Retail HH input price pressure and benchmarking analysis

A report for Yorkshire Water

June 2014

Economic Insight

Document contents

1. Executive Summary

This report sets out a range of highly detailed evidence to quantify the appropriate net adjustment that should be made to Yorkshire's allowed cost to serve within the retail HH control relating to input price pressure.

The features of our analyses – and the resulting conclusions are as follows:

(i) Firstly, in order to meet Ofwat's 'three step' test – and to ensure that only appropriate input price pressure is allowed for, ***it is necessary to 'net off' any efficiency savings Yorkshire could make from 'gross' input price pressure.***

(ii) In order to inform the above, ***we have developed a range of highly detailed quantitative (including econometric analysis) and qualitative evidence,*** which informs both: (i) the size of the gross input price pressure faced by Yorkshire; and (ii) the efficiency savings it could make.

(iii) Our approach includes ***benchmarking, both within the water industry, but also more widely.***

(iv) Based on the range of evidence set out here, ***Yorkshire should be allowed a total net input price pressure adjustment of 1.78% per annum on average over the period 2014/15 to 2019/20*** (1.93% over PR14). This is substantially lower than the net claimed figure of 2.90% in Yorkshire's December Plan.

1.1. Introduction and context

In its December Retail HH Business Plan for PR14, Yorkshire included assumed input price pressure of £39.7m over the whole period, which was based on an assumption regarding: (i) the overall input price pressure it would face; less (ii) overall productivity savings for the industry.

Through its Risk Based Review process, Ofwat rejected Yorkshire's initial claim on the grounds that it was insufficiently evidenced. Specific points made by the regulator included that: (i) the company had not made appropriate assumptions regarding wage cost inflation; (ii) its assumption regarding productivity related savings was not appropriate; and (iii) it had not included benchmarking evidence to support its claim.

Relatedly, Ofwat has advised companies more generally that it will only allow for retail cost adjustments (within its average cost to serve framework) where:

- they have a material impact on costs;
- are beyond management control (having taken all possible steps to control it); and
- impact the company in a materially different way to other companies.

In the above context, Yorkshire commissioned Economic Insight to take forward a range of analyses to support its final retail HH Business Plan's assumptions regarding input price pressure.

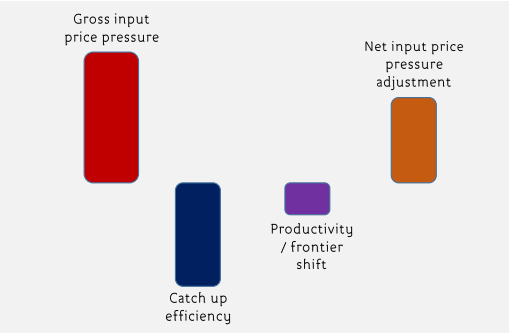
1.2. Our approach and methodology

Our approach to taking forward the analyses set out in this report is to start from economics first principles, which suggest that in competitive markets efficient firms would generally be expected to pass on input price pressure to their customers.

Consequently, we think that the last two pillars of Ofwat's 'three step' test regarding retail cost adjustments fundamentally rest on the question of 'how' efficient Yorkshire is. That is to say, if Yorkshire is relatively efficient compared to a relevant benchmark then, by definition, input price pressure would be less within management control and would impact it more materially than would be the case for a less efficient company (as the inefficient company would have greater scope to absorb this pressure).

Our framework, therefore, is one that starts from the proposition that the net amount of input price pressure that Yorkshire should claim for should take account of both: (i) the productivity gains that could be made across the industry as a whole (i.e. that even an efficient firm could make); and (ii) any further efficiency savings Yorkshire could make as the result of catching up to a defined efficient frontier. In simple terms, our approach is intended to ensure that only cost pressure that is outside of management control and which impacts Yorkshire more materially than other companies is claimed for. Our framework is illustrated below.

Figure 1: Illustration of our framework



Source: Economic Insight

In practice, although Ofwat has set an efficiency challenge in retail HH based on the average cost to serve, it has not: (a) published any assessment of the frontier or benchmark for efficiency; nor (b) has it released any industry wide benchmarking model. That is not to say that Ofwat *should* have adopted a frontier benchmarking approach to the retail HH controls. Rather, it merely implies that, in order for us to appropriately quantify Yorkshire's net input price pressure claim, we have had to reach our own views regarding these matters.

> "Our approach is intended to ensure that only cost pressure that is outside of management control and which impacts Yorkshire more materially than other companies is claimed for."

In the above context, our approach has been to develop a wide range of highly detailed evidence, based on a number of methodologies. These include:

- ***Within industry benchmarking,*** where we have undertaken aggregate level retail unit cost comparisons, disaggregated retail unit cost comparisons; and econometric analysis.

- ***Wider industry benchmarking,*** where we have: compared Yorkshire's retail HH cost to serve with those for energy retailers and mobile virtual network operators; undertaken staff cost benchmarking; and qualitatively reviewed the company's cost management practices.

In relation to the above, it is critical to understand that there is no single robust way to calculate an appropriate level of catch up efficiency for Yorkshire. Here the objective, therefore, is to use

"The wider context for our work is one in which Yorkshire has a strong track record with regard to relative efficiency within the industry - and therefore one might expect it to have lower scope to make efficiency gains than other companies in the HH retail space."

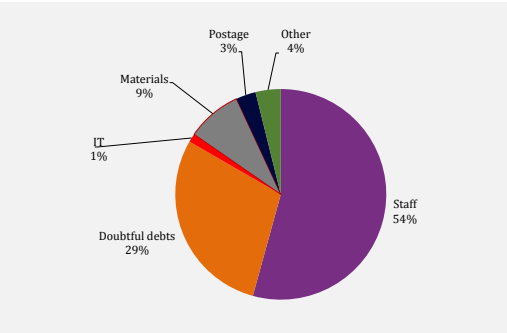
a range of evidence to ensure that, collectively, there is a robust basis for quantifying the company's net input price pressure claim. Importantly, we do not think that Ofwat necessarily needs to agree with any one particular methodology or piece of analysis in order to approve Yorkshire's claim (for example, approving the claim need not mean agreeing with any particular definition of the efficient frontier for retail HH).

Critically, the wider context for our work is one in which Yorkshire has a strong track record with regards to relative efficiency within the industry – and therefore, one might expect it to have lower scope to make efficiency gains than other companies in the retail HH space. Indeed, we note that in PR09 Ofwat selected Yorkshire as the frontier benchmark for water service efficiency. With regards to sewerage services, Yorkshire was ranked third. In both areas the regulator classified the company as being in Band A.

1.3. Gross Input price pressure evidence

In order to estimate the 'gross' input price pressure faced by Yorkshire in retail HH (from which estimated efficiency savings are deducted), our start point was to identify the most relevant historical inflation metrics and then map them to key retail cost categories. Data from Yorkshire shows that the vast majority of its retail HH costs relate to either staff or bad debt.

Figure 2: Split of Yorkshire retail HH costs



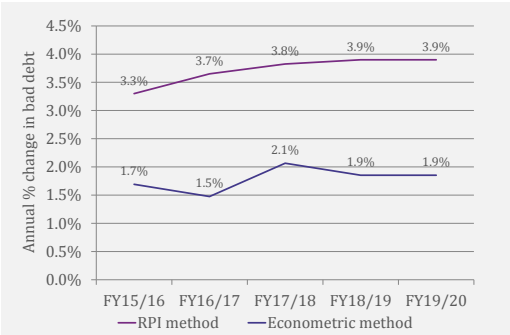
Source: Economic Insight analysis of Yorkshire cost data

For staff related costs, our mapping to historical price pressure data was particularly detailed. Specifically, Yorkshire provided us with a full list of retail functions / roles, with corresponding headcounts and costs (in all, some 27 roles were identified, illustrating the level of detail involved in this analysis). We then mapped each individual function / role to occupational level wage inflation data from the Annual Survey of Hours and Earnings and then used this to construct a weighted average wage index for Yorkshire. For the other key retail HH cost categories, we similarly sought to identify the most relevant inflationary driver (all sourced from ONS).

As we need to derive *projected* input price pressure, we have forecast our individual historical data forward based on the relationship between our individual price pressure measures and aggregate inflation measures – for which there are publically available forecasts (specifically CPI, but in the case of staff costs, overall UK wage inflation). We have measured the historic relationship in terms of a 'wedge' between the relevant aggregate index and our individual measures (as this is the framework HM Treasury / ONS / OBR uses when considering differences between inflation measures).

In relation to bad debt input price pressure, a simplistic approach would be to base this on RPI (the rationale being that bill size is a key driver of these costs, and that bill size is a function of the wholesale price controls, in which RPI will be allowed). However, such an approach would omit the countervailing *downward* cost pressure arising from an expected improvement in the macroeconomic environment over PR14 (which should, in turn, reduce deprivation). For this reason we have undertaken econometric modelling that links projected gross bad debt cost pressure for Yorkshire to its underlying drivers (including bill size and key macroeconomic parameters); and have used this as the basis for our forecasts. This, therefore, provides a highly robust basis for determining Yorkshire's future gross price pressure relating to bad debt. Furthermore, and as shown below, our approach (as expected) results in a materially *lower* forecast level of gross input price pressure for bad debt than would be implied by a simple RPI approach.

Figure 3: Bad debt input price pressure implied by econometrics versus RPI



Source: Economic Insight analysis of ONS data

The key benefits of our overall approach to estimating gross input price pressure are that: (i) it reflects, at a very detailed level, the actual mix of input costs and appropriate measures of related input price pressures Yorkshire will face; and (ii) links projections for those to publically available, credible, wider inflationary metrics.

In conclusion, our analysis suggests a gross input price pressure of 2.78% per annum on average for Yorkshire over the period 2014/15 to 2019/20.

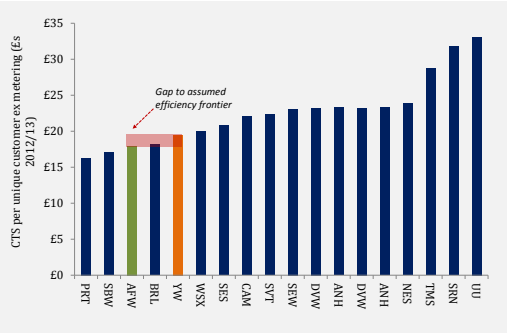
1.4. Benchmarking to determine catch up factors

In order to determine an appropriate assumption for Yorkshire's scope to make catch up efficiency savings in the retail HH space, we undertook both within and wider industry benchmarking.

Our within industry benchmarking includes aggregate level unit cost to serve comparisons, disaggregated unit cost to serve comparisons and an econometric analysis.

In all cases, the precise selection of the frontier/benchmark is somewhat subjective. However, if we apply the historical regulatory approach of discounting companies with a turnover <2%-3% of the industry, an aggregate CTS comparison (excluding metering costs, which Ofwat assesses separately) shows that Yorkshire is already close to the frontier, as illustrated in Figure 4. This is consistent with the company's strong track-record on relative efficiency.

Figure 4 Average CTS ex metering



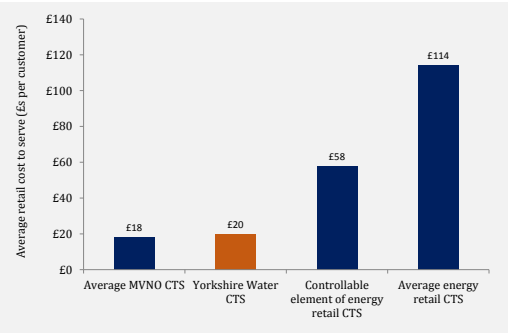
Source: Economic Insight analysis of regulatory accounting data

Given the inherent uncertainty regarding: (a) the selection of the frontier; (b) the extent to which any cost differentials (or in the case of econometrics, the residuals) genuinely reflect inefficiency; and (c) the time period over which companies could genuinely close the gap to the frontier, we have estimated both 'low' and 'high' catch up factors under each methodology. Under the low case we assume that 50% of any gap could be closed during PR14. Under the high case, we assume 60% of the gap could be closed.

Our econometric analysis provides a further methodology for 'within industry' benchmarking. This method is, from an analytical perspective, superior to unit cost comparisons, as it removes some subjectivity regarding appropriate adjustments for economies of scale and scope. This methodology suggests that Yorkshire has zero scope to make catch up efficiency gains.

Of course, one may take the view that the appropriate frontier should be set with reference to retailers in other (i.e. non-water) industries. Consequently, we have also undertaken wider cross industry benchmarking. In practical terms, it must be noted that the benchmarking of operating costs *across* industries is notoriously difficult. In particular, differences in the precise services being provided drive differences in activities and, therefore, the efficient costs that need to be incurred. Therefore, care must be taken in the interpretation of any such cross sector comparisons. Nonetheless, we were able to derive comparable unit cost to serve measures, particularly in relation to mobile virtual network operators and energy retailers where, as shown below, Yorkshire has a relatively low cost to serve. *(Note, limitations in publically available data mean that our cross industry comparators are based on averages across all relevant suppliers).*

Figure 5: Cost to serve across industries



Source: Economic Insight

Finally, the following table summarises the annual catch up factors for Yorkshire implied by our different methodologies.

Table 1 Summary of catch up factors implied by alternative methodologies

Bench-marking method	Implied pa % saving
Aggregate unit cost	**0.84% - 1.01%**
Econometrics	**0.00%**
Wider industry bench-marking	**0.84% - 1.00%**

Source: Economic Insight analysis

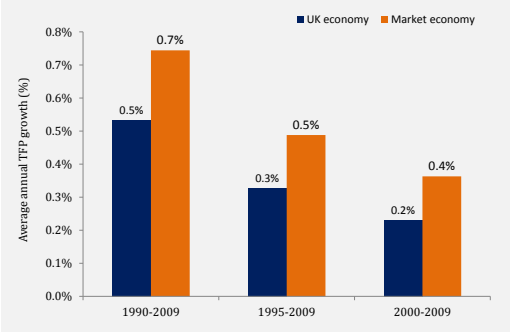
On the basis of the evidence set out above, we suggest that ***the appropriate scope for Yorkshire to make catch up related efficiency savings over PR14 is 0.5% per annum,*** being a mid-point between the overall range of 0.0% and 1.0%.

1.5. Conclusions and recommendations

In order to reach a final view on the net input price pressure Yorkshire will face, we also had to consider what the scope for total factor productivity improvements might be (i.e. the savings even an efficient firm could make). Here we note that, through RBR, Yorkshire was previously advised that its assumption in its December Plan of 0.3% per annum savings was inappropriate.

For the purpose of providing our estimates, ***we recommend that Yorkshire assumes TFP growth of 0.5% per annum,*** which is based on the private sector as a whole in the UK, averaged over 15 years to 2009 (inclusive). This is because, in our view, there is no reason to suppose that the retail element of water companies should not, in the long-run, be able to match private sector gains. This is, however, a relatively aggressive assumption.

Figure 6 TFP growth



Source: Economic Insight analysis of EU KLEMS data

An important point of detail regarding how our final recommendations should be applied in practice relates to the fact that the ACTS for the start of PR14 will be based on 2013/14 data. For this reason we have extended our analysis to include 2014/15, in addition to the PR14 period. This is to ensure that the appropriate amount of input price pressure is incorporated within Yorkshire's retail HH Plan.

Bringing all of the evidence set out here together, our view is that Yorkshire Water will face net input price pressure in its retail HH business of 1.78% per annum on average over the period 2014/15 to 2019/20 (1.93% per annum over PR14). This is substantially lower than the net claimed amount of 2.90% per annum in Yorkshire's December Plan. The details of our assessment are shown in the table below, year-by-year. Recognising the inherent uncertainty regarding forecasts for key parameters (particularly in any individual year), we believe it would be reasonable to apply the average figure in each year, should Yorkshire wish to spread the bill impact of its claim more evenly. We consider this to be a robust, and reasonable, view.

Table 2 Summary of net input price pressure recommendations

	2014 / 15	2015 / 16	2016 / 17	2017 / 18	2018 / 19	2019/20	Average over period
Gross input price pressure (%)	*2.00%*	2.69%	2.80%	3.03%	3.00%	3.15%	2.78%
Catch up efficiency savings (%)	*0.50%*	0.50%	0.50%	0.50%	0.50%	0.50%	0.50%
TFP savings (%)	*0.50%*	0.50%	0.50%	0.50%	0.50%	0.50%	0.50%
YW net input price pressure claim (%)	***1.00%***	**1.69%**	**1.80%**	**2.03%**	**2.00%**	**2.15%**	**1.78%**

Source: Economic Insight

2. Introduction and framework

This introductory section sets out the context for our work for Yorkshire Water, and describes the analytical framework we have used in order to assess the company's case for allowing input price pressure within its Retail HH Business Plan.

Our approach to providing this analysis for Yorkshire Water is to focus on the guidance and criteria set out by Ofwat with regards to companies evidencing the need for adjustments to the average cost to serve measure. Consistent with this, there are three key elements to our framework.

(i) Firstly, ***it depends on being able to robustly identify and evidence*** the nature and quantum of *gross* input cost price pressure that Yorkshire Water faces over the period 2014/15 to 2019/20.

(ii) Secondly – and critically – in order to quantify the amount that should be allowed for (and to show that any pressure impacts Yorkshire more than other companies) ***a detailed assessment of Yorkshire's relative efficiency is essential.*** This is because only costs that Yorkshire cannot control – for example, by absorbing them through efficiency savings – should be claimed for.

(iii) Thirdly, to determine Yorkshire's relative efficiency, one must reach a view as to the appropriate 'frontier'. This can be informed by ***comparative benchmarking, both within the water industry, but also more widely.***

2.1. Introduction

Within the scope of the retail HH control for PR14, Ofwat's approach is to set allowed revenues on the basis of companies being able to recover:

- the lower of the calculated industry average cost to serve (ACTS) and companies' actual projected cost to serve (CTS); and
- an allowed net operating margin – set on an EBIT basis.

The framework Ofwat has adopted also includes adjustments to allowed costs to reflect: (i) economies of scope; and (ii) differing levels of metering.

Unlike the wholesale controls, however, the approach does not explicitly or automatically allow companies to recover the impact of general inflation on their retail cost base. Rather, Ofwat's position is that it is for companies themselves to make the case as to whether they face uncontrollable input price pressures, which would be appropriate to pass onto customers.

In the above context, Yorkshire Water (Yorkshire) commissioned Economic Insight to develop a range of analyses and evidence to help determine: (a) the extent of any uncontrollable input price pressure it faces with respect to retail HH; and (b) to quantify the impact of this for the purpose of making a submission to Ofwat. The scope of our work was primarily focused on the benchmarking analysis required to determine Yorkshire's relative efficiency (and, therefore, ability to absorb gross input price pressure).

This report sets out the details of our analysis and findings – and is structured as follows:

- The remainder of this section provides further context as to Ofwat's overall approach to the retail HH control and ACTS adjustments; Yorkshire's previous analysis of input price pressure; and the analytical framework we have developed in the current analyses.
- Section 3 sets out our quantification of the likely gross input price pressure Yorkshire faces in relation to retail HH. This is based on a range of robust data sources and evidence.
- Section 4 contains a 'within water industry' benchmarking analysis, which seeks to assess Yorkshire's current efficiency in the retail HH market relative to other water companies.
- Section 5 contains a 'cross industry' benchmarking analysis, in which we seek to compare key retail HH cost items for Yorkshire with a wider set of industries in order to provide an alternative view of Yorkshire's relative efficiency.
- Finally, Section 6 sets out our findings and conclusions, including a summary of Yorkshire's quantified claim for input price pressures.

2.2. Overview of the regulatory framework for the retail HH control

In order to determine the appropriate analytical approach to quantifying Yorkshire's claim for input price pressure, it is important to have a clear understanding of the overall methodology for setting the retail HH control.

This is because the key components of the control (allowed costs, cost controllability, efficiency, and allowed retail margins) are all intrinsically linked. Consequently, it is critical to ensure that the assumptions for each individual element are internally consistent in order for the overall retail settlement to be coherent. For example, one might consider whether the net regulated EBIT margin represents the return that an efficient retailer would earn – and, if so, whether the specific comparators were used to set the margin face input price pressure and whether this is typically passed on to end prices. If, for example, the comparators used to set the EBIT margin included input price pressure, then this could imply either that: (i) the regulated margins are too low; and/or (ii) that input price pressure should be allowed for within the HH retail control. We consider this issue further subsequently.

In this section we therefore briefly summarise Ofwat's approach to the retail HH control, addressing in turn how the regulator sets:

- net EBIT margins;
- the ACTS measure;
- the efficiency challenge linked to ACTS; and
- any potential further adjustments to ACTS (other than those explicitly allowed for in Ofwat's framework).

2.2.1. Retail HH margins set on a net EBIT basis

Within the retail HH control, Ofwat determined to set allowed returns on a net EBIT margin basis, reflecting the low capital intensity of the retail part of the business.

Ofwat's assessment of the appropriate EBIT margin was informed by a report by PwC[1], which contained:

[1] *'Water retail net margins a report prepared for Ofwat.' PwC (February 2014).*

- Benchmarking analysis – a comparison of EBIT retail margins earned in other sectors (but also regulatory determinations); and
- A return on capital analysis – which derived the EBIT margin required in order for the retail business to earn a reasonable return on capex and working capital (although this was positioned as a 'cross check', with more weight being attached to comparator evidence).

In its Risk and Reward Guidance[2], Ofwat ultimately determined that for retail HH, a net EBIT margin of 1.0% was appropriate. In reaching this view, Ofwat stated that: *"our assessment of appropriate household retail net margins relies primarily on benchmarking regulatory determinations. The regulatory benchmarks provide a better guide to margins, as they relate to determinations with little or no competition."*[3] Specific regulatory determinations referenced by Ofwat (and in PwC's report on retail margins) are shown in the Table 3.

Table 3 Regulatory determinations referenced by PwC

Determination	Allowed EBIT (%)
Commission for Energy Regulation (2012)	2.0%
Utility Regulator Northern Ireland (2011)	1.7%
Commission for Energy Regulation (2010)	1.3%
Utility Regulator Northern Ireland (2009)	1.5%
Water Industry Commission Scotland (2005)	3.2%
Ofgem / Offer (1998)	1.5%
Monopolies and Mergers Commission (1995)	0.5%
Offer (1994)	0.5%

Source: PwC report (Table 3)

The rationale for relying more heavily on regulatory precedent than actual observed margins in competitive markets could be questioned, to some extent. An underlying principle of regulatory price controls in monopoly areas is that one is (typically) seeking to replicate the returns an efficient operator could earn in a competitive market – and therefore, evidence on returns in suitably comparable, competitive, markets, is highly relevant.

Notwithstanding the above, as the allowed retail HH EBIT margin is based on the regulatory precedent summarised previously, it is essential to examine whether and how both efficiency and inflation were allowed for within those same determinations (as without this assessment, it is difficult to gauge the appropriateness of allowing for input price pressure adjustments for PR14). We have therefore reviewed these and the results of our review are summarised in the table shown on the next page.

[2] *'Setting price controls for 2015-20 – risk and reward guidance.' Ofwat (January 2014).*

[3] *'Setting price controls for 2015-20 – risk and reward guidance.' Ofwat (January 2014). Page 30.*

Table 4 Allowed costs in determinations

Determination	Inflation allowed?	Efficiency targets?
Commission for Energy Regulation (2012)	Yes[4]	Yes (3%)[5]
Utility Regulator Northern Ireland (2011)	Yes[6]	Yes[7]
Commission for Energy Regulation (2010)	Yes[8]	Yes[9]
Utility Regulator Northern Ireland (2009)	Yes[10]	Yes (2.5%)[11]
Water Industry Commission Scotland (2005)	Yes (RPI-X)[12]	Yes[13]
Ofgem / Offer (1998)	Yes (RPI-X)[14]	Yes[15]
Monopolies and Mergers Commission / Scottish Hydro (1995)	Yes[16]	Yes (3%)[17]

Source: Regulatory determinations

The fact that, as shown above, the regulatory determinations that were relied upon in order to set the retail margin explicitly allowed for inflation is a relevant consideration when assessing the appropriateness of company input price pressure claims for PR14.

2.2.2. Allowed costs based on ACTS

Ofwat will calculate an industry ACTS by taking an unweighted average of companies' actual CTS using 2013/14 data (as this will be the latest available data at the point in time at which the regulator makes its final determinations). The ACTS will be based on the number of unique customers, with two key industry-wide adjustments.

Firstly, as differing metering levels can drive differences in costs, Ofwat will calculates the CTS for each company (on which the ACTS is based) on the basis of unique customers for unmeasured customers only, *excluding all metering costs*.

Secondly, the definition of unique customers Ofwat will use for calculating the unmeasured CTS includes an adjustment factor of 1.3 for dual customers, to reflect economies of scope. So that in total, *unique customers* are defined as being:

$$\begin{aligned} &Unique\ customers \\ &= 1.3 * number\ of\ dual\ customers \\ &+ number\ of\ water\ only\ customers \\ &+ number\ of\ wastewater\ only\ customers \end{aligned}$$

On the above basis, Ofwat has set out the full calculation of *unmeasured CTS* as follows:

$$\text{CTS} = \frac{\begin{aligned} &Opex - metering\ costs + depreciation \\ &+ modification\ for\ new\ costs \\ &+ Adjustments \end{aligned}}{No\ of\ unique\ customers}$$

The regulator will then take an unweighted average of the CTS for each company to derive the ACTS for unmeasured HH customers.

Cost of serving metered customers

The additional cost of servicing metering customers will be calculated separately at an industry level (the motivation being to avoid dis-incentivising metering). The additional metering related CTS is calculated as follows:

$$Add\ measured\ CTS = \frac{Total\ metering\ costs}{Unique\ metered\ custs}$$

The following table (see next page) sets out Ofwat's latest industry ACTS estimates, as published in its Draft Determination Notice.

4 *The key factor providing upward pressure on the tariffs are increases in network tariffs. (See Executive Summary of determination document). Page 19 also includes details on adjustment for inflation*

5 *See page 18 of determination document*

6 *Control is set on a 'cost pass through' model, which by definition allows for inflation.*

7 *See page 14 of determination document*

8 *See CER's relevant final determination paper: 'CER 10/182.' (October 2010).*

9 *See section 3.4.2 of determination document*

10 *Inflation costs (assumed at 4% RPI for 2008) were treated as a pass through (page 6 of determination document)*

11 *See section 4.1 of determination document*

12 *Page 363 - 369 shows that retail gross margin (which includes allowed retail opex, financing costs and retail return) are consistent with the wider RPI-X framework – and so retail inflation is included.*

13 *Efficiency targets set out in Table 35.28 of determination document*

14 *See section 6.8 of document – but note PwC's reference to a consultation document, not any actual determination.*

15 *See section 3.3 of document – but note, PwC's reference is to a consultation document, not any actual determination.*

16 *The key factor providing upward pressure on the tariffs are increases in network tariffs. (see Executive Summary of determination document). Page 19 also includes details on adjustment for inflation*

17 *See page 18 of determination document*

Table 5 Ofwat's estimated industry ACTS (2012/13 prices)

Customer type	ACTS (£s per cust)
Unmetered single service	£22.29
Unmetered water and sewerage	£28.98
Metered water only	£28.52
Metered sewerage only	£25.81
Metered water and sewerage	£35.46

Source: Ofwat Draft Determination Notice: Technical Appendix – Table A14

2.2.3. Efficiency challenge based on a glide-path

Having identified companies' relative CTS position, Ofwat will apply an efficiency challenge based on its ACTS measure.

In particular, for companies whose actual CTS is above ACTS in the years 2015/16, 2016/17 or 2017/18, they will be allowed costs consistent with a three year glide path down to the ACTS so that, by 2018/19, they will only be allowed the ACTS. For 2018/19 all companies will only be allowed the lower of their forecast CTS or the ACTS.

For companies whose actual CTS is below the ACTS in any given year, they will only be allowed their CTS (i.e. the aim being that companies can only receive the *lower* of their CTS or the industry ACTS).

Here, it is important to note that: (i) the ACTS measure is not linked to any underlying assessment of efficiency with regards to retail costs (which we discuss further in the following); and (ii) as the ACTS calculation will be based on 2013/14 data, it is appropriate to assess Yorkshire's net input price pressure over the period 2014/15 to 2019/20 (inclusive).

2.2.4. Regulatory guidance regarding adjustments to ACTS and allowed retail HH costs

Ofwat has set out a '3 gate' process for allowing company specific adjustments to the ACTS, which is that the relevant issue:

- Has a material impact on costs (which is defined as costs being >= 2.25% of total AMP6 retail expenditure).
- Is beyond management control (having taken all possible steps to control it).
- Impacts the company in a materially different way to other companies.[18]

Ofwat's general feedback to the industry regarding claims for retail cost adjustments (and in particular, input price pressure related adjustments) was that no company had provided sufficient evidence to demonstrate that they were efficient at managing input price pressure. The regulator further indicated that further required evidence would include:

- quantitative benchmarking relative to other industries beyond the water sector; and
- evidence that companies are efficient across the main cost domains (such as labour) – again compared to cross sectoral benchmarks within and beyond the water sector.

2.3. Yorkshire's previous analysis of input price pressure

In Yorkshire's December PR14 Plan submission, it proposed an adjustment to its allowed retail HH costs relating to input price pressure of £39.7m (out of a total retail cost base for 2015-2020 of £297m).

Yorkshire's claim was based on an assumed gross input price pressure of 3.2% on average, against which productivity related savings of 0.3% per annum were netted off (i.e. a net claim of 2.9% per annum).[19] These assumptions were based on evidence set out in a report by First Economics.

Yorkshire's claim made no assumptions regarding the company being able to make 'catch up' efficiency savings relative to an assumed frontier – a point we address in our framework and approach (discussed subsequently).

[18] *See slides from 'Ofwat Retail Workshop.' (April 2014).*

[19] *See Yorkshire Water's HH Retail Plan, Chapter 8 'financing the Plan', figure 8B.*

2.3.1. Initial assessment of Yorkshire's previous analysis

Through its Risk Based Review (RBR) process, Ofwat rejected Yorkshire's initial claim for input price pressure, stating: *"For the input price pressure adjustment, Yorkshire provided insufficient evidence that such costs are outside of management control and affect them in a materially different way to other companies."*[20]

Ofwat made a number of further specific points in commenting on Yorkshire's initial claim, which are as follows:

- That the evidence Yorkshire provided regarding whether the input price pressure was outside of management control relied upon assumptions.
- That with regard to 'failing to demonstrate that the input price pressure affected the company in a materially different way' Yorkshire had not provided convincing evidence. The regulator specifically referred to Yorkshire failing to provide benchmarking analysis.
- That Yorkshire's approach for quantifying the impact of input price inflation was not appropriate. In particular, in forecasting labour costs, Yorkshire had used OBR's earnings escalator and ONS data on private sector earnings, whereas Ofwat's view was that ONS sourced data on call centre operator's earnings would have been more appropriate. Secondly, Ofwat commented that Yorkshire had used a mixture of 'mid-ranges' and 'averages' for other forecasts, which was not consistent.
- Finally, Ofwat stated that Yorkshire's measure of total factor productivity (TFP) was not appropriate.[21]

2.4. The context of Yorkshire's historical position as an efficient company

It is important to consider the analysis and evidence set out in our report in the context of Yorkshire's historical efficiency performance – and Ofwat's assessment thereof.

In particular, Yorkshire has a strong track record with regards to efficiency. Indeed, over the previous two price controls, the company has consistently been regarded as one of the most efficient in the industry by Ofwat. In particular, we note that:

- At PR09 Ofwat selected Yorkshire as the frontier benchmark for water service efficiency (Yorkshire was ranked fourth out of all the water and sewerage companies). With regards to sewerage services, Yorkshire was ranked third. In both areas Ofwat classified the company as being in Band A.
- At PR04 Yorkshire was set as the frontier for opex sewerage services; and was classified as Band A for water. Yorkshire was also deemed to be the most efficient company on capital maintenance (based on the combined results for cost base and econometrics).

2.5. Our framework for considering the impact of input price pressure

In taking forward our analysis for Yorkshire, we have developed an analytical framework that we consider to be: (i) robust from an economics best practice perspective; and (ii) consistent with Ofwat's three step test for allowing ACTS adjustments.

The underlying rationale for our approach is that – as is well established in the academic economics literature – in competitive markets, efficient firms that experience cost pressures would generally pass these on to end customers.

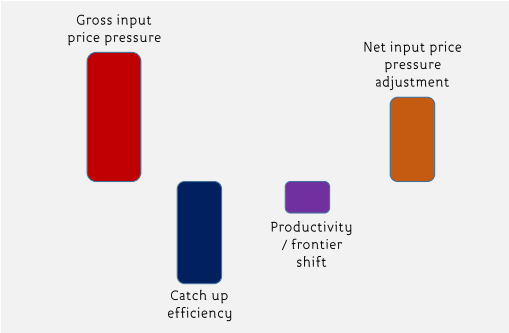
With this context in mind, we suggest that the most economically appropriate interpretation of the second two parts to Ofwat's test (i.e. that any input price pressure is beyond management control; and affects a company in a materially different way to other companies) is that the extent of any input price pressure that companies should be allowed to pass on depends on their current and future efficiency, relative to a defined 'frontier'.

That is to say, to the extent that a company is already efficient (for example, were a company already at the frontier) then clearly: (i) any input price pressure it experienced would arguably, already be outside of management control; and (ii) that input price pressure would affect it more materially than other, less efficient, companies who could absorb some of that pressure by reducing costs that are within management control. Therefore, at a high level, our framework is one that seeks to quantify Yorkshire's claim for input price pressure by 'netting off' any efficiency savings it could make (either by catching up to the frontier, or as a result of general productivity gains) against any 'gross' input price pressures. This framework is summarised in the following figure (see next page).

[20] *'2014 price review risk-based review – recommendation to Ofwat's Board on Yorkshire Water's business plan categorisation.' Ofwat (April 2014). Page 17.*

[21] *Ofwat's detailed comments are set out in its 'Element categorisation scorecards.' (April 2014).*

Figure 7: Illustration of our framework



Source: Economic Insight

2.6. Our methodology

The above framework is conceptually consistent with Ofwat's three step test. However, in order to meet the regulator's requirements 'in practice', this framework needs to be supported by detailed qualitative and quantitative evidence. We have therefore developed a practical methodology that achieves this – of which there are three core parts:

- A robust assessment of the 'gross' input price pressure Yorkshire is likely to face, based on a detailed assessment of Yorkshire's underlying retail HH cost data, and an identification of appropriate price pressure indices.

- To ensure that we only claim for costs that are outside of management control / affect Yorkshire more than other companies, an efficiency benchmarking analysis. Recognising the uncertainty inherent in such approaches, we have applied four different methodologies: (i) a within industry aggregate unit cost benchmarking analysis; (ii) a within industry line item unit cost benchmarking analysis; (iii) a within industry econometric benchmarking analysis; and (iv) a wider industry unit cost benchmarking analysis. This quantitative analysis is supplemented by a qualitative assessment of Yorkshire's cost management practices. By taking a 'multi-tiered' approach, our objective is to provide a range of robust and reasonable estimates as to the savings Yorkshire could make in retail HH, which should be netted off against gross input price pressure.

- Finally, we have estimated the scope for frontier shift by reaching a view on the potential total factor productivity gains that could be made. This is based on EU KLEMS data – and we have made relatively aggressive assumptions, linking our estimate to private market productivity data, reflecting the privatised nature of the water industry and our view that, in principle, we see no reason to suppose that water retailers could not match private sector performance more generally with regards to productivity.

In addition, in developing the detail of our methodology, we have further sought to address the specific, detailed points Ofwat made to Yorkshire regarding its initial input price pressure claim (and as summarised previously). Here the objective is to ensure that Ofwat can be confident that Yorkshire has evidenced and quantified its claim in as robust, and transparent, manner as possible.

"Our framework is one that seeks to quantify Yorkshire's claim for input price pressure by 'netting off' any efficiency savings it could make (either by catching up to the frontier or as a result of general productivity gains) against any 'gross' input price pressures."

3. Input price pressure analysis

This section contains a quantification of the future expected gross input price pressure faced by Yorkshire Water. Our estimated input price pressures are subsequently adjusted downwards to reflect our assessment of the efficiency savings Yorkshire could make – which are detailed in the following sections of this report.

The key aspects of our input price pressure analysis for Yorkshire are as follows.

(i) Our approach has been to identify ***specific historical inflation metrics to map to individual retail cost items for Yorkshire.***

(ii) That for staff related costs, this exercise was particularly detailed, and ***specific staff roles / functions have been mapped to individual occupational level inflation data.***

(iii) We have forecast our individual historical data forward based on its relationship with aggregate inflation measures such as CPI. ***The projections are then linked to official OBR forecasts (e.g. for CPI) to ensure consistency, robustness and transparency.***

(iv) ***Our forecast input price pressure for bad debt is based on our own econometric modelling,*** which takes into account the mitigating impact of an expected improvement in the UK economy over PR14.

(v) Over the period 2014/15 to 2019/20, ***we expect Yorkshire to face gross input price pressure of 2.78% per annum*** on average. However, to quantify Yorkshire's claim, we subsequently deduct both frontier and catch up efficiency from this estimate.

3.1. Overview of our approach to input price pressure analysis

In this section we provide evidence as to the *gross* input price pressure Yorkshire will face over the period 2014/15 to 2019/20. Here it is important to note that, under our approach, in order to ensure that Yorkshire's claim *only* relates to input price pressure that is outside of management control (and affects it more materially than other companies) we subsequently 'net off' our assessment of any efficiency savings we think the company could make over the period (which are based on analyses set out in the subsequent sections of this report).

Consequently, here we are not concerned with whether or how much of the identified pressure is controllable or not. Rather, we are simply seeking to quantify the likely input price pressure that will apply to Yorkshire prior to it taking any mitigating actions.

The methodology we have adopted in order to derive the gross input price pressure is as follows:

» Firstly, for each of Yorkshire's key retail HH cost components, we have identified the most relevant available ***historical*** inflation data, and examined this over time (typically 10 years).

» With regard to staff costs, the above step was based on a very detailed review of the functional roles within Yorkshire's retail HH business where, for each role, we identified historical data based on mapping the role to a specific occupation using ASHE/ONS data.

» As we are interested in ***projected*** input price pressure over the period, we then analysed the historical relationship between our individual input price measures and aggregate inflation (specifically CPI, but in the case of our Yorkshire wage measure, wider economy wage inflation) defined in terms of the percentage point 'wedge', which is how OBR/ONS link RPI and CPI. We then projected our measures forward using OBR forecasts for the aggregate measures, assuming that the historical relationship (i.e. the wedge) between those aggregate measures and our detailed measures holds.

» Finally, to derive Yorkshire's *overall* gross forecast input price pressure for the period, we weight our individual projections by the company's current cost split by category.

We believe that the above approach represents a robust and reasonable methodology for deriving Yorkshire's gross input price pressure. In particular, we consider the approach of linking detailed historical data to OBR forecasts to be particularly important, given that:

- we need to estimate *projected* input price pressure, and historical inflationary pressures may not proxy this;
- that, at the level of detail we have sought to undertake our analysis, reliable forecasts are not available (e.g. there are no official forecasts of call centre staff costs); and
- the OBR's forecasts are generally considered to be robust and are often relied upon in regulatory and competition law determinations.

The remainder of this section is structured as follows:

» Firstly, we set out Yorkshire's historical split of retail HH costs by key category.

» Secondly, we set out our assessment of Yorkshire's gross projected input price pressures for each of the individual retail cost categories.

» We then provide our assessment of the total gross input price pressure Yorkshire will face over the period 2014/15 to 2019/20 (from which efficiency savings should be deducted).

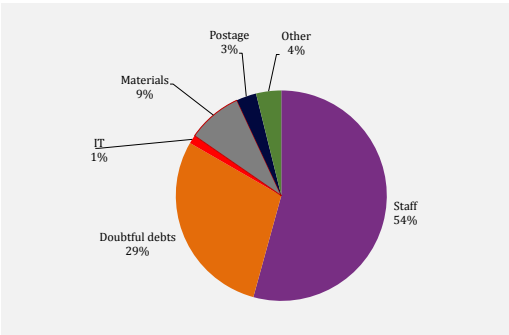
3.2. Yorkshire's retail HH cost split

Yorkshire provided us with a detailed breakdown of its retail HH operating costs. Having reviewed this, we determined that a sensible categorisation of costs for the purposes of projecting input price pressure was as follows:

- staff;
- doubtful debts;
- postage;
- materials;
- IT; and
- Other.

The pie chart below shows the percentage split of the above retail HH costs for Yorkshire based on 2012/13 data.

Figure 8: Split of Yorkshire retail HH costs



Source: Economic Insight analysis of Yorkshire cost data

The above data shows that the overall input price pressure index for Yorkshire will primarily be driven by what one assumes regarding future staff

costs, and future doubtful debt costs. Nonetheless, we have also sought to identify the appropriate measures of price pressure for all of the above categories, as set out in the following sections.

The above split is broadly similar to those published by First Economics in its report for Water UK, although for Yorkshire staff costs represent a slightly higher proportion of the total (54% versus 45% in the First Economics report).[22] We note, however, that the First Economics splits were based on a survey across companies, whereas here we are focused on Yorkshire, which we think is appropriate because:

- our objective is to identify the input price pressure that applies to Yorkshire; and
- Yorkshire is more efficient than the average water retailer, and therefore its split may be more representative of an efficient mix of inputs.

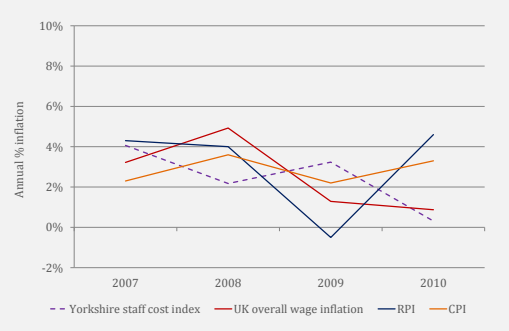
3.3. Staff input price pressure

In order to project input price pressure relating to staff costs, we asked Yorkshire to provide us with a detailed breakdown of its retail HH staff costs by function / role. For each function / role, we then mapped it to an individual 'occupation' within the Annual Survey of Hours and Earnings (ASHE) as published by the ONS – this was undertaken with input from the Company – and our detailed mappings are shown in the table on the following page.

From the ASHE, we collected input data as far back as 2006 up until 2013 (as there was a major SIC code revision in 2007, which makes any time series data before that period difficult to compare with more recent data). However, on examination of the data, we determined to focus on the period 2007-2010 (inclusive), as a further SIC code reclassification in 2010 raised similar issues. Therefore, for each Yorkshire retail HH role / function, we had a measure of the relevant wage inflation from 2007-2010 (for our other cost measures we typically use 10 years' of data).

We then calculated an overall staff inflation index for Yorkshire, by weighting the historical inflation data for each individual role by Yorkshire's estimated headcounts for those roles. Figure 9 compares the historical index we calculated against CPI, RPI and overall UK wage inflation as reported by the ASHE.

Figure 9: Historical wage inflation



Source: Economic Insight analysis of ONS and YW data

Over the time period as a whole, our calculated Yorkshire wage index inflation was 2.45%, which is – on average – lower than CPI and RPI, and also slightly below overall wage inflation (-0.13 percentage points lower on average).

As noted previously, for our purposes we ultimately need to project input price pressure for Yorkshire for the period 2014/15 to 2019/20. In the case of staff related input price pressures, we have done this by assuming that the average historical 'wedge' between our calculated index for Yorkshire and overall UK wage inflation holds going forward. We therefore applied the historical wedge to the OBR's official forecasts for wage inflation for the period.

The results of this are shown in the table at the bottom of the page. ***Our methodology results in assumed input price pressure for staff costs for Yorkshire that are below the OBR's overall forecasts for UK wage inflation.***

Table 6 Projected staff input price pressure

	2014 / 15	2015 / 16	2016 / 17	2017 / 18	2018 / 19	2019/ 20
OBR projected earnings inflation per employee (%)						
Projected YW wage input price pressure for retail HH (%)						

Source: Economic Insight analysis and OBR

[22] *'Assessing Potential Changes in Retail Costs, 2015 to 2020.' First Economics (2013).*

Table 7 Detailed mapping of YW staff roles to occupational level inflation data

Yorkshire Water retail HH staff roles	Estimated headcount	Mapping to ASHE / ONS wage data	Average annual wage inflation 2007-2010
[redacted]	[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	[redacted]	[redacted]
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[redacted]	[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	[redacted]	[redacted]
[redacted]			[redacted]

Source: Economic Insight analysis of ASHE and Yorkshire Water data

3.4. Doubtful debt input price pressure

With regard to doubtful debt costs, it is widely understood that the key input price pressures that are, to a degree, outside of *retail* management control are:

- bill size; and
- deprivation (and relatedly, the wider macroeconomic environment).

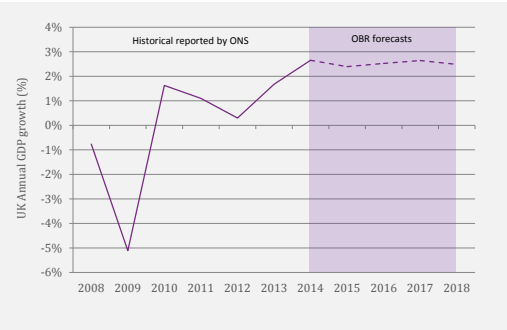
Indeed, Ofwat has accepted the principle of the above cost drivers in considering company retail cost adjustment claims in relation to bad debt (i.e. explaining variances in unit bad debt costs *across companies*).

As the bill size of a water company is primarily driven by its regulated wholesale prices; then, logically, the input price pressure the retail part of the business faces is – to a large degree – determined by the 'K factors' Ofwat sets for the water and sewerage wholesale elements of the PR14 price control.

As it is not possible to determine, a priori, what these will be (as they are a function of allowed operating costs, efficiency, capex and the cost of capital) one approach for projecting bad debt gross price pressure would be to project these costs on the basis of RPI (as this will, by definition, be allowed under the regulatory framework for wholesale). This is equivalent to assuming that Ofwat will set a zero K factor.

However, the risk of simply assuming RPI as the basis for projecting bad debt input price pressure is that it ignores the likely impact of the UK's improving macroeconomic environment over PR14, which will most likely lead to reduced deprivation. This, in turn, should provide a countervailing downward pressure on bad debt costs for the companies. To illustrate this, the below chart shows the expected improvement in UK GDP relative to the recent past.

Figure 10: Historical and projected GDP



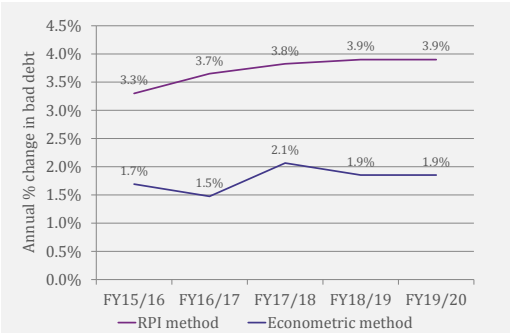
Source: ONS and OBR data[23]

As shown in the previous chart, GDP growth in the UK is expected to be significantly higher, compared to the recent past. We would therefore be concerned that any analysis that did not properly reflect this might materially over-state the likely input price pressure Yorkshire faces in relation to bad debt.

Given the above, we have constructed forecast bad debt cost pressure for Yorkshire based on a detailed econometric modelling analysis, which uses historic data (between 2004/05 and 2011/12) to estimate the relationship between bad debt per property, bill size and two indicators of the health of regional economies – benefits expenditure and gross value added. We then use publically available information to forecast bills, benefits expenditure and gross value added and, with our econometric model, predict the annual growth in bad debt per property over PR14. Further details are set out in Annex A of this report.

The bad debt price pressure projected by our modelling is set out in Table 9 at the end of this section. We find that, on average, Yorkshire is likely to face gross input price pressure of 1.8% per annum in relation to bad debt. As shown in the figure below, our econometric approach, which properly reflects the downward cost pressure arising from the strengthening macroeconomic context, implies materially lower input price pressure for bad debt than a more simplistic RPI based approach.

Figure 11: Bad debt input price pressure implied by econometrics versus RPI



Source: Economic Insight analysis of ONS data

We should also highlight that, as our econometric analysis implies input price pressure for bad debt costs that is below RPI, implicitly our assessment of Yorkshire's net input price pressure assumes bad debt costs decline in real terms over the period on a unit cost basis.

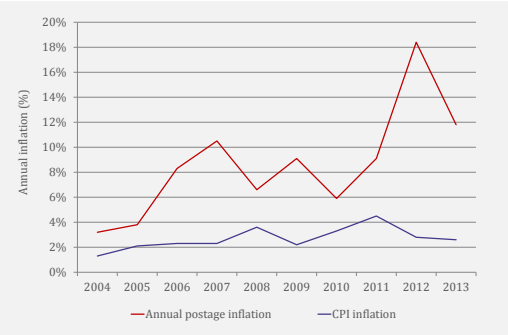
[23] *Historical data from ONS. Measure relates to GPD at market prices, volume chained index. Chart data shown for calendar years.*

3.5. Postage input price pressure

Within its RPI and CPI inflation measures, the ONS provides detailed breakdowns of inflation by individual item, one of which is postage costs.

We therefore examined historical postage inflation back over ten years to 2013, which is compared to CPI in the following figure.

Figure 12: Historical postage inflation



Source: Economic Insight analysis of ONS data

Postage inflation has been materially higher than CPI, particularly in recent years (8.7% over the period). This is not surprising, given that Royal Mail Group (which still has a monopoly position with regard to the wholesale element of its network) was effectively freed from price cap regulation in 2011 by Ofcom.

Consistent with the methodology summarised previously, in order to project postage input price pressure forward over time, we:

- examined the historic wedge between postage inflation and CPI (which we find to be 5.97% over the 10 years);
- obtained the OBR's forecasts for CPI; and
- then assumed the historical wedge over CPI would hold in order to generate expected postal input price pressures.

These are summarised in Table 9, which also includes summaries of our projected input price pressure for: doubtful debt, materials, IT, and 'other' costs (see end of section).

With regard to postage costs, we consider that our approach is likely to be *somewhat conservative.* This is because there is a reasonable prospect that Royal Mail Group will continue to put in price increases that are someway above the longer-term historic average (10 years) that we have used as the basis for our analysis (noting that the Royal Mail Group remains subject to a safeguard price cap with respect to 2nd class stamps, but that this is not linked – in any way – to the likely price profile large business users of post will face).

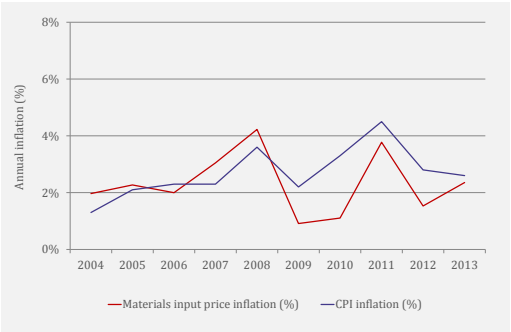
3.6. Materials input price pressure

Whilst the operating cost base of the retail function of water companies largely consists of staff and doubtful debt costs, a relatively modest (9% in the case of Yorkshire) amount of opex is associated with the purchasing of materials – or related activities.

Here it is hard to obtain any meaningful measure of historical 'price' inflation, and so we have used the ONS's published 'input price' data; in order to get a time series of the prices companies pay for materials as inputs into their businesses.[24]

The following chart plots this over the 10 years from 2004 to 2013, relative to CPI (which the data shows it tracks relatively closely).

Figure 13: Historical materials input cost inflation



Source: Economic Insight analysis of ONS data

Over the 10 year period shown, materials input inflation has averaged 2.32%; which, consistent with our approach described elsewhere, we take as our start point.

In order to then project materials input price pressure forward over the relevant period we: (i) calculated the percentage point wedge relative to CPI historically over the 10 year period shown above (which we found to be -0.38%); (ii) extrapolated materials input cost inflation by applying the wedge to the OBR's forecasts for CPI. The implied forecast materials input price pressure is included in Table 9 at the end of this section.

3.7. IT input price pressure

With regard to IT related cost inflation, similar issues arise as set out with respect to materials. That is to say, there is limited 'output price' related information available.

We are aware that First Economics assumed IT cost pressure of 0.7% per annum, based on an experimental dataset that the ONS has published since 2005.[25] We are somewhat reticent to make

[24] *The specific measure used relates to 'machinery and equipment'.*

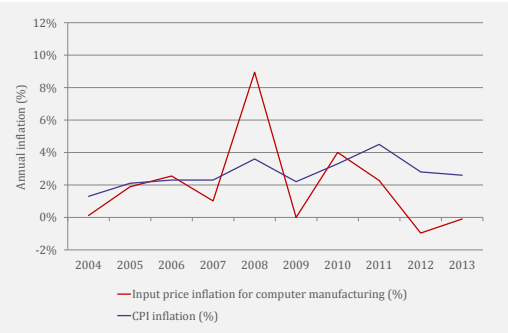
[25] *'Assessing Potential Changes in Retail Costs, 2015 to 2020.' First Economics (2013). Page 13.*

use of this, however, as it is not consistent with our general approach, which is to: (i) identify relevant historical data for the line item in question; then (ii) extrapolate forward based on the relationship between that line item and an aggregate inflation measure, such as CPI.

Given the above we have – as per our measure of materials – used 'input cost' inflation data, as published by the ONS relating to *'inputs for the manufacturing of computers'.* Of the available input cost measures published by the ONS, we consider this to be the most relevant to IT.

As per our other cost categories, we reviewed historical data back over 10 years and compared this to CPI inflation, as shown in Figure 14.

Figure 14: Historical IT input cost inflation



Source: Economic Insight analysis of ONS data

Over the last decade, input costs for computer manufacturing have averaged 1.97%, which is below the long-run average for CPI of 2.70%.

We have projected IT related input price pressure over the time based on applying the historical wedge between our measure and CPI (-0.73 percentage points) to the OBR's CPI forecast, in a manner consistent with the methodology described elsewhere in this report. The projected figures are included in Table 9 at this section's conclusion.

3.8. 'Other' input price pressure

With regard to 'other' retail HH costs for Yorkshire, these include a wide range of items and in total, as shown previously, amount to just 4% of Yorkshire's total costs.

Given the relatively wide mix of items included within this category – and given its relative immateriality to the overall input price pressure index we are seeking to calculate (compared to say, staff or bad debt costs), we think it is reasonable to suppose that forecast CPI inflation represents the most appropriate proxy.

As for RPI, we think that the OBR's forecasts for CPI (which have also been used to derive our forecasts for postage, materials and IT costs) are the most robust; and therefore we use them. The OBR's forecast CPI inflation is shown in Table 8.

Table 8 OBR CPI projections

Year	OBR projected CPI
2014/15	1.93%
2015/16	2.00%
2016/17	2.00%
2017/18	2.00%
2018/19	2.00%
2019/20	2.00%[26]

Source: OBR

3.9. Summary of our projected gross input price pressure for Yorkshire

Having calculated projected input price pressures for each of our key retail HH cost categories (as described in the preceding) the final step is to weight these by Yorkshire's current cost split in order to derive our final projected gross input price pressure for the relevant period. Our final gross input price pressure estimates for Yorkshire's retail HH business are therefore set out in the table on the following page.

It should be noted that our gross input price pressure estimates are *somewhat lower* than those originally proposed by Yorkshire in its December Business Plan submission to Ofwat. Furthermore, we note that:

- Our methodology includes a detailed mapping of retail HH input costs to specific inflation measures – particularly in relation to staff costs.
- That our extrapolation of costs forward is based on a consistent methodology and is rooted in respected independent forecasts for key inflation variables. In particular, we have linked our individual measures to aggregate measures based on the historical percentage point wedge between them, which is consistent with how OBR / ONS / HM Treasury assess the relativity of inflation measures (noting that the alternative would seem to be simply assuming that the historical rate of inflation of our

[26] *There is no forecast for 2019/20 and so we have assumed that it will be equal to the previous year, with the exception of earnings growth, as the OBR has been projecting a steady increase in wage inflation, which we have assumed will continue into 2019/20 based on the historic average forecast growth. All figures presented on an April-March basis.*

detailed measures persists over PR14, which we consider to be a less robust approach).

» That for the purpose of projecting input price pressure with respect to bad debt costs, we have undertaken detailed econometric modelling, which takes into account how likely cost drivers will evolve over time – and their impact on debt costs. In particular, this reflects the fact that an improving macroeconomic environment will exert a countervailing downward pressure on bad debt costs relative to rising bill sizes.

» Finally, from these 'gross' input price pressure estimates, we deduct both: (i) frontier efficiency gains; and (ii) and assumed rate of catch up efficiency for Yorkshire (the latter of which was not included in the company's original claim).

Over the period 2014/15 to 2019/20, we estimate the gross input price pressure faced by Yorkshire in retail HH to be 2.78% per annum on average (2.93% over PR14).

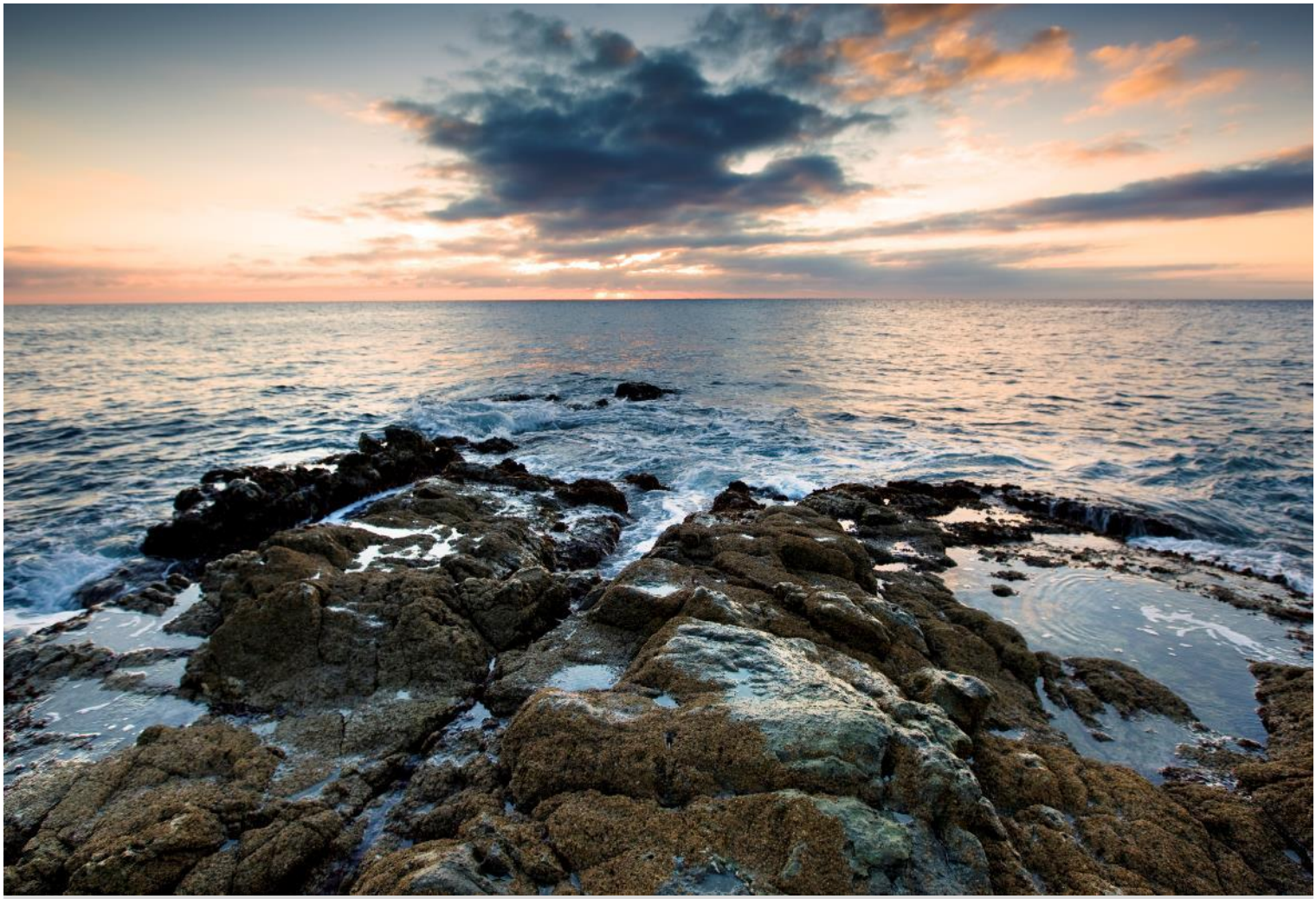
"Over the period 2014/15 to 2019/20, we estimate the gross input price pressure faced by Yorkshire in retail HH to be 2.78% per annum on average."

Table 9 Summary of gross input price assumptions

	2014 / 15	2015 / 16	2016 / 17	2017 / 18	2018 / 19	2019/20	*Weights*
Staff							
Doubtful debts							
IT							
Materials							
Postage							
Other							
Gross input price pressure (%)							

Source: Economic Insight

Weighted average over 2014/15 – 2019/20



4. Within industry benchmarking

This section contains a 'within water industry' benchmarking of Yorkshire's relative efficiency with regards to retail HH. We set out a number of methodologies in order to ensure that there is a robust evidence base on which to build Yorkshire's claim.

Our key messages and findings within this section are as follows:

(i) Our aggregate ***CTS level benchmarking suggests a catch up efficiency factor of 0.84% – 1.01%*** per annum could be appropriate for Yorkshire.

(ii) Our 'disaggregated' line item benchmarking suggests more challenging catch up factors of between 3.56% and 4.28% - although ***we consider it likely that this materially over-states Yorkshire's inefficiency, and so is not suitable.***

(iii) Our econometric analysis suggests that Yorkshire is already at the frontier and so it has ***zero scope to make catch up efficiency gains.***

4.1. Overview of our within industry benchmarking

In this section we set out our 'within industry' benchmarking of Yorkshire's relative efficiency. That is to say, we compare Yorkshire's retail HH costs to those of other water companies.

Under Ofwat's revised regulatory framework for PR14, no 'efficiency frontier' for retail has been publically identified by the regulator. Therefore, here we present three alternative quantitative methodologies for identifying a retail HH efficiency frontier to benchmark Yorkshire against:

- total retail HH unit cost basis;
- disaggregated retail unit cost basis; and
- econometric modelling of efficient retail HH costs.

There are pros and cons with each of the methodologies we employ. In addition, each related set of results carries some uncertainty, about which we are transparent. However, the objective is to provide a number of 'reasonable and robust' approaches, so that across them, we have a sensible range for estimating Yorkshire's relative efficiency (against which input price pressure can be offset).

Importantly, in reviewing the analysis presented here, we do not necessarily expect Ofwat to endorse any particular methodology. Rather, the objective is more to ensure that there is a depth and breadth of evidence that, collectively, provides confidence that Yorkshire's claim for input price pressure is appropriate.

In addition to this quantitative benchmarking, the next section of this report (which benchmarks Yorkshire relative to industries outside of water) also contains a qualitative description and assessment of how Yorkshire currently undertakes its retail HH related cost management. Whilst this qualitative analysis clearly does not help quantify Yorkshire's claim, we consider it to be a relevant and important part of the overall case.

4.2. Unit cost benchmarking

In the following we consider Yorkshire's relative efficiency by comparing its retail costs on a simple unit cost (i.e. CTS) basis with those of other companies. We do this both at an aggregate (i.e. total retail HH) and detailed (individual retail line) level.

As set out in our methodology (Section 2.6), a key difficulty in benchmarking retail costs is the uncertainty regarding precisely how one identifies the frontier. With regard to *the within industry* unit-cost analysis presented in the following, there are three key points to note:

- Firstly, any unit cost based analysis is likely to omit cost drivers that are genuinely outside of management control. All else being equal this could, therefore, over-state the true efficiency savings Yorkshire could make.

- Secondly, a water retailer may not be an accurate measure of the frontier (i.e. because the retail functions of the water industry may be similar to those in other, more efficient, retail service industries, which might in some cases provide a better measure of frontier efficiency). Therefore, the frontier could be lower than the lowest cost water retailer.

- Thirdly, by benchmarking unit costs at an individual retail line level, the result is likely to make Yorkshire appear *less efficient* than it actually is. This is because there may be trade-offs between certain retail cost lines (for example, debt management, call handling and bad debt processes all involve inherent trade-offs). Consequently, a hypothetically frontier efficient retailer firm would most likely not have the lowest costs in *each individual category.* Therefore, some caution should be attached to the line item approach – and so we suggest that the 'aggregate' approach is more meaningful.

Notwithstanding the above, we think that a unit cost approach to approximating the frontier is both helpful and practical. For reasons of simplicity, our start point is to assume that the lowest cost company represents the efficiency frontier (for both the aggregate and line item analysis). Taking this as given, we have quantified the 'efficiency gap' to Yorkshire in £m and percentage terms.

The following analysis is based on 2012/13 retail cost data (as provided to us by Yorkshire). Consequently, it is not based on the actual data Ofwat will use for setting ACTS (2013/14). Nor does it reflect any cost adjustments that may be made for any individual company (such as South West Water's bad debt adjustment claim, or the retail cost reallocations required of Affinity in order to comply with the regulator's guidance).

4.2.1. Aggregate retail HH level

In undertaking our aggregate retail HH unit cost benchmarking, we have taken care to reflect Ofwat's wider methodology for ACTS. We have therefore:

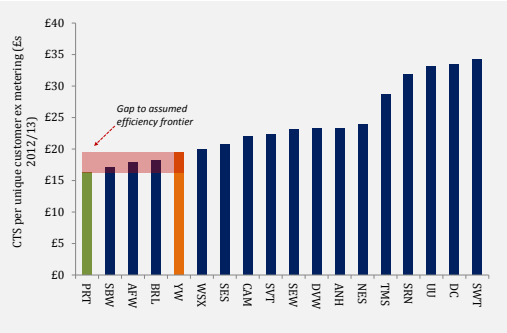
- Separately calculated CTS for retail HH costs *excluding metering costs* – and divided these by the number of unique customers – and then accordingly, calculated the 'gap' between Yorkshire and the frontier (i.e. the lowest cost company). This is defined in terms of the total cost reduction Yorkshire would have to make in order for its unit costs to be the same as the frontier company.

- We have then repeated the above with regard to metering costs only, which are divided by the number of unique metered household customers. The approach to identifying the frontier is as above.
- In both cases, unique customer numbers include Ofwat's adjustment factor of 1.3 for dual service customers, so as to be consistent.
- Finally, the total gap to the frontier is calculated by adding the two gaps for CTS and metered CTS together.
- We then convert this gap into a per annum % catch up factor for Yorkshire – the details of how we do this are set out subsequently.

4.2.1.1. Aggregate unmeasured CTS comparison

Consistent with the above methodology, the following chart shows our analysis of average CTS across the companies, excluding metering costs. On this measure, we find that Yorkshire has the fifth lowest costs in the industry and that, to have unit costs consistent with the 'frontier' (i.e. the lowest cost company, which we find to be Portsmouth) it would need to lower its costs by £8.5m in total.

Figure 15: Aggregate analysis – CTS ex metering

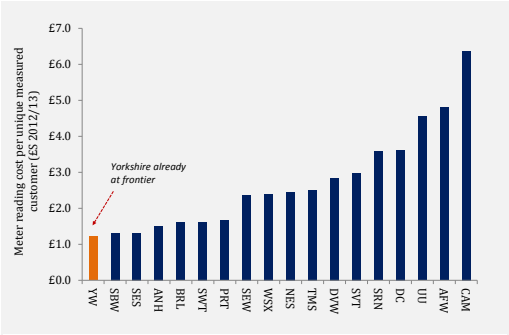


Source: Economic Insight

4.2.1.2. Additional metering CTS comparison

We then repeated the above analysis, but for metering costs only, where the denominator is the number of unique metered customer. Here we find that Yorkshire already has the lowest costs, and so there is no implied efficiency saving to the frontier.

Figure 16: Additional metering CTS analysis



Source: Economic Insight

4.2.1.3. Implied catch up efficiency factors from aggregate unit cost approach

To calculate the efficiency factors implied by the above analysis, we firstly added together the efficiency gap implied by the overall CTS analysis (excluding metering) and the additional metering CTS efficiency gap (which in this case, was zero for Yorkshire).

We then had to make an assumption as to what proportion of this gap could reasonably be expected to be closed over a five year price control period. It is generally accepted within regulatory determinations that even good management practices cannot close the entirety of an efficiency gap in the short term. In addition, uncertainty as to the robustness of any individual efficiency frontier measure means it would be inappropriate to assume 100% of the gap could be closed. Here we have developed two alternative scenarios:

- In the first scenario, we assume that 60% could be closed, in line with Ofwat's previous approach to operating cost benchmarking.
- In the second scenario, we assume that 50% of the gap could be closed, reflecting the fact that: (i) the identification of the frontier firm is subjective and Ofwat has previously determined that Portsmouth is not suitable for this purpose in the previous price control[27]; (ii) Yorkshire is already close to the frontier and has a CTS well below the average – and the marginal scope for making efficiency savings may well diminish as firms that are already relatively efficient, such as Yorkshire, approach the frontier; and (iii) with regard to its historical capital efficiency models, Ofwat assumed that 50% of the gap could be closed – which highlights the subjective nature of determining catch up, and the fact that it is circumstance specific.

We then express the adjusted £m efficiency gap as a percentage of Yorkshire's retail HH costs. Finally, we convert the total percentage gap into a per annum catch up factor by dividing by the five

[27] *'PR09/39: Relative efficiency assessment for operating expenditure 2008-09,' Ofwat (2009). Ofwat concluded that Portsmouth was "too small" to be the frontier for water service and instead chose Yorkshire Water.*

years of PR14. The following table shows the results of our analysis, and the key inputs.

Table 10 Efficiency savings implied by aggregate CTS analysis

Calculation step	Result (low)	Result (high)
Total Yorkshire efficiency gap to frontier (£m)	£8.52	£8.52
Of which can be closed over PR14 (%)	50%	60%
Efficiency gap to frontier for PR14 (£m)[28]	£4.26	£5.11
Yorkshire's retail HH costs (£m)[29]	£49.94	£49.94
Implied % saving to Yorkshire (%)	8.53%	10.23%
Implied pa efficiency catch up factor (%)[30]	**1.71%**	**2.05%**

Source: Economic Insight

As shown in the above table, our aggregate CTS approach to estimating the potential efficiency savings Yorkshire could make in retail HH over PR14 suggest a catch up efficiency factor of between 1.71% and 2.05% per annum.

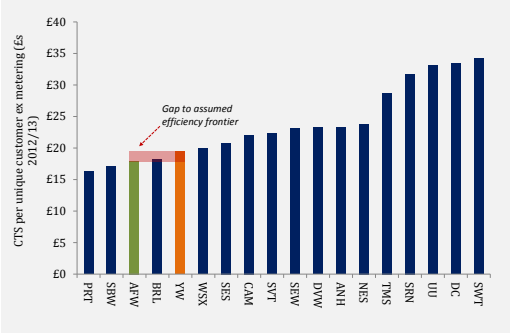
Considering the appropriate frontier for comparison

The above analysis is based on the assumption that the lowest cost company (in this case, Portsmouth) is the appropriate measure of the benchmark / frontier against which to compare Yorkshire's CTS.

However, as noted previously, the selection of the frontier is, in practice, subjective. In particular, Ofwat has typically avoided using very small companies as the industry benchmark when undertaking relative efficiency assessments. Specifically, over PR04 and PR09 the regulator ruled out any companies' for the purpose of being the benchmark if their turnover was < than 2-3% of the industry total.

If we were to apply the same 'pragmatic turnover rule' to the previous analysis then, of the companies ranked by CTS shown earlier in Figure 15, we would suggest that Affinity would be the lowest credible benchmark that could be selected – in which case the gap between Yorkshire and the frontier would be reduced, as shown in the following chart.

Figure 17: Aggregate analysis – CTS ex metering – revised frontier



Source: Economic Insight

If Affinity, rather than Portsmouth, is used as the frontier benchmark, then Yorkshire's total retail HH opex would only need to be reduced by a total of £4.18m in order for it to have a CTS consistent with the frontier. Using the same methodology described before, the following table translates this into per annum efficiency catch-up factors of PR14.

Table 11 Efficiency savings implied by aggregate CTS analysis – alternative frontier

Calculation step	Result (low)	Result (high)
Total Yorkshire efficiency gap to frontier (£m)	£4.18	£4.18
Of which can be closed over PR14 (%)	50%	60%
Efficiency gap to frontier for PR14 (£m)	£2.09	£2.51
Yorkshire's retail HH costs (£m)	£49.94	£49.94
Implied % saving to Yorkshire (%)	4.19%	5.03%
Implied pa efficiency catch up factor (%)	**0.84%**	**1.01%**

Source: Economic Insight

The above shows that, applying Ofwat's 'pragmatic turnover rule' to selecting the benchmark results an implied catch up factors for Yorkshire of between 0.84% and 1.01%.

Given the obvious concerns regarding the use of very small companies as a benchmark, we suggest that the above provides a more robust assessment

[28] *Absolute £m reduction required for unit costs = frontier.*

[29] *Taken from Figure 8C in Yorkshire's December retail HH Plan 'Chapter 8: Financing the Plan.' Figure relates to retail costs for 13/14 before inflation.*

[30] *All annual catch up factors in this report calculated as total % efficiency gap divided by 5.*

of what an aggregate unit cost based methodology implies for an appropriate rate of catch up.

4.2.2. Individual retail cost line analysis

As set out in the description of our methodology, our second approach is to repeat the above unit cost analysis, but at an individual retail line item level (based on the regulatory account definitions). Here a separate 'frontier' is identified for each, and Yorkshire's gap measured separately in each case. These individual 'gaps' are then added together to give an aggregate efficiency saving. Here, again, it should be noted that this approach may well over-state the potential savings Yorkshire could make, as: (i) it assumes a hypothetically efficient retailer could have the lowest costs for each individual line, which we consider unlikely in reality, given that certain trade-offs will exist across operating models; and (ii) for each individual line item we have simply assumed that the lowest cost company is the appropriate benchmark.

In the following we address in turn:

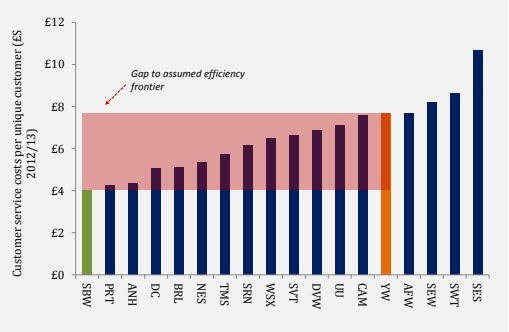
- customer services;
- debt management;
- doubtful debts; and
- other operating expenditures.

Note, metering costs are ignored as we estimated them separately above and found Yorkshire to already be at the frontier.

Customer services

With regard to customer services, we find that Yorkshire has the 14th lowest costs in the industry (again on a unique customer numbers basis as described previously). This translates to a total efficiency gap of £9.68m.

Figure 18: Customer service CTS

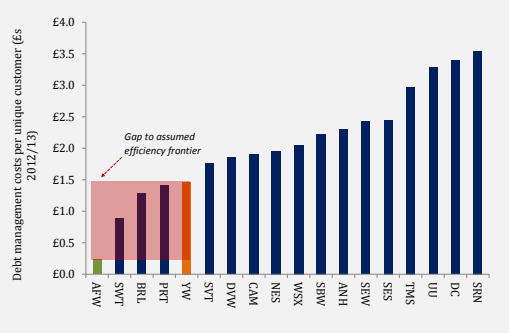


Source: Economic Insight

Debt management

In relation to debt management, we have calculated unit costs (CTS) for all companies based on unique customer numbers. Here the data shows that Yorkshire has low costs compared to the industry overall (the fifth lowest in fact). The total gap to the lowest cost company is £3.28m.

Figure 19: Debt management CTS



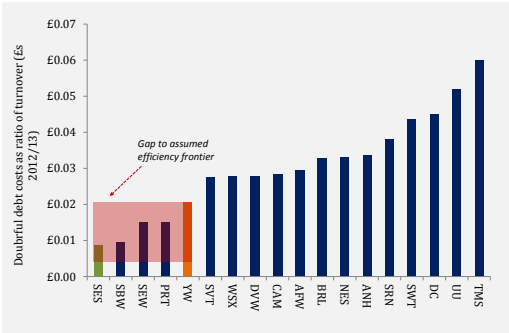
Source: Economic Insight

Doubtful debts

With regard to doubtful debts, rather than divide company costs by unique customer numbers, we have instead used HH turnover. This is because, as reflected Ofwat's assessment of various company claims for bad debt special factors, it is accepted that bill size is a key driver of costs. We therefore think that turnover provides a better basis than customer numbers alone for a unit cost comparison.

As shown in the chart below, we find that (on a £s per turnover basis) Yorkshire has the fifth lowest unit costs in the industry. In absolute terms, the gap to the lowest cost (frontier) is £8.37m.

Figure 20: Doubtful debt CTS

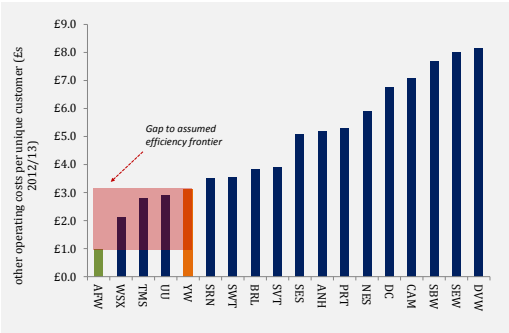


Source: Economic Insight

Other operating expenditures

Finally we examined unit CTS for 'other operating costs', using unique customer numbers as the denominator. We find that Yorkshire is the fifth lowest cost company on this metric, and so the gap to the frontier is relatively small, at £5.67m.

Figure 21: Other operating expenditure CTS



Source: Economic Insight

4.2.2.1. Implied catch up efficiency factors from line item cost approach

Having calculated the efficiency gap for each individual line item in the above, our 'disaggregate' approach requires us to add these 'gaps' together in order to derive the overall efficiency gap for Yorkshire.

Having done this, the steps for calculating the per annum % efficiency catch up factor are as set out previously and shown in the following table.

Table 12 Efficiency savings implied by disaggregate CTS analysis

Calculation step	Result (low)	Result (high)
Customer service efficiency gap (£m)	£9.68	£9.68
Debt management efficiency gap (£m)	£3.28	£3.28
Doubtful debt efficiency gap (£m)	£8.37	£8.37
Other operating expenditure efficiency gap (£m)	£5.67	£5.67
Total Yorkshire efficiency gap to frontier (£m)	£27.00	£27.00
Of which can be closed over PR14 (%)	50%	60%
Efficiency gap to frontier for PR14 (£m)	£13.50	£16.20
Yorkshire's retail HH costs (£m)	£49.94	£49.94
Implied % saving to Yorkshire (%)	27.03%	32.44%
Implied pa efficiency catch up factor (%)	**5.41%**	**6.49%**

Source: Economic Insight

Our more disaggregated, line item, approach to benchmarking yields different results to the aggregate level analysis. As expected, it implies that Yorkshire could make *higher* gross efficiency savings relative to the aggregate analysis. In particular, the disaggregated approach implies a per annum % catch up factor of between 5.41% and 6.49% in the retail HH space. Again, however, we should reiterate that this particular methodology is, overly aggressive and therefore is less appropriate than the aggregate based estimate.

In addition (and as discussed in our aggregated analysis) the above simply assumes that the lowest cost company for each individual element represents the appropriate benchmark. Under this approach the benchmarks used are:

- Sembcorp Bournemouth Water for customer services;
- Affinity for debt management;
- Sutton and East Surrey for doubtful debts; and
- Affinity for other operating expenditure.

Were we to apply the pragmatic turnover rule (which precludes companies with a turnover of <2-3% of the industry total from being the frontier), the benchmarks would instead be:

- Anglian for customer services;
- Affinity for debt management;
- Yorkshire for doubtful debts; and
- Affinity for other operating expenditure.

In which case the above catch up factors would fall to 3.56% – 4.28% per annum. Again, however, we should reiterate that these are higher than the catch up factors implied by our aggregate unit cost analysis (which we consider to be the more suitable unit cost based measure for reasons previously described). Furthermore, and as set out subsequently, we consider an econometric approach to be generally superior to both unit cost methods.

4.3. Econometric benchmarking

Whilst the advantage of the previously presented unit cost benchmarking is that it is highly practical and transparent, the drawback is that there are good reasons to suppose that differences in unit costs alone do not accurately reflect relative efficiency across the companies. Consequently, benchmarking Yorkshire against a frontier that is defined purely in terms of the company with the lowest unit cost could over – or under – state Yorkshire's true efficiency.

Given this, we think a valuable piece of analysis is to develop an econometric benchmarking model for retail HH. We have therefore developed such a model on behalf of Yorkshire. Firstly, in terms of our overall approach, our start point was to estimate models at a total retail level, rather than estimating separate econometric models for each retail area because:

- By adopting this approach, we avoid any potential problems associated with differences in cost allocation methodologies across the companies within each retail cost category – consequently, the model should (from a conceptual perspective) properly capture retail HH efficiency.
- Secondly, and as noted previously, to the extent that there may be 'trade-offs' in operating cost efficiency across individual retail cost lines, modelling at an aggregate level should properly reflect this, and so avoids the risk of setting a hypothetical frontier that, in practice, could never be achieved.
- Thirdly, and finally, to the extent that some cost drivers may impact multiple retail cost lines – but where the nature and strength of the relationship is uncertain – again an aggregate modelling approach allows us to assume this problem away.

Our overall approach and methodology is consistent with that applied by Ofwat in previous price controls. Namely, we assume that the model residuals (i.e. the variation in the data that cannot be accounted for by any explanatory variables) proxy inefficiency. In practice, there is uncertainty regarding whether the residuals entirely capture inefficiency, and so Ofwat has historically reduced these by 10% or 20%.

Secondly, and as noted previously here, there is also uncertainty regarding the extent of any efficiency gap that can be closed over a five year period. Consistent with this the final estimated 'efficiency gap' is typically reduced by either 50% or 60%.

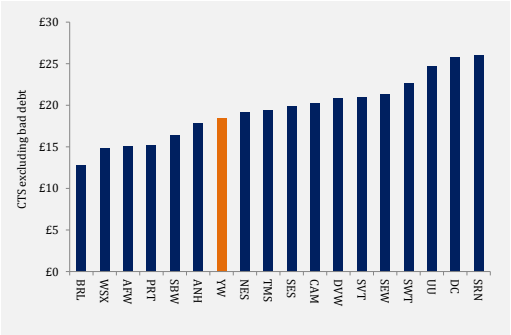
In line with the above, in our econometric models we calculate the per annum efficiency catch up factor for Yorkshire by determining its distance from the frontier, where the frontier is determined by the model's 'predicted' cost to serve for Yorkshire, were Yorkshire to have residuals consistent with the most efficient company (i.e. were it to have the lowest residuals).

Our overall approach was to regress total retail costs excluding bad debt costs against a range of potential explanatory variables using 2012/13 data. Our rationale for excluding bad debt costs from this analysis was twofold:

- Firstly, that bad debt is such an signification proportion of total retail HH costs, that variation in it risks 'masking' potentially relevant explanatory variables for other retail costs.
- Secondly, that Ofwat is separately considering bad debt related adjustment claims from the companies and – in any case – existing evidence suggests Yorkshire is already at the frontier with regard to this important cost item.

For reference purposes, the chart below shows the ranking of companies on CTS excluding bad debt costs (Yorkshire highlighted).

Figure 22 CTS excluding bad debt rankings



Source: Economic Insight

Using the above data, we then developed models using a range of explanatory variables, adopting a 'general-to-specific' approach. Explanatory variables we assessed included: number of dual service customers; number of single service customers; number of metered customers; HH turnover; SIM score; length of water mains (network density); and a deprivation index.

4.3.1. Our preferred model

Our preferred econometric model is set out below and aligns with Ofwat's methodology for calculating the average cost to serve (ACTS). Specifically, it relates the number of dual service customers and single service customers to the total cost to serve. It is our preferred econometric model because:

- as noted above, we have arrived at it through a best practice 'general to specific' econometric methodology;
- it takes account of economies of scale and scope; and
- it passes the relevant diagnostic tests (and appears to be superior to alternative model specifications, as set out in Annex B of this report).

In addition to the above, we consider that this econometric analysis is superior to unit cost comparisons because it helps avoid some of the need to make assumptions regarding the magnitude of scale and scope economies. The table below shows the results of our preferred model.

Table 13 Preferred model results

Variable	Coefficient	t – stat	P - value
Number of dual service customer	.0000224	19.32	0.000
Number of single service customers	.0000145	5.54	0.000

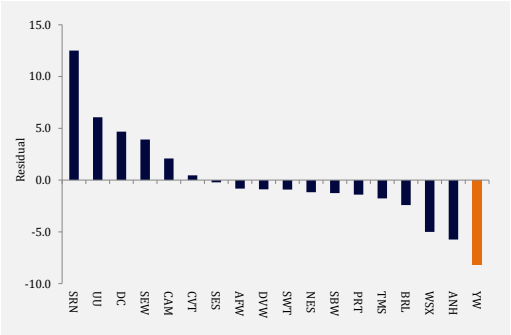
Source: Economic Insight

Our model results above imply that every additional single service customers costs, on average, £14.50 to serve, whereas every additional dual cost customer costs £22.40 to serve (excluding bad debt).[31]

We now turn to calculating the relative efficiency of Yorkshire. Our preferred model calculates a total cost to serve for each company and the residuals from the model indicate how efficient (or inefficient) each firm is compared to the average. As can be seen in the following figure, Yorkshire has the most negative residuals i.e. its actual costs are the most below those expected, given its profile of dual and single service customers.

Consequently, using our preferred model, Yorkshire is the frontier company, and therefore, were this to be used as the benchmarking approach, it would be appropriate to assume that Yorkshire has a zero scope to make catch up efficiency gains.[32]

Figure 23 Residuals from preferred model



Source: Economic Insight

As a sensitivity check we also considered the residuals from two alternative specifications of our preferred model – in both cases Yorkshire was still the frontier company (see Annex B for details).

4.3.2. Consideration of other explanatory variables

With regards to retail HH costs, excluding bad debt, in addition to customer numbers and economies of scope (which are captured in our preferred model) the key other variables we considered that, intuitively, might drive costs in a manner that is outside of efficient management control include:

» ***SIM scores,*** to the extent that they might proxy differences in quality of provision across the companies (an element of which could arguably be interpreted as outside of management control, if customer expectations differed markedly across companies).

» ***Network density measures*** – in particular the number of customers per km of mains length – to the extent that this might impact meter reading costs in particular.

» ***Measures of deprivation*** – to the extent to customers with higher deprivation scores (e.g. being unemployment benefit claimants) may have a higher propensity to contact water companies due to water bills representing a higher proportion of their disposable income.

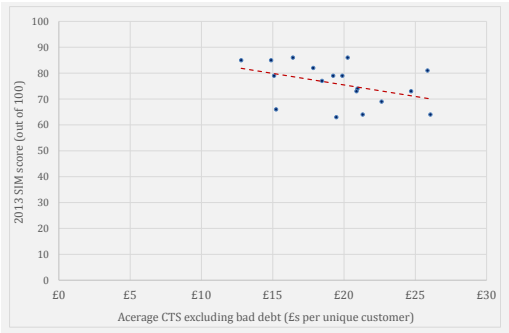
With regard to the SIM score, we were unable to find any model specification including this

[31] *The model also implies fixed costs of around £1.6m, but these are not statistically significant.*

[32] *Consequently we have not shown the impact of reducing the residuals by 10%, or indeed reducing the catch up factors to assume that only a proportion (50% or 60%) can be closed over PR14.*

variable that was robust. This is consistent with there being only a relatively weak correlation between SIM and CTS, as shown in Figure 24.

Figure 24 Scatterplot of SIM scores against CTS excluding bad debt

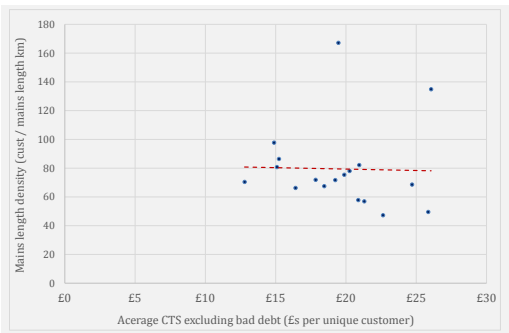


Source: Economic Insight

Furthermore, we note that the correlation between SIM and CTS is actually negative. That is to say, rather than driving increased retail costs, a higher SIM is associated with *lower* costs on average. This might be because, to a degree, customer satisfaction is correlated with a well-run / efficient retail function. In other words, SIM might proxy efficiency, which is within management control. This calls into question the validity of models using SIM scores, without further exploration of the detail at least.

With regard to network density, again we found no robust model that incorporated this as an explanatory variable. This is unsurprising given that the scatterplot below shows no real correlation between CTS and density.

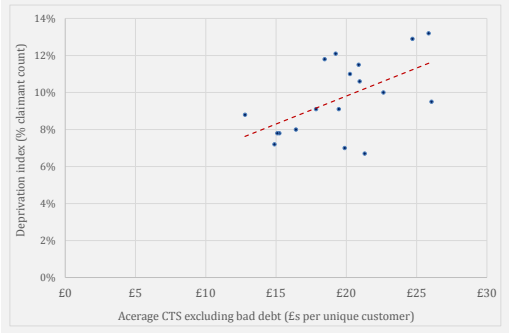
Figure 25 Scatterplot of network density scores against CTS excluding bad debt



Source: Economic Insight

We do, however, observe quite a strong, positive correlation between CTS (excluding bad debt) and our deprivation index, as shown in the next chart. The positive nature of the correlation is intuitively sensible, as described earlier.

Figure 26 Scatterplot of deprivation index against CTS excluding bad debt



Source: Economic Insight

Given the above, we have developed an alternative econometric model that regresses CTS per customer (excluding bad debt) against a deprivation index for 2012/13.[33] The results of our model are summarised in the following table, and are described in more detail in Annex B.

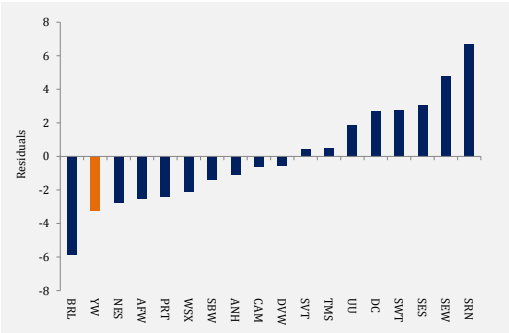
Table 14 Alternative model results

Variable	Coefficient	t – stat	P - value
Deprivation index	102.26	2.68	0.02

Source: Economic Insight

Consistent with our 'preferred model' described earlier, our deprivation index model results in Yorkshire having the second most negative residuals. As the company with the lowest residuals (Bristol) would, under Ofwat's pragmatic turnover rule, be considered 'too small' to be the frontier (accounting for 1% of HH industry turnover in 2012/13), this model would imply that Yorkshire is the frontier. As a result, this analysis also indicates a zero rate of efficiency catch up for Yorkshire with regards to retail HH.

Figure 27 Residuals from alternative model



Source: Economic Insight

[33] *Source: PWC letter 'PwC review of South West Water's doubtful debt cost models. Proxy indicator for the Employment sub-domain of the Index for Multiple deprivation (percentage of working population in receipt of certain benefits).'*

5. Cross industry cost benchmarking

This section sets out a range of evidence that seeks to benchmark the cost efficiency of Yorkshire's retail HH business relative to wider industries (outside of the water sector).

Based on a quantitative and qualitative assessment of the available evidence, our key findings are as follows:

(i) ***External benchmarking of operating cost to serve is inherently subjective*** and imperfect due to differences in services being provided, and therefore activities undertaken, across industries.

(ii) For these purposes, ***we find that mobile virtual network operators provide the best reference point,*** and a comparison of Yorkshire to their average cost to serve implies a catch up efficiency factor of between 0.84% and 1.00% per annum.

(iii) Finally, we note that ***Yorkshire has robust cost management processes already in place*** and, in many areas, has been ahead of other water retailers. This is consistent with the company generally performing well against Ofwat's relative efficiency assessments historically.

5.1. Overview of wider industry benchmarking

In this section we set out a range of evidence that compares Yorkshire's retail HH costs with wider industries, in order to further inform our assessment of Yorkshire's relative efficiency.

Here we note that a comparison of unit operating costs measures across industries is highly subjective, as they can vary for a wide variety of reasons that are unrelated to economic efficiency. In particular, for the analysis to be informative, it is important that comparators are highly similar to water retail in terms of factors such as:

- activities undertaken;
- asset intensity; and
- economies of scale.

If the above is not true, any comparisons are likely to be of questionable merit.

"Our analysis in relation to retail margins suggested that energy retailers and MVNO's were the most comparable industries – and therefore we have focused on these."

With the above in mind, we note that although Ofwat did not rely on comparators from different industries with regard to setting the retail HH margin, it nonetheless made use of this evidence with regards to retail NHH. Specific comparator industries that were referenced by Ofwat / PwC include: energy, mobile (in particular mobile virtual network operators - MVNOs), rail and post.[34]

Furthermore, our own analysis in relation to retail margins suggested that energy retailers and MVNO's were the most comparable industries – and therefore we have focused on these in undertaking our external benchmarking of Yorkshire's retail HH costs.

This section addresses in turn:

» A comparative analysis of Yorkshire's CTS with those of energy retailers and MVNOs.

» A comparison of Yorkshire's retail HH staff costs with those of MVNOs.

» A comparison of Yorkshire's retail HH staff costs with national earnings for equivalent occupations (as based on the wage index we created for Yorkshire in our assessment of gross input price pressure).

» Our qualitative assessment of Yorkshire's existing cost management processes.

» Finally, our conclusions regarding what the above evidence implies in terms of the potential scope for 'catch up' efficiency savings for Yorkshire's retail HH business.

5.2. Cost to serve comparisons

We start with a comparative analysis of Yorkshire's overall average CTS for retail HH relative to MVNOs and energy retailers. Our key methodological steps are as follows.

For Yorkshire the average CTS shown is based on 2012/13 data and includes metering costs (as we wish to include all relevant retail costs in our cross-industry comparison). The denominator is total unique customers as defined by Ofwat.

The MVNO CTS has been calculated at a total industry level, as (with only minor exceptions) individual MVNOs do not publish their number of subscribers within their statutory accounts. Ofcom has published data showing the total size of the mobile market in the UK (in terms of the number of connections – i.e. customers) and the total market share of MVNOs in terms of connection numbers – which relates to 2009.[35] By multiplying these together, we have our measure of total customers served by MVNOS.

To identify the relevant *retail* costs to serve for MVNOs (our numerator) we need to ensure that we do not include the costs associated with the purchase of airtime from the MNOs (i.e. the wholesale costs). To do this, we have added together all of the administrative/overhead costs of all major licensed MVNOs in the UK – our assumption being that 'cost of goods sold' relates to the wholesale element, which is standard accounting practice in similar industries.[36] MVNOs included in our CTS analysis are:

- 2020 Mobile (Asda Mobile's partner in the UK);
- Giffgaff;
- Lebara mobile;
- Lyca;
- Mundio;
- Talk Talk; and
- Virgin Mobile.

Tesco Mobile is excluded, as its statutory accounts do not provide (in our view) an accurate portrayal

[34] *'Water retail net margins a report prepared for Ofwat.' PwC (February 2014) - see Table 4.*

[35] *'The Communications Market 2010.' Ofcom (2011). See* ***http://www.ofcom.org.uk/static/cmr-10/ICMR-6.42.html*** *for market share figures.*

[36] *For example, in Scotland, Business Stream's cost of goods sold relates to the purchase of water wholesale.*

of the MVNO's standalone retail related costs, which we presume will be the result of intra-company transfer charging with Tesco PLC. If anything, therefore, by excluding Tesco (and potentially any other unidentified MVNOs) our methodology *could understate* the average CTS for MVNOs. Also, administrative costs are not split between household and non-household within company accounts, and so our CTS measure for MVNOs includes both.

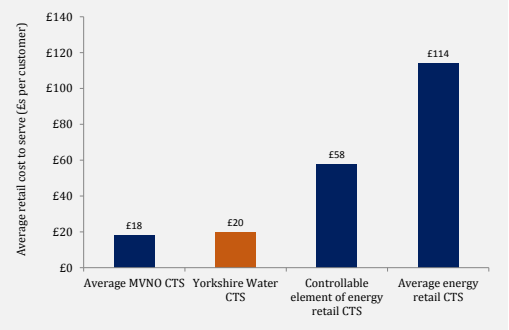
With regard to energy retailers, again our analysis is presented at a total industry level, due to the lack of detailed customer numbers for individual companies. Here, overall customer numbers are based on published data by Ofgem in its 2011 Retail Market Review, which relates to 2008.[37]

Our total retail cost data is based on the Consolidated Segmented Statements of the 'big six' energy retailers: (EDF, Centrica, Eon, RWE Npower, Scottish Power and SSE) and is based on 2012 data. Again, to ensure that we only include retail (and household) related costs, the precise figures we have used relate to 'indirect costs' for domestic customers only.

As a point of reference, we note that Ofgem has separately published data on the 'controllable' element of energy companies' retail costs (which will be a sub-set of their total retail costs to serve). We have therefore included this as a further point of reference.[38]

The results of the above analysis are shown in Figure 28.

Figure 28: Cost to serve across industries



Source: Economic Insight

The first observation we would make regarding the above is that the average CTS for energy retailers is so much higher than for Yorkshire to suggest that any comparison is meaningless. Indeed, this is not surprising given that: (i) the average size of energy bills (£1,174)[39] is substantially higher than that for water at £388;[40] and (ii) retail costs are a higher proportion of the total value chain in energy than for water.

Interestingly, however, the CTS of MVNOs overall is relatively comparable to that which we calculated for Yorkshire. This is not particularly surprising given that the core activities undertaken within the retail elements of MVNOs are likely to be highly similar to those in the domestic water retail space. With that in mind we think that it is informative to set out what the implied efficiency 'catch up' factor would be for Yorkshire, in order for it to achieve an average CTS in line with that of MVNOs overall.

As per our approach in our intra-industry benchmarking, we have developed two scenarios, one based on the assumption that Yorkshire could close 60% of the efficiency gap over PR14 and the other based on closing 50% of the gap. The results imply catch up efficiency factors of between 0.84% and 1.00% per annum. Our approach to calculating these catch up factors is somewhat conservative and they may, therefore, be marginally over-stated.[41]

Table 15 Implied catch up factors based on MVNO CTS benchmark

Calculation step	Result (low)	Result (high)
Unit cost gap to MVNOs (%)	8.36%	8.36%
Of which can be closed over PR14 (%)	50%	60%
Efficiency gap (%)	4.18%	5.01%
Implied catch up factor pa (%)	**0.84%**	**1.00%**

Source: Economic Insight

In relation to the above, we note of course that we are comparing Yorkshire's CTS with that for MVNO's 'on average', rather than any particular (frontier) MVNO. However, as outlined previously, data limitations prevent us from assessing CTS on an individual MVNO basis. Furthermore, the mobile market in the UK is

[37] *See 'The Retail Market Review - Findings and initial proposals supplementary appendices.' (2011).*

[38] *Controllable costs estimated from Ofgem chart ' Figure 7: Trend in controllable costs.' Page 47 of 'The Retail Market Review - Findings and initial proposals.'*

[39] *As published by Ofgem for 2012, relates to dual fuel customers – see:* ***https://www.ofgem.gov.uk/chart/average-bills-costs-and-profits-dual-fuel-household-customer-%C2%A3year***

[40] *See 'Charges and bills publications 2013-14.' Ofwat (2014). Refers to average combined water and sewerage bills for households.*

[41] *In particular, we used the latest filed statutory accounting data for each individual MVNO. This related to either 2011/12 or 2010/11. Strictly speaking, therefore, some indexation may be appropriate in order to compare with the 2013/13 CTS for Yorkshire. By not applying any such indexation, therefore, our approach is conservative.*

widely regarded to be highly competitive and, consequently, we would not necessarily expect the 'average' CTS to contain any material degree of inefficiency. We therefore consider that the above provides a relevant assessment of Yorkshire's scope for catch up efficiency.

5.3. Staff cost analysis

As statutory accounts typically include a breakdown of both staff costs and headcounts in their accompanying notes, it is also possible to compare average staff costs across industries. We think this is particularly relevant, given that staff costs represent a material proportion of total retail HH costs in the water sector. We have therefore undertaken two staff cost benchmarking analyses:

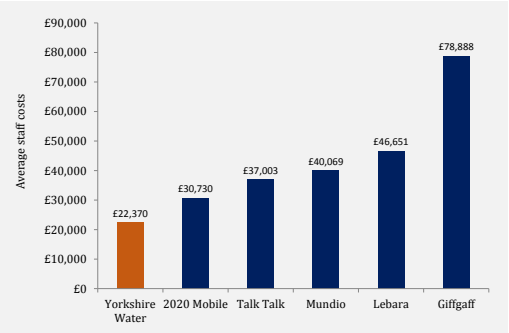
- a comparison of Yorkshire's average retail HH staff costs to those for individual MVNOs; and
- a comparison of Yorkshire's average retail HH staff costs to the 'median' occupational earnings implied by the wage index previously calculated in our assessment of input price pressure.

5.3.1. Comparison of Yorkshire's staff costs to those for MVNOs

Using statutory accounting data, we calculated the average staff costs for the following MVNOs: 20-20 Mobile, Talk Talk, Mundio, Lebara and Giffgaff. The statutory accounts for Tesco Mobile and Virgin Mobile did not include a breakdown of staff costs (for Virgin there is simply an intragroup charge) and so these could not be included.

For Yorkshire Water, the average staff cost shown is based on Loop and is consistent with the detailed breakdown of staff costs relied upon in our input price pressure analysis set out previously (data relates to 2012/13 for Yorkshire). The results of our comparison are shown below.

Figure 29: Comparison to MVNO staff costs



Source: Economic Insight

Our analysis shows that Yorkshire compares favourably to the MVNOs with regards to its average staff costs – and therefore on this metric, could be regarded as being highly efficient. If Yorkshire's average staff costs are based on both Loop *and* central staff, the £22,370 shown above increases to £26,652, which is still lower than any of the MVNOs.

Of course, as with all unit cost measures, some care must be taken when interpreting the above. In particular, it could be that some of the MVNOs outsource key staff cost related activities (such as call centres) and so their reported staff costs reflect an average that is mainly driven by management roles, which could inflate the CTS relative to Yorkshire. However, our review of their statutory accounts indicates that this is not systematically the case. For example, Lebara Mobile's accounts state that the company has: *"an award winning… in-house Lebara call centre."* Consequently, Lebara's average staff costs are likely to reflect its call centre related staff costs.

Yorkshire's strong performance on the above metric is consistent with its decision to outsource the majority of its customer service related retail functions through Loop (discussed in more detail within our qualitative analysis of Yorkshire's cost management processes, set out subsequently).

5.3.2. Comparison of Yorkshire's staff costs with the national median for its wage index

In our gross input price pressure analysis described previously, we created a detailed wage index for Yorkshire based on mapping individual retail HH roles to occupational wage inflation data.

For the purpose of providing a further external cost benchmark, we can compare Yorkshire's overall average staff costs to measures of national wages for the index (weighted by Yorkshire's headcount) using the same occupational level data published by ASHE / ONS.

In relation to the above, ASHE publishes occupational earnings data by percentile, which raises the question as to exactly what measure should be used to approximate Yorkshire's scope for catch up efficiency savings. For example, should it be the lowest percentile, or a measure of the average, such as the median?

Our review of the ASHE data at an individual occupation level reveals a high degree of variation in earnings across percentiles. To illustrate this, the next chart shows the spread of earnings for call centre operatives and customer service professional (two key occupations used in our Yorkshire wage index).

Figure 30 Spread of earnings by percentile

Source: Economic Insight

The above chart shows a variation in earnings ranging from £12.4k to £20.8k for call centre operatives across the percentiles (a variance of 68%). We do not think it credible to suggest that such wide variation could relate purely to efficiency. Rather, it is likely to reflect that, even at a relatively detailed occupational level, there can be wide and important differences in the exact role or function being fulfilled; and by implication therefore, the related skills required and earnings.

As a result of this, we consider that identifying one of the lower percentiles as a frontier would run the risk of materially over-stating the cost savings that Yorkshire could realistically be expected to make.

Recognising that selecting any point of comparison is relatively arbitrary, our approach has been to compare Yorkshire's total average retail HH staff costs, to those it could achieve if each individual function had earnings in line with the national median for each individual occupation to which the role has been mapped in our Yorkshire wage index. The results of this are shown in Figure 31.

Figure 31 Staff cost benchmark based on median of the Yorkshire wage index

Source: Economic Insight

The above implies that Yorkshire's average wages would need to be reduced to £17.7k to be in line with the national median. Taking this as a start point, we have again calculated the implied efficiency catch up factors for Yorkshire, as shown in the following table.

Table 16 Catch up factors implied by wage index comparison

Calculation step	Result (low)	Result (high)
Yorkshire retail HH average wages	£22,370	£22,370
Median of national wages for occupations included in YW wage index	£17,668	£17,668
Implied efficiency gap (%)	21.02%	21.02%
Of which can be caught up over PR14 (%)	50%	60%
Efficiency gap to be closed (%)	10.51%	12.61%
Implied pa catch up factor (%)	**2.10%**	**2.52%**

Source: Economic Insight

Our staff index approach implies efficiency catch up factors of between 2.10% and 2.52% per annum for Yorkshire. However, as shown in Figure 30, the variance in earnings even at the occupational level within the ASHE data is such that we cannot be certain that the above provides a reasonable assessment of the scope for cost savings on a like-for-like basis. We therefore do not think that the above is a particularly robust approach to determining catch up efficiency factors. However, as set out below, Yorkshire itself undertakes cost benchmarking for specific contact centre roles, which may be a better indication of like-for-like cost relativities.

5.4. Yorkshire's own benchmarking of retail staff costs

Yorkshire regularly undertakes cost benchmarking relating to its Loop cost base – the last such exercise was undertaken as part of the Loop 2010 *Fair Deal Review.*

The findings of the review were based on a number of sources, but are in large part sourced from the Contact Centre Research Report. This report was itself based on a national survey containing data from 240 contact centres across the UK (the report also allows Yorkshire to review data by geographic area and to make comparisons specifically with utility company call centres).

Table 17 shows the average salaries within Loop as of 2010 for customer service and debt collection roles, and compares these to those based on the CCR survey for 'all utilities' (240 contact centres) and those in 'Yorkshire and Humber' (33 contact centres).

Table 17 Yorkshire's benchmarking of Loop salary costs for key roles

Comparator	Customer service	Debt collection
All utilities	£16,068	£17,877
Yorkshire and Humber	£17,029	£13,780
Loop	£15,200	£16,928

Source: Loop Fair Deal 2010[42]

The above is consistent with the wider evidence set out previously in this report, insomuch that average Loop salaries within call centre and debt collection functions are generally below national averages.

Considering the appropriateness of overseas call centre benchmarking

In reviewing the above, one obvious question that is raised is whether it would be more efficient for Yorkshire to locate its retail HH call centre functions outside of the UK. This is not a straightforward question, however. Key points to consider in this regard include:

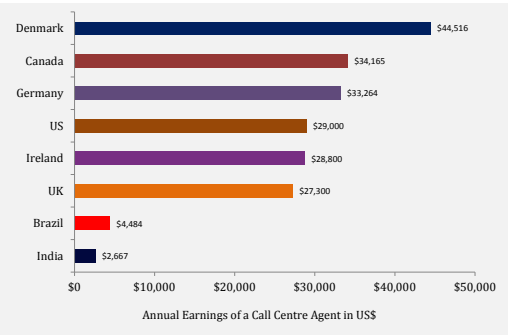
- 'Efficiency' cannot be considered independently of customer needs. Rather, it should be about providing the least cost solution to meeting customer requirements. Consequently, if Yorkshire's retail HH customers require a certain level of service that can only (or most effectively) be provided via UK based call centres, they may not be willing to make the service level trade-off required in order to achieve any incremental cost saving. In particular, we understand from Yorkshire that, via its customer forum and customer engagement, its customers have indicated a preference for calls and enquiries being handled locally.

- Consistent with the above, in a number of (generally competitive, and unregulated) markets, there has been a recent movement of call centres back towards the UK. In particular, we note that in February this year, Everything Everywhere announced the relocation of 1,000 call centre jobs back to the UK due in part to rising costs in India and the Philippines (but also due to concerns regarding customer service). Similarly, Santander UK, United Utilities and BT have shifted call-centre work from India to the UK over the last few years.[43]

- In addition, there could be substantial 'one-off' costs associated with overseas call centre relocations. Importantly, a proportion of which would most likely be 'sunk' from an economics perspective (and thus would be irrecoverable, should the decision need to be reversed).

Importantly, publically available call centre staff cost comparison data indicates that the UK is cost competitive compared to other western, developed countries. For example, as shown in the chart below, the UK has lower average call centre salaries than Ireland, the USA, Canada and Germany.

Figure 32 Comparison of call centre annual salaries



Source: The Global Call Center Report[44]

Furthermore, whilst the above data indicates that call centre staff costs are materially lower in countries such as India and Brazil, we would suggest: (i) that as outlined previously, it cannot be assumed the equivalent customer service levels can be provided – or, more relevantly – whether the service levels desired by Yorkshire's customers could be achieved in those countries; and (ii) that headline staff costs alone do not reflect the full ongoing operating costs associated with running call centres. For example, factors such as staff turnover rates, the processes to support oversight and general management, software and call handling, can all vary materially across countries. Related to this, we note that New Call Telecom's decisions to relocate its call centres from Mumbai to the North of England in 2011 was based on the assessment that, once these factors were taken into account, costs were *"at an absolute parity."*[45]

[42] *Figures shown taken directly from Loop report based on CCR survey. Average Loop salaries cannot be directly compared to average Loop staff costs reported previously as (i) we understand these relate to salary costs only and exclude any other benefits; and (ii) the CCR survey benchmarked specific functions only.*

[43] *Source: Financial Times.*

[44] *"The Global Call Center Report: International Perspectives on Management and Employment.' Holman, D., Batt, R., Holtgrewe, U. (2007). Only a subset of countries shown in above chart for illustrative purposes.*

[45] *Quote from Nigel Eastwood, CEO of New Call Telecom, as reported in the Financial Times 'Indian call centres: not as cheap as the UK.' (2011).*

The above does not necessarily imply that there would not be any efficiencies that could be realised from Yorkshire offshoring call centre activities. However, it highlights the fact that it would be overly simplistic to make headline cost comparisons without a detailed assessment of customer needs.

5.5. Qualitative assessment of Yorkshire's approach to cost management

As set out in the introductory section of our report, Yorkshire has a strong history of being an efficient water and sewerage company; and has previously been identified as a 'frontier' by Ofwat with respect to its relative efficiency.

Consistent with this, with regard to its retail functions, Yorkshire was a relative industry leader when, in 2000, Kelda Group established Loop as a separate customer service provider, to whom Yorkshire outsourced the majority of its customer services functions relating to retail. By being an early adopter of outsourcing, Yorkshire has realised material efficiencies within its retail business and – as outlined in the preceding sections of this report – has strong comparative retail cost efficiency.

Loop now accounts for 99%[46] of Yorkshire's retail HH customer services activities (assessed as a proportion of operating costs). It provides all key customer services activities for Yorkshire, but in particular:

- contact centre services; and
- billing and income services.

In addition to being highly efficient, Loop also helps Yorkshire deliver a high quality of retail service – in line with customers' expectations. We note, for example, that Loop has been named as one of the Sunday Times' Top 100 Best Places to Work in eight times since 2003; and in January 2013 was also accredited with a One Star rating from Best Companies for the seventh time for their employee engagement policies.

We asked Yorkshire to provide us with information regarding its cost management practices relating to each key customer service related activity. Having reviewed this, our view is that Yorkshire has a wide range of detailed, and robust, retail cost management practices in place. In the following we summarise the key elements of these by retail HH cost area.

Staff costs

Yorkshire regularly undertakes extensive labour cost benchmarking for its retail business, which includes the following key elements:

- Loop salaries for specific roles are benchmarked with Contact Centres based in Yorkshire and Utility contact centres based nationwide.
- At the last review, Yorkshire's findings were that salaries at Loop were comparable with the market (which is consistent with our quantitative benchmarking set out previously).
- Yorkshire's retail related staff (i.e. primarily Loop) are located in a low cost area; staff are generally sourced locally and HR controls and management process are designed to ensure that packages for new staff recruited are in line with prevailing market rates.
- The labour market is benchmarked on a 5 year cycle, when a pay award is negotiated with unions. The last time this work was completed was in 2010, when a Loop Fair Deal review was undertaken. The next review is schedule for March 2015.

Billing

In relation to billing activities, key elements of Yorkshire's approach are as follows:

- High volume in house printing facility with automated processes, resulting in low staffing costs associated with bill production.
- Robust capital expenditure business case requirements to ensure optimum capital cost vs operating cost efficiency, using net present value analysis within the retail HH business.

Payment handling

In relation to payment handling, the main elements of Yorkshire's cost management processes are as follows:

- Yorkshire has a bespoke payment processing system called *Yorcash,* which is designed to complement the company's working practices and makes it highly efficient.
- The *Yorcash* system allows efficient management and automation of suspense items, debt collection receipts, direct debits, Girobank, Paypoint and other specialist payment types.

[46] *In 2012/13 Loops' operating costs relating to HH retail for Yorkshire were £20.198m, out of £20.40m customer service costs reported in the regulatory accounts. Note, customer services and doubtful debt collectively account for 72% of Yorkshire's retail HH operating costs and, as set out previously, Yorkshire has the lowest unit doubtful debt costs in the industry (excluding small companies). Consequently effective cost management within Loop with regards to customer service costs is particularly relevant.*

- Yorkshire also has an in house banking facility, which keeps bank charges low.
- The company's payment handling team is mutiskilled which allows efficient resourcing.

Debt management / Collections

Regarding debt management and collections, the core elements of Yorkshire's cost management processes are as follows:

- Yorkshire has informed us that it has the most efficient debt collection in the industry, which is largely due to its data sharing with credit referencing agencies, and the sophisticated data analytical techniques it employs.
- Yorkshire's Debt Management System (DMS) is highly sophisticated, enabling debt collection strategies to be developed in a way that minimises the manual handling of accounts.
- Yorkshire regularly undertakes benchmarking of its debt management / collections with other organisations.
- Recent initiatives have included driving down debt enforcement manual work with the courts, whilst improving debt performance.
- Networking with other water companies and utilities to establish best practice / techniques / innovation; e.g. Yorkshire considers itself to be at forefront of the water industry with regard to credit sharing, and automated meter readings.

Network and Non-network call handling

In relation to call handling, the key points to note regarding Yorkshire's cost management are as follows:

- Yorkshire has a mutiskilled contact centre performing at benchmarked levels.
- It measures productivity through systems and effective performance management processes.
- The company deploys real time resource management to ensure maximum efficiency, e.g. there is a team within Yorkshire dedicated to the management of this.
- Quality management to ensure customer service is right first time, management of repeat calls to keep cost of failure low.
- Year on year efficiency delivered through an efficiency programme with a dedicated project manager. For example, a key element of this was a drive to ensure increased automation of simple transactional work.
- Effective planning through rigorous manpower modelling and forecasting.
- Utilising Automated Meter Reading data, to proactively resolve customer issues. This has reduced repeat contacts from customers.
- Drive to move customers onto direct debits.
- Customer service programme, which targets service improvements to drive down the cost of failure.

Payment and bulk owner commissions

Regarding payment commissions the main elements of Yorkshire's cost management include:

- Yorkshire continually reviews and challenges its existing contracts, and regularly retenders them in order to deliver best value for money (for example, its counter payment services was recently retendered).
- The company has a number of initiatives to increase the number of customers paying by direct debit, such as the Marie Curie campaign. In addition, the commissions charged for direct debit payments are lower than other payment commission types.
- Yorkshire has three bulk owner agreements, which deliver very impressive debt collection efficiency.
- Yorkshire uses a model that reviews debt management and doubtful debt costs to help optimise and minimise these.

IT costs

Significant cost management processes relating to Yorkshire's IT costs are as follows:

- All IT projects are subject to rigorous capital expenditure management, including project governance.
- All IT projects involving outside suppliers are subject to rigorous contract tendering.
- In house development of key systems gives Yorkshire a comparative cost advantage and assists in delivering staff efficiencies.
- Loop benefits from economies of scale from wider Kelda Group IT systems.

Printing and stationery

Yorkshire has two key aspects to its cost management for printing and stationary, which are:

- Contract tendering for annual billing overflow as mentioned under billing. Also competitive tendering for stationery.

- Challenging capital investment processes to ensure capital outlay is balanced by operational efficiency.

Postage

Yorkshire seeks to manage its postage costs using the following processes:

- Annual contract tendering with a number of postage suppliers.

- Sorting mail in house, which enables significant postage discounts.

- Online services available and promoted to drive down billing costs.

- Initiatives to reduce postage by texting customers.

Rent

The main Loop building was acquired at low cost.

- Firstly, Loop agreed a long-term lease for its building to 2025, and negotiated a low leasing cost as part of the negotiation.

- The location for the main Loop building was selected on the basis of it being of low cost.

Other contracts outsourcing

Areas which are outsourced for the purpose of maximising efficiency include:

- Debt collection agencies are used in cases where Yorkshire's own attempts to recover debt have not been successful. The cost of this is very low, as Yorkshire competitively tenders and seeks to use third party providers in the most efficient way possible.

- Given Yorkshire's annual billing volumes for unmeasured customers, it is not practical or efficient to conduct all printing in-house. This is therefore outsourced (through competitive tender). Current annual costs are around £130k.

- Yorkshire uses credit reference agencies to provide customer financial data (annual cost of £50k). This is an essential input into the company's debt management strategy.

- Overhead costs such as payroll, accounts payable, accounts receivable, finance business partner, HR business partner, training, recruitment, legal, IT are outsourced to Kelda / Yorkshire Water shared services. (Annual cost of £500k). Yorkshire considers this to be the most efficient solution.

Options for further outsourcing

Finally, we asked Yorkshire to provide us with information regarding the potential future scope for outsourcing. The key points identified are as follows:

- Yorkshire Water has already outsourced the vast majority of all customer service related retail costs to Loop (which, as set out here, has extensive and robust cost management processes).

- Loop continually reviews opportunities for outsourcing of its own activities as part of its annual business planning. The purpose of this is to ensure that Loop provides its contracted services in the most efficient way possible.

5.6. Conclusions from wider industry benchmarking

As set out in the introduction to this section, wider industry benchmarking of operating costs is notoriously subjective, due to the inherent differences in the services being provided (and therefore activities being undertaken) by firms supplying across different industries.

Given the above, care must be taken when considering precisely how one should quantify relative costs to serve across industries; and, relatedly, the interpretation of this regarding the relative efficiency of Yorkshire.

Of the quantitative benchmarking we have undertaken, we consider that the comparison of Yorkshire's total retail HH CTS with MVNOs to be the most relevant, which suggests a per annum catch up factor of between 0.84% and 1.00%.

With regard to staff costs, the evidence is more mixed and is more difficult to draw clear inferences from. For example, relative to MVNOs, Yorkshire already has very low staff costs in the retail HH space, which is consistent with the company already being highly efficient (potentially, even at the frontier). However, it is unclear to what extent MVNOs might outsource certain staff cost driven functions (such as call centre operations) and, again, care must be taken in drawing any strong inference.

Relatedly, our comparison of Yorkshire's average staff costs in the national median based on our Yorkshire staff cost index also raises questions of interpretation. Specifically, the very wide spread in earnings at the occupation level (as shown in the ASHE data) implies that there are a wide range of roles, skill and activities within each occupational classification.

Consequently, and as noted above, we consider our calculated MVNO benchmark to be the most meaningful.

6. Conclusions

The final section of our report draws together the evidence and analysis set out in the previous chapters in order to provide our quantification of Yorkshire's claim for a net input price pressure adjustment to its retail HH cost to serve.

In turn we address.

(i) Our best views as to the ***gross input price pressure faced by Yorkshire.***

(ii) Our assessment of the ***'catch up' efficiency savings*** Yorkshire could make with regards to retail related costs.

(iii) Our analysis of the ***total factor productivity*** related savings Yorkshire could make.

(iv) Our views as to why our analysis provides a robust assessment of: (i) cost pressures that are ***outside of management control*** and (ii) impact Yorkshire more than other companies.

(v) Finally, our overall ***estimate of the appropriate net adjustment factor*** relating to input price pressures.

6.1. Our assessment of input price pressure

Section 3 of this report set out a detailed analysis of the gross input price pressure Yorkshire's retail HH business will face over the period 2014/15 to 2019/20. This was based on:

- a mapping of individual retail cost lines to the most relevant input price pressure measure or driver (which for staff costs was based on mapping Yorkshire retail roles to occupational level wage data from ASHE/ONS);
- a historical analysis of the relevant input price measure;
- an extrapolation of each individual measure based on the historic 'wedge' to wider inflation measures and official OBR forecasts;
- in relation to bad debt, a detailed econometric modelling exercise that factors in the countervailing impact of an improving macroeconomic climate over PR14; and
- a weighting of the individual measures into an overall input price pressure index for Yorkshire.

Based on this, we concluded that Yorkshire is likely to face ***gross input price press for retail HH of 2.78% per annum on average over the period 2014/15 to 2019/20 (2.93% over PR14).***

6.2. Our assessment of catch up related efficiency savings

Sections 4 and 5 of this report set out a range of benchmarking evidence (both within the water industry, but also more widely) to determine the appropriate % rate of catch up related efficiency savings Yorkshire could conceivably make over PR14.

In relation to this, there are two important points to note:

» Ofwat has not publically set out its own definition of any efficiency frontier for retail HH – and consequently, the existing regulatory framework does not explicitly include any retail related efficiency challenge for companies with a retail CTS already below the ACTS (such as Yorkshire). The approach we have taken, therefore, in effect applies an efficiency challenge to Yorkshire *that it would not otherwise be obliged to meet* (but critically, we think input price pressure should only be allowed for in the context of a robust assessment of the company's ability to mitigate such pressure through efficiency gains).

» Secondly, by adopting multiple methodologies, our objective is to provide Yorkshire, and ultimately Ofwat, with a sufficient range of robust evidence such that the company's claim for net input price pressure is, in totality, credible. We accept that there is no single perfect way of determining the appropriate rate of catch up efficiency for retail HH. Therefore, we suggest that Ofwat does not necessarily have to agree with or approve of any one particular methodology set out in our report in order to approve the claim. With that in mind, in reaching our conclusions regarding catch up, we have considered the evidence developed here 'in the round' and have come to what we consider to be a reasonable and defendable view.

The following table summarises the implied % per annum efficiency catch up factors implied by our alternative methodologies.

Table 18 Summary of catch up factors implied by alternative methodologies

Benchmarking method	Implied pa % saving
Aggregate unit cost	**0.84% - 1.01%**
Econometrics	**0.00%**
Wider industry bench-marking	**0.84% - 1.00%**

Source: Economic Insight analysis

In our view the disaggregated unit cost benchmarking should have relatively low weight attached to it, as it implies a retailer could be lowest cost for each component part of the retail offer, which we consider to be implausible given the inherent trade-offs between certain retail activities (we have not therefore included the results of this in the above summary table).

The aggregate unit cost, econometric modelling and wider industry benchmarking collectively imply catch up factors for Yorkshire that range from 0.0% to 1.0% per annum. ***Our recommendation is that it would be appropriate to assume catch up factors in the middle of this range (0.5% per annum)*** as: (i) the available evidence strongly suggests that Yorkshire is already comparably efficient relative to other water retailers – and in fact, one could credibly argue that it is already at the frontier from a within industry perspective; and relatedly (ii) relative to the catch up factors Ofwat has set historically for companies at or near the frontier, a factor of 0.5% per annum is aggressive – as summarised below.

To put our recommended catch up factors into context, we note the following:

» In PR04 Ofwat assumed opex catch up factors, in aggregate, of 1.1% per annum for water and 0.8% for sewerage (in each case being 60% of Ofwat's assessment of the total scope for catch up to the frontier).[47] However, the catch up factors varied considerably across the companies, from between 0.0% and 2.7% per annum (water) and from 0.0% and 1.5% per annum (sewerage) depending on the relative efficiency bandings.

» At PR09 the opex catch-up factors ranged between 0% and 2.9% per annum for water and 0% and 2.2% per annum for sewerage, depending on companies' relative efficiency performance.[48] As noted previously, Yorkshire was ranked in Band A (upper) for water – where it was set as the benchmark / frontier firm, and Band A (lower) for sewerage.

6.3. Our assessment of total factor productivity related savings

In order to estimate the *total* efficiency savings Yorkshire could make with regard to retail HH over the period, it is also necessary to estimate 'frontier shift' (that is, the cost savings an efficient company could make, through productivity growth).

This is typically calculated as follows:

$$Frontier\ shift = Inflation - productivity\ gain$$

Our estimates of relevant input price pressure (inflation) are summarised above, so here we focus on evidence relating to the productivity gains that an efficient company could make – which are typically defined in terms of total factor productivity (TFP).

The most comprehensive source of data relating to TFP estimates is EU KLEMS, which provides information on economic growth, TFP and technological change for EU countries back to 1970. The dataset includes measures of TFP growth at both an overall economy level, but also disaggregated down to individual sectors or industries. Consequently, when considering an appropriate TFP assumption for retail HH in the water industry, we must determine:

- what index (i.e. economy or individual industry) provides the best guide to TFP growth in the sector; and
- what the most relevant time period is over which to assess TFP growth.

With regard to the former, we note that in Yorkshire's initial submission to Ofwat, it proposed to use a TFP assumption based on *'finance, insurance, real estate and business serves'* over the period 1990-2007. In its RBR assessment of Yorkshire's Plan, Ofwat's view was that this was an *"inappropriate"* TFP measure.[49] Further, the EU KLEMS data we have examined suggests that TFP growth for these sectors is some way below total economy TFP growth (indeed, we further note that the First Economics Report for Water UK on this matter quoted TFP growth of just 0.3% per annum for this category, below overall TFP growth in the UK).[50]

At this time it is difficult to *objectively* identify individual sectors / classifications within the EU KLEMS data that provide a good proxy for the productivity gains that could be made in retail HH. The risk, of identifying any individual category is that it is regarded as being somewhat arbitrary – and therefore is difficult to defend economically. In addition, by seeking to select any individual index – or indeed creating some composite index – there is then the challenge of appropriately matching this to the input price pressure analysis.

Given the above, therefore, we have focused on TFP measures for the UK economy as a whole. Here the key consideration is whether the appropriate measure is the *'UK whole economy'*, or the *'market economy'* (which excludes health, education and other public sector industries). We think that, given that the water industry was privatised some time ago – and that retail functions are likely to be increasingly separate from wholesale going forward – there is no reason to believe that water retailers should not be able to achieve productivity gains in line with the private sector. Consequently, we are minded to propose assuming a more challenging TPF factor based on the 'market economy' measure.

Secondly, with regard to the relevant time period, we examined the data over: (i) 10 years to 2009; (ii) 15 years to 2009; and (iii) 20 years to 2009. Here the key issue is the balance between reflecting the most recent data, whilst also allowing a long enough period of time to provide an accurate measure of likely longer term productivity gains.

We have some concerns regarding relying only on the 10 years to 2009, as the financial crisis and recession (which have some highly unusual features) resulted in sharp falls in productivity across the UK economy. Consequently, this may well under-state the TFP gains that could be achieved going forward. This is consistent with Ofgem's view that TFP should be assessed over a relatively long period, in order to mitigate: *"potential measurement error and the impact of*

[47] *'Future water and sewerage charges 2005-10: Final Determinations.' Ofwat – see page 148.*

[48] *See Chapter 4 of 'Future water and sewerage charges 2010-15: final determinations.' Ofwat (2009).*

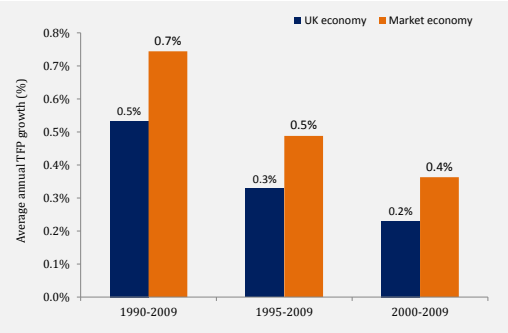
[49] *Ofwat's detailed comments are set out in its 'Element categorisation scorecards.' (April 2014).*

[50] *'Assessing Potential Changes in Retail Costs 2015-2020.' First Economics (20130.*

business cycle."[51] Equally, we would suggest that a 20 year period is perhaps too backwards-looking, and may over-state what can reasonably be expected to be achieved over the period.

On balance, ***our recommendation, therefore, is that Yorkshire should assume a TFP growth factor of 0.5% per annum, based on the 'UK market economy'*** (i.e. private sector) averaged over the 15 years to 2009. We note that this is a more challenging assumption than one based on the UK economy as a whole over this period – and there are also reasons to suppose it would be lower.

Figure 33: TFP growth



Source: Economic Insight analysis of EU KLEMS data

For reference purposes, we note that in PR04 Ofwat assumed a frontier shift for opex of 0.3% for water service and 0.5% for sewerage service.[52] Ofwat's view at the time was that this was around *half* of the total potential scope for frontier improvement (i.e. it chose to split the 'carrot' and 'stick' incentive half and half).

At PR09 Ofwat assumed a continuing efficiency improvement factor of 0.25% per annum for both water and wastewater. In this context, our proposal for assuming TFP gains of 0.5% as the continued efficiency assumption is relatively aggressive.

6.4. Final quantification of claim for net input price pressure

Having set out our conclusions regarding each of the key components of our analysis, the final step is to quantify Yorkshire's claim for net input price pressure. As set out in our methodology section, in order to meet Ofwat's 'three step' test, our general approach is to 'net off' any efficiency savings we think Yorkshire could make from our gross estimate of input price pressure. Therefore, the total net impact of input price pressure is calculated as follows:

Net input price adjustment [1.78%]:

= *gross input price pressure* [2.78%]

−*efficiency catch up* [0.50%]

−*TFP savings* [0.50%]

The results of this are summarised, by year, in the table at the bottom of the page. Our analysis shows that over the period 2014/15 to 2019/20, Yorkshire's net input price pressure will be 1.78% per annum on average (1.93% over PR14). This is substantively lower than the net claimed figure of 2.90%[53] in Yorkshire's December Plan. This reflects the fact that our approach: (i) nets off challenging efficiency savings, both relating to frontier catch up (which was not included within Yorkshire's initial claim) and TFP (where we make more aggressive assumptions than in Yorkshire's December Plan); and (ii) is based on more detailed analysis of the gross input price pressure the company faces – particularly in relation to bad debt and staff costs.

"Our analysis shows that over the period 2014/15 to 2019/20, Yorkshire's net input price pressure will be 1.78% per annum on average. This is substantively lower than the net claimed figure of 2.90% in Yorkshire's December Plan."

Table 19 Summary of net claim

	2014 / 15	2015 / 16	2016 / 17	2017 / 18	2018 / 19	2019 / 20	Average over period
Gross input price pressure (%)	*2.00%*	2.69%	2.80%	3.03%	3.00%	3.15%	2.78%
Catch up efficiency savings (%)	*0.50%*	0.50%	0.50%	0.50%	0.50%	0.50%	0.50%
TFP savings (%)	*0.50%*	0.50%	0.50%	0.50%	0.50%	0.50%	0.50%
YW net input price pressure claim (%)	***1.00%***	**1.69%**	**1.80%**	**2.03%**	**2.00%**	**2.15%**	**1.78%**

Source: Economic Insight

[51] *'RIIO-T1/GD1: Initial Proposals – Real price effects and ongoing efficiency appendix.' Ofgem (2012) Page 22.*

[52] *'Future water and sewerage charges 2005-10: Final Determinations.' Ofwat – see page 148.*

[53] *See Figure 8B of Yorkshire's December HH retail plan (3.0% input price pressure less 0.3% TFP).*

6.5. Applying our net input price pressure estimates

In order for Yorkshire to quantify its claim for net input price pressure, it will need to apply our calculated net % figures (as shown in the previous table) to its projected retail HH costs before inflation, and then compound the impact over time.

In this regard, because 2013/14 cost data will be used to set the ACTS, it is also important to include the net effect of relevant retail cost inflation and efficiencies from 2013/14 to 2014/15 into any claim.

There is some subjectivity as to precisely how one should capture the additional year(s) of retail HH input price pressure and efficiency (i.e. prior to the start of PR14). For current purposes, our approach has been to extend the analysis presented in our report back by one additional year to 2014/15 (for example, as shown in the table on the previous page). The benefit of this is that the net input price pressure Yorkshire assumes for 2014/15 is based on the same detailed evidence base as that we compiled for PR14 as a whole.

Finally, recognising the inherent uncertainty regarding forecasts for key parameters (particularly for any individual year), we believe it would be reasonable to apply the average net input price pressure of 1.78% in each year, should Yorkshire wish to spread the bill impact of its claim more evenly.

6.6. Why our estimates are appropriate

We consider the overall approach – and range of underlying evidence – set out in this report to represent an appropriate and robust methodology for quantifying Yorkshire's net input price pressure claim for retail HH over the period 2014/15 to 2019/20.

In particular, and as described previously, by explicitly seeking to identify and quantify the efficiency savings Yorkshire could make – and netting these off against our quantification of gross input price pressure – we are directly addressing Ofwat's request that any cost adjustment be supported by evidence showing that they are:

- outside of management control (because under our approach they are related to efficiency); and
- impact Yorkshire more materially than other companies (because the ability of Yorkshire to absorb cost pressure, relative to other companies, depends on its comparative efficiency).

In addition, the approach we have adopted also addressed the more detailed feedback Ofwat has provided through its RBR process to date, both to Yorkshire and the industry more generally. In particular, we have included benchmarking evidence – both within sector and more widely – and have also provided details of Yorkshire's existing cost management processes.

Finally, and critically, by adopting a range of methodologies for quantifying the claim, our objective is to ensure that Ofwat has confidence that the claim is both reasonable and robust. In our view, acceptance of the claim does not necessarily require Ofwat do agree with, or endorse, any particular approach – but rather (in the context of company owned plans) merely for it to conclude that, taken in totality, the claim is well evidenced. In particular, therefore, acceptance of the claim would not necessarily indicate that Ofwat accepts any particular definition of a retail efficiency frontier proposed in our report.

7. Annex A – econometrics for forecasting bad debt costs

7.1. Overview of approach

This annex summarises our approach for forecasting Yorkshire's bad debt costs over PR14. In summary, there are three main parts to our approach:

- first, we use historical data (between 2004/05 and 2011/12) to estimate the relationship between bad debt per property, bill size and two indicators of the health of regional economies – benefits expenditure and gross value added;
- second, we use publically available information to forecast bills, benefits expenditure and gross value added; and
- third, using the estimated relationship and the forecasts, we predict the annual growth in bad debt per property over PR14.

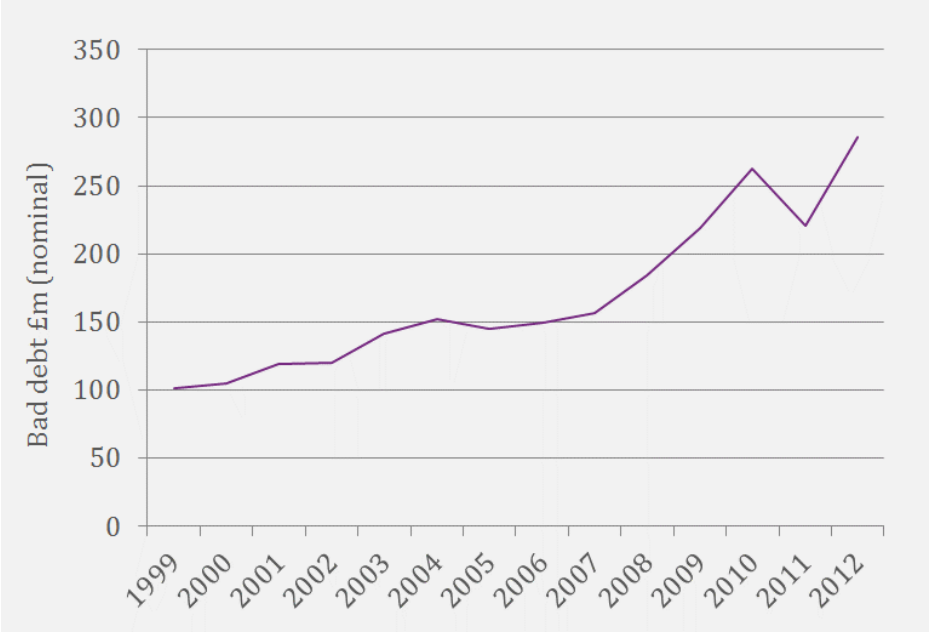
To do this, Yorkshire provided us with, for each of the WaSCs: bad debt charged to profit (£m nominal); appointed company turnover (£m nominal); and the number of (unique) connected properties. We collected information on benefits expenditure (£m nominal) and gross value added (£m nominal) at the regional level from the Office for National Statistics (ONS). Forecast information was also obtained from Yorkshire (bill size); the Office for Budget Responsibility (RPI, GDP); and ONS (benefits expenditure).

Before setting out further details of our analysis, we provide some background trends, which we consider important for interpreting the results of our work.

7.2. Background trends

The figure below shows how the total bad debt charged to profit across the water and sewerage companies (WaSCs) has evolved between 1998/99 and 2012/13. The figure below reveals that total bad debt charged to profit has increase significantly since 1998/99. As expected, the largest increases occurred at or around the time of the recent recession.

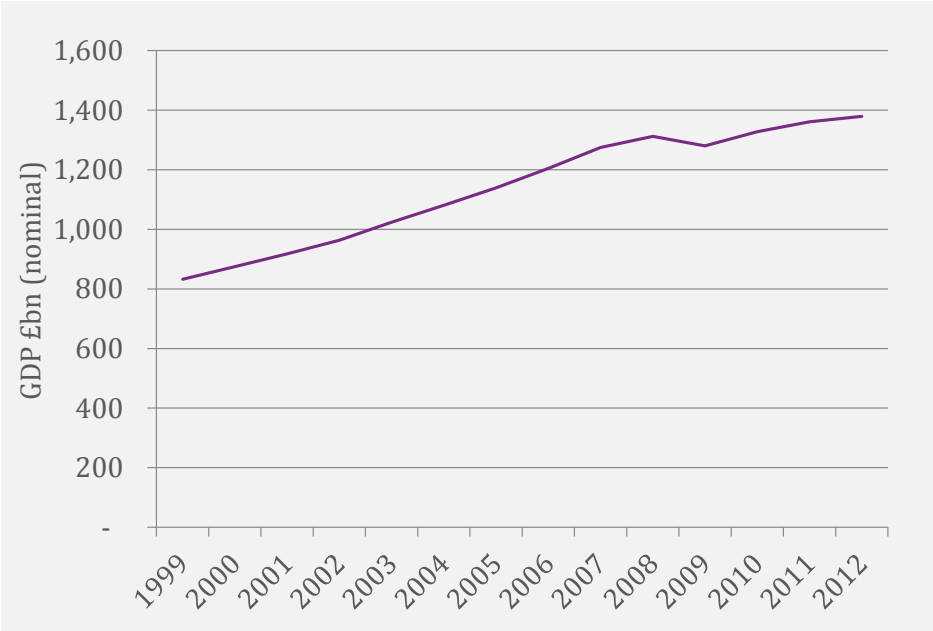
Figure 34: Evolution of bad debt 1998/99 to 2012/13



Source: Yorkshire Water, company regulatory accounts

The figure below illustrates the trend in UK GDP, as one measure of the health of the economy in 2008-09. Comparing it to the total bad debt figure shown previously, it confirms that the decline in the health of the economy was associated with an increase in industry bad debt. However, it also shows that the relationship is not straightforward: that is, in times of economic growth (say in the early part of the 2000s) bad debt continued to rise, suggesting that other factors affect bad debt. Our analysis, set out further below and consistent with previous studies, suggests that bill size and other metrics of the health of the economy – in particular, benefits expenditure, also influence bad debt levels.

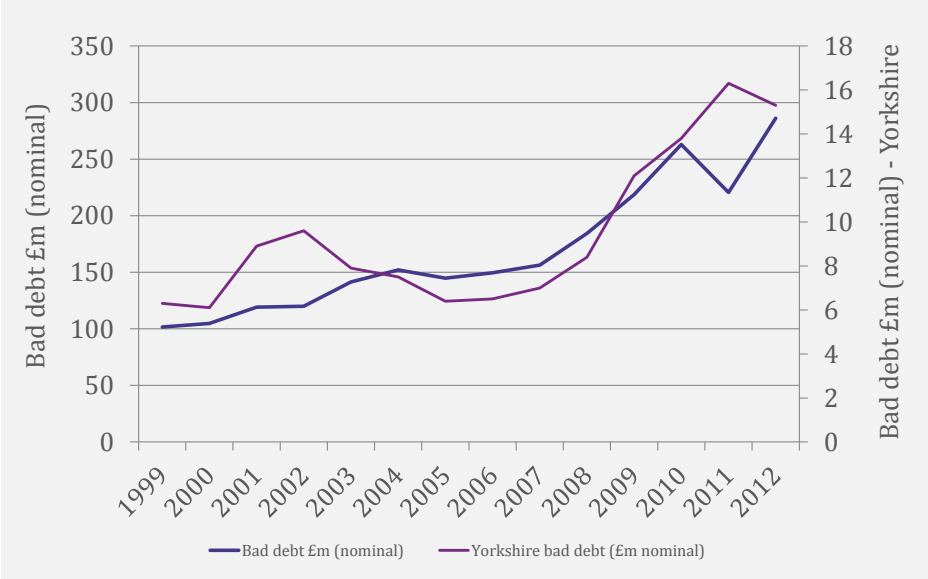
Figure 35: Evolution of GDP 1998/99 to 2012/13



Source: ONS

The figure below compares Yorkshire's annual bad debt to total bad debt across the WaSCs.

Figure 36: Comparison of Yorkshire and total bad debt 1998/99 to 2012/13



Source: ONS

Over the time period as a whole, Yorkshire's bad debt has grown at a somewhat slower rate than for the WaSCs as a group (6.5% CAGR versus 7.7% CAGR). The underlying data also shows that Yorkshire also has a lower bad debt charge as a percentage of turnover compared to the WaSCs as a group (1.3% versus 2.2% over the period as a whole). Although not a focus of this analysis, both points are consistent with the view that Yorkshire is efficient relative to WaSCs (on average) with respect to its levels of bad debt.

Importantly, the previous figure also shows that although the overall trends are broadly similarly, there are some periods of time where the trends in Yorkshire's bad debt follow a different trend to total bad debt. For example, in the early part of the 2000s. This could be caused by a number of factors. One possibility is that it is caused by differences between the regions in terms of their health. We take account of this possibility in our more detailed analysis.

7.3. Econometric modelling

As noted above, we use historical data (between 2004/05 and 2011/12) to estimate the relationship between bad debt per property, bill size and two indicators of the health of regional economies – benefits expenditure and gross value added:

- Bad debt per property is estimated by dividing the bad debt charged to profit divided by the number of connected properties. Both were given to us by Yorkshire. They obtained the former from companies' regulatory accounts and the latter from the company Datashare.
- Average bill size is estimated by dividing total company turnover by the number of connected properties. The source is the same as the above.
- Regional GVA is obtained from the ONS (dataset: rft-gva-nuts1). For each WaSC, we apply the regional GVA that most closely responds to their supply area.
- Benefits expenditure is also obtained from ONS (dataset: expenditure_by_region_2012_13). Again, for each WaSC, we apply the regional benefits expenditure that most closely responds to their supply area.

We have selected a double-log functional form as this seems to fit the data well, helps accounts for any non-linearities in the data and, also, allows for the coefficients to be directly interpreted as elasticities. Rather than using Ordinary Least Squares (OLS) to estimate the coefficients, we use the "random effects" model, which recognises the panel structure of our dataset and helps to accounts for unobserved differences between the WaSCs that, if not controlled for, could bias the coefficients on bill size, regional GVA and benefits expenditure.

The table below shows the results of our preferred model. We also re-estimated the model with robust standard errors, which resulted in higher levels of statistical significance.

Table 20 Preferred model results

Variable	Coefficient	t-statistic	p-value
Average bill size	0.855	2.83	0.005
Benefits expenditure	1.401	3.67	0.000
GVA	-0.845	-2.77	0.000

R^2: 0.51, constant not shown

The coefficients have economically intuitive signs and are of a sensible order of magnitude. The statistics suggest that, other things equal: a 1% increase in average bill size leads to a 0.9% increase in bad debt; a 1% increase in benefits expenditure leads to a 1.4% increase in bad debt; and a 1% increase in GVA leads to a 0.8% reduction in bad debt.

Although this work is not directly comparable to previous studies (as it uses a different methodology and data) we note that the coefficients are of a similar order of magnitude to Oxera's analysis for South West Water. Namely, that study showed that a 1% increase in bill size led to between a 0.9% and 1.1% increase in bad debt – and that a 1% increase in deprivation led to between a 0.7% and 1.7% increase in bad debt. Oxera did not include GVA in their model, but did include a time trend. The time trend in their model is negative, which is consistent with our model, which shows that an increase in GVA leads to a reduction in bad debt – and where GVA has been rising (on average) over time. This similarities between the studies, as well as the economically intuitive and plausible results, give us confidence that the model is sound.

7.4. Forecasts of average bill size, regional GVA and benefits expenditure

The next step in our analysis was to forecast average bill size, regional GVA and benefits expenditure.

7.4.1. Bill size

Yorkshire's plan shows that they expect bills to stay flat in real terms and so increase in line with RPI in nominal terms. Therefore, we have used OBR's forecasts of RPI inflation, as set out in the main body of this report, to estimate the nominal increase in bill size. The year on year percentage change in inflation is set out in the table below.

Table 21 Bill size projection (nominal) in PR14

FY15/16	FY16/17	FY17/18	FY18/19	FY19/20
3.3%	3.7%	3.8%	3.9%	3.9%

Source: OBR

7.4.2. Regional GVA

We have used two methods for forecasting Yorkshire's regional GVA increases in PR14. The first is to assume that it rises in line with OBR's national GVA forecasts – ***shown in the first row of the table below***. The second is to assume that the average historical percentage point gap between national GVA changes and Yorkshire's GVA changes persists into PR14 (latest ten years of data available) – ***shown in the second row of the table below***.

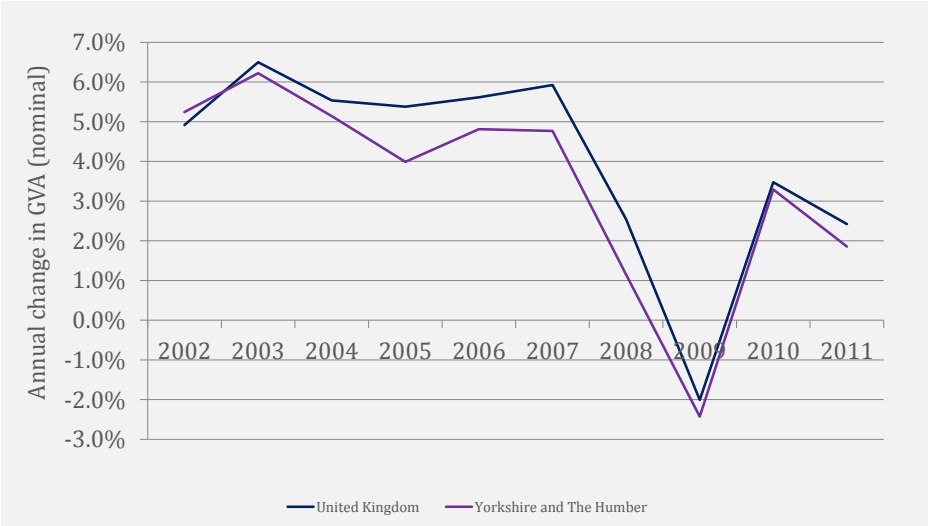
Table 22 GVA projection (nominal) in PR14

FY15/16	FY16/17	FY17/18	FY18/19	FY19/20
5.7% (UK)	6.3%	6.4%	6.4%	6.4%
5.0% (YaTH)	5.6%	5.7%	5.7%	5.7%

Source: OBR, ONS, Economic Insight calculations

The chart below shows the average annual percentage change in GVA (nominal) for the United Kingdom and Yorkshire and The Humber. The figure shows that they're highly correlated over time, but in general, Yorkshire and The Humber has lower rates of growth than the United Kingdom as a whole. The difference is 0.655% CAGR over the entire period. Accordingly, we use this figure to reduce the UK projection.

Figure 37: Evolution of GVA



Source: ONS

7.4.3. Benefits expenditure

As in the case of GVA, we have used two methods for forecasting Yorkshire's regional benefits expenditure increases in PR14. The first is to assume that it rises in line with ONS national benefits forecasts – ***shown in the first row of the table below***. The second is to assume that the average historic percentage point gap between national GVA and Yorkshire's benefits expenditure persists into PR14 (again, latest ten years of data available) – ***shown in the second row of the table below***.

The data shows that Yorkshire and The Humber has lower rates of benefits expenditure growth than the United Kingdom as a whole. The difference is 0.25% CAGR over the entire period. Again, this figure is used to reduce the UK projection.

Table 23 Benefits expenditure projection (nominal) in PR14

FY15/16	FY16/17	FY17/18	FY18/19	FY19/20
2.6% (UK)	2.6%	3.0%	2.8%	2.8%
2.4% (YaTH)	2.3%	2.7%	2.6%	2.6%

Source: ONS, Economic Insight calculations

7.5. Forecasting bad debt

The next step is to combine the econometric results and the forecasts above to project the "*gross input price pressure*" associated with bad debt. Specifically, to estimate the impact of bill size, benefits expenditure and GVA we:

» First, multiply each of the forecasts in the tables set out above by the coefficients from the econometric model (table 20). So, for example, the impact of a 3.3% increase in bill size on bad debt is estimated to be 3.3% x 0.855 = 2.8%. This provides an estimate of the effect of a change in an individual factor on bad debt – and so on.

» Second, we then add up each of the effects of changes in all of the factors, to estimate the combined effect of changes in bill size, benefits expenditure and GVA on bad debt. This, then, gives us our projected bad debt gross input price pressure forecast, based on our econometric model.

The following table sets out our projection, using the UK-level forecasts for GVA and benefits expenditure.

Table 24 Bad debt gross input price pressure for PR14, UK-level forecasts

Variable	FY15/16	FY16/17	FY17/18	FY18/19	FY19/20
Average bill size	2.8%	3.1%	3.3%	3.3%	3.3%
Benefits expenditure	3.7%	3.6%	4.2%	3.9%	3.9%
GVA	-4.8%	-5.3%	-5.4%	-5.4%	-5.4%
Total	**1.7%**	**1.5%**	**2.1%**	**1.9%**	**1.9%**

Source: Economic Insight calculations

Using the UK-level forecasts, the table shows that Yorkshire's bad debt costs are expected to *rise* by **1.8% on average per annum in nominal terms** or *fall* by **1.9% on average per annum in real terms**. That is, bad debt costs will increase, but at a slower rate than RPI. Intuitively, the nominal increases in average bill size is expected to put upward pressure on bad debt at a rate of around 3.2% per annum, but the improvement in the health of the economy (measured by the net effect of rising benefits expenditure and rising GVA) will put downward pressure on bad debt at a rate of around 1.4% per annum.

The table below uses the Yorkshire-level forecasts for benefits expenditure. On this basis, Yorkshire's bad debt costs are expected to *rise* at a rate of **2.0% on average per annum in nominal terms** or *fall* by **1.7% on average per annum in real terms**. The reason for the difference is that the effect of the lower rate of growth in Yorkshire's GVA offsets the effect of the lower rate of growth in Yorkshire's benefits expenditure.

Table 25 Bad debt gross input price pressure for PR14, Yorkshire-level forecasts

Variable	FY15/16	FY16/17	FY17/18	FY18/19	FY19/20
Average bill size	2.8%	3.1%	3.3%	3.3%	3.3%
Benefits expenditure	3.3%	3.3%	3.9%	3.6%	3.6%
GVA	-4.2%	-4.7%	-4.9%	-4.9%	-4.9%
Total	**1.9%**	**1.7%**	**2.3%**	**2.1%**	**2.1%**

Source: Economic Insight calculations

7.6. Conclusions

On the basis of the analysis set out above, we conclude that Yorkshire's bad debt will increase over PR14 – but by a rate that is less than RPI inflation. Our analysis suggests that an estimate between 1.8% and 2.0% per annum is reasonable. For the purpose of our gross input price pressure analysis, therefore, we conservatively use the estimate based on the UK-based analysis – i.e. an average increase in nominal terms of 1.8%.

8. Annex B – econometric benchmarking analysis: technical details

In constructing our model to estimate catch-up we considered a number of variables and functional forms, along with conducting tests on our preferred model. Our preferred model explains a large amount of the variation in total cost to serve (excluding doubtful debt) and all explanatory variables are highly significant. Below we detail the variables that were available to us, the tests we conducted on our preferred model and some of the alternative models we constructed.

8.1. Variables

We had the following variables available to us:

- number of dual service customers;
- number of single service customers;
- number of metered customers;
- HH turnover;
- SIM score;
- length of water mains; and
- deprivation index.

8.2. Preferred model

As detailed in the main section of this report, our preferred model is as follows:

Table 26 Preferred model results

Variable	Coefficient	t-statistic	p-value
Number of dual service customer	.0000224	19.32	0.000
Number of single service customers	.0000145	5.54	0.000

R^2: 0.9742, constant not shown

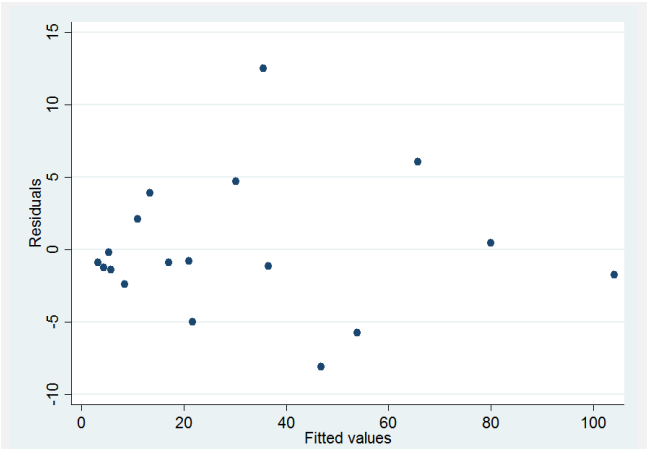
Both explanatory variables are highly significant and the R2 is particularly high. We also conduct a range of tests to ensure that the model does not violate any statistical assumptions:

» The RESET test for omitted variables gives an F-statistic of 0.22 and p-value of 0.8805. The null hypothesis is of no omitted variables and this therefore suggests that our model does not suffer from omitted variable bias.

» The Breusch-Pagan test is used to determine whether the residuals have constant variance. We are not able to reject the null of constant variance with a Chi-squared statistic of 0.75 and a p-value of 0.3871. This is consistent with the figure below, which shows little correlation between the residuals and the fitted values. The implication is that there is limited evidence that the standard errors have been affected by heteroskedasticity,

» Nevertheless, as a further cross-check on the robustness of the model, we run the model again using robust standard errors. Our two explanatory variables are still highly significant with t-statistics of 19.9 and 5.63, respectively.

Figure 38 Plot of residuals against fitted values for preferred model



Source: Economic Insight

An alternative to running the standard OLS model with robust standard errors is to run a robust regression. This model iteratively reweights observations to avoid outliers unduly influencing the results. Extreme outliers, measured by Cook's D, can be given a zero weight. The results of this specification are shown below.

Table 27 Robust regression result

Variable	Coefficient	t-statistic	p-value
Number of dual service customer	0.0000232	23.39	0.000
Number of single service customers	0.0000123	5.49	0.000

Constant not shown

As can be seen by comparison and expected given the results of the statistical tests above, the results are similar to our preferred model.

Another approach to dealing with heteroskedasticity and outliers is to use quantile regression, or specifically median regression. This is where the deviation from the median is minimised, rather than the mean, as it is less affected by outliers. The results of this model are shown below.

Table 28 Quantile regression result

Variable	Coefficient	t-statistic	p-value
Number of dual service customer	0.0000223	15.07	0.000
Number of single service customers	0.0000142	4.24	0.001

Constant not shown

Again, these results are very similar to our preferred model.

8.4. Alternative econometric models

We start with a model that includes all the extra variables we have, including the number of dual and single service customers. We would expect the number of metered customers to increase the total cost to serve as meter reading costs need to be taken into account. Household turnover, SIM score and deprivation index may have a theoretically ambiguous effect on the overall cost to serve (although as set out in the main body of this report, there are some reasons to believe that deprivation might drive customer service costs, even putting bad debt to one side). The length of water mains could be considered as a measure of coverage of the water company, and one would expect a water company with a wider coverage to have higher retail costs (or equally, it might capture network density, which could drive meter reading costs). As can be seen below, all variables apart from the number of single customers are insignificant at the 5% level. However, due to the relatively small sample size and the number of variables included, we do not think anything conclusive can be drawn from this result.

Table 29 Alternative model 1

Variable	Coefficient	t-statistic	p-value
Number of dual service customer	0.00001	1.40	0.191
Number of single service customers	0.0000151	4.17	0.002
Number of metered customers	-0.000011	-1.38	0.198
HH turnover	0.0355224	1.59	0.143
SIM score	-0.3531486	-2.21	0.052
Length of water mains	0.0002002	0.85	0.418
Deprivation index	44.98727	0.54	0.601

R2: 0.9855, constant not shown

An alternative specification that we built was to include only length of mains and number of metered customers, along with dual and single service customer numbers.

As can be seen in the table below, both length of water mains and number of metered customers are insignificant when included in our preferred model. This is also true if they are only included by themselves. Notably, the coefficients on number of dual and single service customers only change marginally compared with our preferred model.

Table 30 Alternative model 2

Variable	Coefficient	t-statistic	p-value
Number of dual service customer	0.0000231	8.39	0.000
Number of single service customers	0.0000161	4.18	0.001
Length of water mains	0.0000507	0.22	0.833
Number of metered customers	-0.0000039	-0.61	0.553

R2: 0.9749, constant not shown

Given the SIM score was almost significant we try a model that includes it. However, as shown below it is not significant. In addition, we note that the coefficient on the SIM score is negative. This could be because customer satisfaction is correlated with retail businesses that are well run and – potentially – efficient.

Therefore, rather than capturing differences in the 'level' or 'quality' of service being provided (which would be a relevant explanatory variable when benchmarking efficiency) the risk is that SIM itself is capturing some variation in efficiency. In any case, the model is not statistically significant.

Table 31 Alternative model 3

Variable	Coefficient	t-statistic	p-value
Number of dual service customer	0.0000219	19.72	0.000
Number of single service customers	0.0000138	5.55	0.000
SIM score	-0.2649626	-1.75	0.102

R2: 0.9788, constant not shown

8.4.1. Final alternative model – the deprivation index

Of the various models we explored using alternative explanatory variables, the 'deprivation model' (summarised in the main body of our report) yielded the most robust and intuitively sensible results. Here, our dependent variable was the average CTS excluding bad debt costs using 2012/13 regulatory accounting data.

Our explanatory variable was a measure of social deprivation by company, which was sourced from information published by PwC in relation to the examination of econometric models to support potential bad debt special factor claims.[54] Our intuition for including this variable in relation to CTS (excluding bad debt) is that customers with a higher social deprivation score might care more about their water bills/service (because they account for a higher proportion of their disposable income) and so might be more likely to make contact with (or complain to) their utility providers than customers with lower deprivation scores. Consequently, companies with a higher proportion of customers with high deprivation scores might face higher retail costs – particularly associated with customer service – which are outside of management control.

Table 32 Alternative model 4 – deprivation index

Variable	Coefficient	t-statistic	p-value
Deprivation index	102.26	2.68	0.02

R2: 0.3095, constant not shown

[54] *Source: PWC letter 'PwC review of South West Water's doubtful debt cost models.' Proxy indicator for the Employment sub-domain of the Index for Multiple deprivation (percentage of working population in receipt of certain benefits).'*

Further information

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