

PR24 Final Determinations

Frontier Shift

Ofwat

11 December 2024



FINAL REPORT

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Contents

1. INTRODUCTION AND EXECUTIVE SUMMARY	4
2. APPROACH TO FRONTIER SHIFT IN THE PR24 DRAFT DETERMINATIONS	11
2.1. CEPA’s analysis of the scope for Frontier Shift at PR24	11
2.2. CEPA’s critique of the evidence presented in the PR24 business plans	13
2.3. Ofwat’s PR24 Draft Determinations	14
3. RESPONSES TO THE PR24 DRAFT DETERMINATIONS – WHOLESAL PRICE CONTROLS	15
3.1. Approach to Frontier Shift in the revised PR24 Business Plans	15
3.2. Water industry TFP growth compared to Frontier Shift targets	17
3.3. Investment trends in the UK and the water sector	23
3.4. Rates of technological change in the water industry	27
3.5. TFP growth and ‘catch-up’ efficiency at PR24	30
3.6. Other issues raised by the companies and their advisers	32
3.7. Recommended frontier shift range for the PR24 Final Determinations	36
4. RESPONSES TO THE PR24 DRAFT DETERMINATIONS – RETAIL PRICE CONTROL	37
4.1. CEPA’s analysis of the scope for frontier shift in the retail businesses	37
4.2. Water company arguments	39
4.3. CEPA’s response to issues raised by the water companies	39
4.4. Recommended frontier shift range for the PR24 Final Determinations	40

1. INTRODUCTION AND EXECUTIVE SUMMARY

An important part of the cost efficiency challenge which Ofwat sets the regulated water and wastewater companies in England and Wales through its price determinations process is known as ‘frontier shift’. Frontier shift is the rate at which even the most efficient company in the water and wastewater sector can improve productivity by reducing the volume of inputs required to produce a given volume of output and it relates to the ability of even the most efficient firms in the sector to become more efficient over time, due to improvements in technology and management practices.²

In the PR24 Draft Determinations, Ofwat proposed a frontier shift challenge of 1.0% per year, which is the mid-point of the range we recommended in a report for Ofwat on *Frontier Shift, Real Price Effects and the Energy Cost Adjustment Mechanism* (hereafter referred to as our June 2024 report).³

In this report, we focus specifically on the scope for frontier shift improvements in the water and wastewater sector during PR24 and the responses to the Draft Determinations consultation submitted by the regulated companies and their advisors. We then set out our latest view on the available evidence and advise Ofwat on its approach to frontier shift in the PR24 Final Determinations.

CEPA’s analysis of the scope for Frontier Shift at the PR24 Draft Determinations

Our June 2024 report set out the basis of our assessment of the scope for frontier shift in the water sector over the period 2025–30. We analysed the EU KLEMS dataset and interpreted the results in a manner consistent with existing UK regulatory practice. But we noted that there are important analytical and interpretation judgements on which expert practitioners may disagree. There are also inherent limitations in any approach that relies exclusively on analysis of historical productivity growth rates to set the potential for productivity growth over future periods. Estimation of the scope for frontier shift efficiency requires a mix of data led analysis and expert judgement to determine the extent to which historical evidence accurately reflects the scope for future frontier productivity growth given likely developments in the sector.

The main results of our EU KLEMS analysis were as follows:

Table 1.1 TFP Gross Output (GO) Productivity estimates (average annual growth rate) from 2023 EU KLEMS

Industry	1996 - 2008	2009 - 2019	1996 - 2019
Chemicals and chemical products	1.8%	2.5%	2.1%
Construction	-1.0%	-0.2%	-0.4%
Machinery and equipment n.e.c	1.9%	-0.8%	0.9%
Manufacture of furniture; jewellery, musical instruments, toys; repair and installation of machinery and equipment	1.4%	-0.2%	0.9%
Professional, Scientific, Technical, Administrative and Support Service Activities	-0.5%	-0.3%	-0.3%
Total manufacturing	1.6%	0.4%	1.1%
Transportation and storage	-0.2%	-0.8%	-0.3%
Unweighted average	0.7%	0.1%	0.6%
Unweighted average of 4 highest performing industries	1.7%	0.5%	1.3%

Source: CEPA analysis of EU KLEMS data (2023 release).

² Ofwat uses the term ‘frontier shift’ to refer to the same concept as ‘ongoing efficiency’ which is the name used in our reports for Ofgem (see most recently, CEPA (June 2022) “RIIO-ED2 Final Determinations: Cost Assessment – Frontier Shift”).

³ CEPA (June 2024), “Frontier Shift, Real Price Effects and the Energy Cost Adjustment Mechanism”, available at [ofwat.gov.uk](https://www.ofwat.gov.uk).

Table 1.2 TFP Value Added (VA) Productivity estimates (average annual growth rate) from 2023 EU KLEMS

Industry	1996 - 2008	2009 - 2019	1996 - 2019
Chemicals and chemical products	5.3%	7.2%	5.9%
Construction	-1.1%	1.4%	-0.5%
Machinery and equipment n.e.c	5.8%	0.7%	2.4%
Manufacture of furniture; jewellery, musical instruments, toys; repair and installation of machinery and equipment	3.1%	0.3%	2.0%
Professional, Scientific, Technical, Administrative and Support Service Activities	-0.9%	-0.1%	-0.5%
Total manufacturing	4.6%	1.3%	2.9%
Transportation and storage	0.9%	-0.6%	-0.3%
Unweighted average	2.5%	1.5%	1.7%

Source: CEPA analysis of EU KLEMS data (2023 release)

Based on our analysis of the EU KLEMS dataset in isolation, our Frontier Shift DD Report concluded that the scope for frontier shift productivity growth at PR19 could lie in either of the following ranges:

- **0.5% to 1.2%**, where the bottom of the range aligns with the frontier shift challenges assumed by the least ambitious water companies and the top of the range is aligned with (a) the mid-point between the GO and VA-based TFP growth rates for the 'PR19 comparator set'; and (b) the highest frontier shift challenge recently set by a UK regulator (1.15%/1.25% by Ofgem at RIIO-GD2/T2); or
- **0.6% to 1.3%**, following the methodology developed by Ofwat's consultants at PR19. The bottom of the range is determined by the unweighted average GO-based TFP growth rates for the 'PR19 comparator set' and the top of the range is determined by the unweighted average GO-based TFP growth rates for the four highest performing industries in the 'PR19 comparator set'.

Rather than selecting a specific value from the EU KLEMS analysis and applying it mechanically, we took into account the principle established at PR19 that the TFP data underestimates the scope for productivity growth due to embodied technical change, the stability provided by the regulatory framework, and the relevance of frontier shift challenges adopted in other recent price reviews.

We advised Ofwat that the plausible Frontier Shift range at the Draft Determinations stage was between **0.8% and 1.2% per year**, based on replication of Ofwat's PR 19 approach, consideration of an alternative means of calculation and because we found no evidence to suggest that the scope for frontier shift during PR24 is substantially different from that which other GB regulators have adopted in recent decisions.

In deciding where to aim within that range, we suggested that Ofwat may wish to consider the following factors:

- Placing some qualitative weight on VA-measures of TFP, which justifies aiming up within the GO-based based range.
- The potential for both embodied and disembodied technical change, i.e. the total potential for cost savings that can be achieved by the companies when quality improvements in the factor inputs are considered, which also justifies aiming up within the GO-based based range.
- The clear ambition to deliver a step-change in investment by the water companies over the PR24 period, which may facilitate a 'learning by doing' productivity effect.

Ofwat's decision at the PR24 Draft Determinations

Ofwat set a frontier shift challenge of 1% per year, applied to both base and enhancement expenditure, for both the wholesale and the retail price controls. Ofwat determined that 1% was a stretching but achievable challenge because it aligned with the challenges proposed by the most ambitious companies in their business plans (notably

South Staffs Water, Portsmouth Water and SES Water), and with recent regulatory decisions in the UK, including the frontier shift challenge set by the CMA in the PR19 redeterminations.

Ofwat also concluded that its point estimate was reasonably conservative given that the evidence could support a more stretching challenge of up to 1.2% per year, because:

- EU KLEMS TFP analysis does not account for cost savings that water companies make through embodied technical shift. This includes an increase in the quality of inputs, for example, new ICT.
- Artificial intelligence (AI) having now reached a stage of development at which it can be widely applied across the economy, raising the potential for an AI driven acceleration in productivity growth over the coming years in wholesale and retail services.
- Innovation fund winners also showing potential for productivity gains specific to the water sector through better use of big data and robotics.
- Water and wastewater companies expecting to deliver a step-change in enhancement investment over the PR24 period, which should facilitate a 'learning by doing' productivity effect.

Responses to the PR24 Draft Determinations

In response to the Draft Determinations, the water and wastewater companies submitted their revised PR24 business plans. In total, 6 of the 16 companies either agree with Ofwat's Draft Determination decision of 1%, adopt it in their revised business plans, or propose an alternative which is close to 1%. For example:

- Northumbrian Water propose 0.8% stating that its challenge “*is above the range suggested by Economic Insight at PR24 and reflects our ambition to deliver leading levels of efficiency in the sector.*”⁴
- Anglian Water states that it adopts 1% based on Ofwat's Draft Determination position, although it continues to argue that, in its view, the evidence supports a less ambitious frontier shift challenge.
- South West Water adopts a 1% challenge⁵ but argues that this is at the top end of evidence provided by companies and Ofwat, and that any increase in the target above 1% would be unbalanced.
- Portsmouth Water, SES Water, South Staffs Water also alight on a frontier shift challenge of 1%, or 1.1% in the case of South Staffs Water, for the wholesale price control.

The least ambitious companies are Affinity Water, South East Water, Southern Water, Welsh Water, and Wessex Water which assume a frontier shift challenge of 0.5% for the wholesale price control. Thames Water (0.45%) and United Utilities (0.55%) also opt for a frontier shift challenge close to 0.5%. These companies commissioned a report from their advisers on the potential scope for productivity growth and select a mid-point from their adviser's alternative frontier shift ranges (see discussion below).

With regards to the retail price control, most companies adopt a similar frontier shift challenge.

Supporting analysis submitted by the companies

Seven companies⁶ refer to a report prepared by Economic Insight on their behalf – hereafter referred to as “Economic Insights’ August 2024 report”⁷ – which follows two previous reports on the scope for frontier shift also prepared by Economic Insight for the companies.⁸

⁴ Northumbrian Water (August 2024). “Draft Determinations: Representations”, p.22, available at nwg.co.uk.

⁵ South West Water (August 2024) “Technical Representations – cost and efficiency”, p.9, available at southwestwater.co.uk.

⁶ Affinity Water, Anglian Water, Portsmouth Water, South East Water, Southern Water, Wessex Water, and Yorkshire Water.

⁷ Economic Insight (August 2024) “The Importance of a Balanced Approach to Frontier Shift”, available at anglianwater.co.uk.

⁸ Economic Insight (April 2023) “Productivity and frontier shift at PR24” available at thameswater.co.uk; and Economic Insight (March 2024) “Further evidence on frontier shift at PR24” available at economic-insight.com.

Economic Insight's work recognises that there are “differing viewpoints” on the scope for frontier shift productivity growth over the PR24 period. However, it argues that the frontier shift target “should be set at a substantially lower level than that currently proposed by Ofwat”.⁹ Its report is structured around the following themes:

- Comparing historic productivity growth in the water industry with Ofwat’s frontier shift targets.
- Investment trends in the UK water sector compared to the UK economy as a whole.
- The rate of technological progress in the UK water sector
- The relationship between TFP productivity growth and ‘catch-up’ productivity growth at PR24.

We summarise and then set out our summary response to each of these themes in Table 1.3 below. We expand on the main areas of debate in Sections 3.2 to 3.5 in the main body of this report.

⁹ Economic Insight (August 2024) “The Importance of a Balanced Approach to Frontier Shift”, available at [anglianwater.co.uk](https://www.anglianwater.co.uk).

Table 1.3: Summary of Economic Insight's arguments and CEPA's response

Theme	Sub-theme	Economic Insight's argument	CEPA's response
Historic productivity growth in the water sector	Historic water sector productivity	Frontier shift targets set by Ofwat in recent price reviews have proven to be materially higher than the actual TFP growth achieved by the 'Water supply; sewerage, waste management and remediation activities' industry over the last 20 years.	A 1% frontier shift challenge is aligned with longer-term TFP growth in the water sector according to analysis commissioned by Water UK in 2017. Additionally, we do not recommend adjusting the frontier shift challenge to account for poor water sector productivity growth in recent periods, because this would create a perverse incentive to underperform in one period in order to influence the efficiency challenge in the next.
Historic productivity growth in the water sector	Productivity in the comparator sectors	TFP growth rates in the relevant comparator sectors used by Ofwat to set the frontier shift target at PR19 have deteriorated. Average productivity growth in these sectors is more in-line with the low productivity growth exhibited by the UK economy as a whole since the Global Financial Crisis.	We analyse TFP growth in the comparator industries used at PR19 over the period 1996–2019. This represents the latest business cycle as defined by the output gap. Our approach places a broadly equal emphasis on the periods before and after the Global Financial Crisis, which is appropriate because the UK productivity slowdown should not fully impact on potential productivity growth in the regulated water sector.
Historic productivity growth in the water sector	Productivity forecasts	Ofwat should not continue to make frontier shift decisions based on expectations that productivity growth will improve as per the OBR and Bank of England forecasts. Given the continued underperformance of UK productivity, it is concerned that the companies have been materially underfunded at PR14 and PR19 because frontier shift was set too high.	Our recommended range of 0.8%–1.2% reflects long-term average productivity growth in the PR19 comparator sectors. We do not take a particular view on the outlook for economy-wide productivity growth, because the relevance to the regulated water and wastewater companies is limited by Brexit-related and wider business investment trends. But it is consistent with regulatory practice to consider other forward-looking factors, including the wider adoption and application of new technologies, such as artificial intelligence.
Investment trends in the UK water sector	Applicability of the productivity puzzle	The water sector exhibits the same underinvestment trend as the UK economy more broadly, suggesting that the water sector is not insulated from the wider productivity slowdown.	We do not agree that Economic Insight evidences sustained underinvestment in the UK water industry relative to the UK economy as a whole. In our view, the water industry capital expenditure data shows the relative stability of capital investment at around £6–£8 billion in real terms every year in recent price controls.
Investment trends in the UK water sector	Underinvestment in the asset base	To maintain water sector investment at a comparatively consistent level over time, Economic Insight would expect the ratio of investment to population to remain constant. But regulated water company capital expenditure per head of population declined between 1997 and 2022.	We do not agree that the relatively limited decline in capital expenditure per head of population identified by Economic Insight demonstrates beyond doubt that there is an underinvestment issue. Over the period 1997–2019 the impact of population growth could feasibly be offset by higher 'asset utilisation'. Given that per capita consumption of water has increased over that period, the alleged underinvestment does not appear to substantially constrain the industry's ability to provide critical outputs. Moreover, extending the analysis to include Ofwat data from 2022/23 and 2023/24 would appear to show an <i>increase</i> in capital expenditure per head.

Theme	Sub-theme	Economic Insight's argument	CEPA's response
Investment trends in the UK water sector	International investment comparisons	Aside from France, water sector investment in the UK has grown more slowly than other OECD countries since the Global Financial Crisis.	We do not accept that international comparisons demonstrate an underinvestment problem in the UK. The need for capital investment varies significantly from country to country, and faster rates of growth in other countries might imply that they are 'catching up' with investment which has already been delivered in the UK. This would appear to be supported by Water UK's research which finds that the UK water sector outperforms those in France, Ireland, Italy and Spain in terms of the most important measures on water and sewerage.
Technological progress in the water sector	Engagement in R&D activities	The water industry is not 'high tech' because it contributes a very small proportion of UK spending on research and development (R&D) and employment in R&D.	The relationship between R&D spending and the extent to which an industry is 'high-tech', 'innovative' and so has greater scope for productivity growth is very indirect. This is well demonstrated by some practical examples drawn from Economic Insight's own analysis. For example, pharmaceuticals contribute 6 times more of UK total R&D expenditure than the 'Telecommunications' industry, but TFP growth in the pharmaceuticals industry is just 1.15% per year (GO-basis) compared to 12.3% per year for telecoms.
Technological progress in the water sector	Intrinsic features of the water sector	It is unsurprising that the water industry reports comparatively low rates of innovation and R&D investment given that the patterns of demand in the water sector are relatively stable; there is limited scope for the industry to change its model of supply; the industry is characterised by long lived assets; and there are constrained returns to R&D investment in UK water.	Although the characteristics of the water sector do not encourage innovation to the same degree as, for example, the pharmaceuticals or telecoms industry, the water companies are continually advancing new and innovative technologies and financing R&D activities. It is not credible to characterise the water sector as 'low tech' when the water companies have invested in a wide range of advanced technologies to manage and control their networks, and to recover energy from the treatment of wastewater and sewage.
Relationship between TFP and 'catch up' productivity	Productivity dispersion	TFP estimates derived from EU KLEMS must also capture 'catch-up' efficiency gains and thereby overstate the scope for frontier shift. Europe Economics is mistaken in arguing that catch-up efficiency has been negative since the Global Financial Crisis, as there are other plausible explanations; and it is inconsistent to argue that productivity dispersion is high over the period 2010–2019 when it was low over 1970–2009.	We do not find objective grounds to adjust our recommended frontier shift range to account for the theoretical possibility that the TFP data also captures 'catch-up' efficiency. The most appropriate approach to the TFP analysis is to select comparator industries characterised by the presence of competition. Competition incentivises firms at the frontier to innovate and grow market share whilst the least productive firms eventually exit the market. In the long run it is reasonable to assume that TFP growth in competitive sectors is determined by frontier shift due to improvements in technology and management.

Recommended frontier shift range for the PR24 Final Determinations

We have looked at the available evidence on the scope for frontier shift productivity growth in the regulated water sector in the round and concluded that the range of 0.8%–1.2% per year remains appropriate at Final Determinations because:

- We show that one can employ multiple approaches to the EU KLEMS analysis to justify a range of 0.8%–1.2% which demonstrates the robustness of our results. By contrast, the companies' advisers make a series of analytical choices which produce a disproportionately negative view of the scope for productivity growth – and is not well aligned with the range of frontier shift challenges proposed by the companies themselves.
- There is scope for productivity growth which is not reflected in the TFP growth rates which we calculate from EU KLEMS and which Ofwat is justified in taking into consideration, including productivity improvements represented by embodied technical change, the potential for digitalisation and automation technologies to become more routinely adopted, and the step-change in investment planned in AMP8.
- It is aligned with the challenges proposed by the most ambitious water companies in their revised business plans, despite the incentive on the companies to understate the potential for productivity growth at this stage of the price control process.
- It is aligned with the frontier shift challenges set in other recent regulatory decisions which generally cluster around 1%. None of the water companies nor their advisers were able to credibly explain why this evidence was not relevant to Ofwat's decision at PR24.

The lower end of the range is aligned with the more ambitious water companies and the more cautious approach to frontier shift in the most recent water and sewerage price review in Northern Ireland. The top end of the range is aligned with the highest frontier shift challenges set in recent GB price reviews, whilst the mid-point of the range has been accepted in the most recent CMA appeals.

Consistent with our advice at the Draft Determinations, when considering where the frontier shift challenge might sit within our range, Ofwat should take into account the level of ambition on cost efficiency and service quality that is implied by the price control 'in the round', to ensure that the frontier shift challenge is part of a stretching but achievable package.

2. APPROACH TO FRONTIER SHIFT IN THE PR24 DRAFT DETERMINATIONS

In this section we summarise the analysis and advice that we provided to Ofwat in our June 2024 report¹⁰ which informed the PR24 Draft Determinations; and for completeness set out the decision that Ofwat reached at the draft stage, and its assessment of the evidence provided.¹¹

2.1. CEPA'S ANALYSIS OF THE SCOPE FOR FRONTIER SHIFT AT PR24

The foundation of CEPA's June 2024 Draft Determinations report was an analysis of the EU KLEMS dataset which provides information on historical productivity trends in the UK economy, disaggregated by industry. The EU KLEMS database is widely used to set the frontier shift challenge in other regulated sectors in the UK, and has been applied by Ofwat, Ofgem and the CMA previously.

Our approach to the analysis, and the interpretation of our results is consistent with existing UK regulatory practice, but we noted that there are important analytical and interpretation judgements on which expert practitioners may disagree. There are also inherent limitations in any approach that relies exclusively on analysis of historical productivity growth rates to set the potential for productivity growth over future periods. Estimation of the scope for frontier shift efficiency requires a mix of data led analysis and expert judgement.

The main results of our EU KLEMS analysis were as follows:

Table 2.1 TFP Gross Output (GO) Productivity estimates (average annual growth rate) from 2023 EU KLEMS

Industry	1996 - 2008	2009 - 2019	1996 - 2019
Chemicals and chemical products	1.8%	2.5%	2.1%
Construction	-1.0%	-0.2%	-0.4%
Machinery and equipment n.e.c	1.9%	-0.8%	0.9%
Manufacture of furniture; jewellery, musical instruments, toys; repair and installation of machinery and equipment	1.4%	-0.2%	0.9%
Professional, Scientific, Technical, Administrative and Support Service Activities	-0.5%	-0.3%	-0.3%
Total manufacturing	1.6%	0.4%	1.1%
Transportation and storage	-0.2%	-0.8%	-0.3%
Unweighted average	0.7%	0.1%	0.6%
Unweighted average of 4 highest performing industries	1.7%	0.5%	1.3%

Source: CEPA analysis of EU KLEMS data (2023 release).

Table 2.1 shows the GO-based TFP results. This is the main basis of Ofwat's previous frontier shift estimates and we replicate the approach it used (and the CMA supported) at PR19 for the purposes of regulatory consistency.¹² Growth rates for the period 1996–2019 vary between -0.3% and 2.1%. The sectors at the lower end of the sample include Construction; Professional, Scientific, Technical, Admin and Support Service Activities; Transportation and storage. Sectors at the top-end are: Chemicals and chemical products; Total manufacturing; and Machinery and equipment n.e.c. The unweighted average for the comparator set over the period 1996–2019 is 0.6% per year.

This analysis suggests a range of 0.6% to 1.3%. The bottom of this range is determined by the unweighted average GO-based TFP growth rates for the PR19 comparator set and the top of the range is determined by the unweighted

¹⁰ CEPA (June 2024) "Frontier Shift, RPEs and the energy crisis cost adjustment mechanism", available at ofwat.gov.uk.

¹¹ Ofwat (July 2024) "PR24 draft determinations: Expenditure allowances", p.135-142, available at ofwat.gov.uk.

¹² Ofwat (December 2019) "PR19 securing cost efficiency technical appendix", p.176, available at ofwat.gov.uk.

average GO-based TFP growth rates for the four highest performing industries in the PR19 comparator set over the period 1996–2019.

Table 2.2 TFP Value Added (VA) Productivity estimates (average annual growth rate) from 2023 EU KLEMS

Industry	1996 - 2008	2009 - 2019	1996 - 2019
Chemicals and chemical products	5.3%	7.2%	5.9%
Construction	-1.1%	1.4%	-0.5%
Machinery and equipment n.e.c	5.8%	0.7%	2.4%
Manufacture of furniture; jewellery, musical instruments, toys; repair and installation of machinery and equipment	3.1%	0.3%	2.0%
Professional, Scientific, Technical, Administrative and Support Service Activities	-0.9%	-0.1%	-0.5%
Total manufacturing	4.6%	1.3%	2.9%
Transportation and storage	0.9%	-0.6%	-0.3%
Unweighted average	2.5%	1.5%	1.7%

Source: CEPA analysis of EU KLEMS data (2023 release)

Table 2.2 shows TFP growth in VA terms. Growth rates for the period 1996–2019 vary between -0.5% and 5.9% and the unweighted average of the PR19 comparator set is 1.7% per year. Other UK regulators – including Ofgem and the CMA – have taken into account the VA-based TFP estimates, and therefore other we find that there are other accepted regulatory approaches to estimating the scope for frontier shift which imply a slightly higher estimate of the scope for frontier shift than that which is implied by the GO-based estimates in isolation.¹³

CEPA’s recommended ‘ranges’ for Frontier Shift at PR24

Based on our analysis of the EU KLEMS dataset in isolation, our Frontier Shift DD Report concluded that the scope for frontier shift productivity growth at PR19 could lie in either of the following ranges:

- **0.5% to 1.2%**, where the bottom of the range aligns with the frontier shift challenges assumed by the least ambitious water companies and the top of the range is aligned with (a) the mid-point between the GO and VA-based TFP growth rates for the ‘PR19 comparator set’; and (b) the highest frontier shift challenge recently set by a UK regulator (1.15%/1.25% by Ofgem at RIIO-GD2/T2); or
- **0.6% to 1.3%**, following the methodology developed by Ofwat’s consultants at PR19. The bottom of the range is determined by the unweighted average GO-based TFP growth rates for the ‘PR19 comparator set’ and the top of the range is determined by the unweighted average GO-based TFP growth rates for the four highest performing industries in the ‘PR19 comparator set’.

Consistent with the approaches taken by the CMA in the PR19 redeterminations and Ofgem in the RIIO-2 price reviews, we said that the potential scope for future frontier productivity growth in the water and wastewater sector required a more holistic, ‘in the round’ view of the evidence. Rather than selecting a specific value from the EU KLEMS analysis and applying it mechanically, we took into account the principle established at PR19 that the TFP data underestimates the scope for productivity growth due to embodied technical change, the stability provided by the regulatory framework, and the relevance of frontier shift challenges adopted in other recent price reviews.

We advised Ofwat that the plausible Frontier Shift range at the Draft Determinations stage was between **0.8% and 1.2% per year**, based on replication of Ofwat’s PR19 approach, consideration of an alternative means of calculation and because we found no evidence to suggest that the scope for frontier shift during PR24 is substantially different

¹³ See also Oxera for Wales and West Utilities (November 2019) “Establishing an appropriate efficiency challenge”, p.20., available at www.utilities.co.uk; and CMA (March 2021) “Anglian Water Services Limited, Bristol Water plc, Northumbrian Water Limited and Yorkshire Water Services Limited price determinations”, p.245–246., available at gov.uk.

from that which other GB regulators have adopted in recent decisions, noting that the CMA has set or accepted frontier shift challenges of around 1% in recent appeals.

In deciding where to aim within that range, we suggested that Ofwat may wish to consider the following factors:

- Placing some qualitative weight on VA-measures of TFP, which justifies aiming up within the GO-based based range.
- The potential for both embodied and disembodied technical change, i.e. the total potential for cost savings that can be achieved by the companies when quality improvements in the factor inputs are considered, which also justifies aiming up within the GO-based based range.
- The clear ambition to deliver a step-change in investment by the water companies over the PR24 period, which may facilitate a ‘learning by doing’ productivity effect.

2.2. CEPA’S CRITIQUE OF THE EVIDENCE PRESENTED IN THE PR24 BUSINESS PLANS

Some of the regulated companies and their consultants (Economic Insight) also analysed the EU KLEMS dataset to set the frontier shift challenges adopted in their initial PR24 business plans. In particular, Economic Insight produced three ranges where the upper and lower bound of the range varied depending on the time period and comparator industries used to calculate the estimate.

Economic Insight argued that the plausible range for frontier shift was between 0.3% and 0.8% per year, based on GO-based TFP growth.¹⁴ Whilst several water companies referenced Economic Insight’s April 2023 report in their business plans, the companies adopted frontier shift estimates of between 0.45% and 1.1% per year which is aligned with the ranges which we identified in our June 2024 Draft Determinations report (see Table 3.1 below).

Whilst the analytical methods adopted by Economic Insight with regards to the EU KLEMS dataset were similar to ours in many respects, we did not agree with some of the judgements and conclusions that it reached:

- First, we argued that Economic Insight failed to present a convincing case that its “preferred set” of comparator industries created a more appropriate basis for estimating frontier shift than the comparator set which Ofwat established at PR19 and which the CMA followed in the PR19 redeterminations.
- Second, Economic Insight argued that “little or no weight” should be given to VA-based TFP estimates. In our view, it failed to consider that the more analytically robust and balanced approach would be to take account of both VA and GO estimates given some of the disadvantages of the GO measures. Doing so would be more consistent with other recent regulatory decisions in the UK.
- Third, Economic Insight focused on TFP growth over the period 2010-2019. We argued that this was a disproportionately narrow period, and a more balanced approach to the analysis should consider a longer period. It was also our view that there is no convincing evidence to suggest that the wider slowdown in UK productivity growth since the Global Financial Crisis (GFC) should fully impact on the potential for ongoing productivity gains in the water sector given the longer-term certainty of planning and investment horizons provided by the regulatory framework.
- Fourth, Economic Insight concluded that if the EU KLEMS data understates the scope for productivity growth due to embodied technical change, the scale of this effect must be small and could be offset by efficiencies other than frontier shift which it argues may be captured in its estimates. We noted that in the PR19 redeterminations and subsequent RIIO-GD2 appeals, the CMA agreed with the principle that an upward adjustment to account for embodied technical change may be appropriate and considered it to be appropriate to take into account as a qualitative factor. We argued that Economic Insight had adopted a disproportionately negative judgement which represented a departure from other recent UK regulatory decisions without a strong evidential basis for doing so.

¹⁴ Economic Insight (April 2023) “Productivity and frontier shift at PR24”, p.12, available at [economic-insight.com](https://www.economic-insight.com).

- Fifth, Economic Insight placed little (if any) weight on other recent UK regulatory decisions. We argued that it was appropriate to take into consideration other recent UK regulatory decisions – including the CMA’s PR19 redeterminations and Ofgem’s RIIO-2 final determinations. The final challenge applied in such decisions has been generally clustered around a value of 1% per annum, which was consistent with the challenges proposed by the most ambitious water companies in their PR24 business plans.

Taken together, we found that Economic Insights’ views produced a disproportionately negative assessment of the scope for productivity growth during PR24. We concluded that our range of 0.8% to 1.2% per year represented a more balanced view of the available evidence and would support a stretching but achievable efficiency challenge, and indeed it was more aligned with the range of frontier shift challenges adopted in the company business plans.

2.3. OFWAT’S PR24 DRAFT DETERMINATIONS

Informed by CEPA’s report and its wider analysis of company business plans, Ofwat set a frontier shift challenge of 1% per year in the PR24 Draft Determinations, applied to both base and enhancement expenditure allowances.¹⁵ It also commissioned a report by Europe Economics to critique Economic Insight’s April 2023 and March 2024 reports on frontier shift at PR24.¹⁶

Ofwat cited the following rationale for its decision:

- A frontier shift challenge of 1% per year aligned with recent regulatory decisions in the UK.
- It also aligned with the frontier shift efficiency challenge applied by the most ambitious water companies – South Staffs Water, Portsmouth Water and SES Water – in their PR24 business plans
- That Europe Economics had found the reasons suggested in the academic literature for low economy-wide productivity growth since the 2007-08 Global Financial Crisis were not as applicable to the water sector.
- There are reasons to be positive about forward-looking outlook for productivity across the economy and the water sector, including via the wider use of artificial intelligence, big data and robotics in the water sector and economy as a whole.

Ofwat concluded that its point estimate was reasonably conservative given that the evidence could support a more stretching challenge of up to 1.2% per annum because

- EU KLEMS TFP analysis does not account for cost savings that water companies make through embodied technical shift. This includes an increase in the quality of inputs, for example, new ICT.
- Artificial intelligence (AI) having now reached a stage of development at which it can be widely applied across the economy, raising the potential for an AI driven acceleration in productivity growth over the coming years in wholesale and retail services.
- Innovation fund winners also showing potential for water sector wide productivity gains through better use of big data and robotics.
- Water and wastewater companies expecting to deliver a step-change in enhancement investment over the 2025-26 to 2029-30 period, which should facilitate a 'learning by doing' productivity effect as companies find better ways of working in order to deliver the increase in workload.

Overall, Ofwat concluded that a 1% per annum frontier shift efficiency challenge would be appropriate but conservative interpretation of the evidence. As part of the Draft Determinations consultation, Ofwat sought views from stakeholders on whether a more stretching challenge should be considered.

¹⁵ In the Draft Determinations, Ofwat did not apply Frontier Shift to allowances for business rates and abstraction charges; and self-financing costs such as third-party services and diversions costs.

¹⁶ Europe Economics (June 2024) “Critique of Economic Insight reports on productivity and frontier shift” available at [ofwat.gov.uk](https://www.ofwat.gov.uk).

3. RESPONSES TO THE PR24 DRAFT DETERMINATIONS – WHOLESALE PRICE CONTROLS

In this section we summarise the water companies’ responses to the PR24 Draft Determinations in respect of the wholesale water, wastewater and bioresources price controls:

- Section 3.1 summarises the updated Frontier Shift challenges adopted by the water and wastewater companies in their revised business plan submissions;
- Sections 3.2 to 3.6 summarise the analysis and arguments presented by the companies and their advisers to justify their revised frontier shift challenges, and provides our response to the issues they raised.

3.1. APPROACH TO FRONTIER SHIFT IN THE REVISED PR24 BUSINESS PLANS

In response to the PR24 Draft Determinations, the water and wastewater companies submitted their revised PR24 business plans and responses to the Draft Determinations consultation. Table 3.1 below summarises the frontier shift challenges proposed by the water companies, highlighting any changes since their original business plans.

Table 3.1 Water company business plan submissions for frontier shift in PR24

Company	Wholesale (% per annum)	Change since business plan (% p.a.)	Retail (% per annum)	Change since business plan (% p.a.)
AFW	0.50%	-	0.45%	-
ANH	1.00%	+0.2%	1.00%	+1.00%
HDD	0.61%	-	0.61%	-
NES	0.80%	-	0.80%	-
PRT	1.00%*	-	0.00%*	-
SBB	1.00%	+0.5%	1.00%	+0.5%
SES	1.00% *	-	1.00%*	-
SEW	0.50% *	-	0.45%*	-
SRN	0.50% *	-	0.50%*	-
SSC	1.10% *	-	0.00%*	-
SVE	0.61%	-	0.61%	-
TMS	0.45%*	-	0.45%*	-
UUW	0.55%	-	0.45%	-
WSH	0.50%	-	0.50%	-
WSX	0.50%	-	0.50%	-
YKY	0.70%*	-	0.60%*	-

Asterisks in Table 4.1 denote companies which argue that frontier shift should apply from 2025/26. All others assume 2023/24.

In total, 6 of the 16 companies either agreed with Ofwat’s Draft Determination decision of 1%, adopted it in their revised business plans, or proposed an alternative which is close to 1%. For example:

- Northumbrian Water proposed 0.8% stating that its challenge “is above the range suggested by Economic Insight at PR24 and reflects our ambition to deliver leading levels of efficiency in the sector [...]. It also

reflects challenge we received from the Water Forum and consideration of the previous efficiencies that the business has been able to achieve in the context of a larger investment programme.”¹⁷

- Anglian Water’s revised business plan submission states that it has adopted 1% based on Ofwat’s Draft Determination position, although it continues to argue that, in its view, the evidence supports a less ambitious frontier shift challenge.
- South West Water adopts a 1% challenge¹⁸ but argues that this is at the top end of evidence provided by companies and Ofwat, and that any increase in the target above 1% would be unbalanced.
- Portsmouth Water, SES Water, South Staffs Water also alighted on a frontier shift challenge of 1%, or 1.1% in the case of South Staffs Water, for the wholesale price control.

The least ambitious companies are Affinity Water, South East Water, Southern Water, Welsh Water, and Wessex Water which assumed a frontier shift challenge of 0.5% for the wholesale price control. Thames Water (0.45%) and United Utilities (0.55%) also opted for a frontier shift challenge close to 0.5%.

With regards to the retail price control, most companies adopted a similar frontier shift challenge to that applied to the wholesale control. We note that two companies, Portsmouth Water and South Staffs Water, have not applied frontier shift to retail costs, as was the case in their original PR24 business plans. South Staffs Water stated that this is because of the *“implied efficiency within the modelled allowances set and the fact that the retail price control was not going to be indexed”*. Portsmouth Water did not provide any justification to support its decision.

Seven of the water companies apply frontier shift to their submitted costs from 2025/26 onwards (i.e. to align with the start of AMP8), rather than from 2024/25 which is the first year of the forecast period. Portsmouth Water argues that frontier shift should not be applied to 2024/25 costs because this efficiency improvement is already included in its budget target for 2024/25 and would therefore represent a double count. SES Water, South East Water, Southern Water, South Staffs Water, Thames Water, and Yorkshire Water did not provide justification for their view that frontier shift should be applied from 2025/26 onwards.

Supporting analysis submitted by the companies

Most companies submitted individual responses on Ofwat’s decision to adopt a 1% frontier shift efficiency challenge. But seven companies¹⁹ referred to a report prepared by Economic Insight on their behalf – hereafter referred to as *“Economic Insights’ August 2024 report”*²⁰ – which follows two previous reports on the scope for frontier shift also prepared by Economic Insight (the April 2023 and March 2024 reports) for the companies.²¹

Economic Insight’s work recognises that there are *“differing viewpoints”* on the scope for frontier shift productivity growth over the PR24 period. However, it argues that the frontier shift target *“should be set at a substantially lower level than that currently proposed by Ofwat”*.²² Its report is structured around the following themes:

- Comparing historic productivity growth in the water industry with Ofwat’s frontier shift targets.
- Investment trends in the UK water sector compared to the UK economy as a whole.
- The rate of technological progress in the UK water sector
- The relationship between TFP productivity growth and ‘catch-up’ productivity growth at PR24.

¹⁷ Northumbrian Water (August 2024). *“Draft Determinations: Representations”*, p.22, available at nwg.co.uk.

¹⁸ South West Water (August 2024) *“Technical Representations – cost and efficiency”*, p.9 available at southwestwater.co.uk.

¹⁹ Affinity Water, Anglian Water, Portsmouth Water, South East Water, Southern Water, Wessex Water, and Yorkshire Water.

²⁰ Economic Insight (August 2024) *“The Importance of a Balanced Approach to Frontier Shift”*, available at anglianwater.co.uk.

²¹ Economic Insight (April 2023) *“Productivity and frontier shift at PR24”* available at thameswater.co.uk; and Economic Insight (March 2024) *“Further evidence on frontier shift at PR24”* available at economic-insight.com.

²² Economic Insight (August 2024) *“The Importance of a Balanced Approach to Frontier Shift”*, available at anglianwater.co.uk.

We summarise and then address each of these themes in Sections 3.2 to 3.5 below along with related company responses.

3.2. WATER INDUSTRY TFP GROWTH COMPARED TO FRONTIER SHIFT TARGETS

Economic Insight's analysis of historic productivity growth in the water industry

Economic Insight argues that that, with the benefit of hindsight, the frontier shift targets set by Ofwat in recent price reviews have proven to be materially higher than the actual TFP growth achieved by the '*Water supply; sewerage, waste management and remediation activities*' industry²³ over the last 20 years. It also argues that expectations of improvements in productivity growth that Ofwat and the CMA relied upon in setting previous frontier shift targets have failed to materialise, and that Ofwat should use this information to correct its approach at PR24.

Economic Insight starts by analysing the Gross Output (GO) and Value Added (VA) -based 5-year average TFP growth rates of the '*Water supply; sewerage, waste management and remediation activities*' industry. It finds negative TFP growth over the AMP5, AMP5 and AMP6 regulatory periods and compares this to the positive 'frontier shift targets' which Ofwat set in the PR04, PR09 and PR14 price reviews – although we note that this is a highly simplified approach to presenting the frontier shift assumptions adopted at PR04 and PR09 since the challenge varied by cost component (and therefore Economic Insight's comparisons provide limited insight).

Based on its analysis, Economic Insight concludes that there is a large difference between realised productivity growth and Ofwat's frontier shift targets and suggests that said targets have been set materially too high in recent price controls. As a result, Economic Insight argues that it is likely that the water industry has been underfunded over previous AMPs.

Economic Insight also argues that the negative TFP performance of the '*Water supply; sewerage, waste management and remediation activities*' industry since the Global Financial Crisis of 2008-09 provides a further indication that the regulated water sector specifically was affected by the wider productivity slowdown.

Finally, Economic Insight clarifies that it does not suggest that Ofwat should use actual water industry productivity performance in order to set a forward-looking frontier shift target, to avoid creating perverse or circular incentives. But it does argue that at some point actual productivity performance must become a relevant source of information and that its analysis suggests a need for Ofwat to recalibrate its approach.

CEPA's response to Economic Insight's arguments: We do not agree that the analysis provided by Economic Insight is a fair representation of achievable productivity gains in the regulated water sector.

First, Economic Insight uses its analysis to imply that that productivity growth in the water sector is close to zero and at times negative, and therefore that the frontier shift targets set by Ofwat and the CMA at PR19 were unachievable. But in fact, previous studies show that the sector's long-run TFP growth since privatisation has averaged 1.0% per year (or 2.1% per year after certain quality adjustments).²⁴ Additionally, Ofwat's consultants at PR19 highlighted that one of the key reasons behind the negative TFP growth in the '*water supply, sewerage, waste management & remediation activities*' industry over time is because the output measures used for the water sector do not account for changes in the quality of output (e.g. reduced leakages and mains bursts) or for actions to

²³ Economic Insight uses the '*Water supply; sewerage, waste management and remediation activities*' because it is the closest industry classification to the regulated water sector within the EU KLEMs dataset. Economic Insight acknowledge that this industry classification includes companies other than the regulated water companies, such as water retailers and waste management companies. It argues that the results are likely representative of the regulated water companies because: (a) in its view, the results are consistent with the 2017 Frontier Economics study that focused specifically on regulated water companies; and (b) the majority of the largest firms within the industry classification are the regulated water companies. But in CEPA's view, the results are not wholly consistent with the Frontier Economics study, because Frontier Economics found that average TFP growth was *positive* in the period 2006-10, when Economic Insight's analysis of EU KLEMS suggests that TFP growth was *negative* over the same period. Additionally, whilst we agree that the regulated water companies are likely to be amongst the largest companies in the NACE industry classification, we note that Economic Insight does not produce any facts which demonstrate that they constitute a sufficiently large share of the industry classification to drive the overall productivity trend.

²⁴ Frontier Economics (September 2017) "Productivity improvement in the water and sewerage industry in England since privatization: Final report for Water UK" available at water.org.uk.

protect the environment, despite the fact that these factors are a significant driver of company investment. In summary, Economic Insight relies on data which is of insufficient quality to inform a balanced assessment.²⁵

Second, we find little support for the argument that the regulated water and wastewater companies have been 'underfunded' by the frontier shift challenge set in previous price reviews. Ofwat notes that over the AMP6 period (2010 – 15), water and sewerage companies actually underspent their allowances for investment in wastewater facilities by 5% and that there was sufficient funding to cover all the improvements set out in the WINEP programme, implying that the companies were well funded.²⁶

We agree that the historic productivity performance of the regulated water sector is a useful 'cross-check' in understanding whether Ofwat's 1% frontier shift target is achievable. Although estimated TFP growth fell over AMP6, there is a lack of information on the sector's performance over AMP7. Economic Insight's attempt to plug that gap by relying on the '*Water supply; sewerage, waste management and remediation activities*' industry (but which includes activities outside the boundary of the provision of water and wastewater services) is potentially misleading because it cannot determine how much of that industry's output (and therefore TFP performance) is accounted for by the regulated water companies.

We remain of the view that the appropriate starting point for setting frontier shift is an objective analysis of the historic TFP growth rates of relevant comparators, not a circuitous mechanism which allows the industry's poor performance to inform the efficiency challenge in the next period.

Actual productivity growth in comparator sectors

The second limb of Economic Insight's argument is that the TFP growth rates in the relevant comparator sectors used by Ofwat to set the frontier shift target at PR19 (as reported in EU KLEMS) have subsequently deteriorated. Economic Insight finds that average productivity growth in these sectors is more in-line with the low productivity growth exhibited by most other UK industries, the UK economy as a whole, and is also below the mid-point of its own recommended frontier shift range for PR24.

Specifically, Economic Insight reports:

- Growth rates for the manufacturing; construction; transport and storage; and professional, scientific, technical, and support services industries; and the market economy and total industries categories.
- Gross Output-based TFP growth rates only – it does not report the corresponding Value-Added results.
- Three separate time periods: 1999–2007; 2010–2019; and 1999–2019. It does not align the time periods considered to any analysis of recent business cycles in the UK.

It finds average annual TFP growth rates for the comparator industries of between 0.04% (for the full 1999–2019 period) to 0.21% (for the post-GFC period 2010–2019).

CEPA's response to Economic Insight's arguments: Economic Insight's August 2024 report does not reflect the rate of TFP growth in 'Ofwat's comparator sectors' and therefore understates the historic growth rates achieved in the sectors deemed comparable to the regulated water companies.

Economic Insight's analysis cherry-picks those sectors which achieve the lowest rates of TFP growth. Specifically, it omits the following industries (without explanation) used in our June 2024 report which were consistent with those used at PR19:

- Manufacturing of chemicals and chemical products;
- Manufacturing of machinery and equipment n.e.c.; and
- Manufacturing of furniture; jewellery, musical instruments, toys; repair and installation of machinery and equipment.

²⁵ Europe Economics (January 2018) "Real Price Effects and Frontier Shift" p.60 – 62., available at [ofwat.gov.uk](https://www.ofwat.gov.uk).

²⁶ Ofwat (March 2022) "Investment in the water industry" available at [ofwat.gov.uk](https://www.ofwat.gov.uk).

Economic Insight does not provide an objective argument to support these omissions, or to demonstrate that the chemicals and the repair and installation of machinery and equipment are not relevant to the water sector.

We also disagree with the argument that the VA TFP measures are less appropriate. It is established regulatory practice to take account of both VA and GO-based estimates. The reasons for this were set out extensively in our June 2024 report.²⁷ By presenting only GO-based estimates, Economic Insight presents a disproportionately negative view of the productivity growth in comparator sectors.

If Economic Insight had replicated the PR19 comparator set in full in its analysis, it would have found a GO TFP growth rate of closer to 0.6% for the full time period and 0.7% for the period before the Global Financial Crisis. If it had also presented VA-based estimates, it would have found TFP growth of 1.7% for the full time period and around 1.5% for the period after the Global Financial Crisis.

In our view, historic TFP growth in the comparator sectors demonstrates that Ofwat's 1% frontier shift target is achievable.

Forecast productivity improvements

Economic Insight then argues that in previous price reviews, Ofwat, Ofgem and the CMA identified the possibility of improvements in UK productivity growth over the following 5-years as a factor in setting a higher frontier shift target. This was informed, in part, by forecasts made by the Bank of England (BoE) and the Office of Budget Responsibility (OBR).

Economic Insight argues that, in practice, the expectations of improvements in productivity growth have not materialised in the outturn data, and that UK-wide productivity growth has remained near zero for the last 15 years. As a result, Economic Insight suggests that Ofwat should not continue to make frontier shift decisions based on expectations that improved productivity growth will happen. It also suggests that it raises concerns that the companies have been materially underfunded at PR14 and PR19 (because frontier shift was set too high). Further, Economic Insight argues that because investment is a key driver of productivity growth, any past underfunding in the water industry could have been an impediment to historical productivity performance in the sector and will continue to impede future productivity performance over PR24.

Finally, Economic Insight highlights that the frontier shift ranges presented in its April 2023 report already embedded an improvement in productivity from current levels. However, it suggests that the frontier shift target proposed by Ofwat and adopted by other regulators (i.e. Ofgem and the CMA) implies a 'full reversion' from current levels to a rate of productivity growth that has not been observed since before the Global Financial Crisis, and that this full reversion occurs at the start of AMP8.

CEPA's response to Economic Insight's arguments: We do not agree that Ofwat's decision to adopt a 1% frontier shift challenge is based on an expectation that UK productivity growth will return to longer-term pre-crisis trends.

We are aligned with Ofwat in so far as the OBR's labour forecasts are an approximate cross-check which suggest that there is scope for a continuing recovery in labour productivity. It is useful evidence in demonstrating why Economic Insight's proposed frontier shift ranges might be considered disproportionately conservative. But we did not use the improvement in UK labour productivity presented in the OBR's most recent forecasts to justify our proposed range of 0.8%–1.2%; and it is clear that Ofwat has taken a variety of other relevant factors into account in deciding on a challenge of 1%. It is factually incorrect for Economic Insight to assert that Ofwat relies on an immediate recovery in UK productivity growth to justify a frontier shift target of 1% per year.

²⁷ CEPA (June 2024) "Frontier Shift, Real Price Effects and the energy crisis cost adjustment mechanism", p.75, available at [ofwat.gov.uk](https://www.ofwat.gov.uk).

Water company responses on the EU KLEMS analysis and applicability to the future scope for frontier shift

Several companies commented on the EU KLEMS analysis conducted by CEPA in our June 2024 report²⁸ which informed Ofwat’s decision on the frontier shift challenge, arguing that it overstated the scope for productivity growth over the PR24 period.

Selected time period

Hafren Dyfrdwy²⁹ and Severn Trent³⁰ argue that the time period used to calculate the TFP growth rates does not reflect a representative business cycle for PR24. They consider that the periods 1992–2009 and 2010–2020 provide the most appropriate comparison for the water industry, and that greater weight should be given to 2010–2020 to reflect lower productivity growth since 2007 (as per Economic Insight’s April 2023 report).

Yorkshire Water argues that time period chosen is less representative of structural break in UK productivity growth in the years following the Global Financial Crisis.³¹

CEPA’s response to company arguments about the time period used in our EU KLEMS analysis

CEPA’s approach to the EU KLEMS analysis over the period 1996–2019 ensures that similar weight is given to the pre- and post-GFC periods in our reported TFP growth rates. We do not agree with the argument that more weight should be given to the post-GFC period (since 2010 in particular) or that the pre-GFC period should be discounted from our analysis.

As we explained in our June 2024 report, where possible it is established good practice to analyse productivity growth over full business cycles. There are a variety of definitions used to identify business cycles but we base our analysis on the UK output gap, where a business cycle is defined as a period where the output gap equals zero three times, where that period includes periods where the output gap is both negative and positive. National accounts data are often subject to revisions that reflect genuine uncertainties about the underlying data - as illustrated by the differences between the 2022 and 2023 October data releases of the IMF’s World Economic Outlook shown below. This means that estimates of the output gap change over time, which has implications for efforts to identify the start and end point of a business cycle.

²⁸ CEPA (June 2024) “Frontier Shift, Real Price Effects and the energy crisis cost adjustment mechanism”, available at [ofwat.gov.uk](https://www.ofwat.gov.uk).

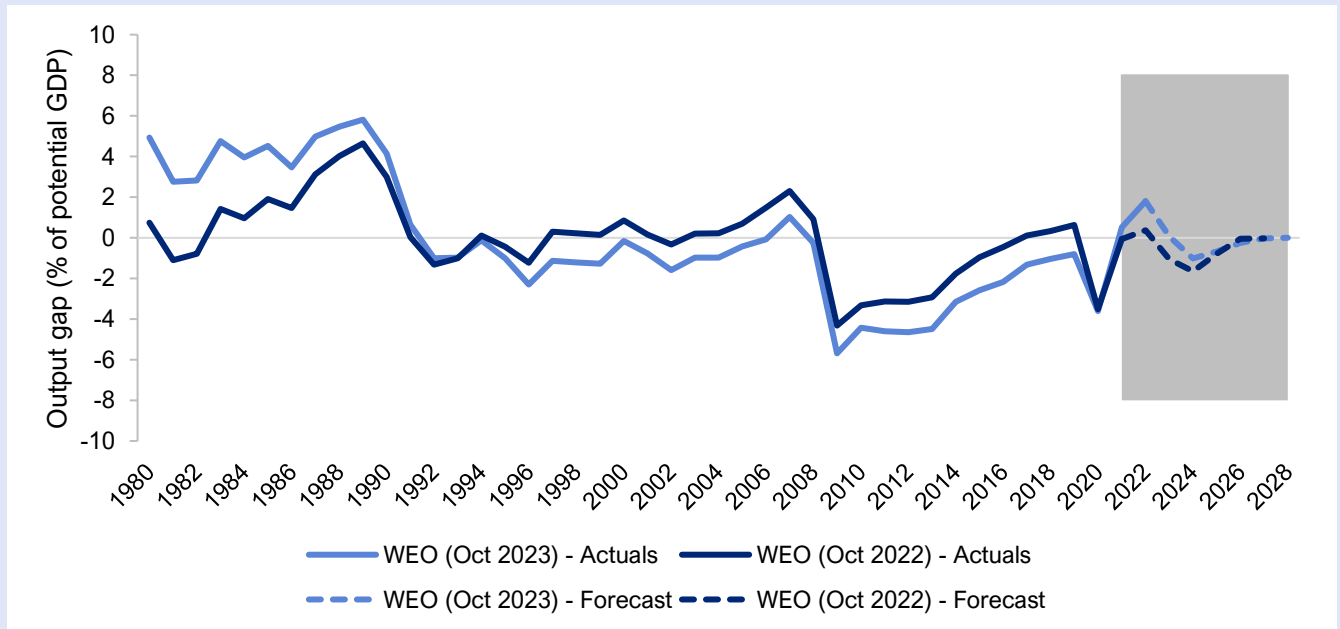
²⁹ Hafren Dyfrdwy (August 2024) “Draft Determinations Representations: Frontier Shift Adjustment”, p.5, available at [hdcymru.co.uk](https://www.hdcymru.co.uk).

³⁰ Severn Trent (August 2024) “Frontier Shift”, p.5, available at [stwater.co.uk](https://www.stwater.co.uk).

³¹ Yorkshire Water (August 2024), “Draft Determination Representation Expenditure allowances: Part 4”, p12-13, available at [yorkshirewater.co.uk](https://www.yorkshirewater.co.uk).

With regards to the most recent business cycle in the UK, the data appears to show two plausible business cycle periods covering the years 1991-2008 and 1996-2019, although the evidence is not clear cut. In that context, we decided to use the period 1996-2019 as it represents the most recent business cycle as objectively identifiable in the data, and made use of almost all the long-term data available in the EU KLEMS dataset.

Figure 3.1: Estimates of the UK output gap, 1980 to 2028



Source: CEPA analysis of IMF World Economic Outlook database

Chosen comparator set

In addition to points made by Economic Insight, Anglian Water responded to the effect that it disagrees with the implicit weight given to the ‘*Manufacture of chemicals and chemicals products*’ within the comparator set. It notes that if the chemicals industry were removed from the comparator set, it would reduce the average of the comparator industries from 0.6% to 0.3% in GO terms, and 1.7% to 1.0% in VA terms.³² United Utilities also makes this point, and disagrees with the inclusion of the ‘*Manufacture of furniture; jewellery; musical instruments; toys repair and installation of machinery and equipment*’ industry within the comparator set.³³ Yorkshire Water argues that the comparator industries chosen were not based on robust, data-driven criteria, but rather on a superficial selection approach.

Hafren Dyfrdwy³⁴ and Severn Trent³⁵ also disagree with how the TFP range was presented. They argue that the use of the highest performing industries to set the top of the GO range is new, unjustified and leads to a systematic misrepresentation of the wider set of cost activities in the water and wastewater sector. Economic Insight also states that the upper end of the range should be informed by an average across comparator sectors. It argues that the TFP data for individual industries is not reliable enough to use a single industry as the benchmark; and that the purpose of choosing multiple industries as comparators is because no single industry can be a ‘perfect’ comparator for the regulated water companies, and choosing a single industry to determine the upper bound ignores this.³⁶

³² Anglian Water (August 2024). “Anglian Water’s AMP8 DD Representations”, p.47, available at [anglianwater.co.uk](https://www.anglianwater.co.uk).

³³ United Utilities (August 2024) “Real price effects and frontier shift”, p.12, available at [unitedutilities.co.uk](https://www.unitedutilities.co.uk).

³⁴ Hafren Dyfrdwy (August 2024) “Draft Determinations Representations: Frontier Shift Adjustment”, p.6, available at [hdcymru.co.uk](https://www.hdcymru.co.uk).

³⁵ Severn Trent (August 2024) “Frontier Shift – Draft Determination representations”, p.6, available at [stwater.co.uk](https://www.stwater.co.uk).

³⁶ Economic Insight (August 2024) “The Importance of a Balanced Approach to Frontier Shift”, p.66, available at [anglianwater.co.uk](https://www.anglianwater.co.uk).

CEPA's response to company arguments about the comparator set used in our EU KLEMS analysis

We do not agree with the view expressed by Anglian Water and United Utilities that an inappropriate weight is given to the chemicals industry within the comparator set. We use a simple average across the industries in the comparator set because in this case there is no means of establishing objectively appropriate industry-specific weights – a point made by the CMA in both the PR19³⁷ and RIIO-GD2³⁸ appeals. We agree that the average is relatively sensitive to the inclusion of the chemicals industry, and as a result it would be inappropriate to set the frontier shift challenge at the very top of the range implied by the EU KLEMS analysis (i.e. 1.7% on a VA-basis).

We do not agree with the companies which assert that the chemicals and the repair and installation of machinery and equipment are not relevant comparators to the water sector. Several of the regulated companies argued in their original business plans for an RPE 'true-up' mechanism to be applied to their chemicals and materials, plant and equipment expenditures, suggesting that they do in fact believe these industry comparators to be of relevance.

We do not agree with Hafren Dyfrdwy and Severn Trent's views on the top end of the GO-range, noting that our approach is consistent with the approach which Ofwat and its advisers adopted at PR19; that it is an average across four industries (and therefore not a single industry as Economic Insight suggests); and that there are other accepted methods of setting the top-end of the frontier shift range which achieve a similar result, as we described in our June 2024 report and in Section 2.1 above. Moreover, the credibility of the top-end of the GO-range is reinforced by the frontier shift challenge proposed by South Staffs Water (1.1%).

We do not agree with Yorkshire Water's assertion that we adopted a superficial selection approach. Our approach was based on the criterion that the comparator sectors should be 'competitive' in that industry-level output should not be influenced by the activities of a regulator with control over prices; and the criterion which ensured that we selected industries which include activities which are similar to those conducted by the regulated water and wastewater companies. For consistency and predictability of approach, we used Ofwat's PR19 comparator set as the logical starting point for our analysis, but we reviewed the continuing relevance of this set and concluded that there was no new, compelling evidence to justify the inclusion or exclusion of other sectors.³⁹

Gross Output and Value Added TFP metrics

Anglian Water⁴⁰ argues that Ofwat appears to have revised its view on the relevance of the VA TFP measure without justification. Hafren Dyfrdwy and Severn Trent argue that VA measures should be excluded from the evidence base because they are systematically higher than the GO measures as a result of omitting the effects of intermediate inputs. They argue that the CMA also found VA TFP to be a less appropriate measure for estimating frontier shift and instead considered it as qualitative evidence for making an in-the-round judgement.⁴¹

Economic Insight also argues that frontier shift estimates should only be based on GO-based TFP growth as these are "*more reflective of the productivity gains achievable by the water sector*". It argues that the use of VA measures is less appropriate as they fail to account for intermediate inputs. Economic Insight also argues that the use of GO is aligned with Ofwat's position at PR19 because Ofwat intends to apply frontier shift to totex, which includes expenditure on intermediate inputs.⁴²

³⁷ CMA (March 2021) "Ofwat Price Determinations – Final Report", paragraphs 4.521 – 4.522, available at [gov.uk](https://www.gov.uk).

³⁸ CMA (November 2021) "Energy licence modification appeals: Volume 2B", paragraph 7.239, available at [gov.uk](https://www.gov.uk).

³⁹ CEPA (June 2024) "Frontier Shift, RPEs and the energy crisis adjustment mechanism", Table 4.3, p.74, available at [ofwat.gov.uk](https://www.ofwat.gov.uk).

⁴⁰ Anglian Water (August 2024). "Anglian Water's business Plan for AMP8, Draft Determinations Representations, p.47, available at [anglianwater.co.uk](https://www.anglianwater.co.uk).

⁴¹ Severn Trent (August 2024) "Frontier Shift – Draft Determination representations", p.7, available at [stwater.co.uk](https://www.stwater.co.uk).

⁴² Economic Insight (August 2024) "The Importance of a Balanced Approach to Frontier Shift", p.67, available at [anglianwater.co.uk](https://www.anglianwater.co.uk).

CEPA's response to company arguments about the Gross Output and Value Added TFP metrics

We disagree with the argument that the VA TFP measures should be excluded from our analysis of the productivity data. As we set out in our June 2024 report⁴³, it is established regulatory practice to take account of both VA and GO-based estimates, which was Ofwat's view at PR19 and was affirmed by the CMA in the PR19 redeterminations and the RIIO-GD2 appeals. Neither the companies nor their advisors have submitted any new evidence or persuasive logic to demonstrate that those decisions were wrong or to justify changing our view on this issue.

In summary, neither the regulated companies nor their advisors have objectively demonstrated that the historic productivity performance of the regulated water sector or its comparators means that Ofwat's decision to adopt a 1% frontier shift challenge in the PR24 Draft Determinations is unachievable.

3.3. INVESTMENT TRENDS IN THE UK AND THE WATER SECTOR

Economic Insight's view and critique of the Europe Economics report

In its March 2024 report, Economic Insight argued that underinvestment is one of the main drivers of the UK productivity slowdown and that the water sector is not insulated from the wider productivity slowdown. It recognised that the regulatory framework might have some mitigating effect but argued that its analysis of the industry investment data suggested that this mitigation appeared limited.

In its June 2024 report for Ofwat, Europe Economics critiqued Economic Insight's analysis and found that the proportion of investment to gross value added was higher in the water and sewerage sector than the UK as a whole. It suggested that this meant that water and sewerage companies had been protected from the wider issues with underinvestment that had contributed to the broader slowdown in UK productivity growth.

In its latest August 2024 report, Economic Insight responds to Europe Economics' critique. Economic Insight argues that the water sector and the UK economy share the same negative investment trajectory; that water sector investment per capita has declined; and that the growth in water sector investment since the Global Financial Crisis has been slower than that experienced in other similar countries.

Economic Insight disputes Europe Economics' interpretation of the ratio of investment to gross output data. It argues that the higher ratio of investment as a share of gross output in the water industry (compared to the UK economy as a whole) merely demonstrates that the water sector is more capital intensive. Instead, it argues that the *trend* in water sector investment relative to the UK economy as a whole is more relevant.

To make its argument that the water industry is affected by the same underinvestment trend that contributes to the wider slowdown in UK productivity growth, Economic Insight draws connections between four analytical results.

First, Economic Insight argues that it is widely accepted that underinvestment in the UK is a longstanding problem and one that is broad-based across industries. To illustrate this, it compares the UK's Gross Fixed Capital Formation (GFCF, a proxy for investment activity) as a share of GDP over time to trends across other G7 countries. It finds that the UK consistently has amongst the lowest GFCF as a share of GDP. It also notes that there has been a slowdown in UK investment growth, because GFCF grew at an average 3.7% per year in the decade before the Global Financial Crisis but only 2.3% per year in the 14 years since. However, we note that this increases to 3.2% per year over the period 2010–2019, which highlights the impact of Covid-19 restrictions on business investment but which is not relevant to the ability of the water companies to invest during the affected period.

⁴³ CEPA (August 2024) "Frontier Shift, RPEs and the energy crisis adjustment mechanism", p.76, available at ofwat.gov.uk.

CEPA's response to Economic Insight's arguments about Gross Fixed Capital Formation

A falling GFCF to gross output ratio does not in and of itself provide evidence of an underinvestment problem in the water sector.⁴⁴ It simply shows that the industry is increasing the amount of output it can generate from each pound of capital investment. Moreover, as Ofwat has noted elsewhere, the regulated water companies actually underspent their allowances for investment in wastewater facilities by 5% and that there was enough funding to cover all the improvements set out in the WINEP programme over the AMP6 period, implying that the companies were well funded over the period in question.⁴⁵

The extent to which the wider slowdown in UK productivity growth might be expected to reduce the underlying scope for productivity growth in the regulated utilities sectors was debated at PR19, in the PR19 redeterminations, at RIIO-GD2/T2 and in the ED2 periodic review submissions. CEPA's view has been consistent throughout: we consider that the 5-year price control period provides a visible pipeline of investment and enables the companies to work with their supply chain to invest in efficiency measures ahead of time. That UK business investment as a share of gross output has been falling over the past decade does not suggest to us that the scope for productivity growth in the water sector must also be in decline.

Second, Economic Insight argues that the water sector exhibits the same underinvestment trend as the UK economy more broadly. Using the '*Water supply, sewerage, waste management and remediation*' industry classification discussed in Section 3.2 above, it compares GFCF as a proportion of Gross Value Added (GVA) in the water industry to the UK economy over the period 1998–2022. It finds that the investment to output ratio has declined more sharply in the water sector than the UK overall.

Economic Insight acknowledges the limitations of the industry classification used in the analysis, and so also looks at capital expenditure by the regulated water companies since 1996. While capital expenditure is not directly comparable to GFCF (because GFCF also includes investment in intangible assets), Economic Insight shows that UK wide GFCF has grown faster since 2009 than regulated water industry capital expenditure.

CEPA's response to Economic Insight's arguments about water industry investment

First, the accuracy of Economic Insight's analysis is contested by Ofwat's other advisers, Europe Economics. Europe Economics concluded that Economic Insight should exclude certain 'outlier' years from its analysis and that – once adjusted – the data shows the opposite trend, i.e. that water sector investment is growing faster than the UK economy as a whole in both the pre- and post- Global Financial Crisis periods.⁴⁶

We do not duplicate Europe Economics' critique in this report but we reach a similar conclusion: Economic Insight does not provide evidence of sustained underinvestment in the UK water industry relative to the UK economy as a whole. In our view, the water industry capital expenditure data shows a relative stability of capital investment at around £6–£8 billion every year in recent price controls, as demonstrated in the chart below (we average capital investment across each AMP period to smooth out the normal 'ramping up' and 'ramping down' at the start and end of each price control). Compared to the 12% reduction in whole economy GFCF in 2009 (Global Financial Crisis) and 11% reduction in 2020 (Covid-19 restrictions), this demonstrates the stability provided by the regulatory framework as compared with the pressures to cut capital investment in other industries when business conditions are challenging.⁴⁷

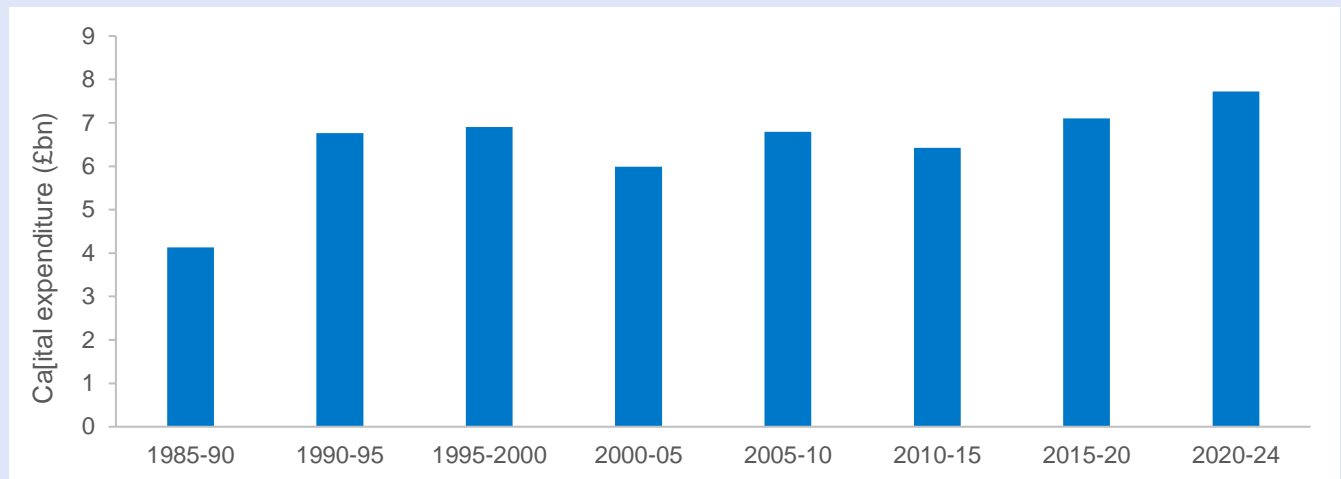
⁴⁴ Conversely, it might indicate that the industry is achieving greater efficiency from its capital investment.

⁴⁵ Ofwat (March 2022) "Investment in the water industry" available at [ofwat.gov.uk](https://www.ofwat.gov.uk).

⁴⁶ Europe Economics (November 2024) "Response to Company Representations regarding Frontier Shift for PR24", p.15–19.

⁴⁷ ONS (October 2023) "Annual gross fixed capital formation by industry –chained volume measure", available at [ons.gov.uk](https://www.ons.gov.uk).

Figure 3.2: Water industry consistent capex (net of grants and contributions) across regulatory periods, £billion



Source: CEPA analysis of Ofwat data

Third, Economic Insight argues that to maintain water sector investment at a comparatively consistent level over time, it would expect the ratio of investment to population to remain constant in real terms. It argues that, if this ratio remains steady as the population grows, it may indicate that investment is broadly ‘keeping up’ with population growth, thereby supporting the sector’s increasing output. However, its analysis shows that regulated water company capital expenditure per head of population has declined from around £125 per head in 1997 to around £110 per head of population in 2022 – although Economic Insight does not describe its method of calculation.

CEPA’s response to Economic Insight’s arguments about water industry investment per head

First, we note that we were unable to replicate Economic Insight’s results. Using Ofwat’s ‘long-term data series of company costs’⁴⁸ which provides regulated company capex in real terms and the ONS’ population estimates for England and Wales⁴⁹, we found total capex per head of £152 in 1997/98 reducing to £147 per head in 2021/22 (-3%) but increasing to £155 per head in 2022/23 (+2%) and £184 per head in 2023/24 (+21%). Therefore, we find that it is reasonable to contest Economic Insight’s assertion that investment per head of population is falling.

Even if one were to agree with Economic Insight’s analysis (which we think is at least contestable), we do not agree that a relatively limited decline in regulated water company capital expenditure per head of population demonstrates beyond doubt that there is an underinvestment issue. Over the long term, population growth will probably require additional investment in new water sources and additional sewage treatment and disposal capacity. But over the timeframe of Economic Insight’s analysis (1997–2022), the impact of population growth could feasibly be offset by higher ‘asset utilisation’. Given that per capita consumption of water has continued to increase over that period despite a relatively limited reduction in capital expenditure per head of population, the alleged underinvestment does not appear to substantially constrain the industry’s ability to provide critical outputs.

Moreover, we note Ofwat’s view that the Environment Agency and the Drinking Water Inspectorate play an important role in determining investment needs in the water sector – and hence the total quantum of investment in the sector is partly outside the control of water companies. Moreover, we note that investment is forecast to increase significantly at PR24.

Fourth, Economic Insight argues that water sector investment in the UK has grown more slowly than other OECD countries since the Global Financial Crisis, with the exception of France. On the GFCF measure, Economic Insight notes that water sector investment in the USA and Italy has increased by over 100% since 2008 and has increased

⁴⁸ Ofwat (November 2022) “Long-term data series of company costs” available at [ofwat.gov.uk](https://www.ofwat.gov.uk).

⁴⁹ ONS (July 2024) “Population estimates for England and Wales” available at [ons.gov.uk](https://www.ons.gov.uk).

by over 60% in Germany. By contrast, investment in the UK's 'Water supply, sewerage, waste management and remediation' industry increased by 24% over the same period.

CEPA's response to Economic Insight's arguments about investment relative to other OECD countries

Economic Insight relies on OECD data to conduct this analysis, but it does not set out its calculations in detail. The OECD data in question only appears to be available in current prices and national currencies (Pounds Sterling, Euros and US Dollars) and when we tried to replicate Economic Insight's analysis we were concerned that it does not appear to have adjusted for differences in exchange rates and inflation across the relevant countries. We did not explore whether adjusting for these factors would change Economic Insight's findings.

Leaving aside the potential analytical issue described above, we do not accept that international comparisons of GFCF growth rates demonstrates an underinvestment problem in the UK. The need for capital investment will vary significantly from country to country, and faster rates of growth in other countries might imply that they are 'catching up' with investment which has already been delivered in the UK. This would appear to be supported by Water UK's own research, which finds that the English and Welsh water sector outperforms those in France, Ireland, Italy and Spain since 1990 in terms of the most important measures on water and sewerage.⁵⁰ So, even if capital investment in the UK water sector has not kept pace with other comparable countries, Water UK's analysis suggests that this does not impact its relative performance.

Economic Insight argues that the combination of analyses described above provides credible evidence that the regulated water sector is not immune from the underinvestment problem observed in the UK more widely. This, it argues, discredits the view that the regulatory framework mitigates the impact of the wider productivity slowdown on the water sector. **However, we do not agree that the evidence supports this view because the English and Welsh water companies have the benefit of a relatively stable and well-funded regime over multiple price control periods, which provides certainty for investment and which continues to support the efficiency challenge proposed by Ofwat in the Draft Determinations.**

Company responses on the extent to which the regulatory framework mitigates the productivity slowdown

Several companies – including Anglian Water⁵¹, Northumbrian Water⁵², Thames Water⁵³, United Utilities⁵⁴ and Yorkshire Water⁵⁵ – also used their response to the Draft Determinations to argue that a 1% frontier shift challenge is inconsistent with the slowdown in productivity growth across the UK economy and disagreed with the conclusion that the regulatory framework mitigates the impact on the water sector.

Anglian Water argues that Ofwat mistakenly assumes that the water sector is "*completely immune from the factors which have affected the rest of the UK economy*".⁵⁶ It accepts Europe Economics' argument that regulated monopolies have been shielded to some degree from some of the factors that are a drag on UK productivity growth. But it also claims that Europe Economics has overlooked that the majority of water companies' enhancement programmes, which constitute a large percentage of water company expenditure allowances, are delivered by a contractor market which is outside the regulatory framework and not immune from economy-wide headwinds. It notes that "*the more relevant factor for the supply chain is the substantial demand for their services over the next*

⁵⁰ Water UK (December 2018) "New research shows water companies in England and Wales outperform comparable water sectors in Europe" available at water.org.uk.

⁵¹ Anglian Water (August 2024). "Anglian Water's AMP8 DD Representations, p.47, available at anglianwater.co.uk.

⁵² Northumbrian Water (August 2024) "Draft Determination Representations", p.116, available at nwg.co.uk.

⁵³ Thames Water (August 2024) "Thames Water PR24 DD Response Cost Efficiency", p.34, available at thameswater.co.uk.

⁵⁴ United Utilities (August 2024) "Real price effects and frontier shift", p.12, available at unitedutilities.co.uk.

⁵⁵ Yorkshire Water (August 2024), "DD Representation Expenditure allowances: Part 4, p.11, available at yorkshirewater.co.uk.

⁵⁶ Anglian Water (August 2024). "Comments on Frontier Shift and Real Price Effects", p.4, available at anglianwater.co.uk.

five years from the water industry and other sectors. The competition for the supply chain, whose capacity concerns many stakeholders, is likely to reduce the [efficiency] pressure on contractors rather than increase it.⁵⁷

Hafren Dyfrdwy argues that the impact of the UK's productivity slowdown after the Global Financial Crisis is not reflected at all in the 1% frontier shift challenge. It argues that it is highly unlikely that the water sector will be able to go against the wider economic trends when other industries have not, as the supply chain is comprised of companies in a range of sectors that have experienced the productivity slowdown.⁵⁸

Thames Water argues that Ofwat's assertion that the water sector is somehow decoupled from the UK economy-wide post-2008 productivity slowdown is not grounded in evidence. Thames Water argues that given the uncertainty around the main causes of the slowdown in UK productivity growth, it would be more appropriate to assume that the water sector was impacted to some degree. Thames Water also argues that in practice, the water companies are closely integrated into the wider UK economy, as a high proportion of expenditure involves work with UK based contractors and supply-chain partners that are affected by wider macro-economic trends.⁵⁹

CEPA's response to water company arguments about the impact of the wider productivity slowdown

We do not agree that our recommended frontier shift range of 0.8% to 1.2% is decoupled from the UK's wider productivity slowdown. Given that our TFP average growth rates are calculated over the period 1996–2019, the evidence used takes into account productivity performance in both the periods before and after the Global Financial Crisis. Our range includes a reflection of the wider productivity slowdown.

There is a potential debate about the extent to which the wider productivity slowdown – partly driven by the sluggish recovery in UK business investment since the Global Financial Crisis – should be expected to impact the scope for frontier productivity growth in the water sector, given the stability and relative predictability of investment horizons facilitated by the regulatory framework. In our view, the 5-year price control period provides significant benefits, particularly in the form of certainty, which enable the regulated companies to drive significant efficiency gains through their supply chains. It is not possible to estimate this benefit precisely, which is why we think there is merit in aiming up from the bottom of the range implied by our EU KLEMS analysis. But we do not think that it would be appropriate to focus on the period 2010–2019 as the companies suggest, because this would put too much weight on the view that the water sector is fully impacted by the wider productivity slowdown, and would likely underestimate the scope for frontier productivity growth over the PR24 period.

In our view, there continues to be a robust basis on which to conclude that the regulatory framework provides stability for investment planning and supports a consistent long-term scope for frontier shift productivity growth.

3.4. RATES OF TECHNOLOGICAL CHANGE IN THE WATER INDUSTRY

Economic Insight's view on rates of technological change in the water industry

In its April 2023 report, Economic Insight argues that “*the water sector likely contains low rates of technological progress, relative to many industries*” and that therefore “*the water industry is unlikely to be able to achieve high productivity due to embodied technical change.*”⁶⁰ In its June 2024 report for Ofwat, Europe Economics critiques this argument as “*pure assertion*” and sets out several reasons why one might reach the opposite conclusion.⁶¹

⁵⁷ Anglian Water (August 2024). “Comments on Frontier Shift and Real Price Effects”, p.4, available at [anglianwater.co.uk](https://www.anglianwater.co.uk).

⁵⁸ Hafren Dyfrdwy (August 2024) “Draft Determinations Representations: Frontier Shift Adjustment”, p.6, available at [hdcymru.co.uk](https://www.hdcymru.co.uk).

⁵⁹ Thames Water (August 2024) “Thames Water PR24 DD Response Cost Efficiency”. p.34, available at [thameswater.co.uk](https://www.thameswater.co.uk).

⁶⁰ Europe Economics (June 2024) “Critique of Economic Insight reports on productivity and frontier shift”, p.13, available at [ofwat.gov.uk](https://www.ofwat.gov.uk).

⁶¹ Europe Economics (June 2024) “Critique of Economic Insight reports on productivity and frontier shift”, p.13, available at [ofwat.gov.uk](https://www.ofwat.gov.uk).

Responding to this critique, Economic Insight now argues that it is “*self-evident*” that the water industry is relatively ‘low-tech’ and does not utilise technologies that are “*extremely advanced and highly sophisticated*”. However, to assist Ofwat, Economic Insight sets out several pieces of analysis to support the claim that the water industry exhibits low rates of technological innovation. This is relevant, Economic Insight argues, because the regulated water and wastewater companies cannot be expected to achieve the high rates of productivity growth achieved by ‘high tech’ industries.

First, Economic Insight argues that the water and wastewater industry contributes a very small proportion of UK spending on research and development (R&D) and employment in R&D. It analyses the ONS Business Enterprise Research and Development (BERD) dataset to show that the ‘Electricity, gas & water supply, waste management’ sector contributes only 0.9% to national R&D spending and 0.6% to R&D employment (slightly below the median industry average). Recognising that the BERD dataset is not adjusted for industry size, Economic Insight then shows that the ‘*Electricity, gas & water supply, waste management*’ industry has the lowest ratio of R&D spending and R&D employment to turnover of any UK industry – although we note that the absolute differences between the ‘*Electricity, gas & water supply, waste management*’ industry and the ‘*Manufacturing*’ industry are small.

CEPA’s response to Economic Insight’s arguments about spending on Research & Development

Economic Insight’s analysis provides little further evidence on the achievable rate of productivity growth in the water sector. The relationship between R&D spending and the extent to which an industry is ‘high-tech’, ‘innovative’ and therefore has greater scope for productivity growth is very indirect. This is well demonstrated by some practical examples drawn from Economic Insight’s own analysis:

- Firms in the ‘manufacture of transport equipment’ classification report high active innovation (it is third on the list behind ‘scientific research and development’ and ‘manufacture of computers, electrical and optical equipment’) but it also has below average TFP growth (0.25% GO/ 1.8% VA) for the total manufacturing sector (1.1% GO / 3.1% VA).
- ‘Pharmaceuticals’ contribute 6 times more of UK total R&D expenditure than the ‘Telecommunications’ industry, but TFP growth in the pharmaceuticals industry is just 1.15% per year (GO-basis, or 2.2% VA) compared to 12.3% per year (GO-basis, or 21.2% VA) for telecoms over the period 1996–2019.
- ‘Construction’ appears to contribute around 6.5% of UK R&D employment (the third highest ranking industry) but has negative TFP growth of -0.4% per year on a GO-basis or -0.5% on a VA-basis.

Therefore, it would seem that the metrics chosen by Economic Insight are not particularly strong indicators of whether an industry is ‘high-tech’ or not; whether that industry is ‘innovative’ or not; and they appear to be a poor predictor of historic TFP performance.

Second, Economic Insight argues that the ‘*Electricity, gas & water supply, waste management*’ industry reports a low rate of technological innovation, relative to other industries. Specifically, it cites an analysis of the UK Innovation Survey which shows that only 36% of companies surveyed in the ‘Electricity, gas & water supply, waste management’ sector reported actively innovating in 2020-22, relative to a national average of 43%.

Finally, Economic Insight argues that the intrinsic features of the water industry differ substantively from high-tech industries. Specifically, it sets out that it considers ‘high-tech’ industries would exhibit the following features:

- **Continuous, rapid and large changes in consumer demands** which incentivises innovation to develop new products and services; and to improve existing products and services. Economic Insight argues that at a fundamental level the product / service provided by the water companies has “*remained largely unchanged for centuries and will continue to be so.*”
- **Scope for (or a need to) the industry to materially change its model of supply.** However, Economic Insight argues that the fundamental means of water industry production “*cannot realistically change*” and must be moved around a network of underground pipes within a specified region.

- **Relatively short asset lives.** All else being equal, Economic Insight argues that industries with a higher turnover of assets will generally benefit from new technologies more rapidly than industries with a slower turnover of assets. It argues that the water industry is characterised by long-lived assets.
- **High returns to R&D investment.** Economic Insight argues that in industries where the returns to R&D investment are higher, it is rational for companies to invest more in innovative technologies because of the ‘winner-takes-all’ market dynamics. However, it argues that the rate of return in the water industry is determined by the regulatory framework and is generally calibrated around a ‘low risk/low return’ model.

CEPA’s response to Economic Insight’s arguments about reported rates of R&D

It is not particularly surprising that the ‘Electricity, gas and water supply, waste management’ industry contributes a relatively low share of the UK’s total R&D spending. There is relatively stable demand for the services provided by many parts of the industry, as compared to the telecoms or pharmaceuticals industries, which Economic Insight recognises. It was also noted in the context of the introduction of Ofwat’s Innovation Fund that there was a fall in water industry R&D expenditure between the early 1990s and 2010s, and that the sector lacked an effective innovation culture. The Innovation Fund was introduced, in part, to encourage more consistent and structured approach to the scale up of innovation within companies to become business as usual and facilitate transfer between companies, and to increase the amount of R&D and associated innovation activities. This does not mean that the water sector is “low tech”. Instead, it reflects justified concerns about whether the sector is maximising opportunities to invest in innovation with longer-term pay-back periods and where the benefits case spans multiple price control periods.

CEPA’s response to Economic Insight’s arguments about the intrinsic features of high-tech industries

Although the characteristics of the water sector do not encourage innovation to the same degree as, for example, the pharmaceuticals or telecoms industry, the water companies are continually advancing new and innovative technologies and financing R&D activities. This includes, for example:

- United Utilities’ PR24 business plan stated that it has “*capitalised on smart networks, open data and Artificial Intelligence. We are well placed to take our sector-leading approach further, setting ourselves ambitious goals and we are ready to deliver the step change required for our customers [...]*”⁶²
- Thames Water is leading a project with other industry partners to repair leaks in live underground water mains without digging them up, which would significantly reduce supply interruptions and reduce costs.⁶³
- Anglian Water and others are leading the Safe Smart Systems project, using artificial intelligence and mathematical optimisation solutions to reduce leakage, interruptions, and pressure issues across the whole water cycle. The project represents the first steps to achieve autonomous control in water systems across the UK.

In our view, it is not credible to characterise the water sector as ‘low tech’ because the water companies have invested in a wide range of advanced technologies to manage and control their networks, and to recover energy from the treatment of wastewater and sewage. Whilst we accept that a substantial portion of the asset base is long-lived and has been in situ for many years, the regulated water and wastewater networks employ a variety of assets including operational technology assets with much shorter lives, which require more frequent replacement, and where improvements in the capability of such assets is rapidly evolving, e.g. to facilitate remote infrastructure monitoring and leak detection.

Company responses on the rates of technological change in the water sector

Anglian Water notes that Europe Economics lists a number of factors which it says will deliver higher future productivity: tightening monetary policy, artificial intelligence and emerging technologies. However, it argues that

⁶² United Utilities “Innovation framework and strategy” (October 2023), available at [unitedutilities.co.uk](https://www.unitedutilities.co.uk).

⁶³ Ofwat (accessed October 2024) “No dig leak repair – From concept to reality”, available at [waterinnovation.challenges.org](https://www.waterinnovation.challenges.org).

estimates of the scale of the contribution of these factors is completely speculative, and it argues seems unreasonable to continue to rely on.⁶⁴

Hafren Dyfrdwy argues that the technological readiness level of AI and its applications to the water and wastewater sectors has not yet reached the point of scalable systems proven in the operational environment and therefore consider this evidence to be too speculative to place any weight on when setting a frontier shift value in AMP8. It notes that such evidence may be available when considering appropriate frontier shift for AMP9.⁶⁵

Thames Water argues that Ofwat’s assumptions of future productivity growth, and evidence presented by Ofwat and Europe Economics relating to potential productivity accelerations due to AI and Big Data in the water sector are speculative and fail to take account of credible forecasts produced by macroeconomic policy institutions.⁶⁶

United Utilities accept that developments in artificial intelligence and other digital technologies could provide a boost to productivity in the coming years but argues that these advances are only likely to be applicable to small portion of the value chain, and as a result it would be unrealistic to suggest this can result in productivity improvements across a companies’ entire cost base.

We do not find objective grounds to support Economic Insight’s or the water companies’ claims that the water industry is relatively ‘low tech’. As such, we do not recommend that Ofwat adjusts the frontier shift challenge in the Final Determinations to take account of the arguments posed by Economic Insight relating to its view of the technological capability of the water sector.

3.5. TFP GROWTH AND ‘CATCH-UP’ EFFICIENCY AT PR24

Economic Insight’s arguments on whether the TFP data also captures ‘catch up’ efficiency

In its August 2024 report, Economic Insight continues its argument that the TFP estimates derived from EU KLEMS also capture ‘catch-up’ efficiency gains in the comparator industries, thereby overstating the scope for frontier shift. It also responds to the critique of this argument made by Europe Economics in its June 2024 report.

First, it argues that TFP must intuitively overstate frontier shift because otherwise it implies that either:

- There are no laggard firms in the comparator industries; or
- Laggard firms achieve catch-up efficiency growth at the same rate as frontier shift.

Economic Insight then demonstrates its argument through an illustrative exercise using dummy data. It acknowledges the theoretical possibility behind Europe Economics’ argument that laggards could have productivity growth less than frontier shift (which Europe Economics describes as ‘productivity dispersion’) but argues that its illustrative analysis demonstrates that Europe Economics’ arguments are not conceptually sound.

Second, Economic Insight states that Europe Economics is mistaken in arguing that catch-up efficiency since the Global Financial Crisis has been negative, meaning that TFP growth has understated frontier shift. Economic Insight argues that:

- It used a data driven approach to select specific comparator industries in its EU KLEMS analysis where there are few laggard firms that are benefitting (or otherwise) from catch-up productivity growth.
- Europe Economics’ evidence does not show that catch-up efficiency has been negative in its (or Ofwat’s) chosen comparator industries (i.e. the productivity dispersion findings are not directly relevant to the comparator industries selected by Economic Insight in its EU KLEMS analysis).
- Europe Economics assumes that increasing productivity dispersion demonstrates slowing or negative catch-up productivity growth. Rather, Economic Insight argues that it could result from (i) widely defined

⁶⁴ Anglian Water (August 2024). “Anglian Water’s business Plan for AMP8, Draft Determinations Representations, p.47, available at anglianwater.co.uk.

⁶⁵ Hafren Dyfrdwy (August 2024) “Draft Determinations Representations: Frontier Shift Adjustment”, p.6, available dcymru.co.uk.

⁶⁶ Thames Water (August 2024) “Thames Water PR24 DD Response Cost Efficiency”, p.34, available thameswater.co.uk.

industries experiencing changes in the relative size of their sub-industries over time; (ii) a high rate of firm entry, where highly inefficient new firms catch up quickly; or (iii) large differences in company size prompting dispersion in efficiencies achieved as a result of economies of scale.

- That it is inconsistent to argue that TFP growth understates the scope for frontier shift productivity growth over the period 2010–2019 (when productivity dispersion was high) without simultaneously recognising that it overstated the scope for frontier shift over the period 1970–2009 (when dispersion was low).
- There are irresolvable technical details, such as the size and direction of bias resulting from catch up efficiency growth. If this is deemed to be material, Economic Insight argues that it would seem to call into question the purpose of TFP analysis as a means of setting frontier shift in the first place. Rather than try to estimate the size of the bias through proxies (such as Europe Economics' efficiency dispersion measure), Economic Insight argues that it is best to avoid the bias in the first place, for example through rigorous and data driven comparator selection.

CEPA's response to Economic Insight's arguments about whether TFP growth captures 'catch-up'

Economic Insight's position appears to change between its April 2023 report and the August 2024 report.

In its April 2023 report, Economic Insight argues that "*Raw TFP data will therefore always overestimate frontier shift to some degree*".⁶⁷ Its August 2024 position is more nuanced. It concedes that it is not possible to determine the size and direction of any bias in the TFP data.⁶⁸ However, it remains of the view that economic theory predicts that catch-up efficiency will be greater than frontier shift.

In our view, Economic Insight's claim is based on the largely unsubstantiated assertion that (according to its own intuition) catch-up productivity growth must always be positive. If that were the case, then Economic Insight should be able to demonstrate why 'laggard' firms have not caught up to the frontier over time. For example, according to the ONS there are over 132,000 enterprises in the manufacturing industry and it is plainly obvious that they do not all operate at frontier, and some may remain 'laggards' for extended periods. Since there remains differences in productivity levels across companies in Economic Insight's chosen comparator industries, one might reasonably conclude that there are periods where catch-up growth is positive and other periods where it is negative.

There is some common ground between our position and Economic Insight, as we agree that the most appropriate approach to the TFP analysis is to select comparator industries characterised by the presence of competition. Competition creates an incentive for firms at the frontier to continue innovating and to grow market share whilst the least productive firms eventually exit the market. Over a long-run period, we consider that it is reasonable to assume that TFP growth in competitive sectors is primarily determined by frontier shift due to improvements in technology and management practices. In that context, we find that our application of the TFP data to provide evidence on the scope for frontier shift in the regulated water and wastewater sector remains appropriate.

Third, Economic Insight argues that Europe Economics misrepresents the evidence cited in Europe Economics' June 2024 report. It states that the cited literature on rising productivity dispersion mainly relates to the service sector and industries that had the most rapid increase in the use of ICT, and that the findings are not relevant to industries that are based on "*extraction and processing of a resource; operation and maintenance of a complex network; and the construction of major infrastructure*".⁶⁹ It also argues that various other papers cited by Europe

⁶⁷ Economic Insight (August 2024) "The Importance of a Balanced Approach to Frontier Shift", p.8, available at anglianwater.co.uk.

⁶⁸ Economic Insight (August 2024) "The Importance of a Balanced Approach to Frontier Shift", p.48, available at anglianwater.co.uk.

⁶⁹ Specifically, Economic Insight refers to Andrews, D, et al (December 2016) "The best versus the rest: the global productivity slowdown, divergence across firms and the role of public policy" available at oecd.org; and Faggio, G. et al (August 2007) "The evolution of inequality in productivity and wages: panel data evidence" available at nber.org.

Economics⁷⁰ do not use data from the UK; and that Europe Economics has misinterpreted the findings of McGowan et al (2017)⁷¹ on the prevalence of, and employment tied up in, zombie firms. Economic Insight cites Haldane (2017) argues that, rather, “*the tail of low productivity companies today is [...] smaller than it was pre-crisis*”.⁷²

CEPA’s response to Economic Insight’s arguments about the studies on productivity dispersion

We have not conducted a detailed review of the academic evidence provided by Europe Economics on the extent to which productivity dispersion has changed over time and within industries. Although those papers most relevant to the wider field of macroeconomic performance and productivity, they are useful in demonstrating that productivity dispersion can be observed in some of the data. In our view, this demonstrates the fallibility of Economic Insight’s intuition that there must “always” be an upwards bias in the TFP data which is overestimating the scope for frontier shift.

In summary, we do not find objective grounds to adjust our recommended frontier shift range to account for any positive or negative bias in the TFP data due to a theoretical possibility that it also captures ‘catch-up’ efficiency.

Company responses on the overlap between the TFP data and ‘catch-up’ efficiency

There were no substantive responses from water companies relating to the overlap between the TFP data and catch-up efficiency.

In summary, neither the regulated companies nor their advisers have objectively or sufficiently demonstrated that TFP estimates derived from EU KLEMS capture ‘catch-up’ efficiency gains in the comparator industries in a way which overstates the scope for frontier shift and means that that Ofwat’s decision to adopt a 1% frontier shift challenge in the PR24 Draft Determinations is unachievable.

3.6. OTHER ISSUES RAISED BY THE COMPANIES AND THEIR ADVISERS

The water and wastewater companies also raised various other issues in their Draft Determination responses which were not covered in Economic Insight’s August 2024 report, so we address them in this sub-section.

Reliance on previous regulatory decisions

Anglian Water⁷³ and United Utilities argue that Ofwat placed excessive reliance on previous regulatory decisions in justifying a 1% frontier shift target. They disagreed with this approach because it undermines the notion of basing the challenge on economy-wide productivity trends.

Severn Trent⁷⁴ argues that the use of evidence from the energy sector is not appropriate because Ofwat cited the highest frontier shift estimate set by Ofgem for the gas and energy sector in the last 10 years, but the CMA’s removal of 0.2% uplift for innovation funding reduced the frontier shift for the appellant companies to 0.95%-1.05% per year. Severn Trent also notes that Ofgem’s latest estimate for frontier shift is 1% for electricity distribution.

CEPA’s response on previous regulatory decisions

We do not agree with the views expressed by Anglian Water, United Utilities and Severn Trent. Firstly, our starting point is the EU KLEMS dataset, which we used to analyse TFP growth across a range of comparator industries which were chosen at PR19 (and reaffirmed in our June 2024 report) because they exhibit certain activities which

⁷⁰ Specifically, Economic Insight refers to McGowan, M. et al (January 2017) “The walking dead? Zombie firms and productivity performance in OECD countries” available at [oecd.org](https://www.oecd.org); and Faggio, G. et al (August 2007) “The evolution of inequality in productivity and wages: panel data evidence” available at [nber.org](https://www.nber.org).

⁷¹ McGowan, M. et al (January 2017) “The walking dead? Zombie firms and productivity performance in OECD countries” available at [oecd.org](https://www.oecd.org).

⁷² Haldane, A., (March 2017) “Speech: Productivity puzzles”, p.15., available at [bis.org](https://www.bis.org).

⁷³ Anglian Water (August 2024). “Anglian Water’s AMP8 DD Representations, p.47, available at [anglianwater.co.uk](https://www.anglianwater.co.uk).

⁷⁴ Severn Trent (August 2024) “Frontier Shift”, p.8, available at [stwater.co.uk](https://www.stwater.co.uk).

are similar to the activities carried out in the water industry. Nonetheless – consistent with the approach taken by other regulators – we consider that the frontier shift challenge set in recent regulatory decisions is relevant evidence, because there are important similarities in the approach to regulation which influence the stability of investment planning over a 5-year price control period and therefore the scope for productivity growth.

Most regulators in Great Britain have set a frontier shift challenge of around 1% in recent regulatory determinations, and in Northern Ireland the challenge ranges from 0.6%–1.0%, as shown in Table 4.8 of our June 2024 report.⁷⁵

Embodied technical change

United Utilities argues that due to the prevalence of long-lived assets, there is limited scope for water companies to rapidly adapt and change inputs which would enhance productivity. It argues that although embodied technological change might be a material driver of productivity in industries with easily interchangeable primary inputs, this is unlikely to be applicable to the water sector. United Utilities disagrees with CEPA's view that there should be an exclusively upwards adjustment to frontier shift to account for embodied technical change⁷⁶

CEPA's response on embodied technical change

We do not agree with United Utilities argument that the asset base is so long lived that there is little scope for a positive adjustment for embodied technical change. In our view, water companies use a range of assets and some parts of the asset base will experience more rapid technological change and shorter asset lives than others, such as infrastructure monitoring and leak detection. Whilst we do not try to quantify the adjustment that Ofwat should make to the TFP growth rates in EU KLEMS to account for embodied technical change, we consider that it would be appropriate to take it into account as a qualitative factor – as the CMA did in the PR19 redeterminations.

Overlap between frontier shift, performance improvements and totex allowances

Portsmouth Water⁷⁷, Thames Water⁷⁸ and United Utilities⁷⁹ argue that the companies have historically overspent on allowances and therefore a frontier shift challenge of 1% or higher is not appropriate.

Thames Water also argues that its analysis of AMP7 performance data to date indicates that all water and sewerage companies are currently in net penalty for the common performance targets, indicating that the regime has been calibrated to require all companies to deliver more efficient performance from base expenditure rather than selected companies achieving catch-up efficiency.

United Utilities argues that the evidence suggests that the companies have not been able to achieve stretching productivity improvements historically, and therefore the PR19 frontier shift target (1.1% per year) might have been too ambitious, arguing that this is apparent from the fact that companies have significantly overspent their totex allowances in AMP7. United Utilities acknowledges that actual totex has been impacted by a number of factors, including input price shocks, extreme weather events and other operational challenges. But it argues that overall, a largely unchanged frontier efficiency target of 1% for AMP8 is likely to be unachievable for most companies.

Welsh Water argues that the delivery of significant performance improvements in PR24 without specific cost allowances should be a relevant factor in Ofwat's decision.⁸⁰ It also argues that there is a lack of empirical support for the methodology taken by Ofwat and its advisors at Draft Determinations and argues that the work carried out for this price review does not appear to have included an analysis of the extent to which its frontier shift assumptions at previous price reviews have been validated by subsequent industry cost performance.

⁷⁵ CEPA (June 2024) "Frontier Shift, Real Price Effects and the energy crisis cost adjustment mechanism", p.82, available at [ofwat.gov.uk](https://www.ofwat.gov.uk).

⁷⁶ United Utilities (August 2024) "Real price effects and frontier shift", p.12, available at [unitedutilities.co.uk](https://www.unitedutilities.co.uk).

⁷⁷ Portsmouth Water (August 2024) "PR24 Draft Determination Response: Expenditure allowances", available at [portsmouthwater.co.uk](https://www.portsmouthwater.co.uk).

⁷⁸ Thames Water (August 2024) "Thames Water PR24 DD Response Cost Efficiency", p.34, available at [thameswater.co.uk](https://www.thameswater.co.uk).

⁷⁹ United Utilities (August 2024) "Real price effects and frontier shift", p.12, available at [unitedutilities.co.uk](https://www.unitedutilities.co.uk)

⁸⁰ Welsh Water (August 2024) "Cost allowances: cross-cutting issues", p.6, available [dwrcymru.co.uk](https://www.dwrcymru.co.uk).

CEPA's response on the overlap between frontier shift, performance improvements and totex allowances

We do not agree with the views expressed by Portsmouth Water, Thames Water, United Utilities and Welsh Water.

First, it would not be appropriate to set the frontier shift challenge on the basis of underperformance against expenditure allowances over the most recent price control periods, as this would be akin to embedding poor productivity growth from one price review to the next. It would create a perverse incentive for companies to consider overspending in one period in order to reduce the efficiency challenge in the next period. Such an analysis would be a more sensible 'cross-check' to ensure that the frontier shift challenge is both stretching and achievable. However:

- None of the companies have demonstrated that they overspent their allowances because the efficiency challenge was too stretching at PR19 (as opposed to them catching-up on investment that was funded previously).
- Ofwat has set out its case elsewhere that the water and wastewater companies are well funded.

A detailed review of individual performance commitments is beyond the scope of this report but the potential overlap between frontier shift and performance commitments has been considered by Ofwat's other advisers, Europe Economics which found that "*the theoretical overlap between frontier shift and outcomes stretch is small*".⁸¹ For the Draft Determinations Ofwat identified performance commitment levels expected from through comparative benchmarking on the basis that improvements in performance over the long term should come from base costs.⁸² To the extent that performance levels are determined by comparative benchmarking, it might be argued that the performance commitments represent 'catch-up' efficiency as opposed to frontier shift – as we argued in our June 2024 report. However, frontier shift is just one part of the complete price control package, so we continue to recommend that Ofwat considers the level of ambition on cost efficiency and service quality that is implied by the Final Determinations 'in the round', to ensure that the frontier shift challenge is part of a stretching but achievable package.

Inconsistencies between frontier shift and RPEs

Anglian Water⁸³ and Northumbrian Water⁸⁴ argue that Ofwat's approach to frontier shift and the labour RPE are inconsistent. Anglian claim that if productivity growth improves to 1% per year as per CEPA's recommended range, that it would expect demands for much higher wage growth than CEPA's RPE estimate suggests. It argues that Ofwat's frontier shift is in line with a labour RPE of 1% per year and conversely, Ofwat's labour RPE is in line with a productivity forecast of 0.8% per year. In the long run, it argues, one or other of the two predictions can be true but not both.

CEPA's response to inconsistencies between frontier shift and RPEs

We do not agree with the views expressed by Anglian Water and Northumbrian Water. The purpose of the labour RPE is to produce the best forecast of input price growth for the PR24 period based on external forecasts. There is no reason why productivity growth (which the companies can drive from factors of production other than labour) should equal wage growth over any 5-year period, as is illustrated by the increase in wider UK pay growth trends over the last 5-years (annual average growth of 4.8% from 2018/19 to 2023/24) compared to low productivity growth in the UK economy more broadly. In our view, Ofwat is correct to decide the frontier shift challenge separately from the RPE forecasts, and to take an objective view of the different sources of evidence for each.

⁸¹ Europe Economics (March 2023) "Frontier Shift and Outcomes Stretch at PR24", p.5–9., available at [ofwat.gov.uk](https://www.ofwat.gov.uk).

⁸² Ofwat (July 2024) "PR24 Draft Determinations: Delivering outcomes for customers and the environment", p.14, available at [ofwat.gov.uk](https://www.ofwat.gov.uk). See also the CMA discussion in the PR19 Redeterminations Final Report at p.259 – 260., available at [gov.uk](https://www.gov.uk).

⁸³ Anglian Water (August 2024). "Anglian Water AMP8 DD Representations, p.47, available at [anglianwater.co.uk](https://www.anglianwater.co.uk).

⁸⁴ Northumbrian Water (August 2024) "Draft Determination Representations", p.117, available at [nwg.oc.uk](https://www.nwg.oc.uk).

Reduced flexibility to achieve cost reduction

Affinity Water⁸⁵, South West Water and Welsh Water⁸⁶ raised concerns regarding the 1% frontier shift target alongside the introduction of specific Price Control Deliverables (PCDs). Affinity Water and Welsh Water claim that PCDs will significantly reduce the flexibility that companies have in optimising the base investment portfolio which may affect the ability to achieve frontier shift improvements. South West Water argue that its acceptance of a 1% frontier shift challenge is subject to a more flexible balance of PCD applications, which will otherwise constrain innovation in the supply chain and reflects a large and inefficient increase in the cost of regulation.⁸⁷ Northumbrian Water argues that when compared to water, the broader PCD and incentive package and larger stretch means it is not possible to achieve the same level of cost reduction in PR24 as previously.⁸⁸ Northumbrian Water also argues that the narrower Outcome Delivery Incentive (ODI) package in RIIO-ED2 combined with less stretch in the PCDs makes the delivery of 1% cost reduction more achievable for electricity distribution as compared to the water sector

United Utilities also considers that the PCD framework, as currently proposed to be implemented by Ofwat, will significantly reduce companies' flexibility in managing their capital delivery programmes. It argues that this will dampen the potential to achieve efficiency gains and therefore it would be improper to suggest that the increase in investment in AMP8 should be seen as a source of productivity improvements.⁸⁹

CEPA's response to inconsistencies between frontier shift and RPEs

We do not agree with the views expressed by Affinity Water, South West Water, Welsh Water and United Utilities. They assert that the increase in investment in AMP8 might have negative effects on productivity without describing in detail the logic behind this assertion or any evidence to support it. We acknowledge that the PCDs set defined outputs which determine how the companies must use certain allowances, however

- Whilst they vary between companies, PCDs apply primarily to enhancements and a more limited range of base expenditures – and it is important that customers do not pay for outputs and outcomes that are not delivered; and
- The overall increase in planned investment creates an opportunity for learning by doing effects, which might increase in proportion to output delivery.

Application of frontier shift to enhancements

South Staffordshire Water⁹⁰ argues that frontier shift should not be applied to enhancements costs because its submitted enhancements costs already include a total efficiency challenge. It argues that its enhancement schemes are based on optioneering analysis and third party cost estimations of specific investment scheme scopes where the associated costs are unlikely to change significantly during AMP8 as a result of productivity improvements. It argues that applying further efficiencies over and above the sector benchmarking and deep-dive assessments risks underfunding companies for crucial investment programmes.

South Staffordshire Water also claim that Ofwat recognised this at PR19 by not applying frontier shift to enhancement schemes in the majority of cases. It also states that the adjusted cost sharing rates on enhancements ensure that if companies do benefit from productivity improvements on these schemes, customers will receive the majority on the benefit.

CEPA's response to inconsistencies between frontier shift and RPEs

We note that at PR19 Ofwat applied frontier shift to specific areas of enhancement costs which are more common and/or are part of large programme of work. Since Ofwat has conducted the benchmarking on PR24 enhancement

⁸⁵ Affinity Water (August 2024) "Affinity Water PR24 Draft Determination Representation", p.183, available affinitywater.co.uk.

⁸⁶ Welsh Water (August 2024) "Cost allowances: cross-cutting issues", p.5, available dwrcymru.co.uk.

⁸⁷ South West Water (August 2024) "Technical Representations – cost and efficiency", p.9, available at southwestwater.co.uk.

⁸⁸ Northumbrian Water (August 2024) "Draft Determination Representations", p.117, available at nwg.co.uk.

⁸⁹ United Utilities (August 2024) "Real price effects and frontier shift", p.12, available at unitedutilities.co.uk.

⁹⁰ South Staffs Water (August 2024) "Representations on Ofwat's draft determination of our business plan for 2025 to 2030", p.58, available at south-staffs-water.co.uk.

schemes based on a combination of actual (historical) unit costs and forecast costs before the application of frontier shift and RPEs, we consider that it would be appropriate to apply frontier shift to the relevant enhancement expenditures in PR24. This would be consistent with Ofwat's approach to base costs.

3.7. RECOMMENDED FRONTIER SHIFT RANGE FOR THE PR24 FINAL DETERMINATIONS

We have looked at the available evidence on the scope for frontier shift productivity growth in the regulated water sector in the round and concluded that the range of 0.8%–1.2% per year remains appropriate at the Final Determinations stage because:

We have looked at the available evidence on the scope for frontier shift productivity growth in the regulated water sector in the round and concluded that the range of 0.8%–1.2% per year remains appropriate at the Final Determinations stage because:

- We show that one can employ multiple approaches to the EU KLEMS analysis to justify a range of 0.8%–1.2% which demonstrates the robustness of our results. By contrast, the companies' advisers make a series of analytical choices which produce a disproportionately negative view of the scope for productivity growth – and is not well aligned with the range of frontier shift challenges proposed by the companies themselves.
- There is scope for productivity growth which is not reflected in the TFP growth rates which we calculate from EU KLEMS and which Ofwat is justified in taking into consideration, including productivity improvements represented by embodied technical change, the potential for digitalisation and automation technologies to become more routinely adopted, and the step-change in investment planned in AMP8.
- It is aligned with the challenges proposed by the four most ambitious water companies in their revised business plans, despite the incentive on the companies to understate the potential for productivity growth at this stage of the price control process.
- It is aligned with the frontier shift challenges set in other recent regulatory decisions which generally cluster around 1%. None of the water companies nor their advisers were able to credibly explain why this evidence was not relevant to Ofwat's decision at PR24.

The lower end of this narrower range is aligned with the more ambitious water companies and the more cautious approach to frontier shift in the most recent water and sewerage price review in Northern Ireland. The top end of the range is aligned with the highest frontier shift challenges set in recent GB price reviews, whilst the mid-point of the range has been accepted in the most recent CMA appeals.

Consistent with our advice at the Draft Determinations, when considering where the frontier shift challenge might sit within our range, Ofwat should take into account the level of ambition on cost efficiency and service quality that is implied by the price control 'in the round', to ensure that the frontier shift challenge is part of a stretching but achievable package.

4. RESPONSES TO THE PR24 DRAFT DETERMINATIONS – RETAIL PRICE CONTROL

4.1. CEPA’S ANALYSIS OF THE SCOPE FOR FRONTIER SHIFT IN THE RETAIL BUSINESSES

In the PR24 Draft Determinations, Ofwat decided to apply a frontier shift challenge of 1% for the retail businesses, consistent with the challenge applied to the wholesale price controls. It did so on the basis of the analysis and recommendations set out in Section 5 of our June 2024 Draft Determinations report.⁹¹

First, we looked at the frontier shift challenges proposed by the companies for their retail activities, which ranged from 0.45% per year to 1.0% per year, although we noted that certain companies (Anglian Water, Portsmouth Water and South Staffs Water) did not propose a frontier shift challenge for retail on the basis that it would be inappropriate in a context where allowances are set in nominal terms.

Second, we used EU KLEMS to analyse the TFP growth rates for a more targeted retail comparator set which is consistent with that developed by Europe Economics for Ofwat at PR19. Using the same comparator set ensures that where possible Ofwat’s advisers employ a stable and predictable approach to the analysis over time. The resulting TFP growth rates for each industry in the comparator set and the unweighted average, for both GO and VA over the period 1996–2019, and for the periods before and after the Global Financial Crisis, are shown in Tables 4.1 and 4.2 below.

Table 4.1: Average annual TFP GO growth for the PR19 retail comparator set, 1996–2019

Industry	1996 - 2008	2009 - 2019	1996 - 2019
Professional, scientific, technical, administrative and support service activities	-0.5%	-0.3%	-0.3%
Wholesale and retail trade; repair of motor vehicles and motorcycles	-0.9%	0.0%	-0.3%
Information and communication	4.6%	3.0%	3.9%
Unweighted average of PR19 retail comparator set	1.1%	0.9%	1.1%

Table 4.2: Average annual TFP VA growth for the PR19 retail comparator set, 1996–2019

Industry	1996 - 2008	2009 - 2019	1996 - 2019
Professional, scientific, technical, administrative and support service activities	-0.9%	-0.1%	-0.5%
Wholesale and retail trade; repair of motor vehicles and motorcycles	-0.7%	0.8%	-0.5%
Information and communication	7.9%	6.5%	7.1%
Unweighted average of PR19 retail comparator set	2.1%	2.4%	2.0%

Third, to the extent that a large share of expenditure in the water retail businesses represents labour costs, we also analysed labour productivity growth rates reported in EU KLEMS for both the PR19 wholesale and retail comparator sets. Labour productivity differs from the concept of Total Factor Productivity because the productivity of each unit of labour can increase as the volume and quality of capital inputs increases. Mathematically, this means that labour productivity is always a higher value than TFP. Over time, there can also be a capital–labour substitution effect, where firms substitute capital for labour to reduce costs, particularly when labour costs are high.

⁹¹ CEPA (June 2024) “Frontier Shift, Real Price Effects and the energy crisis cost adjustment mechanism”, available at [ofwat.gov.uk](https://www.ofwat.gov.uk).

We noted that the unweighted average for the PR19 wholesale comparator set is 2.4% over the period 1996–2019. The unweighted average of the PR19 retail comparator set is 3.0% over the same period, driven by labour productivity growth in the ‘Information and communications’ industry, as shown in Table 4.3 below.

Table 4.3: Labour Productivity estimates (average annual growth rate) from 2023 EU KLEMS, VA only

Industry	1996 - 2008	2009 - 2019	1996 - 2019
Chemicals and chemical products	6.2%	6.3%	6.0%
Construction	-0.7%	1.8%	-0.1%
Machinery and equipment n.e.c	7.2%	1.0%	3.4%
Manufacture of furniture; jewellery, musical instruments, toys; repair and installation of machinery and equipment	5.2%	0.3%	3.1%
Professional, Scientific, Technical, Administrative and Support Service Activities	0.4%	0.1%	0.3%
Total manufacturing	6.3%	1.5%	3.9%
Transportation and storage	2.0%	-0.3%	0.4%
Unweighted average of PR19 wholesale comparator set	3.8%	1.5%	2.4%
Unweighted average of 4 highest performing industries	6.2%	2.3%	4.1%
Professional, Scientific, Technical, Administrative and Support Service Activities	0.4%	0.1%	0.3%
Wholesale and retail trade; repair of motor vehicles and motorcycles	0.6%	1.3%	0.5%
Information and communication	10.3%	6.2%	8.3%
Unweighted average of PR19 retail comparator set	3.8%	2.5%	3.0%

Fourth, we considered wider trends with the potential to impact retail sector productivity over the PR24 period, including:

- The growth of customer service automation, artificial intelligence and machine learning opportunities.
- The continuing shift from in-person customer interaction to telephone and online based interactions, which has accelerated since Covid-19.
- Falling meter reading costs per metered property in the water sector, likely due to increasing smart meter penetration.

In summary, we found substantive opportunities for productivity growth over the AMP8 period. However, given the recency of these trends, we concluded that it is not yet possible to quantify the magnitude of these opportunities based on the available evidence. Instead, we recommended that Ofwat takes these opportunities into account as qualitative considerations.

Finally, we looked at the available evidence on productivity growth in the retail sector in the round. We started from the range that we consider appropriate for the wholesale businesses, 0.8%–1.2%, and cross-checked this against the rate of TFP GO growth achieved by the PR19 retail comparator set over the period 1996–2019 (1.1%). Given that the data from EU KLEMS is the strongest evidence available, we concluded that the range of 0.8% to 1.2% was also appropriate for frontier shift in the retail businesses.

4.2. WATER COMPANY ARGUMENTS

Only 2 of the water companies responded to the Draft Determinations consultation with specific comments on the frontier shift challenge for the retail price control: Severn Trent⁹² and Hafren Dyfrdwy.⁹³

Both companies argued that it would be inappropriate to apply the same PR19 comparator set to the wholesale and retail activities, because the retail activities differ significantly in their factors of production. Instead, they suggest that the following industries would be suitable comparators

- Information and communication
- Financial and insurance activities
- Real estate activities
- Administrative and support service activities
- Other service activities

The overall impact of Severn Trend and Hafren Dyfrdwy's proposal is to use a retail comparator set that gives lower TFP results on average across the set – 0.5% on a GO basis and 1.0% on a VA basis – to justify a lower challenge.

Most other companies proposed a frontier shift challenge of 0.45% to 1.0% and proposed challenges which were similar to the wholesale price control (see Table 3.1).⁹⁴ For the least ambitious companies, this challenge was based on Economic Insight's April 2023 report using the mid-point of either its 'plausible range' (0.3%–0.6%) or the 'PR24 focused range' (0.4%–0.6%). However, 4 companies proposed a frontier shift challenge in their revised business plan that was materially above the ranges proposed by Economic Insight (Anglian Water, Northumbrian Water, South West Water, SES Water).

4.3. CEPA'S RESPONSE TO ISSUES RAISED BY THE WATER COMPANIES

In our view, Severn Trent and Hafren Dyfrdwy's responses do not reflect the full range of evidence that we considered in recommending a similar frontier shift range for both the retail and wholesale business. Specifically:

- We considered the more targeted retail comparator set used at PR19 which gave results of between 1.1% TFP GO growth over the period 1996–2019 and 2.0% TFP VA growth over the same period, noting that the averages were particularly sensitive to the inclusion of the Information and Communications industry (which Severn Trent and Hafren Dyfrdwy agree are relevant comparators).
- We said that in our view, the closest comparator is the 'Office administration, office support and other business support activities' industry group, but this level of disaggregation is not available in EU KLEMS.
- Instead, we looked at Labour Productivity growth in the PR19 wholesale and retail comparator sets which gave results of between 2.4% (wholesale) and 3.0% (retail) over the period 1996–2019. However, we noted that we were unable to convert the VA values reported in EU KLEMS into GO terms with the information provided in the dataset. We also said that the labour productivity measures were relevant in the context of the retail business where staff costs are a primary driver of expenditure, but we did not recommend mechanically applying a labour productivity estimate to set the frontier shift challenge.

Overall, we reached the view that – as with the wholesale price control – there is no comparator or set of comparators which forms a perfect proxy for the retail activities delivered by the water companies. But we

⁹² Severn Trent (August 2024) "Frontier Shift", p.7, available at stwater.co.uk.

⁹³ Hafren Dyfrdwy (August 2024) "Draft Determinations Representations: Frontier Shift Adjustment", p.7, available hdcymru.co.uk.

⁹⁴ Portsmouth Water and South Staffordshire Water did not propose a frontier shift challenge, as described in Section 3.1.

considered that the PR19 wholesale comparator set was a reasonable starting position and cross-checked it against the PR19 retail comparator set (1.1%). Given that the data from EU KLEMS is the strongest evidence available, we concluded that the range of 0.8% to 1.2% remained appropriate.

We do not agree with some of the industries which Severn Trent and Hafren Dyfrdwy suggest are more relevant to the retail businesses. Specifically, the treatment of owner-occupied imputed rental in the national accounts affects the reported TFP growth rates of the 'Real estate activities' sector, which in turn means that TFP growth rate in that sector is not a good proxy for the retail activities conducted by the regulated water and wastewater companies. Although there is inevitably a degree of judgement involved in selecting industries that have some similarities to the retail businesses, we were also concerned that:

- Productivity growth in the 'financial services and insurance activities' industry will be driven by a wide range of activities beyond the relatively narrow act of selling financial services products to retail consumers.
- The 'other services' industry includes the activities of membership organisations, the repair of computers and personal and household goods, and other personal service activities. We were not wholly convinced on the basis of the information provided by the water companies and their advisers, that this was a sufficiently valuable addition to the PR19 comparator set.

4.4. RECOMMENDED FRONTIER SHIFT RANGE FOR THE PR24 FINAL DETERMINATIONS

We have looked at the available evidence on productivity growth in the retail sector in the round and concluded that the range of 0.8%–1.2% per year remains appropriate at the Final Determinations stage because:

- Four of the companies have proposed a revised frontier shift challenge which is within our range, despite the general incentive on the water companies to understate the potential scope for productivity growth in the retail businesses at this stage of the price review process; and
- The other water and wastewater companies did not provide sufficient evidence in their Draft Determination responses to justify a different conclusion from that reached in our June 2024 Draft Determinations report.

We also said in our June 2024 report that Ofwat would need to ensure that its decision on frontier shift is consistent with the wider approach to setting allowances for the retail control. Specifically:

- Assuming Ofwat sets nominal retail allowances which include an ex-ante CPIH inflation forecast for all costs, it would also be appropriate to set a full frontier shift challenge that broadly reflects the ongoing efficiency incentives generated by competition in the wider retail sector.
- If Ofwat only builds in an inflation forecast for certain costs, then it should consider the impact on the implied efficiency challenge for the retail businesses in the round. This might imply that it only applies frontier shift to those costs which the companies can control.

Ofwat has subsequently confirmed its approach to both of these issues in the Draft Determinations and so we do not comment further at this stage.



UK

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