A REVIEW OF OFWAT'S PR19 APPROACH TO ESTIMATING FRONTIER SHIFT

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March 2019

EXECUTIVE SUMMARY

- One important component part in a suite of PR19 documents published by Ofwat in January 2019 was an initial estimate of the rate of frontier shift that is likely to impact on water industry wholesale costs through to 2024/25.

- The methodology that Ofwat uses in its analysis is unusual. Instead of adopting the now-standard regulatory approach of making a forecast of real price effects (RPEs) and deducting an allowance for ongoing productivity growth, Ofwat elects at this time not to make any allowance for wholesale RPEs, principally on the grounds that CPIH indexation of price controls will automatically 'capture' industry input price inflation.

- Ofwat makes no such argument in relation to productivity growth – i.e. it does not recognise that CPIH indexation challenges water companies to match the productivity improvements achieved by the firms that supply goods and services to UK households. I regard this as a pick'n'mix error. If Ofwat wishes to argue that CPIH inflation indexation captures industry input price pressures, it also has to acknowledge that CPIH inflation, in and of itself, captures a non-trivial level of ongoing productivity growth. Alternatively, if Ofwat wishes to make a completely stand-alone allowance for productivity growth, it must also make a stand-alone allowance for RPEs.

- There are also a series of other problems with Ofwat's analysis of RPEs:

    - Ofwat effectively limits its analysis of RPEs to two cost categories – wage inflation and materials, plant and equipment inflation. These inputs constitute only approximately 55% of totex. All cost items within the other 45% of totex are deemed individually to be immaterial even though collectively they constitute a very large proportion of companies' annual expenditures and are capable in combination of generating non-zero RPEs;

    - Ofwat insists that RPEs can only be factored into price controls if input price increases are outside of management control. However, many of the steps that Ofwat says that firms can take to 'control' prices – e.g. the use of long-term contracts, hedging, input substitution – enable firms to manage price volatility rather than avoid input price increases entirely. As such, Ofwat fails to evidence that companies are capable of holding input costs at 2017/18 prices all the way through to March 2025; and

    - Ofwat's consultant, Europe Economics, dismisses forecasts produced by the Office of Budget Responsibility (OBR) and BEIS as "unreliable". This leads Ofwat, in effect, to adopt Europe Economics' house view of RPEs – i.e. projections which, for the most part, sit a long way outside of current consensus forecasts for the AMP7 period.

- I consider that these deficiencies, when taken together, cause Ofwat to reach faulty conclusions about the RPEs that water companies are likely to encounter in the next seven years and, hence, cause Ofwat to make insufficient allowance in its cost assessment for future industry cost escalation.

- Ofwat's estimate of the historical, long-term rate of productivity growth in the water industry is, for the most part, based on a much more reliable benchmarking methodology (subject to the earlier point about the RPE/productivity pick'n'mix error). Ofwat's 0.6% to 1.2% benchmark range for productivity growth is also broadly in line with recent regulatory precedent.

- An important question for Ofwat in PR19, and for economic regulators more generally at present, is whether past experience of productivity improvement offers a reasonable guide to the future. Elsewhere in the economy, productivity growth has stalled since the global financial crisis, and the likes of the OBR and the Bank of England have been cutting forecasts of future productivity growth quite markedly.

Table A: Bank of England estimates of annual total factor productivity growth

	1998-07	2008-10	2011-14	2015-18Q3	2018Q4-22Q1
TFP growth	1.0%	-0.6%	-0.1%	0.2%	0.3%

- The water industry is not immune from factors that are affecting other firms, not least because water companies contract out a significant amount of their expenditure to alliances and supply chain partners. I would like to see Ofwat give more attention in the remainder of PR19 to the structural break that seems to have occurred in 2008, including by considering the possibility that it might be necessary to scale back expectations of productivity growth in line with the lowering of productivity forecasts that there has been across the UK economy in recent years.

- Ofwat also needs to consider very carefully whether it has the evidence to justify factoring an extra amount of cost reduction into PR19 base expenditure allowances due to regulatory innovations introduced in PR14. Ofwat has noticeably backed off from the very large overlay that it tentatively suggested one year ago, but it is still worrying reliant on a simplistic and subjective interpretation of recent experience in the energy industry. More fundamentally, it is not at all clear why the kinds of regulatory innovation that Ofwat is talking about – totex and outcome regulation – should lead to reduction in recurring expenditures; rather, there is a respectable argument that Ofwat's incentives will typically lead to companies incurring higher ongoing expenditures in the short term as part of a drive towards whole-life cost optimisation.

1. INTRODUCTION

This paper[1] contains a review of Ofwat's approach to estimating AMP7 RPEs and frontier productivity growth (collectively "frontier shift"). It is intended to be a contribution to the water industry's PR19 periodic review of water and sewerage price controls, focusing especially on the methodological framework that regulator and companies can use to identify and estimate the rate at which a frontier company's costs might be expected to change during the period 2017/18 to 2024/25.

The paper is structured into five main parts as follows:

- section 2 briefly summarises the key points that Ofwat made in January 2019 when it published its initial assessment of companies' business plans,[2] and seeks to position Ofwat's approach in relation to wider regulatory practice;
- section 3 identifies an inconsistency as regards Ofwat's treatment of RPEs and its approach to making allowance for future productivity growth;
- section 4 makes a number of additional observations about Ofwat's RPE analysis;
- section 5 looks in more detail at Ofwat's productivity growth benchmarking; and
- section 6 concludes.

2. BACKGROUND

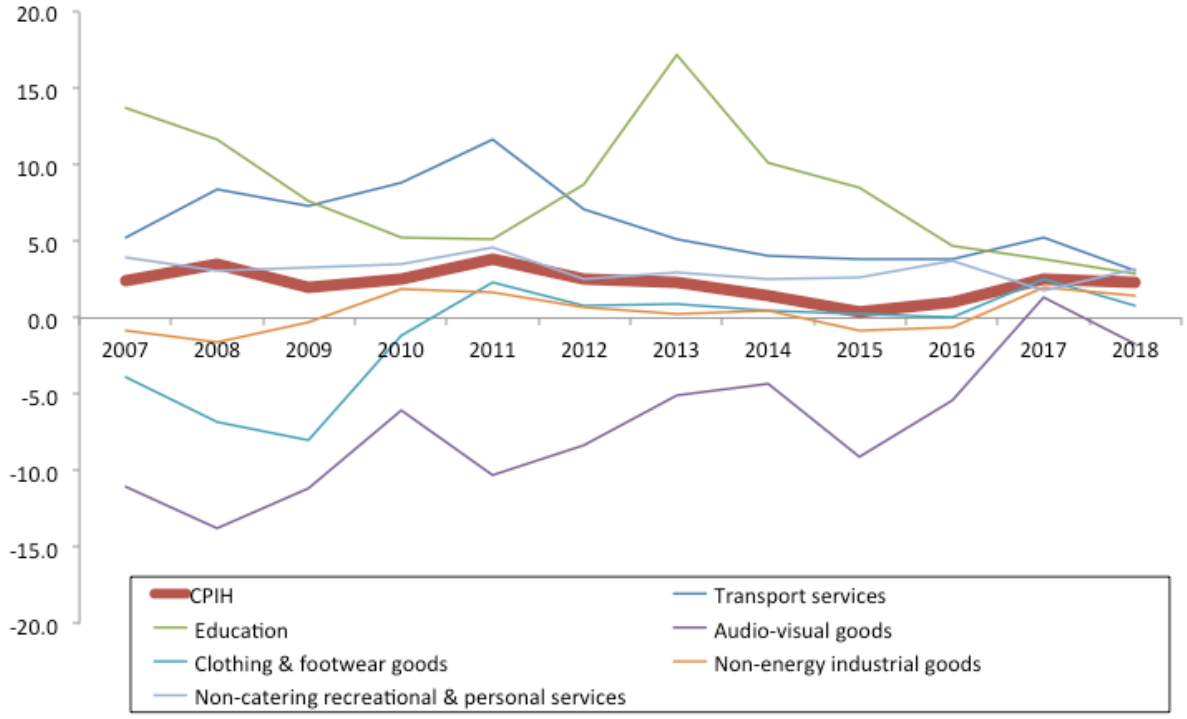
Ofwat's allowances for the base expenditure (botex) that water companies are likely to incur in AMP7 (2020/21 to 2024/25) are being built piece-by-piece from a number of complementary cost assessment models. Much of the evidence that Ofwat is assembling entails identifying the prevailing level of efficient costs during the period 2011/12 to 2017/18 and then rolling forward this benchmark level of expenditure through to the end of AMP7. This requires companies and Ofwat to think carefully about the extent to which the industry cost frontier might itself move during the next few years, and in particular how much:

- input price inflation might cause costs to increase from one year to the next; and
- ongoing productivity growth is likely to offset such cost increases.

A key consideration in this analysis is that all of Ofwat's wholesale price controls will automatically index in line with out-turn CPIH inflation. This is akin to a very rough initial estimate of, and allowance for, the aforementioned cost drivers. However, it is highly unlikely that CPIH inflation will exactly match the particular combination of input price inflation and ongoing productivity growth that will impact on companies' AMP7 expenditures. Elsewhere in the economy, it can be observed that the costs of very few, if any, goods and services move exactly in line with CPIH; rather, there are some sectors of the economy in which costs/prices tend to increase by more than consumer price inflation, and some sectors in which costs/prices tend to increase by less than CPIH inflation (or where costs/prices even tend to fall year on year). This is illustrated in the chart overleaf.

[1] This paper was originally prepared for attendees of First Economics' *Economic Regulation Forum*.
[2] Ofwat (2019), Technical appendix 2: securing cost efficiency.

Figure 1: Annual % change in prices of selected goods and services



Note: to keep the chart readable, yet still illustrate the point I am trying to make, I have picked out just six of the 34 aggregate goods and services price series that the ONS publishes as part of its CPIH data set.

PR19 is not the first review in which companies and regulator have had to determine the trajectory that a frontier company's costs are likely to move on. Since 2009, there have been more than half a dozen price reviews in which regulators have made an explicit allowance for frontier shift. Almost all of these calculations have been built by putting numbers on the terms in the following formula:

	frontier shift in real terms
=	forecast nominal industry input price inflation
less	underlying industry frontier productivity growth
less	forecast consumer price inflation

or, equivalently:

	frontier shift in real terms
=	forecast RPEs
less	underlying industry frontier productivity growth (1)

Specific assumptions made by different regulators are summarised in table 1.

Table 1: Assumptions made by regulators about frontier shift

Regulator/review	RPEs	Productivity growth	Frontier shift
CC, Bristol Water, 2010	RPI + 0.65%	0.9%	RPI – 0.25%
Ofgem, RIIO-GD1/T1, 2012	RPI + 0.2% to + 0.8%	0.7% to 1.0%	RPI - 0.7% to + 0.1%
CC, Northern Ireland Electricity, 2014	RPI – 1.5% to + 0.8%	1.0%	RPI – 2.5% to – 0.2%
Ofgem, RIIO-ED1, 2014	RPI – 1.4% to + 0.6%	0.7% to 1.1%	RPI – 2.3% to – 0.3%
Utility Regulator, NI Water, 2014	RPI + 0.1% to + 0.9%	0.6% to 0.9%	RPI – 0.5% to – 0.1%
CMA, Bristol Water, 2015	RPI + 0.5%	1.0%	RPI – 0.5%
Utility Regulator, GD17, 2016	RPI + 0% to + 1.0%	1.0%	RPI – 1.0% to + 0%
Ofwat, PR19, 2019 (consultation range)	CPIH + 0%	1.5%	CPIH – 1.5%

Source: regulators' documents.
Note: the ranges in the table come from different calculations for different years and/or from separate calculations for opex and capex.

Ofwat's initial estimate of AMP7 frontier shift was unveiled on 31 January 2019, and is a noticeably different take in comparison to the other entries in table 1. First, the headline frontier shift estimate of CPIH – 1.5% stands well below the medium-term rates of frontier shift that regulators in the electricity, gas and water sectors have previously factored into price controls. (NB: the low-end estimates in table 1 are typically for a single year only.) Second, the methodology that Ofwat used to derive its CPIH – 1.5% was atypical in a number of respects. Most notably, where recently it has become standard regulatory practice to estimate forecast nominal input price inflation less productivity growth less forecast consumer price inflation directly (see equation 1 and table 1 above), Ofwat took a different approach in which it laid out a number of tests that companies would have to pass before it could consider making any allowance for RPEs.

Figure 2: Ofwat's PR19 approach to RPEs and productivity growth

RPEs

Q1: Is an input cost category a material part of a company's expenditure (i.e. >10% of totex)?

Q2: Is there reason to think that input price increases will not be 'captured' by CPIH indexation?

Q3: Will RPEs be significantly different from zero?

Q4: Is a company's exposure to input price inflation something that management cannot control?

Productivity growth

Q5: At what rate will leading companies be able to go on improving productivity?

Ofwat's initial assessment was that there is no category of wholesale input costs for which it can answer all of questions 1, 2, 3 and 4 in the affirmative. In particular, it found that no input cost passes tests 2 and 3. This led Ofwat to conclude that it does not need to make any allowance for RPEs when it sets PR19 price controls. Ofwat did, however, determine that the sector's leading companies ought to be capable of making productivity improvements worth 1.5% per annum, and, hence, that frontier companies are capable of holding increases in botex to a net CPIH – 1.5% per annum over the remainder of AMP6 and the whole of AMP7.

It is not my intention in this paper to question this estimate directly or to table my own, alternative estimate of frontier shift. Rather, it is principally the novel nature of Ofwat's *methodology* that I wish to focus on. 14 of the 17 companies will be submitting revised business plans to Ofwat on 1 April and it is for the individual companies to come to their own views about numbers. I do think it is important, however, that Ofwat has a comprehensive and reliable analytical framework with which to assess the reasonableness of the forecasts it receives, and that its draft determination and final determination allowances for frontier shift are neither biased up nor down.

In the remainder of this paper, I first consider the coherence of Ofwat's overall approach to RPEs and productivity growth. I then look in more detail at the line-by-line RPE and productivity growth calculations.

3. COHERENCE OF METHODOLOGY

The stand-out feature of Ofwat's PR19 approach to frontier shift is the different thought processes that Ofwat is applying in the case of RPEs and productivity growth. As set out in figure 2, Ofwat is saying in the case of RPEs that there has to be a compelling case in order for Ofwat to make an allowance for above- or below-CPIH cost escalation, in accordance with its four tests. But in the case of productivity growth, Ofwat is happy to proceed straight to an unconditional assessment of the scope for companies to reduce costs year-on-year via efficiency improvements.

I offer the following observations about this.

3.1 Does CPIH capture input price inflation and productivity growth?

Looking at Ofwat's RPE tests, my eye is immediately drawn to the critical importance that criterion 2 takes on in Ofwat's framework of analysis. Ofwat's consultant, Europe Economics, in a report that Ofwat published alongside its January 2019 initial assessment of plans, explains the logic behind this test in the following terms:[3]

> … if the share of a cost item in totex is similar to the share of that cost item in CPIH, then CPIH indexation should already be capturing well the evolution of that cost item in company costs … A cost item fails against this criterion if there is no conclusive evidence that CPIH fails to adequately capture the input price.

I consider the workability (or otherwise) of this test in section 3.2. But at the very outset it is important to emphasise that if Ofwat wishes to approach RPEs in this way, it also has to approach productivity growth with the same mindset.

[3] Europe Economics (2019), Frontier shift and real price effects.

CPIH is an index that tracks the price of a basket of goods and services bought by UK households. Individual prices can fluctuate for a variety of reasons, but two of the key drivers of product prices increases and price reductions will be (a) changes in the costs of the inputs that firms use, and (b) the scale of any unit cost reductions resulting from productivity improvements. As a rough approximation, over a period of several years, it is not unreasonable to think of CPIH inflation as an indicator of the average rate of input price inflation affecting the firms that supply goods and services to UK households less the average rate of productivity growth that such firms are able to achieve, i.e.:

	CPIH inflation
≈	average input price inflation
less	average productivity growth (2)

Ofwat's criterion 2 starts from the premise that in-period CPIH indexation is akin, in part, to in-period input price indexation. But Ofwat then fails to acknowledge that if CPIH indexation compensates water companies for an average rate of labour, materials, etc. input price inflation, it also challenges water companies to match the average rate of productivity growth that is being achieved by the companies that supply goods and services to households.

The consequences that this omission has can be seen can be seen clearly if we substitute the relationship between CPIH inflation, input price inflation and productivity growth from equation 2 into the earlier equation 1, i.e.:

	frontier shift in real terms
=	forecast nominal industry input price inflation
less	underlying industry frontier productivity growth
less	forecast consumer price inflation
=	forecast nominal industry input price inflation – average input price inflation
less	underlying industry productivity growth – average industry productivity growth (3)

This expression says that scale and direction of the PR19 CPIH ± z% roll forward of efficient industry costs can be calibrated by reference to the extent to which water industry input price inflation exceeds or falls short of the average rate of input price inflation feeding into the prices of the goods and services in the CPIH basket *and* the extent to which water industry productivity growth exceeds or falls short of average productivity growth. Europe Economics and Ofwat seize upon the first of these things when they observe that CPIH inflation might 'capture' industry input price inflation. But they do not go on to recognise that there is a corollary for productivity improvement – i.e. that CPIH indexation might also 'capture' industry productivity growth.

Ofwat ought to recall this point was given some prominence in the work that it carried out at previous periodic reviews, as set out in the box overleaf.

Box 1

During PR99 and PR04, Ofwat, advised by Europe Economics, viewed real terms frontier shift via a comparative lens. That is to say that it allowed for RPEs only to the extent that it considered that the input mix in a typical water and sewerage company was different from the input mix in the economy as a whole. Similarly, Ofwat allowed for productivity growth only to the extent that it considered that the underlying pace of productivity growth in the sector exceeded the rate of productivity growth in the rest of the economy.

A Europe Economics report from 2003 highlights the point very explicitly [4]

> … if the trends in input prices in the water and sewerage industries reflect the input price trend in the economy as a whole, the water and sewerage industries will be able to achieve real cost reductions (measured against the RPI) to the extent that they can improve TFP faster than the economy as a whole.

(NB: the reference to RPI reflects Ofwat's use of RPI as its preferred inflation metric at that time.)

Despite using the same consultants that helped Ofwat develop the PR99/PR04 framework, Ofwat is not re-using its old methodology in PR19. But neither is it moving to the more modern methodology that the likes of the CMA, CAA, Ofgem and the NI Utility Regulator have used in their recent periodic reviews, involving stand-alone calculations of nominal input price inflation, industry productivity growth and forecast consumer price inflation (i.e. equation 1). Instead, Ofwat has alighted on a sort of pick'n'mix approach in which it looks at RPEs in the old, comparative equation 3 way and then considers ongoing productivity growth in absolute equation 1 terms.

The obvious problem with this contradictory and inconsistent approach is that it will give Ofwat an inadmissible estimate of overall frontier shift.

3.2 Should Ofwat approach PR19 frontier shift in comparative or absolute terms?

If Ofwat is willing to accept this uncontroversial statement, it will need to decide whether to reassemble its analysis in either the framework provided by equation 1 or the framework of equation 3. My strong advice is that it should opt for the former.

I am not aware of any price review that has taken place in the UK in the last ten years in which a regulator has deemed it appropriate to use the comparative approach set out in equation 3. The principal reason for this is that no one can say for sure what average rate of input price inflation or what average rate of productivity improvement feed into CPIH inflation. It used to be that regulators and their consultants would try to reference average UK economy input price inflation rates and average UK economy productivity growth, respectively, until a number of us

[4] Europe Economics (2003), Scope for efficiency improvement in the water and sewerage industries: final report, available at: https://webarchive.nationalarchives.gov.uk/20100514023213/http://www.ofwat.gov.uk/legacy/aptrix/ofwat/publish.nsf/Content/efficiency_report.html

pointed out that many of the goods that appear in the CPIH basket are nowadays manufactured overseas. This means that the averages feeding into CPIH inflation are not UK economy averages but are partly a function of domestic input price inflation and domestic productivity growth and partly a function of input price inflation and productivity growth in overseas economies – the average values of which I do not think anyone could hope to pinpoint with any accuracy.

Ofwat will recall that its PR09 consultant, Reckon, endorsed criticisms of the comparative equation 3 approach in a report a decade ago:[5]

> At best, this approach seems unnecessarily complicated; at worst, the forecasts of future cost reductions will be based on unjustified assumptions …

Given the unknowns in any comparative exercise, the framework that equation 1 provides is far more straight-forward for everyone to analyse frontier shift with. A regulator and/or a company only needs to assemble their best current estimates of the rate at which input costs like wages, materials prices, electricity purchase costs etc. will increase or decrease over the AMP7 period. It can then combine these input price forecasts with the kind of productivity growth assumption that Ofwat has already been assembling in its PR19 work. Placed together, these two parameters will give a sense of the nominal cost escalation that a frontier company is likely to experience in the coming years, which can be translated into a real terms equivalent, if desired, by deducting a forecast of CPIH inflation.

The likes of the Competition Commission, the Competition & Markets Authority, Ofgem and the NI Utility Regulator have all been comfortable using this approach in recent periodic reviews, as have the companies that they regulate. I can see absolutely no reason why Ofwat should not be using the same approach in PR19.

4. OTHER OBSERVATIONS: REAL PRICE EFFECTS

The other three limbs in Ofwat's RPE tests are that:

- a cost item must be material;
- there must be a discernible wedge between input price inflation and CPIH inflation (or the wedge must be highly volatile); and
- the wedge must be outside management control.

I now consider each of these points in turn.

4.1 Materiality test

Ofwat's materiality test requires that a cost item must represent more than 10% of wholesale totex (i.e circa £900m per annum) in order to warrant any regulatory consideration. As a consequence of this criterion, Ofwat deems that only two cost items – labour costs and materials, plant and equipment costs – are eligible for above- or below-CPIH allowances.

[5] Reckon (2008), PR09 scope for efficiency studies, available at: https://webarchive.nationalarchives.gov.uk/20150604082240/http://www.ofwat.gov.uk/publications/commissioned/rpt_com_scopeefficiencyreckon.pdf

Table 2 shows that, by Ofwat's calculations, labour and materials, plant and equipment costs constitute approximately 55% of wholesale expenditure. This means that Ofwat is unwilling to consider provision for RPEs in respect of almost half of water companies' input costs.

Table 2: Input costs considered eligible for an RPE allowance

Input category	Percentage of totex
Labour	35%
~~Energy~~	~~8%~~
~~Chemicals~~	~~2%~~
Materials, plant and equipment	20%
Other	not stated
Total	55%

In other price reviews, it is not uncommon to see regulators focus mainly on major cost items. But in this case, it feels like Ofwat is narrowing its field of vision far too much. As evidence of this, I note that:

- in its 2010 and 2015 Bristol Water determinations, the CC/CMA considered six categories of wholesale opex input price inflation, leaving it with a residual 'other' amount of only 6-12% of totex;[6]
- in its 2014 price control for NI Water, the NI Utility Regulator had ten totex input cost categories, leaving an 'other' amount of only 5%;[7] and
- in its 2014 decision for NIE – as an example of practice in another industry – the CC considered four input types and had an 'other' basket of 11-15% of totex.[8]

In these other price reviews, the regulators were therefore able to obtain a much more comprehensive picture of aggregate input price inflation. I think that Ofwat should be seeking to compile a similarly thorough assessment in PR19. For example, Ofwat could, without much difficulty:

- discard Europe Economics' arbitrary 10% cut-off line and admit analysis of all separately identifiable input cost categories; and
- dig deeper into what at the moment feels like an over-sized bucket of 'other' costs with a view to ascertaining if this expenditure can be further broken down into meaningful cost categories or is otherwise allocatable to labour, materials etc. input types.

Once armed with an understanding of the input price inflation driving, say, 80-90% of expenditure, Ofwat will be able to make more robust conclusions about future cost escalation. This will be essential if Ofwat accepts the recommendations in section 3 and proceeds to make a stand-alone RPE allowance. But I also note, as an aside, that it would also be vital if Ofwat were to continue with its comparative approach. (As things stand, Ofwat has satisfied itself that there

[6] CC (2010), Bristol Water plc, appendix K; and CMA (2015), Bristol Water plc.
[7] Utility Regulator (2014), Water and sewerage services price control 2015-21: final determination, annexes O and S, available at: https://www.uregni.gov.uk/publications/pc15-final-determination
[8] CC (2014), Northern Ireland Electricity Limited, appendix 11.1, available at: https://assets.publishing.service.gov.uk/media/534cd4b4ed915d630e000041/appendices-glossary.pdf

is a reasonable mapping between 55-65% or so of companies' input costs and 55-65% or so of CPIH. But it cannot conclude its analysis of RPEs without having some confidence that the other 35-45% of water industry input costs also map reasonably well to the remaining 35-45% of CPIH (which likely includes CPIH basket items like agriculture products, goods manufactured in less-developed countries and housing costs, many of which will not match up readily to water industry cost categories).)

4.2 Use of independent forecasts

Arguably the most eye-catching aspect of Europe Economics', and, by implication, Ofwat's approach to RPEs is the consultant's out-of-hand dismissal of the OBR's and BEIS' forecasts of real wage inflation and electricity prices, respectively.

At the time of writing, the OBR and BEIS each have central forecasts in which wages and electricity prices escalate on a path that differs from forecast CPIH inflation. I would have thought it natural and obvious that an economic regulator like Ofwat should factor these independent forecasts into its AMP7 cost projections.

Europe Economics, though, advises against this. Its reasons for not using the OBR and BEIS projections is "the lack of reliability" of previous OBR and BEIS forecasts"[9]. This is a very odd position to take. The last ten years have been a very challenging period for all economic forecasters, and it is undoubtedly the case that many previous forecasts turned out to be wrong. However, it is a very big leap to say that the latest OBR and government forecasts should now simply be ignored. This is a particularly worrying position to take when Europe Economics separately acknowledges that OBR and BEIS projections are 'in the pack' with other economic forecasts – essentially, Europe Economics is advising Ofwat not only to disregard two highly regarded forecasts, but also to pay no attention to expert opinion more generally.

The folly in this position becomes even more clear one recognises that Europe Economics actually wants Ofwat to supplant consensus forecasts with Europe Economics' own house take on input prices – i.e. that all types of input price can reasonably be assumed to move in line with CPIH inflation. I would have hoped that Ofwat would have been able to see that this is an extreme position. It means, for example, that Ofwat is assuming that a typical UK household is not going to see any real wage growth and accompanying improvement in living standards over a seven-year period, having already suffered an unprecedented loss of purchasing power over the ten years since the global financial crisis. This is not an inadmissible prediction, but it sits well outside of mainstream thinking and ought, at the very least, to have been acknowledged and defended as such by Ofwat in its own document.

4.3 Management control

The final criterion on Europe Economics'/Ofwat's RPEs list requires Ofwat to be satisfied that exposure to input price pressures is not something that management can control. On the face of it, this is a reasonable test to apply, but the particular way in Europe Economics interprets 'controllability' is not very intuitive.

At various points, Europe Economics points out that companies can:

[9] Europe Economics report p.24 and p.30.

- control labour and materials costs by tying staff and contractors into long-term contracts;
- hedge against future volatility in energy prices; and
- substitute from expensive inputs to cheaper alternatives.

In all of these cases, I think that Europe Economics is conflating the question of whether firms can take steps to *manage* input price pressures with the question of whether firms can take steps to *avoid* input price increases entirely. It may well be that long-term contracts, hedging and input substitution constitute sensible management action in the face of input inflation risks, but it is not at all clear that they enable companies to side-step cost increases for a full seven-year period. I would have thought it likely that long-term contracts, for example, would entail factoring upfront a basic level of cost escalation into future wages, electricity purchases costs and supply chain prices. A firm might be able to protect itself to some degree against future input price volatility via such contracts but it is highly unlikely that it will be able to persuade the people and businesses it contracts with to go on supplying inputs to it at 2017/18 prices all the way to through to 2024/25.

As such, I do not find Europe Economics' fourth criterion adds a great deal to the discussion.

5. OTHER OBSERVATIONS: PRODUCTIVITY GROWTH

Ofwat's allowance for productivity growth comprises:

- a long-term, underlying water and sewerage industry productivity growth trend; and
- a short-term boost to productivity growth in AMP6 and AMP7 arising from Ofwat's PR14 switch towards totex and outcome regulation.

5.1 The water industry's underlying productivity growth potential

Ofwat's and Europe Economics' analysis of the natural, long-term rate of productivity growth in the water industry sits much more consistently with analysis carried out by regulators in other sectors. Europe Economics' conclusions – i.e. that companies might be able to increase productivity by between 0.6% and 1.2% per annum – are also broadly in line with the conclusions reached in other periodic reviews, as set out in table 3.

Table 3: Assumptions made by regulators about rates of annual frontier productivity growth

	Opex	Capex
CC, Bristol Water, 2010	0.9%	-
Ofgem, RIIO-GD1/T1, 2012	1.0%	0.7%
CC, Northern Ireland Electricity, 2014	1.0%	1.0%
Ofgem, RIIO-ED1, 2014	1.0%	0.7% to 1.1%
Utility Regulator, NI Water, 2014	0.9%	0.6%
CMA, Bristol Water, 2015	1.0%	-
Utility Regulator, GD17, 2016	1.0%	1.0%
Ofwat, PR19, 2019 (current consultation range)	0.6% to 1.2%	

The one departure that I can see from standard regulatory practice is Europe Economics' remark that in calculating the upper bound of its range it "takes note of Ofwat's approach of setting stretching performance targets for the water sector" and so "focuses on the TFP growth performance of the stronger performing comparator sectors (rather than taking an average across all comparator sectors as we do for determining the lower bound)". This turns what is otherwise a very logical piece of benchmarking into an apples-to-pears comparison to rates of productivity growth in other parts of the UK economy. It means, in particular, that Ofwat is asked to discard comparisons to the construction and transport and storage sectors of the economy. These two sectors always feature prominently in any 'nature of work' benchmarking, principally because a significant proportion of water and sewerage companies' costs come from activities that entail construction, transport and storage. I do not think that they can dismissed in the course of a consultant's attempt to manufacture a range.

This said, the main observation that I wish to make on productivity growth is that Ofwat ought to be reflecting in PR19 much more than it has on the implications of the slowdown in productivity growth that has affected the UK and the other western economies since the global financial crisis. This is one of the big macroeconomic issues of the day, yet, curiously, it does not get a single mention in Ofwat's January 2019 document.

The following charts and tables hopefully bring out the importance of the point. Table 4 contains the ONS' estimates of average annual total factor productivity growth over the period 1998 to 2018, together with the Bank of England's forecast out to 2022. It can be seen that the Bank of England is currently expecting productivity to grow at less than half the rate seen prior to the onset of the global financial crisis.

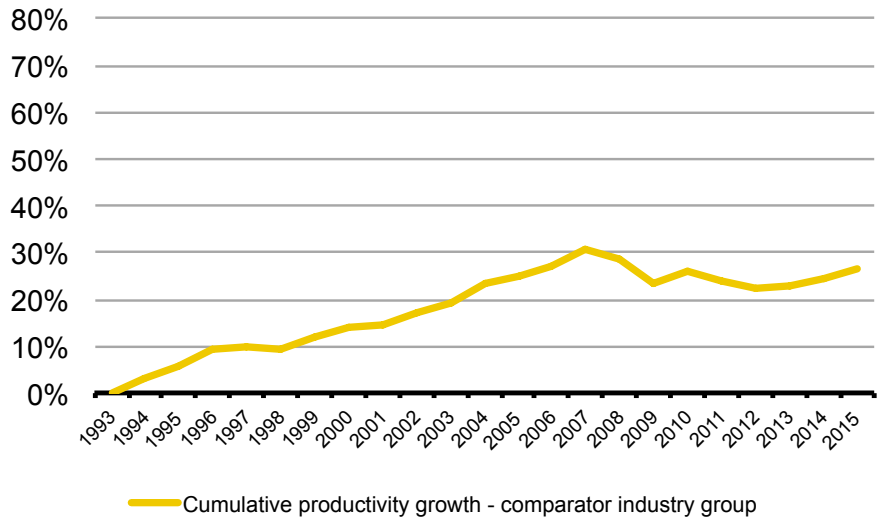
Table 4: Bank of England estimates of annual total factor productivity growth

	1998-07	2008-10	2011-14	2015-18Q3	2018Q4-22Q1
TFP growth	1.0%	-0.6%	-0.1%	0.2%	0.3%

Figure 3 shows that the sectors which Ofwat and Europe Economics (and other regulators/consultants) pick out as useful comparators for the water and sewerage industry[10] have been as affected as any other parts of the economy by stalled productivity growth.

[10] The full set of comparator industries feeding into this calculation is: construction; manufacture of chemicals and chemical products; manufacture of electrical and optical equipment; manufacture of transport equipment; transport and storage; electricity, gas & water supply; sale, maintenance and repair of motor vehicles and the retail supply of fuel; renting of machinery and equipment and other business activities; finance, insurance, real estate and business services; financial intermediation; post and telecommunications.

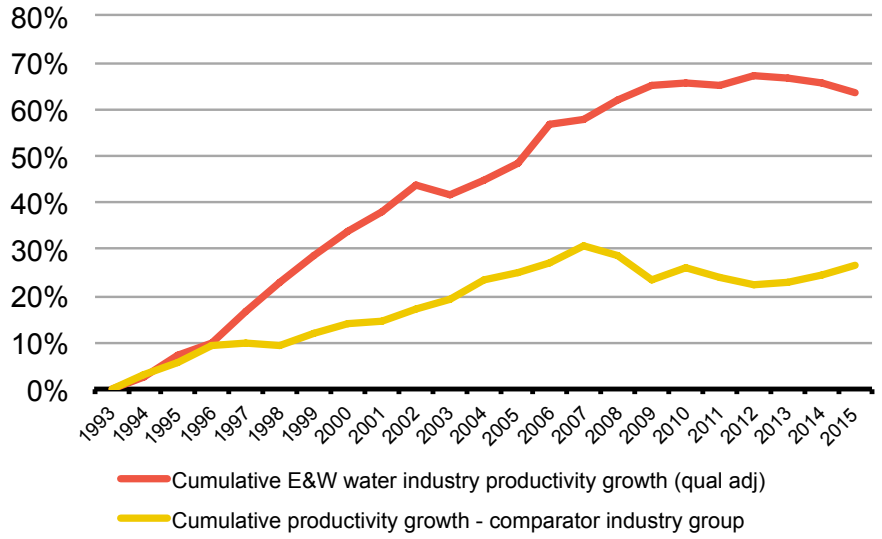
Figure 3: Total factor productivity growth in comparator sectors to the water and sewerage industry (cumulative)



Source: Frontier Economics.

Figure 4 reproduces analysis published by Frontier Economics in late 2017, which indicates that the productivity growth in the water industry has also been broadly flat in recent years.

Figure 4: Total factor productivity growth (cumulative)



Source: Frontier Economics.

These numbers are clearly telling an important story. A variety of explanations have been put forward for the "productivity puzzle" that the table and charts depict. I provide a brief survey in the box below.

Box 2: Explanations for the fall in productivity growth

The following is a synthesis of research and views that have come from the Bank of England, the Office of National Statistics and the Office for Budget Responsibility (OBR) during the last 12 months. References are given in the appendix.

Sector-specific effects

When economists have dug below the whole-economy productivity data, they have found that certain sectors of the economy have contributed disproportionately to lower/flat productivity growth.

A chief culprit is the finance sector. Prior to the financial crisis, the finance sector was one of the engines of UK GDP and productivity growth. Since 2008, the ratio of output to inputs in this industry has fallen markedly. This can be seen to be a function of the underlying credit cycle: in the good times leading up to recession, increased leverage and higher risk taking boosted activity and sector revenues beyond sustainable levels; since the credit bubble burst, activity levels have fallen off and profits have been much harder to come by.

The contraction – which to some extent has been a deliberately policy choice – is estimated to account for as much as two fifths of the UK's recent loss of productivity growth.

Lower capital investment

Other sectors which have contributed disproportionately to the slowdown in productivity growth include manufacturing, professional services and ICT. In these sectors, there are not the kind of exceptional circumstances like there are in the finance sector. Instead, attention has been given to lower levels of R&D and capital investment, over-reliance on labour and the effect that capital shallowing might have had on innovation and productivity growth.

Some of the possible reasons for low under-investment are intertwined with factors that I go on to pick out under subsequent headings below. However, one over-arching narrative is that managers might have become more risk averse after living through the financial crisis. This risk aversion appears to have caused firms to prefer to deleverage or accumulate cash reserves rather than invest, especially where new investment entails borrowing or taking on risk.

In the last two years, uncertainties about Brexit may also have had an effect on UK firms' appetites for new investment.

Market concentration and competition between firms

Empirical work suggests that there is a noticeable and growing disparity between efficient companies that operate at the frontier of their industries and a long-tail of less efficient, non-frontier companies that fail to keep pace with innovation. Normally one would expect to see a diffusion of technical progress across firms. In recent years, this doesn't appear to have been happening to the same extent as in the past.

This could be because there are increasingly large barriers to competition in modern-day markets, e.g. restrictions on patents and intellectual property. It could also be because certain

markets are more concentrated than in the past, with larger players dominating certain sectors and firms generally facing much less in the way of competitive threat from rival firms.

Loose monetary policy

Some commentators have argued that there is a link between accommodative interest rate policy and low productivity growth. The contention is that loose monetary policy has primarily benefited low-productivity companies who might otherwise have failed, and that policy actions may therefore have inhibited the processes of "creative destruction" that would normally affect industries.

The continued existence of these "zombie firms" may be regarded as a problem in its own right. But there may also have been a multiplier effect if the survival of low-productivity firms has prevented the reallocation of labour and capital to more productive sectors of the economy.

Slower technological progress

Some economists believe that the persistence of low productivity growth, not just in the UK but across much of the developed world, is evidence that there has been a slowdown in innate technological progress. This could be because there are inherently diminishing returns from new research and development. Or it could be because the particular revolution that has been impacting on the global economy since the 1990s, centring on the harnessing of IT, is now quite mature, meaning that current and future waves of IT innovations are unlikely to have the same potential as past innovations.

At first sight, it might seem like a regulated, monopoly industry like the water and sewerage sector should be less affected by the above developments in comparison to other industries. However, it is important to remember that modern-day network businesses tend to contract a significant proportion of their expenditures through alliance and other supply chain partners. Even if regulated companies should not have been unduly affected internally by some of the above factors, any sense in which increasing market concentration, lower R&D and capital investment, a slowdown in the rate of creative destruction, etc. have weighed at all on the contractor market would mean that the resulting slowdown in productivity growth will ultimately also feed through into a slowdown in overall water industry productivity growth.

In the circumstances, I do not think that it is tenable for companies or Ofwat to assume automatically that productivity growth in the rest of AMP6 and throughout AMP7 will come out in line with the rates of productivity growth that were seen up to 2007. Europe Economics does recognise this when they set the lower bound of their range with reference to EU KLEMS data for a more recent 2010-14 period. However, I do not think that this is sufficient, for two reasons:

- first, the 0.6% is a curiously high number when put next to the ONS' flat productivity data[11] for the whole 2008-17 period (see table 4) . This is because Europe Economics is putting undue weight on the immediate bounce-back that there was from the very low,

[11] Available at: https://www.ons.gov.uk/economy/economicoutputandproductivity/productivitymeasures/datasets/multifactorproductivityexperimentalestimatesreferencetables

middle-of-recession productivity levels in its chosen base year of 2009 and overlooking evidence of stagnant productivity over a longer time horizon; and

- second, Ofwat and other stakeholders can easily misinterpret a presented range to be a reflection of inherent imprecision in productivity measurement rather than a function of very different perspectives on future economic fundamentals.

When it comes to make its draft and final determinations, I think Ofwat has to select a point productivity estimate based on the position that it takes on the uncertainties that I have just outlined – i.e. it can go towards the top of the Europe Economics range if it judges that companies are capable of replicating pre-2008 productivity growth with near-immediate effect or it can go towards the bottom end of the range (or lower) if it considers that there are short-to-medium term obstacles to productivity improvement in the sector. Not only will this make its regulatory judgment more transparent, it also precludes the possibility that RPE forecasts and assumptions about productivity growth become misaligned – e.g. if Ofwat were to settle on a relatively low real wage forecast but a relatively high productivity growth figure.

5.2 Uplift for totex and outcome regulation

The rate of productivity growth that Ofwat allows for in its initial assessment of plans includes an uplift to the Europe Economics 0.6% to 1.2% range. This uplift comes principally from a report by KPMG, which argues that the PR14 switch to totex and outcomes regulation has enabled water and sewerage companies to make additional productivity gains during the 2015-20 regulatory period and will continue to exert a downward influence on costs in the 2020-25 regulatory period.

The numerical evidence that KPMG relies upon in its report relates primarily to the totex performance of electricity distribution network operators (DNOs) during the early part of the 2015-23 RIIO-ED1 price control period. I urge extreme caution in attributing what is actually quite a modest amount of DNO out-performance[12] to totex- and outcomes-driven ongoing efficiency improvement, for a number of reasons:

- first, it is incontrovertibly the case that some of the DNOs' under-spending against Ofgem's RIIO-ED1 allowances has been due to slower-than-forecast GDP growth and slower-than-expected technological change, e.g. in relation to the take-up of electric vehicles and heat pumps.[13] KPMG should not be confusing this under-spending with efficiency improvement;

- second, Ofwat will be aware that there have been criticisms in recent years about the alleged 'softness' of Ofgem's determinations (see, for example, the Citizens Advice report Energy Consumers' Missing Billions,[14] the Energy and Climate Change Committee report Energy Network Costs: Transparent and Fair?[15] and Dieter Helm's Cost of Energy

[12] Ofgem's latest RIIO-ED1 annual report states that companies expect to underspend eight-year totex allowances by 5%. See Ofgem (2019), RIIO-ED1 annual report 2017/19, para 4.20, available at: https://www.ofgem.gov.uk/system/files/docs/2019/03/riio-ed1_annual_report_2017-18.pdf
[13] ibid. para 4.11.
[14] https://www.citizensadvice.org.uk/Global/CitizensAdvice/Energy/EnergyConsumersMissingBillions.pdf
[15] https://www.publications.parliament.uk/pa/cm201415/cmselect/cmenergy/386/386.pdf

Review[16]). While I do not necessarily agree with these critiques, they do serve to illustrate an important point, namely that out-performance can be as much about the quality of a regulator's starting baseline as of year-on-year efficiency improvement; and

- finally, and most obviously, even if it were possible to establish that energy networks have made genuine new productivity improvements, it is would be impossible to attribute the savings to specific regulatory innovations or to conclude that companies in the water sector are capable of replicating the DNOs' productivity performance over a ten-year period.

Rather than grasp for simple takeaways from the complex experiences of a different class of regulated company, Ofwat is far better off concentrating on the actions that water companies have taken since 2015 and on the behaviours that it think its PR19 framework of incentives are likely to stimulate. On the first of these points, KPMG presents case studies which indicate that totex and outcome regulation have unlocked genuine whole-life cost savings. The main question I have after reading this material is: how many of these initiatives led to a reduction in recurring *botex*? The thinking is normally that:

- totex regulation encourages firms to take on opex solutions where previously companies would have preferred capex solutions, implying that totex regulation might have increased not reduced AMP6 botex; and
- one desirable consequence of outcome regulation is to encourage companies to go beyond their performance commitments within period if and/when there is customer benefit in incurring additional expenditure in order to further improve customer outcomes. This might also have led to higher costs at some companies since 2015.

If am not sure, therefore, that I see the direct link that Ofwat is seeing between totex/outcomes regulation and *botex* reduction. I note that KPMG explicitly states that its numbers relate to the scope for *totex* reduction, and I worry, in the absence of any clear statement from Ofwat on the transmission mechanism between regulatory incentives and recurring costs, that Ofwat is mistakenly loading a quite flimsily justified totex reduction target on to exactly the wrong part of companies' cost allowances.

6. CONCLUSION

The critique set out in this paper leads me to conclude that Ofwat needs to make some quite fundamental changes to its January 2019 analysis before it issues its draft and final PR19 determinations. My main recommendations are as follows.

1. Ofwat should reconstitute its analysis of RPEs and productivity growth under a more standard methodological framework in preference to the pick'n'mix approach given to it by Europe Economics.

2. The analysis of RPEs should extend to all major cost categories, with the aim of covering at least 80-90% of totex by value.

16 https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/654902/Cost_of_Energy_Review.pdf

3. Ofwat by default should use OBR/BEIS/consensus forecasts of input prices, where available, as the best current predictions of input price changes, unless Ofwat has compelling insights as an expert regulator to justify departing from independent projections.

4. In its analysis of productivity growth, Ofwat should consider more explicitly the observable slowdown in the rates of productivity growth in the wider economy and the implications that this might have for water company / water industry contractor costs.

5. Before layering on a stretch productivity target, Ofwat should explain clearly why totex and outcome regulation should lead and has led to reductions in recurring botex (as opposed to reductions in whole-life costs).

The first three suggestions on this list would do no more than align Ofwat's PR19 methodology with what I think is widely considered to be best regulatory practice. The fourth recommendation is one that I have been making to companies and regulators since late 2016 when the OBR and the Bank of England started cutting growth forecasts (i.e. after the regulatory decisions listed in table 3 in this paper). It reflects my sense that it is increasingly untenable for regulators to use the hitherto sensible ~1% rule-of-thumb for frontier productivity growth that emerged from regulators' analysis of pre-2008 productivity data. The fifth point is more specific to PR19.

I do not know how much Ofwat's initial CPIH – 1.5% estimate of frontier shift might change if it takes these suggestions on board. Indeed, I would caution anyone from trying to pre-judge what a 'reasonable' frontier shift number might prior to completing a detailed analysis of both RPEs and productivity growth potential. As I noted in section 2, there are some goods and services whose costs/prices increase quite naturally ahead of CPIH inflation and other goods and services who costs/prices tend to move on a below-CPIH trend, and at the moment there is no reason that I can think of why one should presume a priori that water and sewerage costs will necessarily fit to a greater or a lesser extent into one of these categories.

What is clear is that Ofwat's conclusions on frontier shift are a very significant element in the PR19 cost assessment. It is not therefore sufficient to take a relaxed, hands-off approach to RPEs and/or productivity growth on the grounds that companies and customers will split any forecasting error, say, 50:50, as Ofwat seemed to imply in January. The difference between a frontier shift assumption computed on the basis of robust, defensible assumptions and a frontier shift assumption computed using a faulty methodology could easily be worth at least ±5% of industry totex by 2024/25, and I would hope that Ofwat will be willing to give the issues raised in this paper as much focus as any other totex item that impacts bills to tune of several hundreds of millions of pounds.

Appendix: References for further reading on the UK productivity puzzle

Bank of England (2017), Productivity puzzles – speech by Andy Haldane, Chief Economist

https://www.bankofengland.co.uk/-/media/boe/files/speech/2017/productivity-puzzles.pdf?la=en&hash=708C7CFD5E8417000655BA4AA0E0E873D98A18DE

Bank of England (2018), The fall in productivity growth: causes and implication – speech by Silvana Tenreyro, External MPC member

https://www.bankofengland.co.uk/-/media/boe/files/speech/2018/the-fall-in-productivity-growth-causes-and-implications.pdf?la=en&hash=FC604765727E702F0DEB4DE5EE779F87DD7E9EAD

Bank of England (2018), The UK's productivity growth challenge – speech by Dave Ramsden, Deputy Governor

https://www.bankofengland.co.uk/-/media/boe/files/speech/2018/the-uks-productivity-growth-challenge.pdf?la=en&hash=67858DDD61D3946EFFC24CB00EEE4AE7791721D5

Bank of England (2019), Inflation report, February

https://www.bankofengland.co.uk/-/media/boe/files/inflation-report/2019/february/inflation-report-february-2019.pdf

OBR (2017), Economic and fiscal outlook, November

http://cdn.obr.uk/Nov2017EFOwebversion-2.pdf

Frontier Economics (2017), Productivity improvement in the water and sewerage industry in England since privatisation

https://www.dropbox.com/s/39373yt7ir364iq/Water%20UK%20Frontier%20-%20Productivity.PDF?dl=0

Ajayi, Ayani, Pollitt (2018), Productivity in the electricity and gas networks since 1990

https://www.ofgem.gov.uk/system/files/docs/2019/01/ofgem_productivity_report_dec_2018_1.pdf