be: no coherent infrastructure strategy; a lack of investment; and no clear government policies.
- 10 respondents believe productivity performance will improve (i.e. be above zero, but no more than 0.5% pa) over the next five calendar years (2024–2028). Reasons for this include that they believe there will be increased private and public investment, as well as increased stock (and quality) of human capital and increased openness to trade. We explore the importance of different factors driving productivity performance in more detail in chapter 3.

Leading academic experts expect water sector specific productivity growth over the next five calendar years (2024–2028) to be in line with, or lower than, average UK productivity over the same time period.

As shown in Figure 7, most academic experts expect productivity growth over the next five calendar years (2024–2028) to be 0.50% pa or lower.

The survey also asked them how they expect productivity growth in each sector to change over the next five years, *compared to their expectations of how overall UK productivity might change over the next five years* (i.e. whether a sector might out- or underperform). Figure 8 shows their responses.

Figure 8: Expectations of how sector-level productivity might change over the next five years (2024–2028), compared to the expectation of how overall UK productivity might change relative to the last five years (2016–2020)



Source: survey of academic experts, N=23.

As can be seen, for some sectors, academic experts agree that these will mostly outperform the overall UK change in productivity, such as '*Information and Communication*'. Similarly, there is agreement that some sectors, such as '*Wholesale and retail trade*', will remain broadly similar to the overall UK change in productivity.

In respect to the '*Water Supply and Sewerage*' sector, 8 experts expect it to underperform the UK economy; with a further 7 expecting it to perform in line with the UK economy. In other words, 15 experts (83% of respondents who provided an estimate for this question) expect the sector to perform *below* or *in line with* the UK economy. Only 3 expect it to outperform the UK economy.

This is important because to meet their financing and customer related duties, regulators need to set price controls such that firms can expect to recover efficiently incurred costs. Therefore, cost related targets (such as frontier shift) should be determined based on a balancing of evidence that weighs up the risk of them being

either 'too easy' or 'too hard' to achieve[39], given that efficient costs cannot be directly observed. Thus, what this evidence suggests is that, were Ofwat to set a frontier shift target well above UK productivity performance, said target would most likely *not* be achieved in the view of academic experts.

In relation to reasons given by experts expecting the sector to underperform, key factors most frequently raised include: a decrease in appropriability of R&D investment; a decrease in scope for technological change; changes in government policy; and a reduction in management quality. They also noted that "*environmental policies will slow growth of demand and reduce capital productivity"*, and that "*investments that provide security of service do not necessarily result in additional outputs"*. This highlights an important point: in the water sector, increased investment may not always lead to productivity growth. For example, for some water companies, the biggest investments in the current AMP are installing over 500km of pipe to move water from one area to another. This costs £1bn to install and will be costly to run; yet, it is not providing additional outputs – or additional outputs at a lower cost – thus, in and of itself, may not be providing any productivity improvements.

[39] *Strictly speaking, each target should be set such that it represents the 'most likely' level an efficient firm can achieve (i.e. in this case, the P50 view on frontier shift).*

3 Are regulated industries less impacted by the factors causing low productivity in the UK?

To answer this question, we have: (i) undertaken a detailed literature review; (ii) analysed trends in productivity and investment; and (iii) drawn on insights from a survey of academic experts in the field of productivity. We find limited reasons to believe regulated industries (in particular, water) are less impacted by factors causing the UK productivity slowdown. This is because the literature mostly points to economy-wide causes explaining the UK's productivity flatline (and surveyed academic experts concur with that view). Additionally, when one looks across the various factors driving the productivity slowdown, there are limited reasons to believe regulation could plausibly influence their impact on water sector productivity, to any material degree.

3A. Context

THE DISCUSSION OF WHETHER REGULATION MIGHT MITIGATE THE IMPACT OF THE PRODUCTIVITY SLOWDOWN ON REGULATED COMPANIES HAS, TO DATE, BEEN LARGELY INFORMED BY HIGH-LEVEL REASONING.

Ofwat and other sectoral regulators have previously suggested that the factors causing persistently low productivity in the UK, post-financial crisis, may not apply (or apply to a lesser extent) to regulated industries. However, to date this important issue has primarily been informed by relatively high-level reasoning, rather than robust evidence. Moreover, without more clarity as to what factors have most contributed to the UK's productivity slowdown, there are inherent limits as to the extent to which one can reliably conclude that regulation may, or may not, have mitigated the effect of said factors. In light of these limitations, but recognising the valid in-principle arguments regarding the role of regulation, it is appropriate to ask: *are regulated industries less impacted by the factors causing the UK productivity slowdown?*

To answer the above question, we need to:

a. Firstly, based on evidence, identify and consider what the main factors causing the UK productivity slowdown are.

b. Secondly, consider the extent to which regulation might mitigate (or potentially increase) their impact on the water sector.[40]

In the remainder of this chapter, we firstly summarise our method and key findings, before addressing both (a) and (b) in turn.

3B. Overview of method and key findings

Key evidence considered

To answer both (a) and (b) above, we have drawn on the following evidence.

- **Productivity trend analysis**. We have used EU KLEMS data to examine the trends in productivity metrics across the UK and various sectors.
- **Literature review**. We undertook a detailed literature review on the:
  - (i) key theoretical drivers of productivity growth *in general*; and
  - (ii) extent to which these drivers help explain the UK's slowdown in productivity growth since 2008.
- **Survey of leading UK academic experts in productivity**. As part of an academic research exercise, we undertook an online survey of leading independent UK academic experts in productivity analysis (as set out in more detail in section 2D).
- **Investment trend and type analysis**. We have used ONS and OECD gross fixed capital formation (GFCF) data, to understand trends in overall UK investment and how that compares to investment in the UK water sector and other G7 countries.

Key findings

Overall, we find that:

- The main factors primarily causing low productivity growth in the UK are the: extent of investment (both private and public); quality of infrastructure; quality of the existing human capital stock; and management quality. These tend to be (primarily) *economy-wide* factors, thus affecting all sectors of the UK economy *to a degree*.

[40] *We note that regulation might also increase the impact of these factors on water sector specific productivity. That is, while it is, in principle, plausible that regulation might assist productivity in some ways, it is similarly plausible that it might be detrimental to productivity in other ways. We do not consider the latter within the scope of this report, but note that should the role of regulation prove to be the basis for some form of upwards adjustment to frontier shift under Ofwat's determinations, it would be appropriate to revisit this.*

- Based on the evidence, the extent to which regulation might mitigate the impact of these factors on water sector specific productivity is limited. Although regulation might help sustain investment in the water sector (relative to the UK economy more broadly) there are no strong reasons to believe that regulation mitigates *any* of the other main causal factors. This is because the quality of infrastructure; existing human capital stock; and firm management affect firms across all sectors of the UK economy. For example, if management quality is generally low in the UK, then all companies (including water companies) recruiting management employees from labour markets will be affected, because they are all competing for that same resource. There is no part of the regulatory regime that inherently improves the employee management skills available to water companies, relative to other sectors.

3C. What are the main factors causing the UK productivity slowdown?

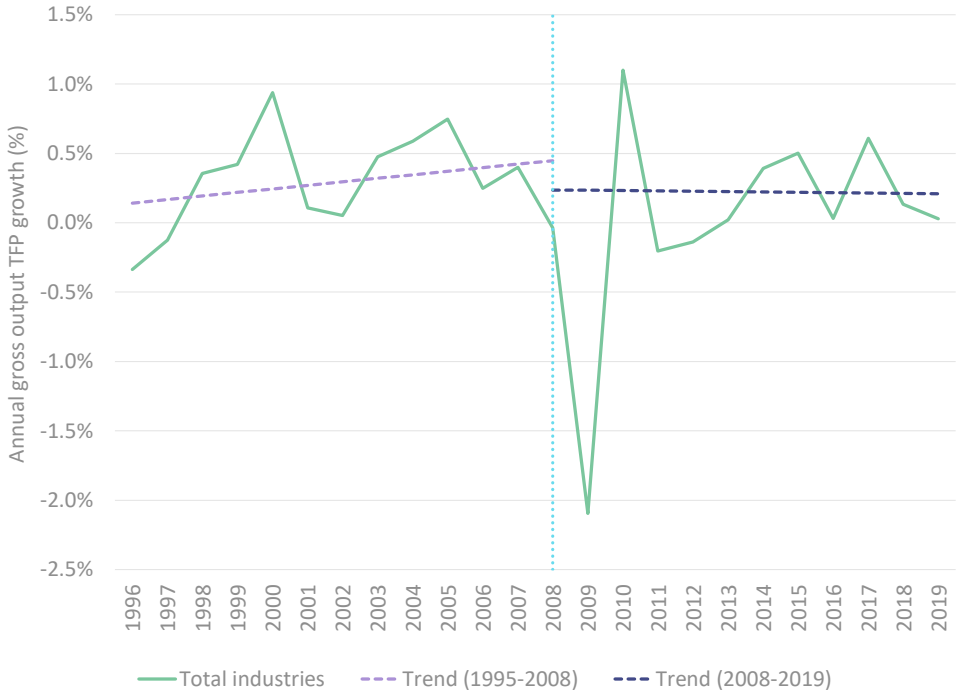
To address this question, we consider the following evidence: (i) the pattern of the productivity slowdown across the UK; (ii) academic literature (which we use to identify the range of factors that affect productivity); and (iii) results from a survey of leading academic experts in productivity (which provides valuable evidence as to which factors are *most important* in causing the UK's productivity slowdown since 2008).

Pattern of productivity slowdown: pervasive across most sectors of the economy

As highlighted in our April 2023 report, the UK's low-to-zero productivity growth since the 2008 financial crisis, shown in Figure 9 overleaf, has been well documented in the literature.[41] A wide range of possible factors likely contributes to the observed slowdown. However, there is no clear consensus on the exact reasons why the slowdown has occurred, leading it to be commonly termed *the productivity puzzle.*

[41] *'UK skills and productivity in an international context.' NIESR (2015); 'The UK productivity puzzle, 2008–2012: evidence using plant-level estimates of total factor productivity.' Harris, R. and J. Moffat (2017); 'The UK's Productivity Problem: Hub No Spokes.' A. Haldane (2018); Below the aggregate: a sectoral account of the UK productivity puzzle.' Riley, R.; Rincon-Aznar, A.; and L. Samek (2018); 'The UK's productivity puzzle is in the top tail of the distribution.' P. Schneider (2018); 'Accounting for the UK productivity puzzle: a decomposition and predictions.' Goodridge, P.; Haskel, J.; and G. Wallis (2018); 'Is the UK productivity slowdown unprecedented?' Crafts, N. and T. Mills (2020); 'Productivity in the UK: Evidence Review.' UK Productivity Commission (2022).*

Figure 9: Average annual gross output TFP growth rates with pre- and post-GFC trend lines



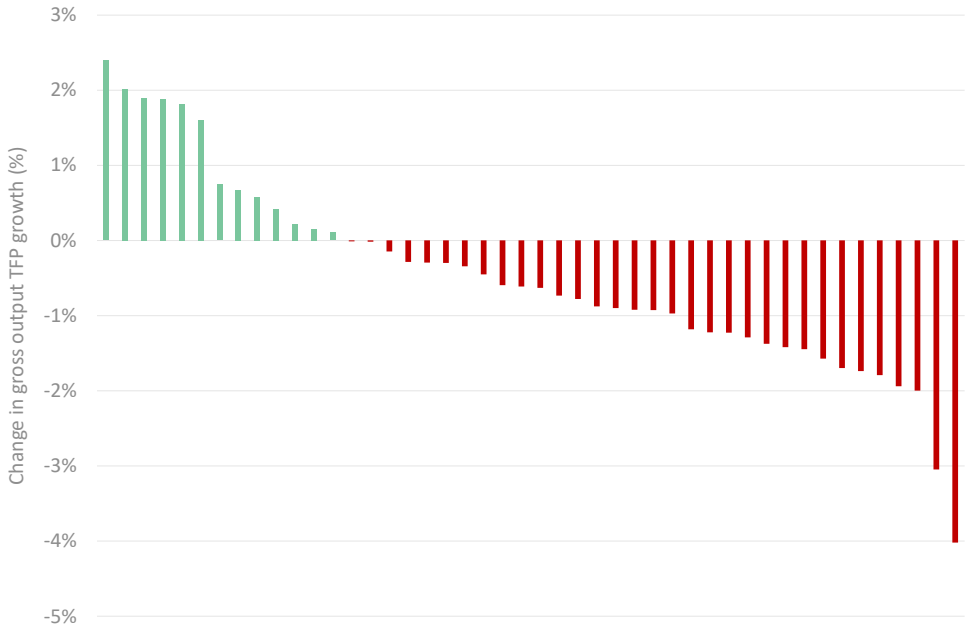
Source: Economic Insight analysis of EU KLEMS NACE II data

Further to the above, and as set out in sections 2C and 2D of this report, the UK's current economic outlook remains poor. This indicates that a material improvement in UK productivity growth is unlikely to occur in the near term.

The pattern of the UK's slowdown is important to consider. In particular, the academic literature emphasises that the UK's productivity slowdown can be observed across most sectors of the economy.[42] This is further illustrated in Figure 10, where we can see that 33 out of the 46 sectors in the UK experienced a reduction in productivity growth from 2008 to 2019 (compared to 1995 to 2007).

[42] *'Solving the United Kingdom's productivity puzzle in a digital age.' Bughin, J.; Dimson, J.; Hunt, V.; Allas, T.; Krishnan, M.; Mischke, J.; Chambers, L.; and M. Canal (2018); 'Below the aggregate: a sectoral account of the UK productivity puzzle.' Riley, R.; Rincon-Aznar, A.; and L. Samek (2018); 'Why is productivity slowing down?' Goldin, I.; Koutroumpis, P.; Lafond, F.; and J. Winkler (2021).*

Figure 10: Change in gross output average annual TFP growth from 1995–2007 to 2008–2019



Source: Economic Insight analysis of EU KLEMS NACE II data
Notes: The graph subtracts the average annual gross output TFP growth rates from the period before the financial crisis (1995–2007), from the average annual gross output TFP growth rates from the period after the crisis (2008–2019) for each sector. Sectors that had slower growth rates following 2008 are highlighted in red, whilst those that had higher growth rate following the 2008 crisis are highlighted in green.

The intuitive inference one might draw from the above is that, if the slowdown is observed across the majority of the economy, it would suggest that the causal factors are *primarily* economy-wide (i.e. affecting all / most sectors, *to a degree*). In turn, this might lead us to expect that the impact of economic regulation (on productivity) on any one sector is also likely to be limited. This is because, even if regulation had some effect on some specific drivers of productivity, it cannot affect fundamental shortcomings in economy-wide productivity drivers, such as the quality / stock of human capital in the UK, on which all companies rely.

The literature identifies a range of factors affecting productivity

We have recently published a working paper[43] on the key factors affecting UK productivity, the scope of which included a review of the academic literature. Whilst the literature does not point to a clear consensus as to which factors are most relevant to the current slowdown, it does identify the possible range of those factors. These include the following:

[43] *'The UK productivity puzzle: A survey of the literature and expert views.' Williams, S.; Glass, A.; Matos, M.; Elder, T.; and D. Arnett (January 2024).*

- **Investment (private and public)** is a factor that has long been associated with productivity growth.[44] A study by Syverson (2011) highlights the large body of research evidencing this.[45] Existing research covers the: (i) effect of private investment on productivity growth at the *economy, industry and firm-level*; and (ii) influence of public investment on aggregate productivity growth. In addition, several studies find that underinvestment is one of the factors most strongly linked to the current productivity slowdown in the UK.[46] For example, Van Reenen (2023) states that the "*UK's productivity problem can be summed up in three words: investment, investment, investment. Or lack thereof*."[47] As a result, increasing private and public investment is widely proposed as one of the key steps in solving the UK's productivity puzzle.[48]

- **Infrastructure quality** is another factor frequently associated with productivity growth in the literature. Both theoretical and empirical research has shown that infrastructure positively affects productivity.[49] Relatedly, many papers identify the poor state of the UK's infrastructure as a key factor in explaining the flatlining of productivity growth since 2008.[50] As all sectors of the economy (including the water sector) rely on infrastructure as an input into production, one would expect this to adversely affect productivity quite broadly across the economy.

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44 *For example: 'The level of inventive activity.' J. Schmookler (1954); 'The sources of measured productivity growth: United States agriculture, 1940-60.' Z. Griliches (1963); 'Research expenditures, education, and the aggregate agricultural production function.' Z. Griliches (1964); 'Sources of measured productivity change: Capital input.' Griliches, Z. and D. Jorgenson (1966); 'The explanation of productivity change.' Jorgenson, D. and Z. Griliches (1967); 'Productivity and the Role of Government.' Griffith, R. and H. Simpson (1998).*

45 *'What determines productivity?' C. Syverson (2011).*

46 *For example: 'Investing for prosperity: skills, infrastructure and innovation.' Besley, T.; Coelho, M.; and J. Van Reenen (2013); 'Can intangible investment explain the UK productivity puzzle?' Goodridge, P.; Haskel, J.; and G. Wallis (2013); 'Why should we care about productivity?' V. Pryce (2015); 'Innovation, research and the UK's productivity crisis.' R. Jones (2016); 'The UK's productivity puzzle: labour, investment and finance.' J. Chadha (2017); 'What Is Holding Back UK Productivity? Lessons from Decades of Measurement.' Mason, J.; O'Mahony, M.; and R. Riley (2018); 'Solving the United Kingdom's productivity puzzle in a digital age.' Bughin, J.; Dimson, J.; Hunt, V.; Allas, T.; Krishnan, M.; Mischke, J.; Chambers, L.; and M. Canal (2018); 'A concerted effort to tackle the UK productivity puzzle.' Van Ark, B. and A. Venables (2020).*

47 *'Chronic under-investment has led to productivity slowdown in the UK.' J. Van Reenen (November 2023).*

48 *For example: 'Why should we care about productivity?' V. Pryce (2015); 'Innovation, research and the UK's productivity crisis.' R. Jones (2016); 'The Productivity Puzzle: It's the Lack of Investment, Stupid!' Herzog-Stein, A.; and G. Horn (2018); 'The UK's productivity puzzle: labour, investment and finance.' J. Chadha (2017); 'Productivity in the UK: Evidence Review.' UK Productivity Commission (2022).*

49 *For example: 'The political economy of Leviathan.' Findlay, R. and J. Wilson (1987); 'Government, Trade, and Comparative Advantage.' Clarida, R. and R. Findlay (1992); 'International productivity differences, infrastructure, and comparative advantage.' Yeaple, S. and S. Golub (2007); 'Effects of Road Infrastructure on Employment, Productivity and Growth: An Empirical Analysis at Country Level.' Sotelsek, D. and L. Laborda (2019); 'Productivity impacts of infrastructure development in Asia.' Arif, U.; Javid, M.; and F. Khan (2021).*

50 *For example: 'Designing a new fiscal framework: Understanding and confronting uncertainty.' Chadha, J.; Küçük, H.; and A. Pabst (2021); 'A concerted effort to tackle the UK productivity puzzle.' Van Ark, B. and A. Venables (2020); 'The UK's Productivity Problem: Hub No Spokes.' A. Haldane (2018); 'Investing for prosperity: skills, infrastructure and innovation.' Besley, T.; Coelho, M.; and J. Van Reenen (2013); 'Productivity in the UK: Evidence Review.' UK Productivity Commission (2022).*

- **Quality of the human capital stock** is a key factor determining productivity growth, as an educated and skilled workforce is known to raise productivity.[51] With regards to the UK productivity puzzle specifically, views in the academic literature are somewhat mixed as to its relative importance. This is because, although the UK appears to be close to the OECD average in terms of childhood education, primary and secondary schooling, and higher education, there are clear and large disparities between socio-economic groups.[52] This skills problem appears to have been compounded by the UK's widely known underperformance in both further education and adult skills.[53] In addition, there is evidence that firms in the UK have been less likely to increase expenditure on worker training, following both the 2008 financial crisis and the EU referendum.[54] This is likely to lead to a worse skills mismatch in the future. For example, research by the Industrial Strategy Council (2019) finds that, by 2030, 7 million additional workers (or 20% of the labour market) could be under-skilled for their job requirements.[55] Additionally, recent evidence from the OECD (2023)[56] shows that vocational training is less common in the UK than in other OECD countries.

- **Management quality** has been found to affect overall firm-level productivity growth. Managers influence firm productivity by coordinating the application of inputs.[57] Relatedly, management quality is commonly mentioned in the literature as a contributing factor to the UK's slowdown in productivity growth since 2008.[58]

- The **misallocation of capital and labour** is widely identified as a driver of productivity.[59] Put simply, if inputs / resources are not put to their most productive use (at an economy; industry; or firm level) then productivity will be lower.

  - Within the existing academic literature, *capital* misallocation is not so frequently referenced in relation to the UK's current productivity puzzle. However, a study by Pessoa and Van Reenen (2013) suggests that capital misallocation has increased in recent years; and therefore has contributed to the slowdown.[60] Specifically, they highlighted that: (i) the rate of bankruptcies and liquidations appears low; (ii) the cross-sectional variance of employment, output, and prices has increased across sectors; and (iii) there is an increased variance of productivity between firms within sectors.[61]

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51 *'UK skills and productivity in an international context.' NIESR (2015).*
52 *'Putting together the pieces of the productivity puzzle: review article of productivity perspectives and productivity and the pandemic.' B. Van Ark (2021).*
53 *'Putting together the pieces of the productivity puzzle: review article of productivity perspectives and productivity and the pandemic.' B. Van Ark (2021).*
54 *'Firm investments in skills and capital in the UK services sector.' OECD (November 2020).*
55 *'UK Skills Mismatch in 2030.' Industrial Strategy Council (October 2019).*
56 *'Education at a Glance 2023: OECD Indicators.' OECD (2023).*
57 *'What determines productivity?' C. Syverson (2011).*
58 *See for example: 'What Is Holding Back UK Productivity? Lessons from Decades of Measurement.' Mason, J.; O'Mahony, M.; and R. Riley (2018); 'The UK's Productivity Problem: Hub No Spokes.' A. Haldane (2018); 'Why is productivity slowing down?' Goldin, I.; Koutroumpis, P.; Lafond, F.; and J. Winkler (2021); 'Putting together the pieces of the productivity puzzle: review article of productivity perspectives and productivity and the pandemic.' B. Van Ark (2021).*
59 *'Misallocation and manufacturing TFP in China and India.' Hsieh, C. and P. Klenow (2009).*
60 *'The UK Productivity and Jobs Puzzle: Does the Answer Lie in Labour Market Flexibility?' Pessoa, J. P. and J. Van Reenen (2013).*
61 *'Micro-data: Perspectives on the UK Productivity Conundrum.' Field, S. and M. Franklin (2013).*

  - In terms of *labour* allocation, evidence of its specific impact on the UK's productivity puzzle in the literature is mixed. Some studies consider that a poor allocation of labour resources is a contributing factor to the slowdown in productivity growth,[62] while others argue it is less significant.[63]

- **Openness to trade** has been linked to improved productivity growth in theoretical studies.[64] However, it is not generally considered a key explanatory factor for the UK's productivity puzzle.[65]

- **Government policy** is another factor that has been shown to influence productivity growth. However, in the specific context of the UK's slowdown in productivity growth since 2008, previous research on the contribution of government policy is limited and this is an area where further work is needed.[66]

- **Ownership structure of firms** has also been found to be a determinant of aggregate productivity.[67] It has not been frequently linked to the UK's productivity puzzle, although there is some evidence that, generally, foreign-owned firms are more productive than domestically owned ones.[68]

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62 *See for example: 'Productivity: The route to Brexit success.' Dimson, J.; Hunt, V.; Mikkelsen, D.; Scanlan, J.; and J. Solyom (2016); 'What Is Holding Back UK Productivity? Lessons from Decades of Measurement.' Mason, J.; O'Mahony, M.; and R. Riley (2018); 'Putting together the pieces of the productivity puzzle: review article of productivity perspectives and productivity and the pandemic.' Van Ark, B. (2021); 'Productivity in the UK: Evidence Review.' UK Productivity Commission (2022).*

63 *'Accounting for the UK productivity puzzle: a decomposition and predictions.' Goodridge, P.; Haskel, J.; and G. Wallis (2018).*

64 *'The impact of trade on intra-industry reallocations and aggregate industry productivity.' M. Melitz (2003); 'What determines productivity?' C. Syverson (2011).*

65 *'The UK's Productivity Problem: Hub No Spokes.' A. Haldane (2018).*

66 *'The Politics of Productivity: institutions, governance and policy: Working Paper No. 015.' Pabst, A., and A. Westwood (2021).*

67 *'Trade, location of economic activity and the MNE: A search for an eclectic approach.' J. H. Dunning (1977); 'Toward an eclectic theory of international production: Some empirical tests.' J. H. Dunning (1980); 'The eclectic paradigm of international production: A restatement and some possible extensions.' J. H. Dunning (1988).*

68 *'The UK's Productivity Problem: Hub No Spokes.' A. Haldane (2018); 'Productivity in the UK: Evidence Review – First report of the UK Productivity Commission.' UK Productivity Commission (2022).*

Academic experts in productivity consider there to be five main drivers of the UK's current slowdown

As can be seen above, the literature provides a helpful start point for understanding the full scope of factors that might affect UK productivity. However, given the lack of consensus in said literature as to what the main determinants of the current slowdown are, we have undertaken a survey of leading UK academic experts (set out in more detail in section 2D).

Within the survey, academics were asked to identify the factors that were most important in explaining the slowdown. We have done this by:

- first, asking them to select which factors they consider explain the UK productivity slowdown since 2008; and
- second, asking them to rank the five most important factors in explaining the slowdown.

Surveyed academic experts consider that the five most important factors explaining the productivity slowdown are the: (i) extent of **private investment**; (ii) **quality of infrastructure**; (iii) the extent of **public investment**; (iv) quality of the **human capital stock**; and (v) quality of **firm management**.[69] The relevant results are summarised in Table 2 overleaf.

[69] *Please note that for the subsequent analysis we refer to investment as encompassing both private and public investment.*

Table 2: Factors driving lower UK MFP growth since 2008, ranked by most important

Ranked … factor by experts ➔ Factor ➔	Most important	Second most important	Third most important	Fourth most important	Fifth most important	Total mentions as one of the five most important factors	Total mentions as factor explaining UK MFP growth
Private investment	11	1	4	0	1	**17**	**17**
Quality of infrastructure	1	5	2	6	1	**15**	**17**
Public investment	1	6	2	3	2	**14**	**15**
Human capital stock	4	2	2	1	2	**11**	**14**
Firm management quality	2	4	2	1	2	**11**	**13**
Capital allocation across industries	2	3	1	1	2	**9**	**9**
Openness to trade	0	1	1	4	1	**7**	**7**
Labour allocation across industries	3	0	2	1	0	**6**	**8**
Regulatory and competition policy	0	2	2	0	0	**4**	**4**
Other factors	0	1	2	0	0	**3**	**3**
Government fiscal policy	1	0	0	1	0	**2**	**3**
Mix of firm ownership structures	0	0	2	0	0	**2**	**3**
Government monetary policy	0	0	0	0	0	**0**	**0**

Source: survey of academic experts, N=26.

3D. To what extent might regulation mitigate the impact of these factors on the water sector?

Having more precisely identified the causal factors of the UK productivity slowdown, we can consider whether (and to what extent) regulation might mitigate its impact on the water industry. To address this, we assess a range of evidence, including: academic and practitioner literature; results from a survey of leading academic experts; and trends in investment levels and growth in the UK and the water sector. The remainder of this section is structured as follows:

- We firstly summarise the main ways in which it has previously been suggested that regulation might mitigate the impact of the productivity slowdown on regulated industries.
- Next we set out our assessment of the potential impact of regulation, stepping through each of the key productivity drivers, as identified in the evidence.
- We then examine drivers of across-sector variation in productivity – and what that implies for the impact of regulation – particularly with respect to regulatory innovation funding and incentives.
- Finally, we summarise our findings on the potential for regulation to mitigate the impact of the productivity slowdown on the water industry.

IN PREVIOUS DISCUSSIONS, SECURITY OF INVESTMENT AND BOOSTS TO INNOVATION HAVE BEEN THE MAIN PROPOSED REASONS AS TO WHY REGULATION MIGHT MITIGATE THE PRODUCTIVITY SLOWDOWN.

Suggested ways in which regulation might mitigate the impact of the productivity slowdown on regulated industries

Sectoral regulators and the CMA have previously suggested that regulated industries are less affected by the UK's post-2008 productivity slowdown. The reasons postulated for this are as follows:

- Ofwat, in giving evidence to the CMA during the PR19 redeterminations, highlighted a range of reasons proposed by its consultants; primarily being that water companies are shielded from demand reductions and reductions in investment.[70]
- Additionally, in setting the PR19 frontier shift productivity improvement, Ofwat suggested that water companies would be making greater use of the totex and outcomes framework.[71]

[70] *'Additional Evidence on Some Points Relating to Frontier Shift.' Europe Economics (2020); page 16.*
[71] *'PR19 final determinations: Securing cost efficiency technical appendix.' Ofwat (2019); page 121.*

- In the PR19 redeterminations, the CMA accepted the argument that water companies may be less impacted (than other sectors) by factors causing the productivity flatline. The CMA specifically referenced that the water sector might be less affected by reduced investment, given the certainty provided by the regulatory regime, stating that *"[t]here were reasons which indicated that water companies were likely to be less impacted than other sectors. For example, the water sector would be less impacted by lower capital investment given the certainty provided by the regulatory regime and the innovation fund encouraging investments in new technologies."*[72] However, the CMA's position was, in part, also informed by it taking the view that UK productivity performance was likely to improve over the following 5 years (so far, factually, it has not).[73]

- During the RIIO-2 price control period, Ofgem's consultants suggested *"[p]lacing less weight on the wider productivity slowdown in recent years, which would effectively see the productivity puzzle as being less relevant for regulated utility sectors – e.g. because of greater revenue and investment certainty in the regulated sectors."*[74] They also suggested Ofgem ought to consider "*the benefits of innovation funding provided in RIIO-1 in improving the potential for the network companies to achieve productivity levels closer to those in the better performing competitive sectors*,"[75] when setting the ongoing efficiency (OE) challenge.

- In its Final Determinations, Ofgem took the view that "*the innovation funding provided by consumers since 2007 should deliver efficiency benefits over and above those achieved in the wider economy, in comparator sectors, and beyond the range indicated by EU KLEMS."*[76] Relatedly, in the RIIO-2 energy appeals, the CMA found that GEMA (Ofgem) had not erred in double-counting innovation funding in the OE challenge,[77] although it did find that Ofgem had made errors in aspects of its decision to set the innovation uplift at 0.2% (and thus, overturned this).[78]

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72 *'Anglian Water Services Limited, Bristol Water plc, Northumbrian Water Limited and Yorkshire Water Services Limited price determinations: Final report.' CMA (March 2021); para. 4.537.*

73 *'Anglian Water Services Limited, Bristol Water plc, Northumbrian Water Limited and Yorkshire Water Services Limited price determinations: Final report.' CMA (March 2021); para. 4.537.*

74 *'RIIO-GD2 and T2: Cost Assessment – Advice on Frontier Shift policy for Final Determinations.' CEPA (November 2020); page 8.*

75 *'RIIO-GD2 and T2: Cost Assessment – Advice on Frontier Shift policy for Final Determinations.' CEPA (November 2020); page 8.*

76 *'RIIO-2 Final Determinations - Core Document (REVISED).' Ofgem (February 2021); para. 5.26*

77 *Cadent Gas Limited, National Grid Electricity Transmission plc, National Grid Gas plc, Northern Gas Networks Limited, Scottish Hydro Electric Transmission plc, Southern Gas Networks plc and Scotland Gas Networks plc, SP Transmission plc, Wales & West Utilities Limited vs the Gas and Electricity Markets Authority: Final determination Volume 2B: Joined Grounds B, C and D.' CMA (October 2021); para. 7.412.*

78 *Cadent Gas Limited, National Grid Electricity Transmission plc, National Grid Gas plc, Northern Gas Networks Limited, Scottish Hydro Electric Transmission plc, Southern Gas Networks plc and Scotland Gas Networks plc, SP Transmission plc, Wales & West Utilities Limited vs the Gas and Electricity Markets Authority: Final determination Volume 2B: Joined Grounds B, C and D.' CMA (October 2021); para. 7.802.*

- The CMA, in hearing the RIIO-2 energy appeals, similarly found that: "*there are reasons why the energy companies may be less impacted than other sectors. For example, the comparative certainty provided by the regulatory regime could facilitate investment.*"[79] However, it also noted that there was a risk that attaching undue weight to the post-crisis period risked setting a frontier shift challenge that was too high: "*we agree with the appellants that an approach which placed insufficient weight on the lower productivity since 2008 could lead to an overestimate of the appropriate OE challenge.*"[80] This latter observation is important in the context of the CMA choosing not to overturn GEMA's (Ofgem's) weighting of the pre-post crisis time periods. This is because, in this case, the CMA was considering the narrow question of whether GEMA was 'wrong', rather than what the most appropriate method was, 'de-novo.'

Summarising the above, regulators and the CMA have forwarded various reasons as to why regulation might mitigate the impact of the productivity slowdown in the UK on regulated companies. In practice, the two main reasons cited are that: (i) regulation makes investment more secure, meaning regulated sectors may be less exposed to underinvestment; and (ii) regulators have introduced specific incentives to boost innovation. We would agree that these are sound in-principle considerations and that, more broadly, it is appropriate to consider whether, and how, regulation might affect productivity. However, two complications are that:

- The discussion of this to date has been based on hypotheses, rather than a robust evidence base (which is unsatisfactory).

'The lack of clarity around the causes of the slowdown in the first place means any discussion of the impact of regulation is inherently somewhat speculative.'

- The lack of clarity around the causes of the slowdown in the first place means any discussion of the impact of regulation is inherently somewhat speculative (i.e., to robustly evaluate any impact of regulation on causal factors, one must first identify them and consider how regulation might affect each in turn). For example, suppose regulation did have mitigating impacts in the two areas previously proposed above (investment and innovation). If those are just two factors out of many that have caused the slowdown, where for the remaining causal factors regulation has no impact, then the overall mitigation is likely small (and vice-versa).

In the following sections, to address the above limitations, we therefore discuss each of the main causal factors as regards the UK productivity slowdown (as identified by the academic experts). For each, we evaluate whether, and in what ways, regulation might affect those factors in a way that could impact the productivity of water companies.

[79] '*Cadent Gas Limited, National Grid Electricity Transmission plc, National Grid Gas plc, Northern Gas Networks Limited, Scottish Hydro Electric Transmission plc, Southern Gas Networks plc and Scotland Gas Networks plc, SP Transmission plc, Wales & West Utilities Limited vs the Gas and Electricity Markets Authority: Final determination Volume 2B: Joined Grounds B, C and D.*' *CMA (October 2021); para. 7.87.*

[80] '*Cadent Gas Limited, National Grid Electricity Transmission plc, National Grid Gas plc, Northern Gas Networks Limited, Scottish Hydro Electric Transmission plc, Southern Gas Networks plc and Scotland Gas Networks plc, SP Transmission plc, Wales & West Utilities Limited vs the Gas and Electricity Markets Authority: Final determination Volume 2B: Joined Grounds B, C and D.*' *CMA (October 2021); para. 7.80.*

The extent to which regulation might affect the most important factors determining the UK's productivity slowdown

Here, we explore the extent to which regulation might mitigate the impact of the following factors on water companies' productivity: (i) investment; (ii) infrastructure quality; (iii) quality of human capital stock; and (iv) management quality. Figure 11 summarises the extent to which regulation might affect the above factors. We provide evidence for each, in turn.

Figure 11: Summary of extent to which regulation might affect the most important factors determining the UK's productivity slowdown

Most important factors determining UK productivity slowdown	Extent to which regulation affects factor
Investment	Limited reasons to believe regulation mitigates this factor.
Infrastructure quality	No reason to believe regulation mitigates this factor.
Quality of human capital stock	No reason to believe regulation mitigates this factor.
Management quality	No reason to believe regulation mitigates this factor.

Source: Economic Insight

Investment

As set out above, investment is a key factor in determining productivity growth in general. Furthermore, the available evidence also suggests this (i.e., underinvestment) helps to explain the productivity slowdown in the UK since 2008. Key drivers of investment include: interest rates; the level of economic activity; the stock of capital; capacity utilisation; the cost of capital goods; technological change; and public policy. In essence, though, the key drivers boil down to whether returns to investors are attractive, relative to the risks they face.

Through the existing regulatory framework, some of the usually uncertain and unknown risk-return balance is more certain, i.e., providing investors with a minimum return (or, at least, a narrower range of returns, relative to unregulated sectors). Therefore, in principle through this mechanism, regulation might mitigate the prospects of underinvestment harming productivity performance in the water industry, relative to the wider UK economy.

However, in practice, the above is dependent on Ofwat setting price controls such that investment in the sector is attractive, relative to its risk (i.e., setting the 'right' amount

of allowed revenues). That is to say, if price controls were set 'too tight' (which includes setting the frontier shift challenge 'too high'), regulation would actually have the opposite effect, leading to investment being below the level necessary to give customers and society their desired outcomes (and vice-versa). Additionally, one also needs to consider how water sector performance is affected by investment in other sectors. For example, as we show subsequently, where the UK *in general* is underinvesting in skills / human capital / other inputs used by the water sector, this will have an effect on the water sector productivity, even where regulation (to some degree) mitigates investment *in the sector itself.*

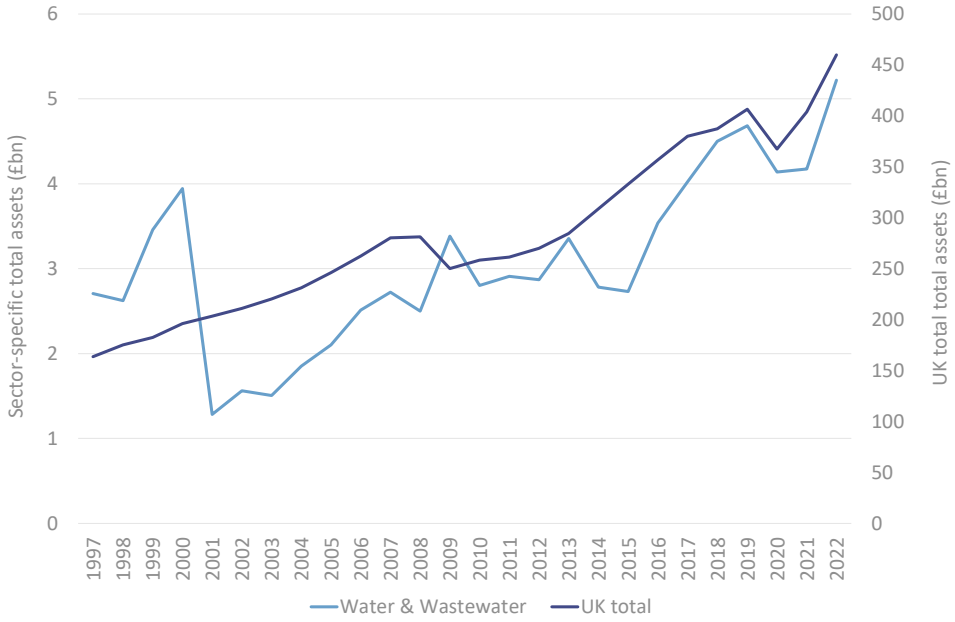
To help understand *whether* regulation does, indeed, mitigate the impact of investment on productivity growth in the water sector, in the following we consider: (i) trends in water sector investment relative to overall UK investment; and (ii) implications of the extent of underinvestment across the UK overall.

Trends in water sector investment relative to overall UK investment

'Total investment in the water sector follows a similar trend to the UK from 2001 onwards, albeit being somewhat more volatile.'

When looking at investment (as measured by gross fixed capital formation - GFCF) across the UK and the water sector[81] specifically, we can see that total investment in the water sector follows a similar trend to the UK from 2001 onwards, albeit being somewhat more volatile than the UK overall (see Figure 12).[82] This similar trend suggests that, relative to other sectors, the water sector has *not* been receiving systematically more, or less, investment. Thus, if it is considered that the UK overall has been underinvesting (and that this has contributed to the productivity slowdown) it follows that this also holds for the water industry.

Figure 12: Annual gross fixed capital formation, total assets (£bn, current prices)

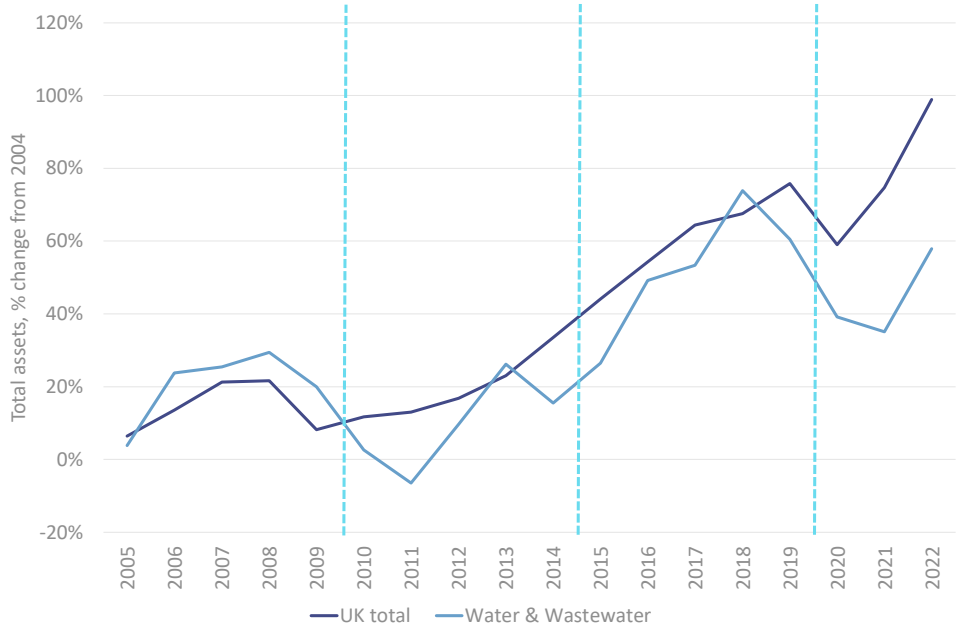


Source: Economic Insight analysis of ONS GFCF by asset and industry data

[81] *Note we use water sector in the text to encompass both the water and wastewater sectors.*
[82] *The sharp drop in water and wastewater between 2000 and 2001 is mostly driven by a steep drop in water GFCF across all asset types.*

Figure 13 (which shows trends in total assets for the water sector and the UK) further shows that the water sector has followed a similar trend in investment to the UK overall, going back to 2004. Notably, the growth rate in total assets has actually been *slower* for the water industry than for the UK since then.

Figure 13: Percentage change in annual gross fixed capital formation (total assets) from 2004 (%)



Source: Economic Insight analysis of ONS GFCF by asset, and industry, data
Notes: light blue dotted lines illustrate start of PR09, PR14, and PR19

Additionally, from the above analyses, we can see that:

- only in the PR04 period (2004–2009) was GFCF growth in the water sector higher than for the UK overall;
- in the PR09 period (2009–2014), water sector GFCF growth was negative in 2011, whilst it remained positive for the UK overall;
- from 2009 onwards, although water GFCF growth followed a similar trend to the UK overall, it generally did so at a slower growth rate; and
- finally, during both the 2008 financial crisis and the COVID-19 pandemic water GFCF growth dropped at a faster rate than for the UK overall.

This suggests that, compared to the UK economy as a whole, water sector investment broadly follows a similar pattern. Moreover, reductions in investment at times of downturns actually appear larger in the water sector than for the UK overall. Thus, when one examines the data, there is no clear evidence to suggest that regulation is materially affecting investment in the water industry, relative to the (likely much larger) drivers of investment attractiveness across the economy more broadly.

The above is not a surprising result. The literature identifies a range of different types of shocks that affect the UK economy, reducing investment certainty and harming the overall investment environment for businesses and investors. Examples of relevant

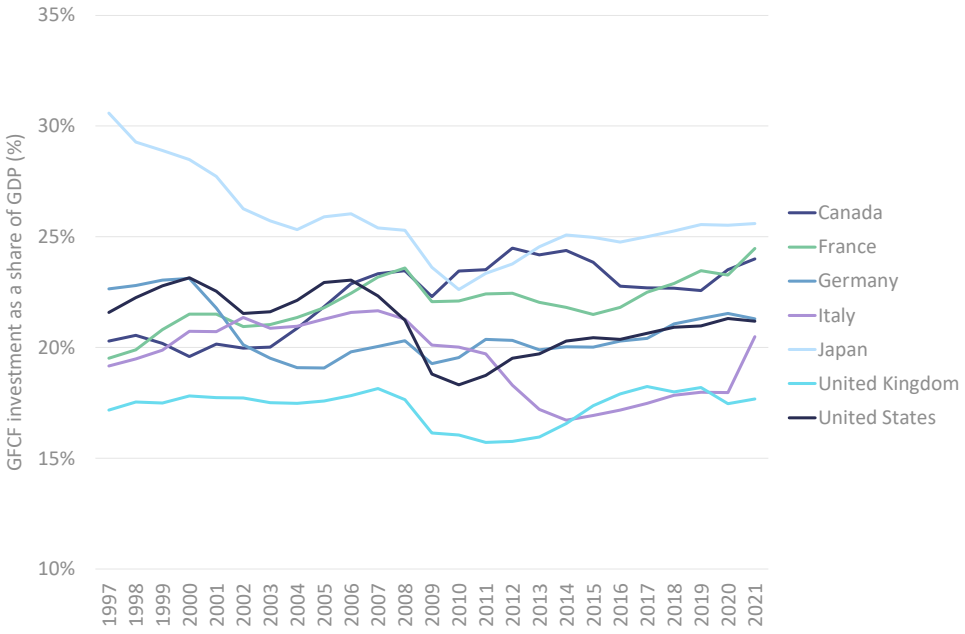
events include: (i) the 2008 financial crisis; followed by (ii) the 2010s austerity; (iii) the UK's withdrawal from the European Union in 2020; (iv) the COVID-19 pandemic in 2020; and most recently (v) global conflicts.[83] The point is, therefore, that even if the regulatory regime has some impact on investment-returns certainty, regulated companies' ability to attract investment is still affected by these external shocks. Most pertinently, it is likely determined by the overall UK investment environment.

UNDERINVESTMENT IN THE UK IS CHRONIC, AND ECONOMY-WIDE.

Evidence suggests there is economy-wide underinvestment in the UK

Further to the relative trends analysis above, there is broad agreement in the literature that: (i) underinvestment in the UK is chronic, i.e., it is not a recent problem; and (ii) weak investment is broad-based, across industries.[84] For example, it is widely recognised that the UK persistently lags behind other comparable countries when it comes to investment.[85] As illustrated in Figure 14, since 1997, UK total investment (GFCF) as a share of GDP has consistently lagged G7 countries.

Figure 14: Total investment (GFCF) as a share of GDP



Source: Economic Insight analysis of OECD data

Various organisations suggest that structural features of the UK economy help explain this persistent underinvestment, including the UK's business culture and its institutions, leading to short-termism and aversion to investment.[86] To the extent that these factors cause the underinvestment, they are economy-wide and further, are unlikely to be mitigated by regulation (e.g. a wider business culture is a UK wide phenomenon).

[83] *'Business investment: Not just one big problem.' Institute for Government (August 2022); 'The Productivity Agenda.' The Productivity Institute (2023).*
[84] *'The Productivity Agenda.' The Productivity Institute (2023); page 9.*
[85] *'Investment in the UK: Longer term trends.' Bennett Institute for Public Policy (November 2023).*
[86] *'Britain's Investment Gap.' TUC (2014); 'Britain's productivity problem is long-standing and getting worse.' The Economist (June 2022); 'Business investment: Not just one big problem.' Institute for Government (August 2022).*

Quality of infrastructure

Infrastructure – the "*economic arteries and veins; roads, ports, railways, airports, power lines, pipes and wires that enable people, goods, commodities, water, energy and information to move about efficiently*"[87] – is a key factor in determining productivity growth in general and helps to explain the productivity slowdown since 2008. Both the academic literature and surveyed academic experts note the close link between the quality of infrastructure and investment (set out above). In 2021, Parliament noted that "*[b]etter quality infrastructure allows an economy to be more efficient, improving its productivity, and raising its long-term growth rate and living standards.*"[88]

There is a range of evidence that the UK has low quality of infrastructure:

- In 2015, a report by the OECD noted that the UK's public spending on infrastructure has been lower over the past thirty years, compared to other OECD countries'.[89] Additionally, it found that, although the perceived quality of UK infrastructure assets is close to the OECD average, it is lower than in other G7 countries. Specifically, the report found that:
  - The perceived quality of the UK's **road system** was worse than in most OECD countries of similar size and wealth, with investment in UK roads being considerably below the level in Germany and France.[90] Additionally, it found that commuting times were long.
  - Although the OECD considered that the **railway sector** in the UK was much improved over the last 20 years, and quality of railroad infrastructure was edging up, significant concerns around overcrowding remained.[91] This was still a concern in 2021, where the UK government noted that the railway's "*performance was disappointing and passengers' biggest priority for improvement was punctuality*."[92]
  - In relation to **air transport**, the UK is significantly capacity constrained.
  - There was increasing congestion at UK **sea ports** and that further investment was needed to ensure adequate capacity.[93] Notwithstanding this, it found that the perception of UK port infrastructure was relatively good, but not as high as in the best-performing OECD countries.

87 *'What is infrastructure?' The Economist (2021).*
88 *'Infrastructure policies and investment.' UK Parliament (March 2021).*
89 *'Improving infrastructure in the United Kingdom: Economics Department Working Papers No. 1244.' OECD (July 2015).*
90 *'Improving infrastructure in the United Kingdom: Economics Department Working Papers No. 1244.' OECD (July 2015); page 15.*
91 *'Improving infrastructure in the United Kingdom: Economics Department Working Papers No. 1244.' OECD (July 2015); page 17.*
92 *'Great British Railways: The Williams-Shapps Plan for Rail.' Department for Transport (May 2021); page 13.*
93 *'Improving infrastructure in the United Kingdom: Economics Department Working Papers No. 1244.' OECD (July 2015); page 22.*

- In relation to the UK **healthcare infrastructure**, a report by the Kings Fund (2023) found that the "*NHS, which sits at the core of the UK health system, is neither a leader nor a laggard when compared to the health systems of 18 similar countries*."[94] Further, it found that the UK's health spending per person was below average compared to other countries; and that the UK lagged behind other countries in its capital investment. This manifested in fewer key physical resources, such as computerised tomography (CT) and magnetic resonance imaging (MRI) scanners, and hospital beds, compared to many of its peers.

- The National Infrastructure Commission (NIC) noted that "*much of the country's infrastructure is under strain, not keeping pace with population growth and modern requirements.*"[95]

- In October 2023, the NIC further found that "*there are significant deficiencies that are holding the UK back. There has been under investment in transport systems in regional English cities, no major water resource reservoirs have been built in England in the last 30 years, too many properties are at risk of flooding, and recycling rates have not increased in a decade.*"[96]

The reason infrastructure quality is so important to productivity performance is that all companies and sectors depend on it in the production of goods and services. Whilst water regulation might (if it mitigated underinvestment – which we addressed above) result in higher quality *water* infrastructure, it does not (and cannot) shield water companies from the effect of low-quality infrastructure across the UK economy (e.g. low-quality transport links). Thus, in relation to this factor, there is no basis to suppose regulation can mitigate the productivity slowdown on water companies.

Quality of human capital stock

The quality of human capital stock is a key factor driving both productivity growth and explaining the slowdown since 2008. There is a range of evidence as to the low quality of the UK's human capital stock:

- In 2015, the Department for Business, Innovation & Skills (BIS) found that the UK performs relatively well in terms of higher skills (bachelor's degree and above) compared to other countries.[97] However, it found that the UK's comparative performance in intermediate (practical, technical, and occupational) skills was a concern.

- This is echoed by the UK Commission for Employment and Skills[98] report, which shows that the UK ranks below average compared to the OECD and EU averages on both lower (i.e., below upper secondary) and intermediate skills (i.e., upper secondary), whereas it scores above average for higher skills (i.e., tertiary).

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94 *'How does the NHS compare to the health care systems of other countries?' The King's Fund (June 2023).*
95 *'Congestion, Capacity, Carbon: Priorities for national infrastructure: consultation ahead of National Infrastructure Assessment.' National Infrastructure Commission (October 2017); page 2.*
96 *'The Second National Infrastructure Assessment.' National Infrastructure Commission (October 2023); page 8.*
97 *'UK skills and productivity in an international context.' BIS (December 2015).*
98 *'UK Skills Levels and International Competitiveness 2014.' UK Commission for Employment and Skills (October 2015).*

- In its response to the Government's Industrial Strategy Green Paper, the CIPD (2017)[99] highlighted multiple shortcomings in relation to the UK's skills. These included: (i) England and Northern Ireland together ranking in the bottom four OECD countries for literacy and numeracy among 16–24 year olds; (ii) the UK ranking bottom (out of 19 countries) on young people's computer problem-solving skills; (iii) UK employers spending less on training than other major EU economies, and less than the EU average; (iv) the UK ranking fourth from the bottom on the EU league table on job-related adult learning participation.

As with (physical) infrastructure set out previously, the quality of human capital stock available across the UK economy will affect all sectors. This is because all sectors of the economy are (in the broadest sense) drawing from the same pool of applicants / labour market(s). The economic regulation of the water industry cannot influence the human capital stock (e.g., knowledge and skills) within relevant labour markets. Therefore, in relation to this important driver of the UK productivity slowdown, there is no evidence to suggest that regulation can mitigate its impact on water companies.

Management quality

Finally, firm management quality is also an important determinant of productivity growth, and a driver of the slowdown since 2008 (and is further connected to some of the issues relating to the human capital stock, as set out previously). Evidence of the UK's shortcomings in relation to management quality include:

- In 2012, BIS found that nearly three quarters of organisations in England reported a deficit in management and leadership skills.[100] BIS put forward the following reasons as explaining the UK's underperformance relative to its peers; UK managers: (i) being less qualified; (ii) being under-trained; (iii) lacking key skills; and (iv) not applying leadership and management skills strategically.

- Bloom and Van Reenen (2007) highlight that the UK has a deficit in management quality compared to the US, Germany, Japan, and Sweden. [101] They also find that this management deficit is likely to be the cause of the productivity gap to those countries.

- Managers in the United Kingdom tend to have lower levels of formal education than in other countries. In 2017, the share of managers with at least a tertiary education in the UK was below the EU average, and well below the best performers.[102]

As with the quality of the human capital stock set out previously, companies across all sectors in the UK will be (in broad terms) drawing from the same pool of managers. Thus, there are limited reasons to believe that regulation might mitigate the impact of management quality on water sector specific productivity. Relatedly, any government

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99 *'From 'inadequate' to 'outstanding': making the UK's skills system world class.' CIPD (April 2017).*
100 *'Leadership & management in the UK – The key to sustainable growth.' BIS (July 2012); page 15.*
101 *'Measuring and Explaining Management Practices Across Firms and Countries.' Bloom, N. and J. Van Reenen (2007); 'Constraints on Developing UK Management Practices.' Bloom, N.; Lemor, R.; Qi, M.; Sadun, R.; and Van Reenen, J. (2011).*
102 *'Leadership & management in the UK – The key to sustainable growth.' BIS (July 2012); page 44.*

intervention or oversight of any kind in relation to management rewards can have some downsides and negatively impact the quality of management.[103]

Understanding drivers of across-sector variation in productivity

Whilst, as above, the main drivers of the productivity slowdown are economy-wide (explaining its pervasive nature), it is also helpful to consider across-sector variation in productivity performance and its causes. This is because understanding that variation is itself relevant to a consideration of whether, and to what degree, regulation might mitigate the productivity slowdown on the water industry.

In the following, we explore:

- what factors academic experts consider drive sectoral variation in productivity growth;
- how the scope for technological change, the factor most commonly identified by the academic experts as explaining sectoral variation in productivity growth, is intrinsic to industry characteristics; and
- the implications of this for any impacts of regulation on productivity.

Academic experts consider the scope for technological change to be the most important driver of variation in sectoral productivity growth

To help us understand what most drives differences in productivity growth across sectors, within the survey independent academic experts were asked:

- which factors they consider explained variations in productivity growth across sectors; and
- of those factors, which ones were the five most important in explaining those variations.

Surveyed academic experts consider that the most important factor explaining variations in productivity growth across sectors is the **scope for technological change**. The relevant results are summarised in Table 3.

[103] *For example, current government and regulatory interventions to restrict management rewards in the water sector: https://lordslibrary.parliament.uk/water-and-sewage-companies-executive-remuneration/*

Table 3: Factors explaining historical variations in MFP growth rates across sectors, ranked by most important

Ranked … factor by expert ➔ Factor ➔	Most important	Second most important	Third most important	Fourth most important	Fifth most important	Total mentions as one of the five most important factors	Total mentions as factor explaining UK MFP growth
Differences in scope for technological change	8	3	2	1	1	**15**	**16**
Differences in the extent of investment	5	2	0	4	0	**11**	**11**
Differences in scope for human capital gains	1	6	0	1	1	**9**	**9**
Interactions with place-based factors	3	2	3	0	0	**8**	**9**
Other factors	2	1	3	0	0	**6**	**6**
Differences in openness to international trade	1	2	1	1	0	**5**	**6**
Differences in appropriability of R&D investment	0	2	2	0	1	**5**	**5**
Differences in regulatory and competition policy	0	1	3	0	1	**5**	**5**
Barriers / frictions to labour substitutability	0	1	1	1	2	**5**	**7**
Differences in management performance	2	0	1	1	0	**4**	**5**
Differences in Government policy	0	0	2	1	1	**4**	**4**
Barriers / frictions to capital substitutability	1	1	1	0	0	**3**	**3**
Differences in firm ownership structure	1	0	0	2	0	**3**	**3**

Source: survey of academic experts, N=26.

The scope for technological change is intrinsic to industry characteristics

The key issue to understand as regards the 'scope for technological change' as a driver of industry productivity is that said scope is a function of intrinsic industry characteristics. Most obviously:

- Firstly, some industries inherently 'rely on' the latest technology / high tech as an input into their production processes more than others. Therefore, improvements in technology in general will boost the productivity of those industries more than, say, industries that utilise technology assets to a lesser degree in the production process. For example, pharmaceuticals and computer manufacturing naturally have more scope to benefit from technological change than others, for this reason.[104]

- Secondly, some industries' outputs themselves, by definition, require the constant generation of new products and services, which, in turn, requires a continuous cycle of R&D investment and idea generation. Again, pharmaceuticals would be a good example of this, whereby new drugs and formulations are constantly required.

- Thirdly, there is significant variation in asset lives across industries, which affects the speed and frequency with which they benefit from improvements in technology. All else equal, firms replacing technology related assets more frequently than others will benefit more from productivity related gains.

In line with the above, the minority of industries that have performed more strongly in the UK in relation to productivity include high-tech industries. For example, between 1995 and 2019, average annual productivity growth for the following sectors was:

  - 12.95% for 'Telecommunications';
  - 3.62% for 'Manufacture of computer, electronic and optical products'; and
  - 1.16% for 'Manufacture of basic pharmaceutical products and pharmaceutical preparations'.

Also following from the above, the intrinsic characteristics of the water sector are not amenable to it having material scope to achieve large productivity gains from technology. Most obviously: (i) its main input factors are not high-tech assets; (ii) it does not have to constantly invent new products or services in the way that pharmaceuticals has to; and (iii) it is characterised by long-lived assets.

Consistent with this, Water UK highlighted that technological change is more likely to occur in sectors with much shorter asset lives than the water industry, recognising that, although water companies: "*have found innovative ways of achieving higher levels of performance from these assets, […] this can only go so far*."[105]

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[104] *'Factors behind cross-industry differences in technical progress.' Nelson, R.R.; and E.N. Wolff (1997).*
[105] *'Water 2050 – A White Paper.' Water UK (2022); page 17.*

'There are… three reasons why (based on the evidence) this proposition [that regulatory innovation incentives allow regulated companies to outperform on productivity] *does not stand up to scrutiny.'*

Given that gains from technology are primarily related to industry characteristics, the scope for regulatory innovation incentives to materially impact productivity must be limited

As previously discussed, regulators have suggested that innovation funding / incentives (as implemented within regulatory frameworks) can act as a boost to productivity in regulated sectors. They have further argued that this might enable regulated companies to outperform the current very low levels of productivity in the UK economy. There are, however, three reasons why (based on the evidence) this proposition does not stand up to scrutiny.

- Firstly, and as explained above, if **the scope for industries to benefit (in productivity terms) from new technology is primarily a function of intrinsic industry characteristics,** then (by definition) the ability for any regulatory innovation incentive to materially affect productivity through this channel must be negligible.

- **Secondly, the rationale for a regulatory innovation incentive in the first place contradicts the conclusion that their existence provides a basis to suppose regulated companies can outperform the UK economy on productivity**. Put simply, the rationale for a regulatory innovation incentive must be a belief that innovation in said industries is inefficiently low, because companies are natural monopolies. The introduction of an incentive, even if it were 100% effective, can therefore only solve that market failure, bringing innovation in line with that which would occur in a competitive market. Thus, at best, said incentives provide reasons to believe regulated industries might perform more in line with the UK economy (relative to the counterfactual without such incentives). They do not, however, provide a sound basis for supposing monopoly industries can materially outperform UK productivity.

- **Thirdly, the materiality of innovation investment (in total and under regulatory incentives) in the water industry is simply too low, relative to other industries,** to have any meaningful effect on industry productivity. We expand on this point below.

Ofwat established a £200 million innovation fund "*to unleash a wave of innovation in the water sector and tackle some of the major challenges of our time – delivering transformative benefits for consumers, society and the environment*."[106] However, this amounts to just 0.33% of totex over the last five years (2018/19 to 2022/23).[107] Other, more intrinsically innovative and higher-productivity industries, invest significantly more in R&D. Looking at these industries' proportion of total investment (GFCF) that is R&D over the last five calendar years (2018–2022), we find that the proportion of total investment (GFCF) that is R&D amounts to:

[106] *See: https://waterinnovation.challenges.org/ofwat-innovation-fund/about-the-fund/*

[107] *We note that this percentage would be even smaller (0.002%) if we were to calculate it on a forward-looking basis, on the currently proposed £96 billion set to be invested in water and sewerage infrastructure in the next price control period (2025 to 2030). See here: https://www.water.org.uk/news-views-publications/news/water-companies-propose-largest-ever-investment*

- 8.3% for 'Telecommunications';
- 65.5% for 'Manufacture of computer, electronic and optical products'; and
- 84.1% for 'Manufacture of basic pharmaceutical products and pharmaceutical preparations'.

Following from the above, the large differences in the amounts invested in R&D across industries (with high-tech industries having high proportions of investment in R&D) is consistent with the intrinsic characteristics of industries determining their scope to benefit from technological change. In this context, regulatory innovation incentives and funding will likely not have any material impact on industry productivity (this is not a criticism of those incentives, which may be effective, on their own terms).

In summary: limited evidence that regulation can materially mitigate the impact of the slowdown on the water industry

In summary, whilst we consider that regulation may, in principle, mitigate the impact of the slowdown on the water industry through the 'certainty of investment' channel, in practice the data does not support that this occurs in practice. Moreover, once the wider set of causal factors of the productivity flatline are identified, we find no reasons to believe regulation can materially impact water industry productivity: it cannot address wider issues with the human capital stock, management quality, and so on. The proposition that innovation incentives and funding can materially mitigate the productivity slowdown in regulated industries therefore lacks a strong rationale and is unsupported by the evidence.

We would further note that the survey of academic experts is also consistent with this finding, the results indicating that regulation and competition policy are not especially material drivers of productivity. Specifically:

- Only 4 out of 26 academics (15%) identified 'regulatory and competition policy' as being an important driver of UK productivity growth since 2008 (see Table 2).
- Only 5 out of 26 (19%) academics identified differences in 'regulatory and competition policy' as being an important driver of variations in productivity across industries (see Table 3).

4 Conclusions

4A. Implications of recent evidence for our recommended range for frontier shift at PR24

- Recent evidence on actual productivity performance suggests that the UK's productivity performance has *declined* since our April 2023 report.
- Recent productivity forecasts suggest a more pessimistic view on future performance now exists than prevailed at the time of our April 2023 report.

Taking the most recent data and evidence into account, we find no reasons to depart from our recommended range, as per our April 2023 report. That is to say, the most recent evidence would point to incorporating an additional year, in which productivity performance has further declined. This might provide some reason for considering values towards the lower end of our previously recommended range.

4B. Whether regulated industries are less impacted by the factors causing low productivity in the UK

- The five most important factors driving the UK productivity slowdown since 2008 are the: (i) extent of private investment; (ii) quality of infrastructure; (iii) extent of public investment; (iv) quality of the human capital stock; and (v) quality of firm management.
- The above factors are primarily 'economy-wide' in scope, meaning that they will adversely impact productivity in firms across most sectors in the economy. This is consistent with data showing that the productivity slowdown in the UK post-2008 is pervasive and is not limited to a small number of sectors. Indeed, the slowdown is not limited to the UK.
- Of the five most important factors set out above, we consider that regulation might (in principle) mitigate any slowdown due to underinvestment. However, in practice the data and evidence show this not to be the case. There is no basis to suppose that regulation might mitigate the impacts of the quality of infrastructure, the quality of human capital stock, or the quality of firm management, on the productivity slowdown in the water sector.
- The proposition that regulatory incentives and funding of innovation may enable the water industry to outperform the UK economy on productivity is unsupported for three reasons:

- the scope for productivity gains from technology is largely determined by intrinsic industry characteristics;
- regulatory incentive mechanisms (even if effective) could in theory remove underperformance – due to correcting a market failure – but therefore they provide no logical reason to propose outperformance, relative to the UK; and
- the scale of R&D investment under said incentives is de-minimis, relative to high-tech industries.

In conclusion, we find that there are limited reasons to believe that regulated industries (in particular, water) are less impacted by factors causing the UK productivity slowdown. This further points to no amendment to our recommended range for frontier shift at PR24.

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