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Appendix 7.2

PR19 RETAIL HOUSEHOLD IPP ANALYSIS AND EVIDENCE

September 2018

PR19 RETAIL HOUSEHOLD IPP ANALYSIS AND EVIDENCE

A report for Northumbrian Water

February 2018

Economic Insight Ltd

CONTENTS

1. Introduction and executive summary

This report for Northumbrian Water (Northumbrian) provides forecasts of input price pressure for household (HH) retail over the PR19 price control period. The main purpose of this is to help inform the company in deriving its retail cost baselines – and as supporting evidence for the relevant data tables specified by Ofwat. In addition, the forecasts contained here may be used to inform a suitable 'common method' to allowing for inflation in retail, should Ofwat decide to do so. Equally, should inflation not be allowed for by Ofwat, the evidence could form the basis for a special factor cost claim for Northumbrian.

Northumbrian commissioned Economic Insight to provide a comprehensive analysis of the scope for retail input price pressure (IPP) over PR19. This report sets out the results of our work – and is structured as follows:

- The remainder of this section provides some context to our work, as well as an overview of our approach and methodology.
- Chapter 2 provides detailed gross retail IPP forecasts for all of Northumbrian's relevant retail cost categories.
- Chapter 3 sets out our assessment of the frontier shift savings that Northumbrian could achieve over PR19.
- Chapter 4 summarises the potential for Northumbrian's catch-up efficiency.
- Finally, chapter 5 explains how our analysis can be used as supporting evidence for various Ofwat data tables, as well as setting out implications for a 'common approach' to IPP; and a HH retail IPP special factor cost claim.
- Annexes provide more details of our methodology and results.

1.1 Introduction and context

'We will not index the retail controls to a general measure of inflation.' - Ofwat

Ofwat has confirmed that it does not intend to automatically index for inflation in relation to the HH retail control for PR19. The regulator set out its position as follows in the Final Methodology:

"We will not index the retail controls to a general measure of inflation. We consider that this approach is most appropriate for the retail controls, and provides appropriate incentives for companies to manage input costs. This is consistent with the incentives for businesses in more competitive markets."[1]

Nevertheless, Ofwat also confirmed that it may still consider allowing for retail inflation within its forward-looking totex allowances. The regulator further stated that the evidence it will review from companies relates to that provided to support the

[1] *'Delivering Water 2020: Our final methodology for the 2019 price review.' Ofwat (December 2017), Appendix 11: Securing cost efficiency, page 23.*

real price effects analysis contained in Appointee Tables 24 and 24a.[2] This is set out below:

"We will review evidence on forecast IPP in retail for the duration of the price control. If appropriate, we will make a cost allowance for inflation as part of totex. This approach ensures companies stay incentivised to manage the risk of IPP.

We will consider evidence on IPP submitted by companies. We will also consider independent data sources and forecasts, such as data from the Office for National Statistics on wage growth rates. Given that our PR19 approach involves setting an efficient cost allowance for all companies, we intend to apply a common method for determining an inflation allowance for all companies, if we consider that such an allowance is appropriate."[3]

As such – regardless as to how the analysis will be used - companies must provide robust evidence as to the IPP they will face in respect to HH retail over PR19. Given Ofwat's position in the Final Methodology, this analysis and evidence may, ultimately, be used in the following ways:

- **Firstly, an analysis of retail IPP is necessary in order to assist companies with deriving their retail cost baselines** and, relatedly as *supporting evidence* for Appointee Data Tables 24 and 24a.

- Secondly, the development of robust analysis, may: (i) help provide evidence to Ofwat that it should, indeed, include retail IPP in forward-looking totex allowances; and relatedly (ii) **assist Ofwat in determining a consistent method that can be applied for all companies**.

- Thirdly, if Ofwat does not apply an allowance for all companies, **this analysis could form the basis of a special factor cost claim.**

The main objective of the analyses set out in this report is to provide robust evidence as to the retail IPP that will arise over PR19. In practice, this can be used for any of the above purposes. Therefore, we set out clearly what our evidence implies in relation to each of the above in our findings and conclusions chapter.

[2] *'Delivering Water 2020: Our final methodology for the 2019 price review.' Ofwat (December 2017), Appendix 11: Securing cost efficiency, page 24.*

[3] *'Delivering Water 2020: Our final methodology for the 2019 price review.' Ofwat (December 2017), Appendix 11: Securing cost efficiency, page 24.*

1.2 Our approach and methodology

1.2.1 Our conceptual approach

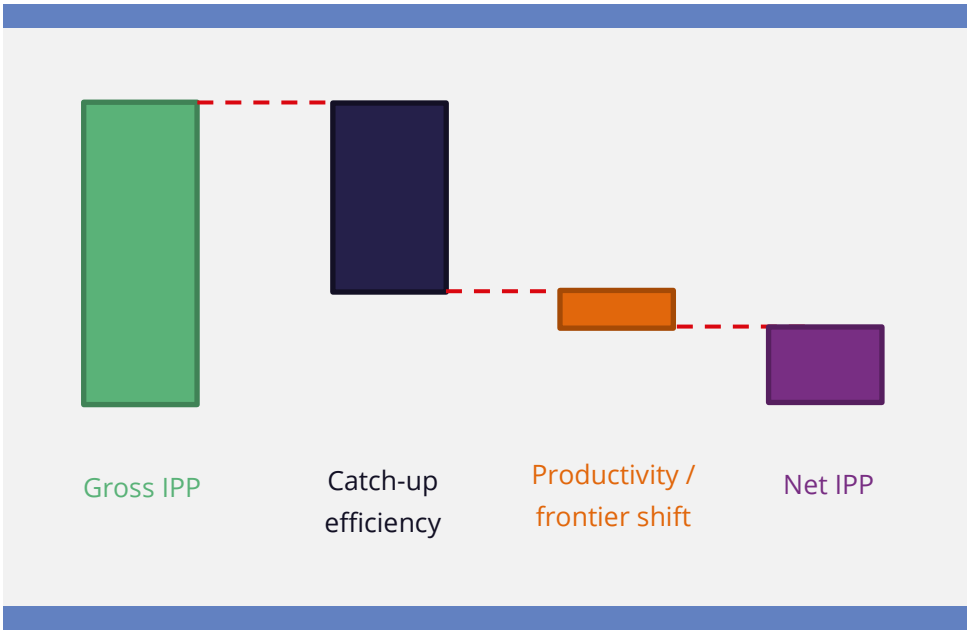
Consistent with our conceptual approach that was accepted by Ofwat at PR14, the subsequent analyses set out in this report are rooted in established economic theory and evidence. This starts from the observation that **all firms face IPP** – and that, in a competitive market, **efficient firms would be expected to pass that IPP onto their customers.** Firms that are **not perfectly efficient,** however, would **only be able to pass on the 'net' impact of IPP and their inefficiency.**

Therefore, our report starts from the proposition that, ultimately, the various elements of the regulatory framework should (collectively) ensure that the net amount of IPP is allowed for, taking account of:

- underlying gross IPP;
- the productivity gains that could be made across the industry as a whole that even an efficient firm could make (i.e. productivity / frontier shift); and
- any further efficiency savings that could make as a result of catching up to a defined efficiency frontier (i.e. catch-up efficiency).

The above matters, because it is intended to ensure that only cost pressure that is outside of (efficient) management control is included within the price control. Our framework is illustrated in the following figure.

Figure 1: Illustration of our framework



Source: Economic Insight

1.2.2 Our method

To apply our approach in practice, we have developed a range of detailed analyses. These include:

- **Forecasting underlying gross input inflation**, where we have used three approaches:
  - **Economic fundamentals.** This is based on the analysis of the relationship between input costs and key economic indicators.
    - » Some methods are based on the '**wedge'** between input costs and other inflation indicators, such as the Consumer Prices Index (CPI).
    - » Other methods are based on **statistical analysis** of the relationship between input costs and economic fundamentals, such as gross domestic product (GDP).
  - **Extrapolations**. Here, we extrapolate existing trends in input costs forward. This approach was widely used by companies at PR14. However, our view is that Ofwat may place less emphasis on it at PR19 (relative to technically superior analytical methods).[4]
  - **Independent third-party forecasts.** There are independent third-party forecasts for certain input costs, such as labour. Where these exist, we examine them in detail.
- **Determining the scope for productivity / frontier shift**, where we have analysed a range of publicly available data – including EU KLEMS.
- **Estimating the scope for retail 'catch-up' efficiency**, which is addressed by our separate econometric modelling work for Northumbrian (and so is only summarised here).

[4] *See: 'Delivering Water 2020: Our final methodology for the 2019 price review.' Ofwat (December 2017), page 143.*

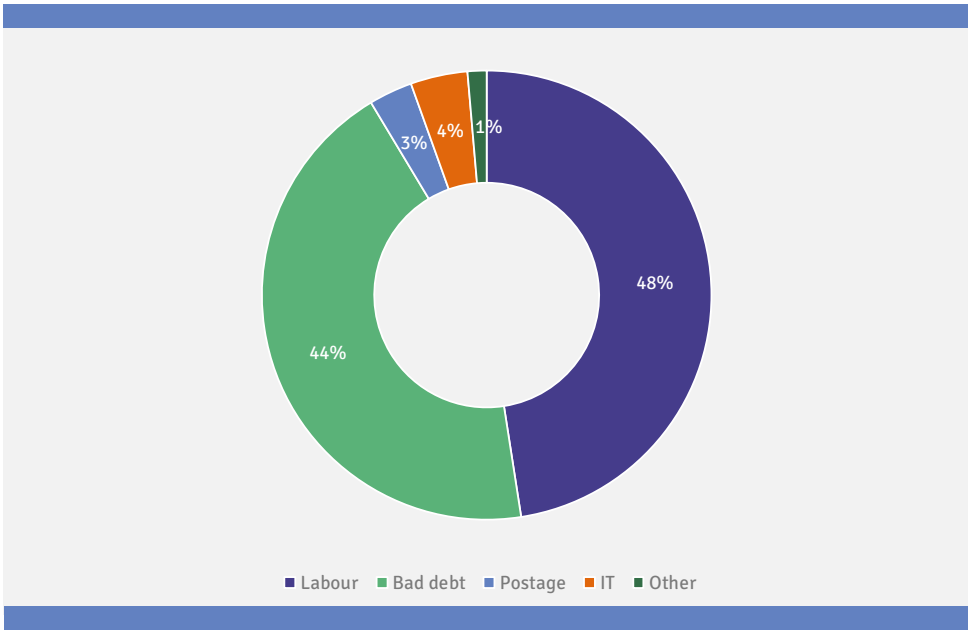
1.3 Summary of our findings

1.3.1 Gross IPP evidence

Our analysis suggests a gross IPP for HH retail of between 1.86% to 2.50% per annum on average for Northumbrian Water over the period 2020/21 to 2024/25. This is based on the analysis set out subsequently.

Northumbrian's data shows that most of its opex HH retail costs relate to either staff or bad debt, as the following chart illustrates.

Figure 2: Split of Northumbrian Water's opex HH retail costs, 2016/17 (reconciled to regulatory accounts)[5]



Source: Economic Insight analysis of Northumbrian Water cost data

All of our gross inflation forecasts start from a detailed mapping of the key categories of retail costs incurred to independent inflation data. For example, in relation to labour costs, we asked Northumbrian to provide us with a full list of retail roles, including associated costs and headcounts. Northumbrian mapped each individual role to occupational level wage inflation data from the ONS (i.e. by SOC code), to create a Northumbrian specific retail wage index.

For the other key retail cost categories, we similarly sought to identify the most relevant historical data from the ONS and other credible sources at a very granular level. Here, our key objective was to avoid basing forecasts on the 'actual' costs incurred by Northumbrian – as this might embed a degree of inefficiency. Rather, for each cost category, we have created a bespoke inflation 'index', which avoids any conflation of inefficiency.

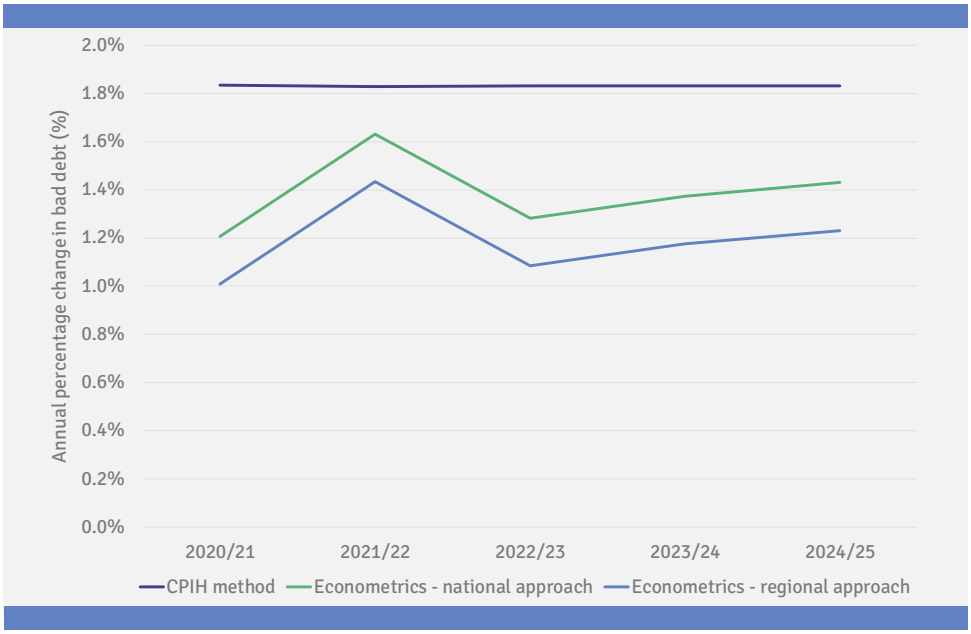
Having created our bespoke inflation indices, we project IPP over the price control period (2020/21 to 2024/25). We have utilised a range of methods to achieve this, as

[5] *To ensure consistency with the company's published regulatory accounts, we used the 'other' category as a balancing item, calculated as 'opex' (as per regulatory accounts) minus the sum of granular opex costs by category (e.g. labour, bad debt, postage and IT) provided by the company.*

summarised above. These included undertaking econometric analysis, as well as extrapolating historical data forward, by assuming that the relationship between individual price pressure measures and more aggregate measures (for which there are official forecasts, such as CPI or wage inflation) hold over time.

Regarding bad debt, the simplest approach would have been to assume CPIH (as CPIH is included within the wholesale controls, which, by definition, flows through to retail). However, this ignores the fact that (and as established in our retail econometric cost benchmarking analysis) both deprivation (i.e. socio-economic factors) and average wholesale bill size, will also impact bad debt costs over time. Given this, we used an econometric model to project Northumbrian's *underlying* bad debt inflation, which incorporates both expected changes in bill size and macroeconomic factors. As shown below, this approach results in **lower** bad debt inflation forecasts, relative to a simple CPIH method.

Figure 3: Bad debt IPP implied by econometrics versus CPIH



Source: Economic Insight analysis

Drawing our various approaches together, the following table summarises our forecasts of overall gross retail IPP over the period.

Table 1: Summary of forecast gross retail IPP

	2020/21	2021/22	2022/23	2023/24	2024/25	Average
High	2.35%	2.55%	2.53%	2.53%	2.53%	2.50%
Medium	1.84%	2.20%	2.04%	2.08%	2.11%	2.05%
Low	1.64%	2.02%	1.85%	1.89%	1.92%	1.86%

Source: Economic Insight analysis

1.3.2 Frontier shift efficiency

Our analysis suggests that Northumbrian could make HH retail productivity savings of between -0.42% (i.e. negative) and +1.10% pa in relation to opex (which is most relevant to retail). This is primarily based on an analysis of EU KLEMS data.

Further to the gross IPP, we considered the scope for productivity improvements (i.e. the savings even an efficient firm could make) for Northumbrian Water. Here our approach was primarily based on an analysis of EU KLEMS data, whereby we:

- developed a composite index of comparators, based on an analysis of their underlying characteristics; and then
- evaluated the TFP trend of the index over differing time-periods.

A key issue for PR19 is how best to reflect the UK's poor productivity performance since the 2008 financial crisis (which data shows is the longest period of flatlining productivity performance in history). As such, we developed three scenarios:

- **Our central case covers the 16-year period from 1999 and 2015.** It therefore includes 8 years post-crisis and 8 years pre-crisis (when productivity was nearer its long-term average). This approach attaches equal weight to both periods – and thus implicitly assumes that productivity will improve over PR19 back towards its long-term position. **We consider this to be a balanced and neutral interpretation of the data.**

- **Our low scenario focuses on the post-crisis period (2007 to 2015).** As such, it implicitly assumes that the current flatline performance will continue. Given the current outlook for the UK, we also consider this to be plausible.

- **Our high scenario uses the period from 1999-2008.** As such, it 'ignores' the post crisis period and the UK's decade long low productivity performance. Under this scenario, one would implicitly be assuming that the UK quickly returns to its long-term productivity trend. We consider this to be less plausible than our central and low scenarios.

Our results for HH retail are summarised below.

Table 2: Summary of frontier-shift analysis

Scenario / cost type		Low	Central	High
Time-period data based on		2007-2015	1999-2015	1999-2008
Retail	Opex	-0.42%	0.42%	1.10%
	Capex	-0.31%	0.28%	0.56%

Source: Economic Insight analysis

1.3.3 Catch-up efficiency

Our econometric benchmarking analysis for HH retail suggests that the appropriate scope for Northumbrian Water to make catch-up related efficiency savings over PR19 is between 0.00% and 0.40% (equivalent to a range of between 0.00% and 0.08% pa), with a central case of 0.00% in total (0.00% pa).

We have previously undertaken econometric cost benchmarking analysis on behalf of Northumbrian. As this is set out in separate reports, we do not repeat the methodology or approach here. However, in summary, our analysis implies that a suitable level of efficiency catch-up (over the whole of PR19) is likely to lie in the range of between 0.00% an 0.40% – as shown in the table below.

Table 3: Catch up efficiency challenge (% total over PR19)

Parameter / scenario	Low (less challenging)	Central	High (more challenging)
Model weights	Equal weights	Equal weights	Equal weights
Residual adjustment	None	None	None
Benchmark	Average	Upper quartile	Upper quintile
Glide path	5 years	None	None
Total efficiency challenge over PR19 %)	0.00%	0.00%	0.40%
Average catch up efficiency challenge pa (%)	0.00%	0.00%	0.08%

Source: Economic Insight analysis

For the purpose of setting a cost efficiency challenge for HH retail, Ofwat is not proposing to set a 'glide path' (the implication being that the entirety of the above efficiency challenge would need to be delivered by the first year of the control).

2. Gross IPP analysis

In this chapter, we quantify the future expected gross IPP faced by Northumbrian Water, using a range of forecasting techniques. Our approach is based on developing detailed 'indices' of Northumbrian's input costs, which mitigates the risk of implicitly including inefficiency in our forecasts.

The key aspects of our gross HH retail IPP analysis for Northumbrian are as follows:

- **We have used three different approaches to forecasting IPP for Northumbrian.** These are based on mapping historical inflation metrics to individual Northumbrian retail cost items, to create bespoke indices of underlying inflation.
- **For staff costs, this process was especially detailed** - and we have mapped specific staff roles / functions to individual occupational level inflation data.
- **We have forecast individual historical data forward based on its relationship with aggregate inflation measures,** such as CPI. The projections are then linked to official OBR forecasts to ensure consistency, robustness and transparency.
- **We have used econometric models** (where feasible) to allow for the effects of the general UK economy on our inflationary measures.
- **Our analysis suggests that Northumbrian will face gross IPP of between 1.86% to 2.50% pa,** on average between 2020/21 and 2024/25.

2.1 Overview of our approach to IPP analysis

Here, we set out evidence and analysis relating to the *'gross'* IPP Northumbrian will face from 2020/21 to 2024/25. The approach we have followed to derive gross IPP is as follows:

- We have identified the most relevant **historical** inflation data for each of Northumbrian's key HH retail cost categories; and have examined this over time (typically ten years).
- Specifically, in relation to staff costs, the above step was based on a detailed review of the functional roles within Northumbrian's HH retail business where, for each role, we identified historical data based on mapping the role to a specific occupation using the Annual Survey of Hours and Earnings (ASHE) data, as published by the ONS.
- As we need to **project** IPP over PR19, we have then employed three approaches to forecasting, namely:

- **Economic fundamentals.** This is our preferred methodology, which is based on the analysis of the relationship between input costs and key economic indicators.
  - » Some methods are based on the '**wedge'** between input costs and other inflation indicators, such as the CPI.
  - » Other methods are based on **statistical analysis** of the relationship between input costs and economic fundamentals, such as GDP growth.
- **Extrapolations**. Here, we extrapolate existing trends in input costs forward. This approach was widely used by companies at PR14. However, we consider that Ofwat may place less emphasis on it at PR19 (relative to other, analytically superior, methods).[6]
- **Independent third-party forecasts.** There are independent third-party forecasts for certain input costs, such as labour. Where these exist, we have examined them in detail.

- Finally, to derive Northumbrian's *overall* gross forecast IPP for the price control period, we weight our individual projections by the company's cost split by category.

It should be noted that, where possible, when forecasting gross IPP in the remainder of this chapter, we have applied all of the above three methods to arrive at more robust forecasts. However, due to data limitations, we were unable to use all of the above methods for all input cost types. The following figure summarises our forecasting approaches across Northumbrian's different retail input costs. Where possible, we prefer the econometric forecasting approach. However, for some input costs – such as postage and IT – this method did not provide sufficiently robust forecasts; and as such we utilise other methods.

Figure 4: Our forecasting approaches

	Economic fundamentals		Extrapolations	Independent third-party forecasts
	Econometrics	Wedge		
Labour	✓	✓	✓	✓
Bad debt	✓	✗	✗	✗
Postage	✓	✓	✓	✗
IT	✓	✓	✓	✗
Other	✗	✗	✗	✓

Source: Economic Insight

[6] *See: 'Delivering Water 2020: Our final methodology for the 2019 price review.' Ofwat (December 2017), page 143.*

We believe that the above approach represents a robust and reasonable method for deriving Northumbrian's gross IPP. Specifically, we believe that our linking of detailed historical data to independent third-party forecasts to be particularly important, given that:

- we need to estimate *projected* IPP – 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 forecast of call centre staff costs);
- the OBR's forecasts are generally considered to be robust and often relied upon in regulatory and competition law determinations; and
- our approach avoids basing forecasts on Northumbrian's actual historical costs, which may embed a degree of inefficiency.

The rest of this chapter is structured as follows:

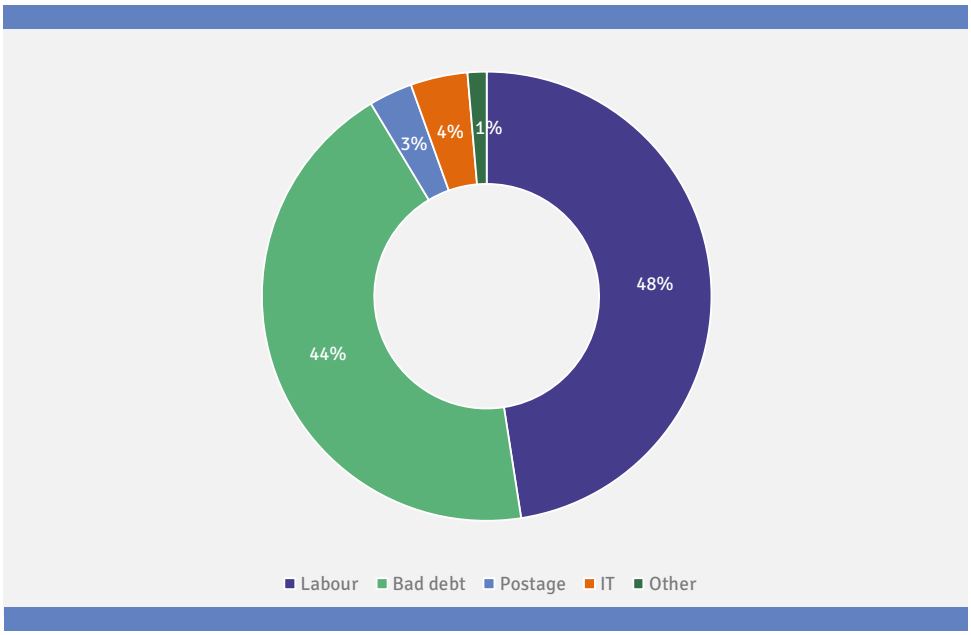
- First, we set out **Northumbrian's historical split of HH retail costs** by key cost category.
- Second, we set out **our assessment of Northumbrian's gross projected IPP for each of the individual retail cost categories.**
- Finally, we provide our assessment of **the total gross IPP Northumbrian will face** over the period 2020/21 to 2024/25 in relation to HH retail.

2.2 Northumbrian Water's HH retail cost split

Northumbrian provided us with a breakdown of its HH retail operating costs into the following input cost categories for 2016/17 (illustrated in the following pie chart):

- staff;
- doubtful debts;
- postage;
- IT; and
- other.

Figure 5: Split of Northumbrian Water's opex HH retail costs, 2016/17 (reconciled to regulatory accounts)[7]



Source: Economic Insight analysis of Northumbrian Water cost data

The above figure shows that the overall IPP forecast for Northumbrian will primarily be driven by what we will assume about future staff and doubtful debt inflation.

2.3 Labour costs

NORTHUMBRIAN PROVIDED US WITH A DETAILED BREAKDOWN OF ITS HH RETAIL COSTS, WHICH ALLOWED US TO CREATE BESPOKE INDICES THAT DO NOT 'BAKE IN' UNDERLYING INEFFICIENCIES.

To forecast IPP relating to *staff costs,* Northumbrian provided us with a detailed breakdown of its HH retail staff costs by function / role. This, therefore, gives us Northumbrian's actual mix of employees.

For each function / role, Northumbrian matched employee data to specific jobs and occupations, as defined using Standard Occupation Classification (SOC) 2010 codes. This data is published by the ONS within its ASHE survey.

The ASHE data contains detailed information on wages by SOC code. So, by matching Northumbrian's employee roles to SOC codes, we could create a HH retail specific index of underlying wage inflation over time. Importantly, this allows us to create a measure of underlying historical inflationary pressure for the company, without

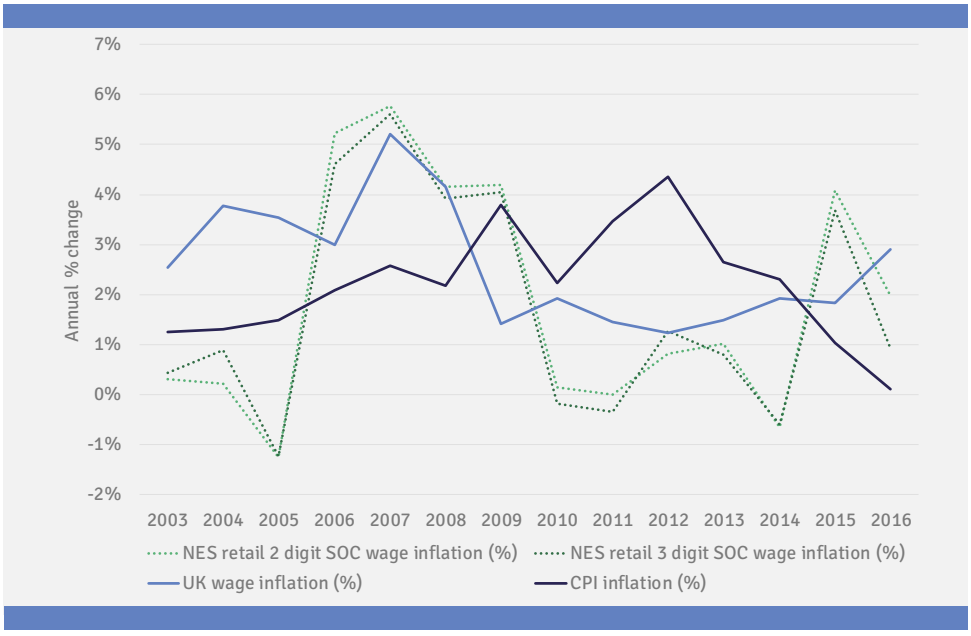
[7] *To ensure consistency with the company's published regulatory accounts, we used the 'other' category as a balancing item, calculated as 'opex' (as per regulatory accounts) minus the sum of granular opex costs by category (e.g. labour, energy and chemicals) provided by the company.*

conflating any inefficiency inherent in Northumbrian's actual labour costs incurred in the past.

In creating the index, an important consideration is the level of disaggregation applied in matching job roles to SOC codes. Specifically, within the ASHE, SOC codes range from 1 digit (which are general occupation types, but have reliable wage inflation estimates due to a larger sample size) to 4 digit SOC codes (which are very specific, but are subject to greater uncertainty in their estimation, due to small sample size). Thus, there is a trade-off between using codes that are most relevant to Northumbrian's actual roles, and the precision of the estimates of wage inflation for each role. We therefore created wage inflation indices using both 2 and 3 digit SOC codes, which we consider are most likely to strike the appropriate balance between these two considerations.

Following from the above, the figure below shows how Northumbrian's HH retail labour cost index compares to CPI and overall UK average wage inflation over time, as reported by the ONS. To be consistent with the Office of Budget Responsibility (OBR) forecasts (on which we subsequently base our projections), UK average wage inflation is calculated from wages and salaries data in the National Accounts and employee numbers from the Labour Force Survey (LFS).

Figure 6: Historical wage inflation



Source: Economic Insight analysis of ONS ASHE and Northumbrian Water data

As can be seen from the chart above, our calculated Northumbrian 2 digit (3 digit) SOC code wage inflation was 1.86% (1.70%), which is – on average – **lower than CPI and overall UK wage inflation** – albeit all measures follow a broadly similar trend.

The following subsections set out our projections using the three forecasting methodologies described above:

- firstly, we set out forecasts derived from economy-based estimates of wage inflation, including both wedge and econometric methodologies;
- secondly, we provide forecasts based on an analysis of past trends in the wage index;

- thirdly, we discuss independent third-party estimates of future UK wage inflation; and
- finally, we summarise the evidence we have analysed and provide our overall forecasts of underlying HH retail wage inflation for 2020/21 to 2024/25.

2.3.1 Economy based estimates

As we set out above, our preferred methodology bases wage forecasts on economic fundamentals, rather than extrapolations of historical labour costs. Our approach to generating economy-based estimates of labour cost inflation was based on two key steps:

- First, we used data from our company labour cost index (calculated as above) to explore relationships between wider measures of the UK's economic performance. We used two approaches for this step:
  - (a) we identified the historical '*wedge*' between our index for Northumbrian's labour cost inflation and more general inflation measures (in particular, UK average wage inflation and CPI); and
  - (b) we used econometrics to identify a *statistical relationship* between Northumbrian's wage inflation (again, as measured by our index) and GDP and average UK wage growth.
- We then assumed that the identified relationships hold in the future – and developed forecasts for Northumbrian HH retail labour cost inflation based on official forecasts for GDP; average wage growth; and general inflation in the UK economy.

In the following we set out our forecasts.

2.3.1.1 Wedge estimates

Here, we calculated the wedge between inflation in our Northumbrian HH retail labour cost index and both: (i) average UK wages; and (ii) CPI inflation. Overall, we consider that deriving forecast using the *wedge to average UK wage inflation* should be preferred over the *wedge to CPI inflation*. This is because we expect that there will be more commonality between the drivers of UK wage inflation and Northumbrian labour cost inflation than is the case for CPI. CPI inflation is based on a basket of goods and services; and will be driven by supply and demand *across the economy*. Wage inflation is driven by supply and demand in the *labour market specifically*.

The following table shows the size of these wedges for the whole period for which data is available, from 2003 to 2016. In general, Northumbrian's underlying wage inflation (as measured by our index) is below UK average wage inflation (i.e. the wedges are negative), although the difference is slightly less pronounced based on 2 digit SOC codes, rather than 3 digit ones. Northumbrian's underlying wage inflation also tends to be below CPI, although the wedges are smaller in this case.

Table 4: Historical wedge between Northumbrian Water HH retail labour cost index and: (i) average UK wage inflation; and (ii) CPI

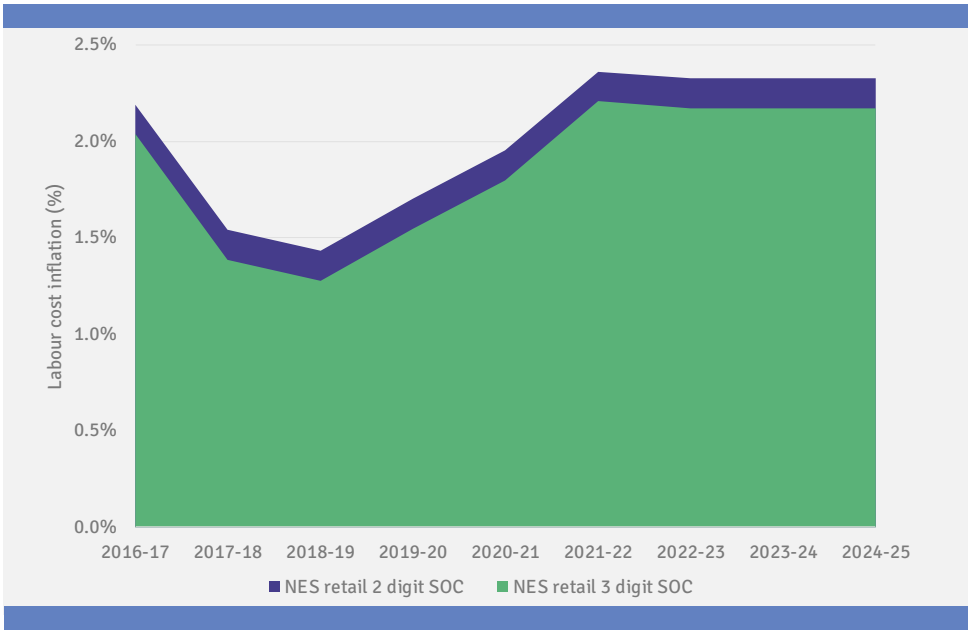
Wedge	2 digit SOC codes	3 digit SOC codes
Wedge to **average UK wage inflation**	-0.74%	-0.90%
Wedge to **CPI inflation**	-0.34%	-0.50%

Source: Economic Insight analysis

To derive forecast underlying HH retail labour input cost inflation for Northumbrian, we combined these 'wedges' with the most recent projections for both wage and CPI growth, taken from the OBR. These are available up to the year 2021/22 and are shown in the appendix. For years beyond 2022, we assumed that wage and CPI growth continue at the level forecast for 2022.

Our forecasts using this methodology, with respect to UK wage inflation, are shown in the following figures. Estimates based on 2 digit SOC codes are generally higher than those based on 3 digit SOC codes. Further, estimates based on wage inflation are usually higher than those based on CPI (which are set out in the appendix). This is mostly driven by the fact that the OBR forecasts wage inflation to be materially higher than CPI by the early 2020s (i.e. it forecasts real wage growth).

Figure 7: Forecast labour cost inflation – based on wage inflation wedge



Source: Economic Insight analysis of ONS ASHE and Northumbrian Water data

As can be seen, forecasts based on the 'wedge' with national wage growth are reasonably consistent cross the 2 and 3 digit SOC code indices.

2.3.1.2 Econometric estimates

We used econometric analysis to investigate the statistical relationship between the Northumbrian HH retail labour cost index and: (i) UK GDP; and (ii) average UK wages. Variables such as GDP and wages are generally *non-stationary*, meaning that simple regressions of wage levels on GDP can lead to spurious findings of relationships. We addressed this in two ways:

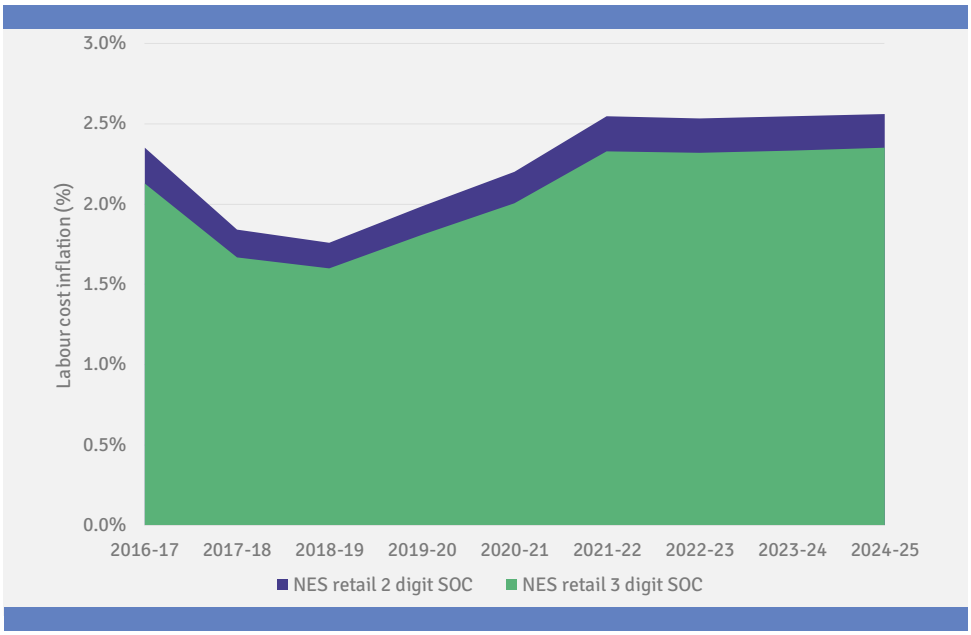
- Firstly, we developed regressions of the *percentage changes* in the Northumbrian HH retail labour cost index on changes in nominal GDP / average UK wages.
- Secondly, we regressed levels of the Northumbrian HH retail labour cost index on the level of nominal GDP / average UK wages (both expressed as an index) *and lagged values of the Northumbrian Water HH retail labour cost index.*

Our overall preference is for the former method, as this allows for easier comparisons to be made between the R^2 of the regressions – since the presence of lagged values of the labour cost index in the levels regression results in high R^2 values across the board.

The regressions relating our retail labour cost indices to percentage changes in UK average wages performed less well. The regression in levels, however, performed better. We have, therefore, based our retail estimates on the regressions in **levels**, using the slightly higher 2 digit SOC code estimates.

The following figure shows projected HH retail labour cost inflation, based on the wage regression in levels. It suggests HH retail labour cost inflation for 2020 to 2025 of around 2.48% for 2-digit SOC codes, and around 2.27% for 3 digit ones.

Figure 8: Forecast labour cost inflation – based on average UK wage (levels)



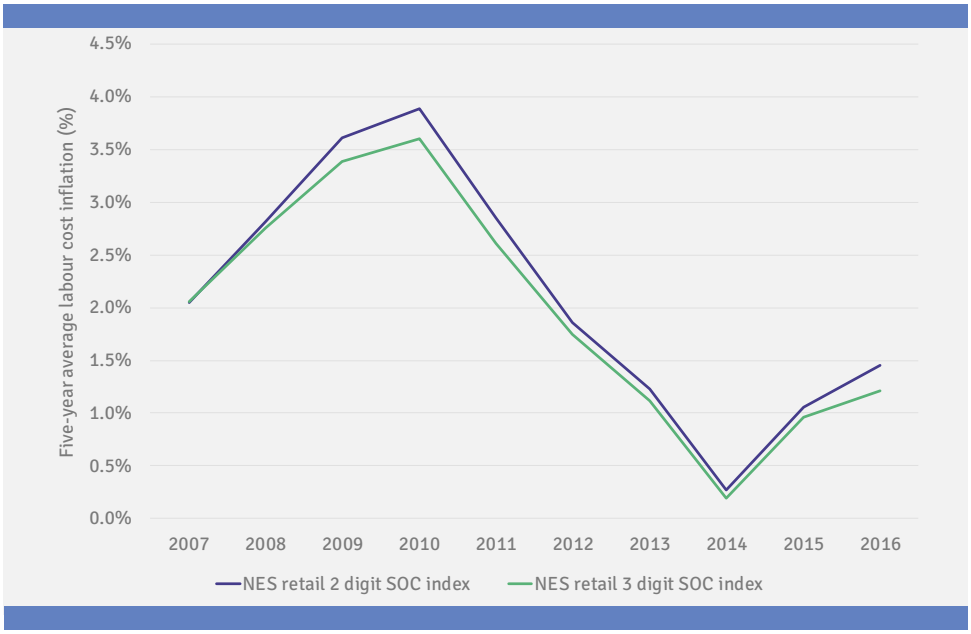
Source: Economic Insight analysis of ONS ASHE and Northumbrian Water data

2.3.2 Extrapolating existing trends

The second methodology for forecasting wage inflation for PR19 is to extrapolate forward existing trends in our Northumbrian HH retail labour cost index. We place less weight on this approach than on approaches based on economic fundamentals. This is because, clearly, a limitation of an extrapolation approach is that the implied forecast is *simply a continuation of the past*. Consequently, this method implies relatively low future labour cost inflation. In practice, and as explained elsewhere, it is well established that labour market performance and inflation are, in fact, closely linked to the wider macroeconomic environment. In this case, therefore, extrapolations ignore the OBR's expected upturn in the UK's performance in general, and its projections for real wage growth in particular, between now and 2020.

The following figure below show five-year rolling averages of the Northumbrian HH retail labour cost index at both the 2 and 3 digit SOC code level. Both show a prominent downward trend, combined with a levelling off and a slight increase around 2013/14. We note that these trends mirror the performance of the economy over the relevant time-period.

Figure 9: Northumbrian Water HH retail wage inflation index – 5 year rolling average



Source: Economic Insight analysis of ONS ASHE and Northumbrian Water data

Alongside five-year windows for calculating average inflation, we have also examined average inflation over the whole period for which data are available (2003 to 2016). This is shown in the following table.

Table 5: Existing trends in Northumbrian Water HH retail labour cost index inflation

Trend	2 digit SOC code	3 digit SOC code
Whole period	1.86%	1.70%
Last 5 years	1.45%	1.21%

Source: Economic Insight analysis of ONS ASHE and Northumbrian Water data

As with the longer-term average shown previously, the above does not take into account the OBR's expected upturn in UK wage growth between now and 2020. In addition, arguably a shorter-term historical average has the further drawback of being less likely to be *representative* of future economic conditions (i.e. if one extrapolates from the above table, one would be placing undue weight on just the more recent wage inflation data).

Consequently, if one were to use an extrapolation approach, we would advocate placing more weight on data using the whole time-period, which would suggest a wage inflation in the range of 1.70% to 1.86% per annum.

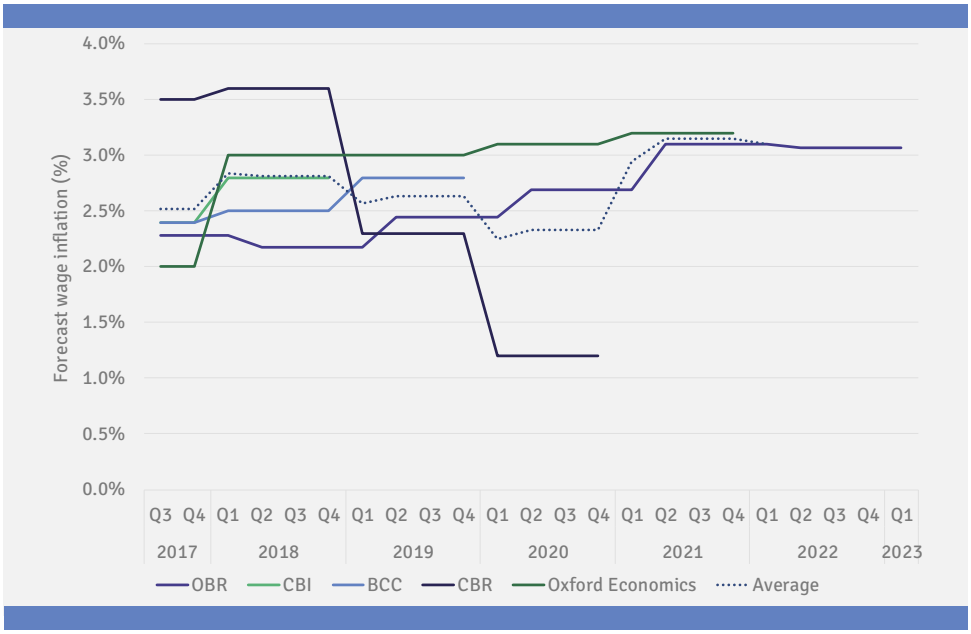
2.3.3 Independent wage growth forecasts

Finally, we examined a range of independent forecasts of future wage growth in the UK from government bodies and other forecasters, namely: the OBR; the Confederation of British Industry (CBI); the British Chambers of Commerce (BCC); the Centre for Business Research (CBR); and Oxford Economics. These are shown in the subsequent figure. We highlight the following:

- None of the forecasts provides projections for the whole of 2020 to 2025; and only the OBR's and Oxford Economics' forecasts extend beyond 2020.
- Forecasts for 2018/19 are in the range of 2.2% to 3.6% per annum. Most forecasts are relatively stable, although the CBR's suggests a material fall in wages between 2018 and 2019.
- There are differences in forecast wage growth in 2020. Whereas the OBR's and Oxford Economics' forecasts are in the range of 2.7% to 3.1% per annum, CBR forecasts wage growth to be 1.2%.
- Across the independent forecasts we have reviewed, the average expected UK wage inflation rate is estimated to be in the range of 2.4% to 2.9% per annum (note, as above, this refers to the period up to 2020, as only the OBR and Oxford Economics provide longer-term forecasts).

'Across the independent forecasts we have reviewed, the average expected UK wage inflation rate is estimated to be in the range of 2.4% to 2.9% per annum.'

Figure 10: Forecast UK wage inflation



Source: OBR, CBI, BCC, CBR and Oxford Economics

While these results are inherently uncertain, we place most weight on the OBR's forecasts, which are used for official purposes. Moreover, they are towards the 'middle' of the range of available nearer-term forecasts.

2.3.4 Summary of labour inflation forecasts over PR19

As described in the preceding subsections, we have used a range of methods to forecast Northumbrian's underlying HH retail labour cost inflation, covering the period 2020/21 to 2024/25. The next two tables set these out in full.

Table 6: Northumbrian Water HH retail labour cost inflation forecasts, 2020/21 - 2024/25 – 2 digit SOC – **preferred results**

Methodology	Wage inflation forecasts (%)	2020/21	2021/22	2022/23	2023/24	2024/25	Avg
Economy-based	GDP econometrics – levels	1.83%	2.03%	2.05%	2.07%	2.10%	2.02%
	GDP econometrics – changes	1.75%	1.80%	1.80%	1.80%	1.80%	1.79%
	Wage econometrics – levels	**2.20%**	**2.55%**	**2.53%**	**2.55%**	**2.56%**	**2.48%**
	Wage econometrics – changes	1.92%	2.21%	2.18%	2.18%	2.18%	2.14%
	Wedge to UK wage inflation	**1.95%**	**2.36%**	**2.33%**	**2.33%**	**2.33%**	**2.26%**
	Wedge to CPI inflation	1.66%	1.65%	1.66%	1.66%	1.66%	1.66%
Extrapolation	Whole period trend	1.86%	1.86%	1.86%	1.86%	1.86%	1.86%
Third-party	**Independent forecasts**	**2.69%**	**3.11%**	**3.07%**	**3.07%**	**3.07%**	**3.00%**

Source: Economic Insight analysis

Table 7: Northumbrian Water HH retail labour cost inflation forecasts, 2020/21 - 2024/25 – 3 digit SOC

Methodology	Wage inflation forecasts (%)	2020/21	2021/22	2022/23	2023/24	2024/25	Avg
Economy-based	GDP econometrics – levels	1.62%	1.80%	1.82%	1.85%	1.88%	1.80%
	GDP econometrics – changes	1.58%	1.63%	1.63%	1.63%	1.63%	1.62%
	Wage econometrics – levels	2.01%	2.33%	2.32%	2.34%	2.35%	2.27%
	Wage econometrics – changes	1.77%	2.06%	2.03%	2.03%	2.03%	1.98%
	Wedge to UK wage inflation	1.80%	2.21%	2.17%	2.17%	2.17%	2.11%
	Wedge to CPI inflation	1.51%	1.50%	1.50%	1.50%	1.50%	1.50%
Extrapolation	Whole period trend	1.70%	1.70%	1.70%	1.70%	1.70%	1.70%
Third-party	Independent forecasts	2.69%	3.11%	3.07%	3.07%	3.07%	3.00%

Source: Economic Insight analysis

Drawing the above together, our 'high', 'central' and 'low' forecasts are shown below. All are based on the 2 digit SOC code HH retail index, as we consider this one to be superior.

Table 8: Summary of final labour inflation forecasts used

Scenario		2020/21	2021/22	2022/23	2023/24	2024/25	Avg
High	Independent forecasts	2.69%	3.11%	3.07%	3.07%	3.07%	3.00%
Central	Wage econometrics – levels	2.20%	2.55%	2.53%	2.55%	2.56%	2.48%
Low	Wedge to UK wage inflation	1.95%	2.36%	2.33%	2.33%	2.33%	2.26%

Source: Economic Insight analysis

2.4 Doubtful debt

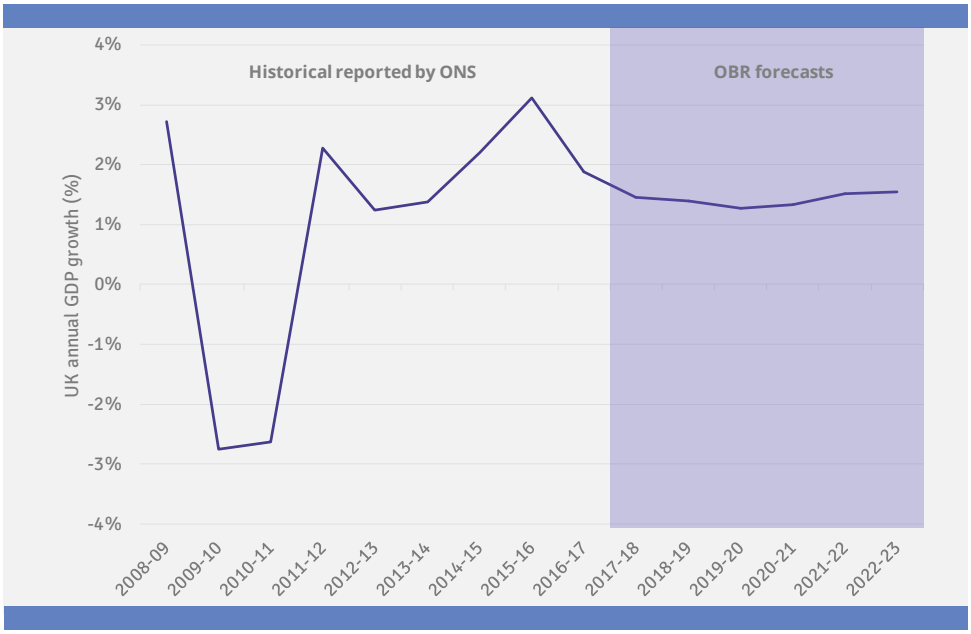
It is widely accepted that in relation to doubtful debts, two key cost drivers are: (i) bill size; and (ii) socioeconomic factors (such as deprivation – and thus, relatedly, the wider macroeconomic environment).

From a retail perspective, clearly bill size is primarily driven by whatever regulated prices are set at the wholesale level. This, in turn, implies that the IPP relating to bad debt in the retail part of the supply chain is, to a large degree, determined by the 'K factors' Ofwat sets for the water and wastewater wholesale elements of the PR19 price control.

Clearly, 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). Given this, one approach for projecting bad debt gross IPP would be to project these costs based on CPIH.[8] The rationale for this, of course, is that CPIH is allowed for in the regulatory approach for wholesale. Therefore, by definition, it is an inflationary pressure that flows through to retail.

Nonetheless, the risk of simply assuming CPIH as the basis for projecting doubtful debt IPP is that it ignores the likely impact of changes to the UK's macroeconomic environment during PR19 (including, of course, any impacts of Brexit). To illustrate this, the following chart shows the OBR's forecasts for UK GDP growth.

Figure 11: Historical and projected GDP



Source: ONS and OBR data

As can be seen, GDP growth in the UK is expected to reduce slightly in comparison to the recent past, starting to rise again slowly from 2020 onwards.

Therefore, we have constructed forecast bad debt cost pressure for Northumbrian based on an econometric modelling analysis, which uses historic data (between 2010/11 – 2016/17) to estimate the relationship between bad debt per property,

[8] *Which is consumer price inflation including a measure of owner occupiers' housing.*

average wholesale bill size per unique customer and an indicator of the health of regional economies – benefits expenditure. We then use publicly available information to forecast bills and benefits expenditure and, with our econometric model, predict the annual growth in bad debt per property over PR19. Further details of our econometric model and method are set out in Annex A to this report.

The doubtful debt IPP projected by our modelling is set out in Table 9 below. We find that, on average, Northumbrian is likely to face gross IPP of between 1.4% to 1.8% per annum in relation to doubtful debts.

Table 9: Bad debt forecasts using different methodologies

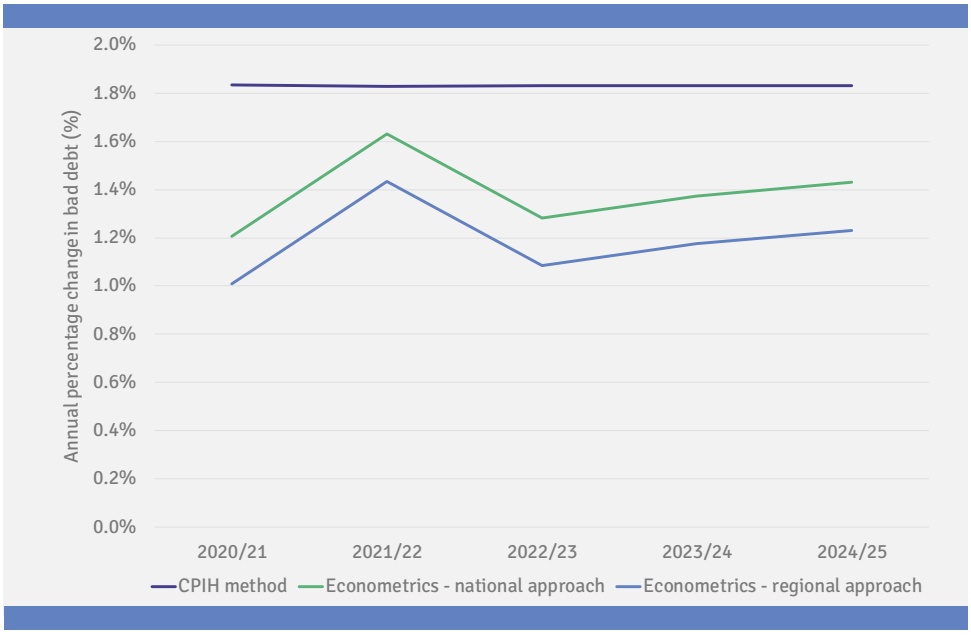
Method	2020/21	2021/22	2022/23	2023/24	2024/25	Average
CPIH	1.8%	1.8%	1.8%	1.8%	1.8%	1.8%
National	1.2%	1.6%	1.3%	1.4%	1.4%	1.4%
Regional	1.0%	1.4%	1.1%	1.2%	1.2%	1.2%

Source: Economic Insight analysis of ONS and water companies' data

The following figure shows how our econometric approaches, based on economic fundamentals, compare to a simple CPIH approach. Our modelling reflects the OBR's expected (modest) GDP growth, which of course mitigates bad debt costs for companies over time. This, then, explains why our statistical forecasts are somewhat **below** the CPIH method.

OUR ECONOMETRIC BAD DEBT FORECASTS ARE MORE CONSERVATIVE COMPARED TO A SIMPLE CPI-H APPROACH.

Figure 12: Doubtful debt IPP implied by econometrics versus CPIH



Source: Economic Insight analysis of ONS data

Drawing the above together, our 'high', 'central' and 'low' forecasts for bad debt are shown below.

Table 10: Summary of final bad debt inflation forecasts used

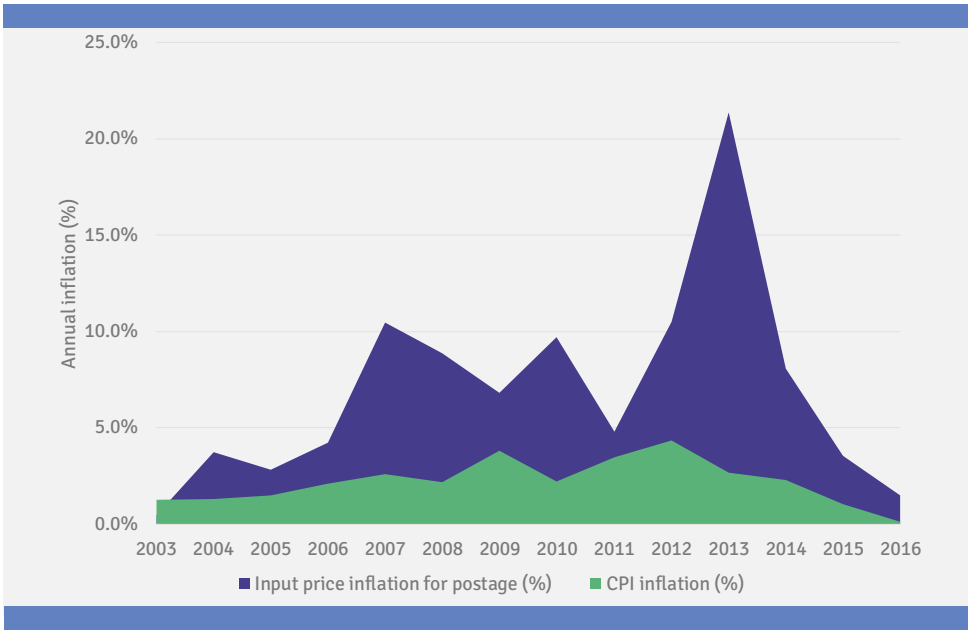
Scenario		2020 / 21	2021 / 22	2022 / 23	2023 / 24	2024 / 25	Avg
High	CPIH	1.8%	1.8%	1.8%	1.8%	1.8%	1.8%
Central	Econometrics - national	1.2%	1.6%	1.3%	1.4%	1.4%	1.4%
Low	Econometrics - regional	1.0%	1.4%	1.1%	1.2%	1.2%	1.2%

Source: Economic Insight analysis

2.5 Postage

The ONS publishes detailed breakdowns of inflation by individual items within its RPI and CPI measures – one of them being postage costs. We therefore examined historical postage inflation back over 13 years to 2003, which is compared to CPI in the following figure.

Figure 13: Historical postage inflation



Source: Economic Insight analysis of ONS data

Postage inflation has been significantly higher than CPI throughout the time 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; and privatised in 2013.

Consistent with the 'wedge' methodology summarised previously, to project postage IPP forward over time, we:

- examined the historical wedge between postage inflation and CPI (which was 4.7% over the 13 years);
- obtained the OBR's forecasts for CPI; and
- then assumed the historical wedge over CPI would hold, to generate expected future postal IPP.

The results of the above analysis are summarised in the following table, which also incorporates the forecasts on postage inflation extrapolating the whole period trend of annual post inflation (6.9%) forward.

Our approach is likely to be *conservative* in relation to postage costs. This is because there is a reasonable prospect that Royal Mail Group will continue to put in price increases that are materially above the longer-term historic average (13 years) that we have used as the basis for our analysis. Here, it is worth noting that 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.

Table 11: Northumbrian Water postage cost inflation forecasts, 2020/21 - 2024/25

Methodology	Postage inflation forecasts (%)	2020/21	2021/22	2022/23	2023/24	2024/25	Avg
Economy-based	Wedge to CPI inflation	6.7%	6.7%	6.7%	6.7%	6.7%	6.7%
Extrapolation	Whole period trend	6.9%	6.9%	6.9%	6.9%	6.9%	6.9%

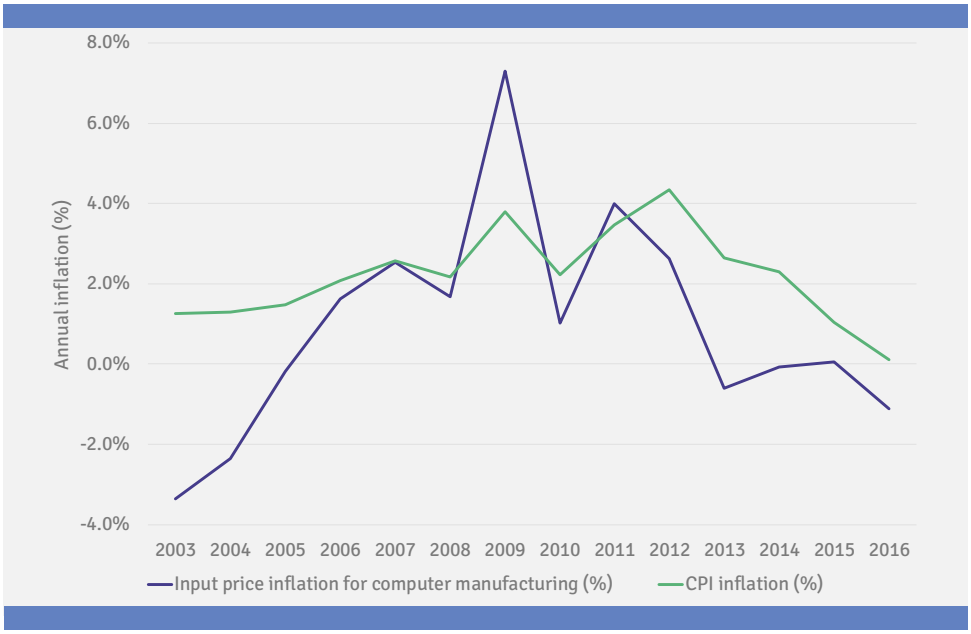
Source: Economic Insight analysis

2.6 IT

In relation to IT related costs, there is more limited 'output price' related information available. We have, therefore, applied the same approaches set out above, but instead have utilised the producer price index, published by the ONS, in relation to '*inputs for the manufacturing of computers*'. We consider this to be the index most relevant to IT.

The following chart shows the historical IPP for the manufacturing of computers, compared to CPI inflation.

Figure 14: Historical IT input cost inflation



Source: Economic Insight analysis of ONS data

Over the last 13 years, input cost inflation for computer manufacturing has averaged 0.9%, which is below the average for the same period for CPI of 2.2%.

To project IT related IPP forward, we have applied the historical wedge between our measure and CPI (-1.3%) to the OBR's CPI forecast, in a manner consistent with the methodology described elsewhere in this report. We have, similarly, also utilised econometric modelling and an extrapolation approach – both of which are also summarised below.

Table 12: Northumbrian Water IT cost inflation forecasts, 2020/21 - 2024/25

Methodology	IT inflation forecasts (%)	2020 / 21	2021 / 22	2022 / 23	2023 / 24	2024 / 25	Avg
Economy-based	Wedge to CPI inflation	0.7%	0.7%	0.7%	0.7%	0.7%	0.7%
	GDP econometrics – levels	1.6%	1.8%	1.8%	1.8%	1.9%	1.8%
Extrapolation	Whole period trend	0.9%	0.9%	0.9%	0.9%	0.9%	0.9%

Source: Economic Insight analysis

2.7 'Other' IPP

Northumbrian's 'other' HH retail costs include a range of items; and amount to just 1% of total costs, as shown previously in Figure 2.

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

The following table illustrates the OBR's forecast CPI inflation, which we have therefore used for this purpose.

Table 13: OBR CPI projections

Year	OBR projected CPI
2017/18	3.0%
2018/19	2.2%
2019/20	1.8%
2020/21	2.0%
2021/22	2.0%
2022/23	2.0%

Source: OBR

2.8 Summary of our projected gross IPP for Northumbrian Water

Having undertaken detailed projections for IPP for each of Northumbrian's key HH retail cost categories, the final step is to weight these by Northumbrian's mix of cost, to derive our final projected gross IPP for PR19.

It should be noted that:

- **Our methodology includes a detailed mapping of HH retail input costs to specific inflation measures** – particularly in relation to staff costs.
- Our projections of costs into the future are based on various methodologies and are consistent overall. Moreover, they are **rooted in respected independent forecasts for key inflation variables.**
- **For projecting bad debt costs forward, we have undertaken econometric modelling, which considers how likely cost drivers will evolve over time,** and their impact on debt costs.

Over the period 2020/21 to 2024/25, we estimate that Northumbrian's gross IPP in HH retail will be between 1.86% - 2.50% per annum on average. This is based on our following low, medium and high estimates:

- our **central** estimates derive from:
  - staff costs being forecast based on the wage econometrics approach in levels (2 digit SOC);
  - doubtful debts being forecast based on the national econometrics approach;
  - IT and postage costs being forecast based on the wedge to CPI method; and
  - other costs being forecast based on independent forecasts (CPI).
- our **high** estimates derive from:
  - staff costs being forecast based on independent forecasts (OBR);
  - doubtful debts being forecast based on the CPIH approach;
  - IT and postage costs being forecast based on the wedge to CPI method; and
  - other costs being forecast based on independent forecasts (CPI).
- our **low** estimates derive from:
  - staff costs being forecast based on the wedge to average UK wages (2 digit SOC) approach;
  - doubtful debts being forecast based on the regional econometrics approach;
  - IT and postage costs being forecast based on the wedge to CPI method; and
  - other costs being forecast based on independent forecasts (CPI).

The tables overleaf set out the results for **gross IPP,** based on these assumptions.

Table 14: Summary of gross input price assumptions – **central case**

	2020/21	2021/22	2022/23	2023/24	2024/25	Cost mix (%)
Staff	2.20%	2.55%	2.53%	2.55%	2.56%	*47.55%*
Doubtful debts	1.21%	1.63%	1.28%	1.37%	1.43%	*43.85%*
Postage	6.72%	6.71%	6.71%	6.71%	6.71%	*3.14%*
IT	0.74%	0.73%	0.74%	0.74%	0.74%	*4.10%*
Other	2.00%	2.00%	2.00%	2.00%	2.00%	*1.37%*
Gross IPP (%)	**1.84%**	**2.20%**	**2.04%**	**2.08%**	**2.11%**	**2.05%**

Source: Economic Insight analysis

Table 15: Summary of gross input price assumptions – **high case**

	2020/21	2021/22	2022/23	2023/24	2024/25	Cost mix (%)
Staff	2.69%	3.11%	3.07%	3.07%	3.07%	*47.55%*
Doubtful debts	1.84%	1.83%	1.83%	1.83%	1.83%	*43.85%*
Postage	6.72%	6.71%	6.71%	6.71%	6.71%	*3.14%*
IT	0.74%	0.73%	0.74%	0.74%	0.74%	*4.10%*
Other	2.00%	2.00%	2.00%	2.00%	2.00%	*1.37%*
Gross IPP (%)	2.35%	2.55%	2.53%	2.53%	2.53%	**2.50%**

Source: Economic Insight analysis

Table 16: Summary of gross input price assumptions – **low case**

	2020/21	2021/22	2022/23	2023/24	2024/25	Cost mix (%)
Staff	1.95%	2.36%	2.33%	2.33%	2.33%	*47.55%*
Doubtful debts	1.01%	1.43%	1.08%	1.18%	1.23%	*43.85%*
Postage	6.72%	6.71%	6.71%	6.71%	6.71%	*3.14%*
IT	0.74%	0.73%	0.74%	0.74%	0.74%	*4.10%*
Other	2.00%	2.00%	2.00%	2.00%	2.00%	*1.37%*
Gross IPP (%)	1.64%	2.02%	1.85%	1.89%	1.92%	**1.86%**

Source: Economic Insight analysis

3. Frontier shift

Here, we assess the scope for Northumbrian to make productivity / frontier shift savings in HH retail. This is based on both a review of regulatory precedent - and an analysis of EU KLEMS data.

In order to determine the net amount of IPP that will arise in HH retail over PR19, we need to reach a view on the extent of '*frontier shift*' efficiency improvement that can be achieved. By this we mean the efficiency savings that even a perfectly efficient firm could make, due to assumed productivity gains. In this chapter, we therefore set out our views as to what a reasonable forecast for frontier shift potential might be, where we address in turn:

- the UK's overall productivity performance;
- an overview of the EU KLEMs TFP dataset and how this can be used to inform frontier shift;
- our analysis of the scope for frontier efficiency gains in HH retail, based on a composite index analysis using EU KLEMS; and
- an overview of relevant regulatory precedent.

3.1 The UK's productivity performance

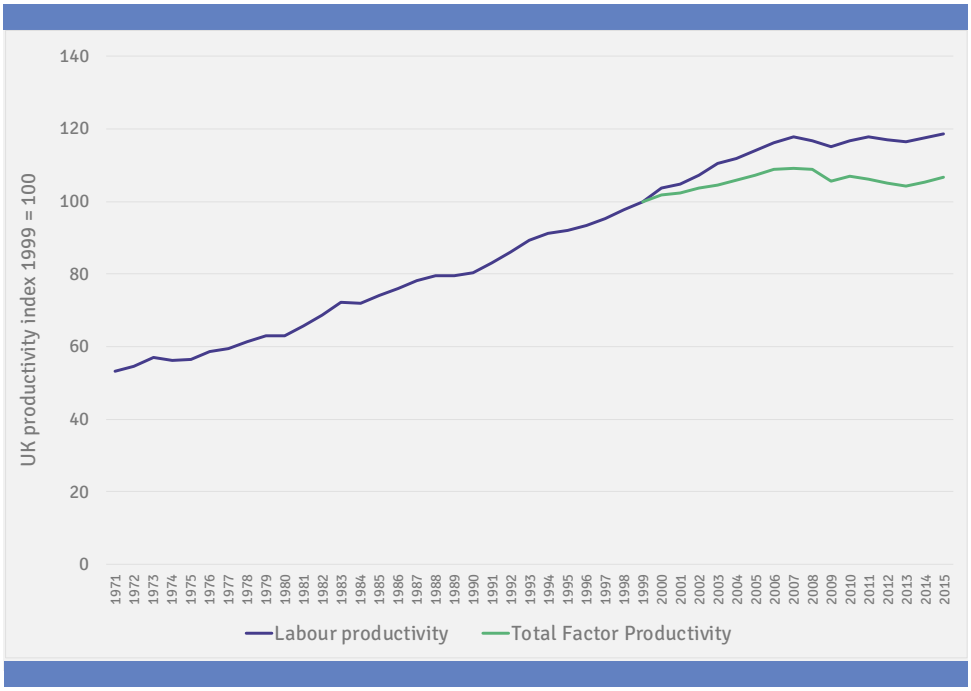
In reaching a view on the potential scope for frontier shift gains in HH retail, it is important to understand the broader context of historical productivity performance in the UK.

3.1.1 The UK's broader productivity position

The following figure shows both the UK's TFP and labour productivity (measured in output per hour worked) over time. A longer time series is available for the latter, which extends back to 1971. This shows that, in the decade prior to the 2008/09 financial crisis and recession, labour productivity was growing in line with its long-term average, of around 2% pa. However, since then, productivity has flat-lined, or slightly fallen. Specifically:

- Labour productivity has averaged just 0.1% pa since 2008.
- TFP has averaged -0.3% pa since 2008.

Figure 15: UK productivity levels – annual index



Source: ONS and EU KLEMS

The fact that productivity has not increased for a period of time (or slightly fallen) is not particularly unusual. Indeed, the chart shows that it has fallen or flattened in the past. What is unusual, however, is the duration of the 'flat line', which is longer than any other period previously experienced, including the heavy recessions of the late 1980s and early 1990s.

The UK's weak productivity performance since 2008 is well documented – and has become a key policy issue in the recent past – as highlighted in the following:

'The main reason for lowering our GDP forecast since March is a significant downward revision to potential productivity growth, reflecting a reassessment of the post-crisis weakness and the hypotheses to explain it.' – The OBR

- In November 2017, the OBR downgraded its GDP forecasts for the UK. This, in turn, was driven by the authority reaching a more pessimistic view regarding the outlook for productivity. *"The main reason for lowering our GDP forecast since March is a significant downward revision to potential productivity growth, reflecting a reassessment of the post-crisis weakness and the hypotheses to explain it."*[9]

- The IFS notes: *"Productivity growth has been weak in almost all sectors of the [UK] economy, and negative in some. The lack of productivity growth in the finance sector has been important, but cannot explain the majority of the recent weakness."*[10]

- The Financial Times' survey of economists in January 2018 reported that: *"more than half of all respondents said there was unlikely to be any pick-up in productivity this year."*[11]

9 *'Economic and fiscal outlook – November 2017 .' OBR (2017).*
10 *https://www.ifs.org.uk/publications/7821*
11 *'UK productivity performance will be sluggish, say economists.' The FT, January 1st 2018.*

The cyclical nature of the UK's economy – coupled with its flatlining productivity performance since the financial crisis – has important implications for any analysis used to set expected 'frontier shift' efficiency in future. The key considerations are as follows:

- Firstly, to the extent that expected frontier shift must draw on historical data, **the time-period over which any such analysis is undertaken will clearly materially impact the conclusions one reaches.**

- Secondly, **determining 'which' time-period is appropriate thus turns the purpose for which any forecast frontier shift analysis is being used.** Most obviously:

  - If the primary purpose is to inform frontier shift potential over the relative near-term (e.g. say the 5-year period of a price control) then one should most likely attach more weight to the recent past.
  - If, on the other hand, one wanted a view of longer-term frontier shift potential, so in turn, one should use longer-term historical data to inform that analysis.

3.2 EU KLEMS composite index analysis

In this section, we set out an analysis of TFP, as reported in the EU KLEMS data (a commonly used source by regulators in setting price determinations). Here, our methodology is as follows:

- **We identify sectors within EU KLEMS that we consider to be 'comparable'** to HH retail (reflecting our views on 'input mix' and 'activities' in particular).
- **We then develop a composite TFP index** for HH retail, based on weighting the individual comparators.
- **Finally, we estimate the scope for future frontier shift for HH retail,** based on the historical trends implied by our indices. Here, and with reference to the previous discussion of the UK's historical productivity performance, a range of time periods are tested.

3.2.1 The EU KLEMS data

The EU KLEMS is the most comprehensive data source relating to TFP estimates. It includes measures of TFP growth at both an overall economy level, as well as disaggregated down to individual sectors or industries by country (including within the UK). The most recent 2017 EU KLEMS databases retain the standard EU KLEMS structure of previous rounds. However, the number of years for which growth accounting data is available is slightly reduced. For example, whereas the 2011 EU KLEMS release allowed one to calculate TFP growth since the 1970s, the current release only goes back to 1998 for the UK. The EU KLEMS database contains information on 34 industries and 8 more aggregate categories.

3.2.2 Composite index assumptions

Following from the above, the next step in our analysis was to consider 'which' elements of the EU KLEMS data to include as comparators for HH retail – and 'how much' weight to attach to each. Consistent with economic theory, when determining which components of the EU KLEMS data to include, we considered:

- the relative mix of labour and capital as inputs into production;
- the activities undertaken within the sector / industry; and
- the likely competitiveness of the sector / industry.

Having applied these criteria, we arrived at the weightings set out in the following table.

Table 17: Weightings used in composite EU KLEMS index – for use in opex HH retail

Sectors used for composite opex index and % weightings	HH retail weighting (%)
Total industries (whole UK)	75%
Financial and insurance activities	12.5%
Retail trade, except of motor vehicles and motorcycles	12.5%

Source: Economic Insight analysis

With reference to the above, we should highlight that:

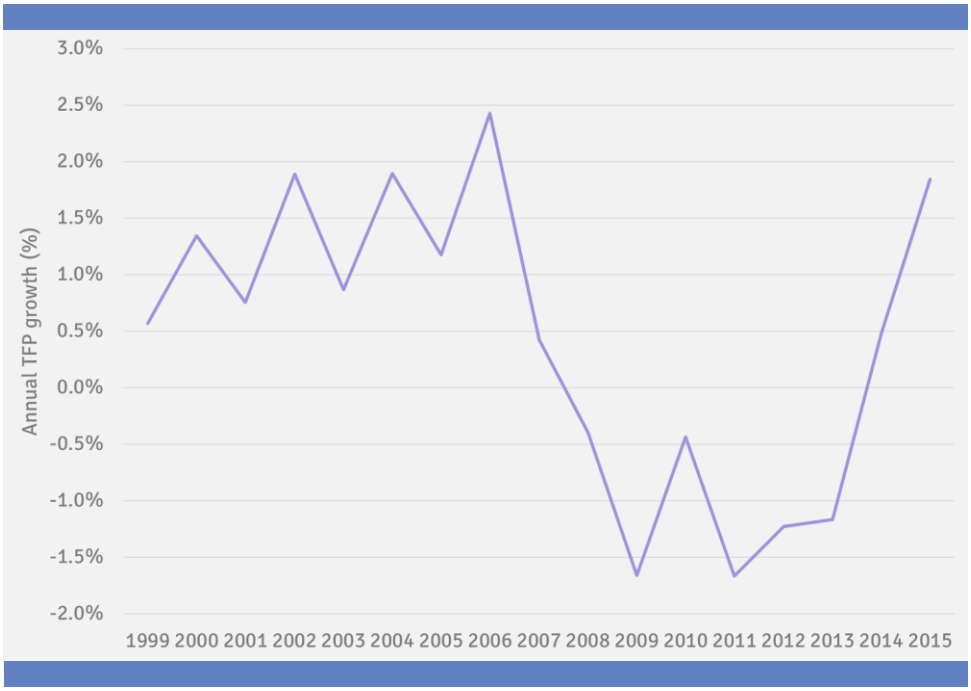
- Our index includes a 75% weighting on the UK's 'all industries' TFP performance. This reflects: (i) the fact – even with the use of evaluation criteria - the selection of individual sectors remains subjective, and so we did not want our results to be overly sensitive to our choices; and (ii) there are good reasons to suppose the retail element of the value chain in particular should perform broadly in line with overall UK productivity.

- Financial and insurance activities have a very similar input mix of labour and capital to HH retail – and furthermore, involve similar activities – making them a credible comparator.

- Retail trade also involves similar activities to HH retail – and also is widely considered to be highly competitive.

Following from the above, the following chart shows the historical performance of our opex composite index for HH retail.

Figure 16: Historical TFP performance – composite opex index for HH retail



Source: Economic Insight analysis

3.2.3 Results

Based on the evidence set in the preceding sections, the following table shows our forecasts for the scope for frontier shift efficiency savings for HH retail. These are set out for both opex and capex. However, given the asset light nature of retail, we would suggest that one could rely on the opex figures alone.

We further present figures based on a 'central case'; a 'high case' and a 'low case'. In all cases, the makeup of the composite index for opex is the same. What varies is the time-period from which the data is drawn. Specifically:

- **Our central case is based on the last 16 years from 1999 to 2015.** We have chosen this period as our central estimate because it attaches an equal balance of weight to the 8-year period of low productivity growth since the financial crisis and the 8 preceding years. As the EU KLEMS data does not contain a 'whole' business cycle (and because one cannot be certain when the next one will occur) we consider this to be a neutral and balanced interpretation of the data. Implicit in this assumption is that the UK's productivity will improve over PR19 relative to current performance.

- **Our high case is based on the 9 years from 1999 – 2008**. This includes the period of growth since the early 90s recession (albeit not the whole period), and the start of the 2007 recession. This is our high scenario, because it effectively 'ignores' the last decade of low productivity performance. As such, this scenario implicitly assumes that the UK quickly returns to its longer-term productivity growth trend. In our view, this is 'less plausible' than either our central or low case scenarios.

- **Our low case is based on the last 8 years from 2007 to 2015**. Our low scenario assumes that the UK's productivity performance since 2007 persists in the near-term. Given the unusual length of the current 'flat-lining' productivity performance, and the uncertainty arising from Brexit, we also consider this to be a plausible basis for forecasting frontier-shift over PR19.

The following table sets out the results of our analysis in relation to HH retail. As noted above, given the capex light nature of retail, one may wish only to make use of the opex figures alone.

Table 18: HH retail frontier shift forecasts

Scenario / cost type		Low	Central	High
Time-period data based on		2007-2015	1999-2015	1999-2008
Retail	Opex	-0.42%	0.42%	1.10%
	Capex	-0.31%	0.28%	0.56%

Source: Economic Insight analysis

3.3 Review of regulatory precedent (opex frontier shift)

Our view is that Northumbrian should base its Plan assumptions on our analysis of EU KLEMS data, as set out above. However, as a further source of information, we undertook a review of regulatory precedent. Accordingly, the following table sets out a summary of our findings relating to opex (which is most relevant to retail).

Table 19: Opex productivity assumptions (frontier shift) in other price control reviews

Regulator - price control	% reduction in opex per annum	What is being measured	Notes on adjustments
ORR – Network Rail, opex (CP4)[12]	0.2%	*Ongoing productivity improvements* ('frontier-shift') that even the best performing companies would be expected to achieve, above that reflected in general inflation. Measured as *TFP (net of economy TFP)* based on Oxera (2007) study on the scope for CP4 efficiency improvement.	Lowered amount for maintenance and renewals (60%) of Oxera's estimate as a prudent value, to account for the possibility of double counting productivity improvements in the TFP estimates and in the input price estimates produced by LEK for Network Rail.
ORR – Network Rail, maintenance (CP4)[13]	0.7%		
Ofwat – water and sewerage (PR09)[14]	0.25%	*Continuing efficiency* - a continuing improvement factor linked to the improvement that can be expected from the leading or frontier companies.	N/A
CC - Northumbrian Water PR09[15]	0.9%	*Productivity improvement*	Marginally lower than the 1 per cent figure, which appeared to be the consensus view. This downward adjustment reflected the CC's view of the balance between two offsetting factors: (i) the scale of the industry capital investment programme, which at £22 billion was higher than in any other previous five year period, presenting an opportunity for continuing efficiency improvements for the water sector; and (ii) the fact that some of the forecasts of productivity improvements reviewed were based in part on historic averages that incorporate the catch-up element of improvement in productivity which needs to be netted out from our estimate.
PPP Arbiter – underground infracos,	0.7%	unclear	unclear

12 *'Periodic Review 2008: Determination of Network Rail's outputs and funding for 2009-14.' Office of Rail and Road (October 2008).*
13 *'Periodic Review 2008: Determination of Network Rail's outputs and funding for 2009-14.' Office of Rail and Road (October 2008).*
14 *'Future water and sewerage charges 2010-15: Final determinations.' Ofwat (2009)*
15 *'Bristol Water plc: A reference under section 12(3)(a) of the Water Industry Act 1991 Report.' Competition Commission (4 August 2010).*

Regulator - price control	% reduction in opex per annum	What is being measured	Notes on adjustments
central costs (2010)[16]			
PPP Arbiter – underground infracos, opex (2010)[17]	0.9%	unclear	unclear
UR – water and sewerage (PC13)[18]	0.9%	*Productivity improvement* measured by EU KLEMS TFP growth rates in comparator sectors.	Adjustments for capital substitution and catch-up efficiency cancel each other out.
Ofgem – electricity and gas transmission (T1)[19]	1.0%	The *ongoing efficiency assumption* is a measure of the *productivity improvements* that are expected to be made by the network companies over the price control period. EU KLEMS sector comparators on total factor productivity (TFP) measures and partial factor productivity (PFP) measures. Review of recent regulatory reports, including a report by Reckon commissioned by the ORR in May 2011.[20]	Excluded industries (namely, utilities) from EU KLEMS comparator set where systematic catch-up was expected, i.e. where the historic productivity improvements for these industries will reflect a material element of movement to the efficiency frontier (which Ofgem's comparative efficiency assessment addresses), as well as movement of the efficiency frontier (which is the element Ofgem needs to identify).
Ofgem – gas distribution (GD1)[21]	1.0%		
UR – gas distribution (GD14)[22]	1.0%	The move of the frontier – or frontier shift – describes the *efficiency gains* resulting from companies becoming more efficient over time, e.g. through technological progress. The frontier shift in real terms can be measured as follows: *input price inflation – forecast RPI (measured inflation) – productivity increase.*	This 1.0% is the estimated average annual productivity increase.
CC – NIE (RP5)[23]	1.0%	*Annual productivity growth* based on the following evidence: (i) review of regulatory precedent; (ii)	

16 *'Northern Ireland Electricity Limited price determination A reference under Article 15 of the Electricity (Northern Ireland) Order 1992 – Final Determination.' Competition Commission (26 March 2014) Table 11.1.*

17 *'Northern Ireland Electricity Limited price determination A reference under Article 15 of the Electricity (Northern Ireland) Order 1992 – Final Determination.' Competition Commission (26 March 2014) Table 11.1.*

18 *'PC13 Annex D The Rate of Frontier Shift Affecting Water Industry Costs.' First Economics (December 2012).*

19 *'RIIO-T1/GD1: Real price effects and ongoing efficiency appendix.' Ofgem (17 December 2012).*

20 *'Productivity and unit cost change in UK regulated network industries and other UK sectors: initial analysis for Network Rail's periodic review.' Reckon (May 2011).*

21 *'RIIO-GD1: Final Proposals – Supporting document - Cost efficiency.' Ofgem (17 December 2012).*

22 *'GD14 Price Control for northern Ireland's Gas Distribution Networks for 2014-2016 Final Determination.' Utility Regulator (20 December 2013).*

23 *'Northern Ireland Electricity Limited price determination A reference under Article 15 of the Electricity (Northern Ireland) Order 1992 – Final Determination.' Competition Commission (26 March 2014).*

Regulator - price control	% reduction in opex per annum	What is being measured	Notes on adjustments
		EU KLEMS growth and productivity accounts based on comparator analysis; and (iii) recent business plans submitted by GB DNOs.	
Ofgem – electricity distribution (ED1)[24]	1.0% (midpoint of 0.8% and 1.1%)	*Ongoing efficiency assumption,* whereby even the most efficient DNO should make *productivity improvements* over the price control period, such as by employing new technologies. These improvements are captured by the ongoing efficiency assumption which represents the potential reduction in input volumes that can be achieved while delivering the same outputs.	
UR – water and sewerage (PC15)[25]	0.9%	*Productivity gains* which the frontier companies are expected to deliver over the price control period.	
CMA - Bristol Water PR14 (totex)[26]	1.0%	*Productivity improvements*	
UR – gas distribution (GD17)[27]	1.0% (midpoint of 0.5% and 1.5%)	*Productivity growth*: it is necessary to apply a productivity assumption to both opex and capex so as to take account of continuing efficiencies which the industry can achieve over the price control period. This is a base level of efficiency which even frontier companies would be expected to achieve as they continually improve their business over time (with new technologies and working practices for example).	
UR – electricity networks (RP6)[28]	1.0% (midpoint of	*Productivity assumption* applied to opex and capex so as to take account of continuing efficiencies	

[24] *'RIIO-ED1: Final determinations for the slowtrack electricity distribution companies.' Ofgem (28 November 2014).*
[25] *'Water & Sewerage Services Price Control 2015-21 Final Determination – Main Report.' Utility Regulator (December 2014).*
[26] *'Bristol Water plc: A reference under section 12(3)(1) of the Water Industry Act 1991 Report.' Competition and Markets Authority (6 October 2015).*
[27] *'Annex 6: Real Price Effects & Frontier Shift GD17 Final Determination.' Utility Regulator (15 September 2016).*
[28] *'Annex C Frontier Shift: Real Price Effects & Productivity RP6 Final Determination.' Utility Regulator (30 June 2017).*

Regulator - price control	% reduction in opex per annum	What is being measured	Notes on adjustments
	0.5% and 1.5%)	which the industry can achieve over the price control period. This is a base level of efficiency which even frontier companies would be expected to achieve as they continually improve their business over time. For example with the use of new technologies, new working practices or other means to enable their businesses to run more efficiently.	

Source: various, see footnotes

In relation to the precedent set out in the above table, some key points to note include:

- The average frontier shift assumed by regulators across all the decisions relating to opex is 0.85%.
- There seems to be a general pattern of more recent decisions settling on figures of around 1.0% pa (i.e. consistent with the upper bound of our forecast). However, older decisions seem to include lower assumptions (for example, opex frontier shift as low as 0.2% pa has been assumed by regulators during the last decade).
- In hindsight, the decisions have systematically overshot the UK's actual delivered productivity performance. As even the UK's overall productivity performance (measured in TFP terms) may overestimate true 'frontier' shift, the overestimation of productivity potential by regulators may be even greater than what this implies.

4. Catch-up efficiency

This chapter contains a summary of our previous work for Northumbrian Water in relation to its potential to achieve catch-up efficiency savings in HH retail.

The key messages and findings from our previous work for Northumbrian regarding catch-up efficiency are as follows.

- **Our benchmarking analysis is consistent with Northumbrian having a highly efficient retail business** (in most cases, we find the company to be the 'frontier').
- Over the course of PR19, our analysis suggests that an appropriate total 'catch up' efficiency challenge for Northumbrian is between 0.00% and 0.40% (with a central case of 0.00%).
- This is equivalent to making annual efficiency savings of between **0.00% and 0.08% pa**, with a central case of 0.00% pa (although we note Ofwat is not proposing to apply a glide-path at PR19).

4.1 Overview of our previous report setting out catch-up efficiency

We have previously undertaken extensive econometric cost benchmarking analysis for Northumbrian. Our work is set out across two reports:

- *'Household Retail Efficiency Benchmarking at PR19: Report for Northumbrian Water.'*
- *'Household Retail Efficiency Benchmarking at PR19: Update report for Northumbrian Water.'*

As both reports provide a detailed description of our methodology, data and results, we do not repeat such information here. In summary, however, the analysis implies that suitable level of efficiency catch-up (over the whole of PR19) is likely to lie in the range of between 0.00% and 0.40% – as shown in the table overleaf.

For the purpose of setting a cost efficiency challenge for HH retail, Ofwat is not proposing to set a 'glide path' (the implication being that the entirety of the above efficiency challenge would need to be delivered by the first year of the control).

Table 20: Catch up efficiency challenge (% total over PR19)

Parameter / scenario	Low (less challenging)	Central	High (more challenging)
Model weights	Equal weights	Equal weights	Equal weights
Residual adjustment	None	None	None
Benchmark	Average	Upper quartile	Upper quintile
Glide path	5 years	None	None
Total efficiency challenge over PR19 %)	0.00%	0.00%	0.40%
Average catch up efficiency challenge pa (%)	0.00%	0.00%	0.08%

Source: Economic Insight

5. Conclusions and recommendations

This chapter brings together all the evidence contained in this report, providing Northumbrian with a range of net IPP figures for HH retail. It also sets out the implications regarding whether and how Ofwat should apply a common approach across companies. Finally, in the event that Ofwat does not apply a common approach to IPP, it also details the implications for submitting a HH retail IPP special factor cost claim.

Bringing all of the evidence together, our view is that Northumbrian could face **net** IPP in its HH retail business of between 1.44% and 2.08% per annum (on average over the period 2020/21 to 2024/25) with a **central case of 1.63% pa.**

The details of our assessment are summarised 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:

- Use either of the low, medium, or high estimates from our forecasts, depending on how much Northumbrian wants to challenge itself over PR19.[29]
- Use either the projected annual profile, or apply the annual averages, depending on the company's preference for smoothing bill impacts.

[29] *Note that in our estimates for gross IPP we always use the wedge to CPI estimates for the IT and postage IPP estimates, as well as the independent forecasts for the other IPP estimates, as the other methods did not produce robust estimates. The high, medium and low estimates are arrived at by using the following methods for labour and bad debt.* ***High*** *estimates: labour – independent forecasts; bad debt – CPIH.* ***Medium*** *estimates: labour – wedge to UK wages (2 digit SOC); bad debt – regional.* ***Low*** *estimates: labour – wage econometrics, percentage changes (2 digit SOC); bad debt – national.*

Table 21: Summary of net IPP recommendations

Calculation step	Scenario	2020 / 21	2021 / 22	2022 / 23	2023 / 24	2024 / 25	Average over PR19
Gross IPP (%)	High	2.35%	2.55%	2.53%	2.53%	2.53%	2.50%
	Medium	1.84%	2.20%	2.04%	2.08%	2.11%	2.05%
	Low	1.64%	2.02%	1.85%	1.89%	1.92%	1.86%
Catch-up efficiency savings (%)	High	0.40%	0.00%	0.00%	0.00%	0.00%	0.08%
	Medium	**0.00%**	**0.00%**	**0.00%**	**0.00%**	**0.00%**	**0.00%**
	Low	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Productivity savings (%)	High	1.10%	1.10%	1.10%	1.10%	1.10%	1.10%
	Medium	**0.42%**	**0.42%**	**0.42%**	**0.42%**	**0.42%**	**0.42%**
	Low	-0.42%	-0.42%	-0.42%	-0.42%	-0.42%	-0.42%
Northumbrian Water net IPP (%)[30]	High	1.93%	2.13%	2.11%	2.11%	2.11%	2.08%
	Medium	1.42%	1.78%	1.62%	1.66%	1.69%	1.63%
	Low	1.22%	1.60%	1.43%	1.47%	1.50%	1.44%

Source: Economic Insight analysis

In the following subsections, we set out in more detail what the above findings imply in terms of:

- supporting evidence for relevant Ofwat data tables;
- developing robust analysis, which may: (i) help provide evidence to Ofwat that it should, indeed, include retail IPP in forward-looking totex allowances; and relatedly (ii) assist Ofwat in determining a consistent method that can be applied for all companies – as referenced above; and
- forming the basis for a retail special factor cost claim, should Ofwat not apply an allowance for all companies.

[30] *Note that in our estimates for net IPP we have always deducted the **medium** catch-up efficiency and productivity savings from the **high**, **medium**, and **low** gross IPP.*

5.1 Using the analysis as supporting evidence for Ofwat data tables

The evidence set out in this report provides *supporting evidence* that can assist in the population of Ofwat data tables.

5.1.1 Appointee Table 24a

Section F of Appointee Data Table 24a asks for **IPP** included in residential retail – and section L asks for the **assumed efficiency gains** assumed in residential retail. In both cases, separate lines are shown for 'operating expenditure' and 'depreciation.' All figures are asked for on a % pa basis.

Section F: underlying IPP for residential retail

In relation to Section F, Ofwat specifically states: *"For retail services, companies should provide the forecast of IPI (input price inflation) for each cost category, rather than the RPE. This is because we do not index the retail control to the CPIH or any other inflation index. "*[31]

Following from the above, for HH retail, we consider that the appropriate figures to use in Table App24a are the gross IPP numbers set out previously (repeated below for ease of reference). Northumbrian could choose either the 'high', 'medium' or 'low' case, depending on 'how challenging' it wanted to be. It should use these numbers to populate the 'opex' related IPP line.

Table 22: Summary of forecast gross retail IPP (use for completing opex line)

	2020/21	2021/22	2022/23	2023/24	2024/25	Average
High	2.35%	2.55%	2.53%	2.53%	2.53%	2.50%
Medium	1.84%	2.20%	2.04%	2.08%	2.11%	2.05%
Low	1.64%	2.02%	1.85%	1.89%	1.92%	1.86%

Source: Economic Insight analysis

In relation to populating the IPP line for **depreciation** for HH retail, there is some discretion as to what the appropriate approach should be. Given that HH retail is relatively asset light, we consider it credible to use the same assumptions as per opex above. Alternatively, as the majority of retail related capital expenditure will relate to IT and billing related systems, we consider that using the gross IPP figures for "IT", as set out in the main body of this report, would also be credible. For summary purposes, these are shown overleaf.

[31] *'Delivering Water 2020: Our methodology for the 2019 price review Final guidance on business plan data tables.' Ofwat (2017), page 32.*

Table 23: Summary of gross IPP for retail IT (alternative to depreciation IPP line)

	2020/21	2021/22	2022/23	2023/24	2024/25	Average
IT gross IPP (%)	0.7%	0.7%	0.7%	0.7%	0.7%	0.7%

Source: Economic Insight analysis

Section L: assumed efficiency gains for residential retail

As noted above, Section L of App24a requires companies to enter the assumed efficiency gains for residential retail, in % pa. We assume that the total efficiency gain required includes **both** the **'catch up'** element (derived from our econometric analysis) and the scope for **'frontier shift'**). However, we note that Ofwat's methodology is not explicit on this matter; and so we recommend that the company seeks clarification from Ofwat before populating the data table.

For both 'catch up' and 'frontier' (productivity) savings, we have identified 'low', 'medium' and 'high' case projections. As such, the **total** % efficiency savings that should be used in Section L of Table App24a will depend on which of these Northumbrian elects to use. Again, for ease of reference, the relevant figures are completed below.

Table 24: Figures relevant to Section L of table App24a

Variable	Scenario	2020 / 21	2021 / 22	2022 / 23	2023 / 24	2024 / 25	Average over PR19
Catch-up efficiency savings (%)	High	0.40%	0.00%	0.00%	0.00%	0.00%	0.08%
	Medium	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
	Low	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Productivity savings (%)	High	1.10%	1.10%	1.10%	1.10%	1.10%	1.10%
	Medium	0.42%	0.42%	0.42%	0.42%	0.42%	0.42%
	Low	-0.42%	-0.42%	-0.42%	-0.42%	-0.42%	-0.42%

Source: Economic Insight analysis

5.1.2 Reconciliation to Appointee Table 24

Section E of Appointee Table 24 relates specifically to residential retail. Ofwat's guidance in relation to this states: *"Table App 24 should be reported as percentages on the basis of total expenditure, including both operating expenditure and capital expenditure. The reported proportions of all input price categories should add up to 100%."*[32]

We note that Appointee Table 24 requires companies to provide % breakdowns of **totex** for residential retail and cost category, as follows:

- labour; and
- other (please specify).

Consequently, to assist in ensuring internal consistency, the following table shows how the cost splits we have used in deriving our inflation forecasts translate to the required totex cost splits of Table 24. Here, the key points to note are as follows:

- We have created a row for each of the relevant residential retail opex input costs, as well as an additional row for all capex costs.
- The opex related percentages are based on the same absolute values used in our inflation forecasts, but are rebased over totex (as per the company's latest regulatory accounts).
- We have ensured that overall totex is consistent with that reported in the company's latest regulatory accounts – and all percentage splits are therefore consistent with this.
- As Appointee Table 24 further requires the above percentage totex splits to be forecast over PR19, below we set out our projections for this, consistent with our inflation forecasts. Note, Northumbrian should not necessarily populate Table 24 with these figures. Rather, the company should: (i) clarify with Ofwat exactly how the regulator wishes Table 24 to be populated; and then (ii) use our evidence in a manner consistent with this. Specifically:
  - The splits below reflect our 'central case' inflation forecasts (which are set out in the relevant sections of chapter 2). If Northumbrian were to apply different inflation assumptions, it would accordingly need to revise the projected cost splits over time.
  - Similarly, we have based these projections **solely** on the effect of input price inflation over time. In practice, Northumbrian's Plan may include changes in cost 'mix' over time (most obviously relating to the timing of capital spend over the Plan period, which would materially affect mix).

[32] *'Delivering Water 2020: Our methodology for the 2019 price review Final guidance on business plan data tables.' Ofwat (2017), page 32.*

Table 25: Projected percentage cost splits (totex) over PR19 by type of cost – consistent with our inflation forecasts

Retail cost item	2020-21	2021-22	2022-23	2023-24	2024-25
Labour	37.65%	37.71%	37.80%	37.89%	37.96%
Bad debt	34.72%	34.46%	34.13%	33.81%	33.51%
IT	2.48%	2.59%	2.70%	2.82%	2.94%
Postage	3.25%	3.20%	3.15%	3.10%	3.05%
Other	1.08%	1.08%	1.07%	1.07%	1.07%
Capex	20.82%	20.97%	21.15%	21.31%	21.48%
Total	100%	100 %	100%	100%	100%

Source: Economic Insight analysis of Northumbrian Water data

5.2 Implications for whether and how Ofwat should apply a common approach across companies

It is clearly and demonstrably the case that all companies (irrespective of their relative or absolute efficiency) face underlying IPP. In a competitive market, for firms that were assumed to be efficient, economics theory states that this should be expected to be passed through to end prices. Firms that were less than perfectly efficient, whilst still facing this IPP, would only be able to 'pass on' the net impact of the inflationary pressure and their inefficiency.

Applying the above logic to the water sector, where price control regulation applies and firms cannot be assumed to be efficient – again it is important to emphasise that all firms will face underlying inflationary pressure, regardless of whether they are efficient or not. With this in mind, we should highlight that, at PR19, Ofwat will separately apply an efficiency challenge in HH retail, which by definition results in allowed revenues and prices being 'lower' for less efficient firms than more efficient ones. Consequently, as the impact of the efficiency of firms on prices is already being controlled for elsewhere, **it logically follows that gross retail IPP should be included in totex for all companies.**

This is the only approach that:

- ensures that the appropriate 'net' effect of inflation and efficiency is reflected in the price limits;
- accords with economic theory; and
- is consistent with outcomes that one would expect to arise in a competitive market.

The above 'in principle' issues strongly point to it being essential for Ofwat to allow for HH retail IPP in allowed totex for all companies. In addition, we consider that the range of evidence and analytical approaches set out here provide a good basis from which Ofwat could adopt a 'common method' for making such allowances for firms, as suggested in the regulator's Final Methodology.

OUR ANALYSIS SUGGESTS THAT A CREDIBLE HH RETAIL IPP SPECIAL FACTOR CLAIM FOR NORTHUMBRIAN AT PR19 SHOULD BE £14.8m.

5.3 Implications for submitting a HH retail IPP special factor cost claim

Given Ofwat's Final Methodology, there are two circumstances under which it could be appropriate for Northumbrian to use the evidence and analysis set out here as the basis for a special factor cost claim:

- Firstly, in the event that Ofwat does not, as a matter of course, include an allowance for HH retail IPP for all companies on a consistent basis in forward-looking totex, then clearly (as a matter of principle) such costs could only be allowed for through a special factor cost claim.

- Secondly, if Ofwat did apply a common method for allowing for HH retail IPP for all companies, but where that amount was below the IPP figures for Northumbrian set out here, again a claim could be appropriate. In this case, the appropriate size of the claim would need to reflect **the 'difference' between the figures in this report and those allowed for by Ofwat.**

Focusing on the first possibility (as the second cannot be known in advance), to translate our analysis into a £m special factor claim the appropriate approach is to:

- Forecast HH retail costs over PR19, assuming no allowance for underlying IPP.

- Then apply our 'gross' retail IPP % figures in each year, compounding up the amount in £s terms.

- Calculate the difference between the two, then check that this meets Ofwat's new, increased materiality threshold of 4% of retail totex over 5 years for HH retail.

Following from the above, the table overleaf sets out the quantification of the implied special factor cost claim for Northumbrian, should one be appropriate. As, for each key parameter, we have identified plausible ranges, the figures in the table represent the central case. For example, for efficiency savings we have deducted the totality of the central catch-up efficiency estimate in year 1 (as Ofwat is not allowing for a glide path), as well as the assumed central case of frontier shift savings in each year from year 1 to 5.

You will see that **this implies a total special factor cost claim of £14.8m for PR19.** This amount would be:

- £18.2m using our high case figures; and
- £13.4m using our low case figures.

Table 26: Quantification of implied special factor cost claim – using central assumptions

	2020 / 21	2021 / 22	2022 / 23	2023 / 24	2024 / 25	Total
Retail costs with no IPP allowance						
Retail opex (opening value)	£47.4	£47.2	£47.0	£46.8	£46.6	£235.0
Less assumed efficiency	0.4%	0.4%	0.4%	0.4%	0.4%	
Retail opex (closing value)	£47.2	£47.0	£46.8	£46.6	£46.4	£234.0
Retail costs with IPP allowance included						
Retail opex (opening value)	£47.4	£48.2	£49.0	£49.8	£50.6	£244.9
Less assumed efficiency	0.4%	0.4%	0.4%	0.4%	0.4%	
Plus gross IPP	2.05%	2.05%	2.05%	2.05%	2.05%	
Retail opex (closing value)	£48.2	£49.0	£49.8	£50.6	£51.4	£248.8
Implied value of special factor cost claim - difference between above (£m)						**£14.8**
As a % of HH retail costs over 5 years						**6.3%**

Source: Economic Insight analysis

'Ofwat specifically states that special cost factor claims should be 'convincing' and 'well-evidenced'. We are confident that, in totality, the extensive range of analysis set out here is sufficient to meet these tests.'

In terms of how Ofwat will assess any claim, we note that the regulator has been explicit that a 'high evidence bar' will apply. Ofwat specifically states that any such claims should be '*convincing*' and '*well-evidenced*'.[33] We are confident that, in totality, the extensive range of analysis set out here is sufficient to meet these tests.

Based on the above figures, a claim would also seem likely to meet the (higher) materiality threshold. However, Northumbrian would need to reassess the above amounts relative to its finalised HH retail totex included in its PR19 Plan.

[33] *'Delivering Water 2020: Our final methodology for the 2019 price review.' Ofwat (December 2017).*

6. Annex A: econometrics for forecasting bad debt costs

This annex provides more detail on our approach for forecasting bad debt costs.

In summary, there are three main parts to our approach:

- First, we use historical data (between 2010/11 and 2016/17) to estimate the relationship between bad debt per unique customer, bill size and an indicator of the health of regional economies – benefits expenditure.
- Second, we use publicly available information to forecast bills and benefits expenditure.
- Third, using the estimated relationship and the forecasts, we predict the annual growth in bad debt per unique customer over PR19.

In order to do this, Northumbrian provided us with the following for each WaSC:

- debt management and doubtful debt charges (£m, nominal); and
- the number of (unique) connected properties.

We then collected information at the regional level from the ONS on benefits expenditure (£m, nominal).

In order to forecast Northumbrian's bill size we have assumed that bill size would move in line with CPIH inflation, as well as adjusting for any K-factors that Ofwat allows in its wholesale controls. We have further used forecasts from the OBR on CPI; and the Department for Work & Pensions (DWP) on benefits expenditure (£m, nominal).

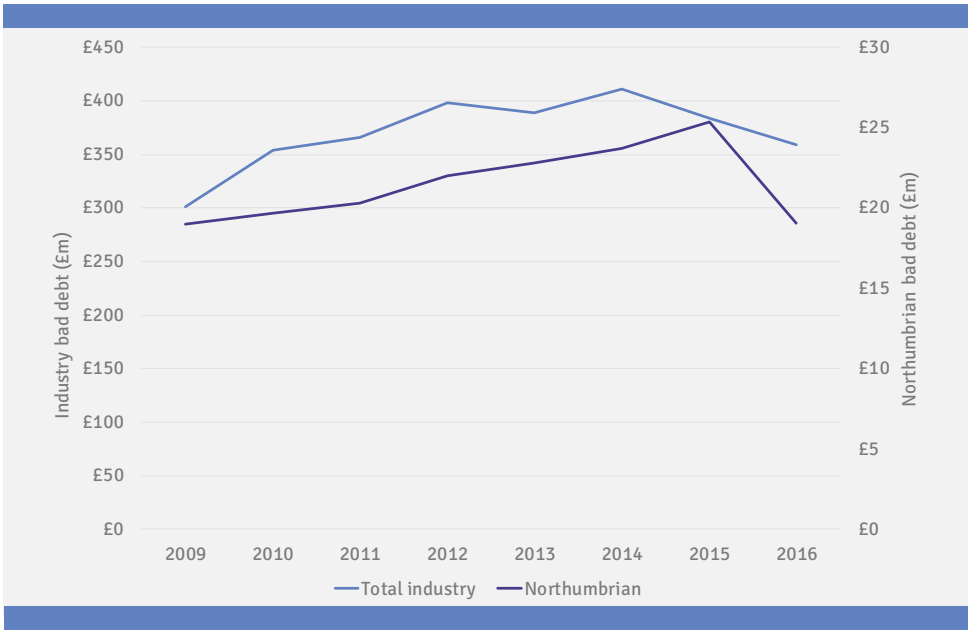
In the following we provide some background trends, followed by a more detailed description of our analysis.

6.1 Background trends

The figure below shows how total bad debt and debt management charges across both the water and sewerage (WaSCs) and the water only companies (WoCs) evolved between 2009 and 2016. As can be seen, bad debt increased steadily across the industry until 2012 and has been on a declining path since 2014.

It also illustrates that Northumbrian's bad debt costs have moved roughly in line with the total industry. That is, they rose up until about 2015 and have been on a declining path from then onwards.

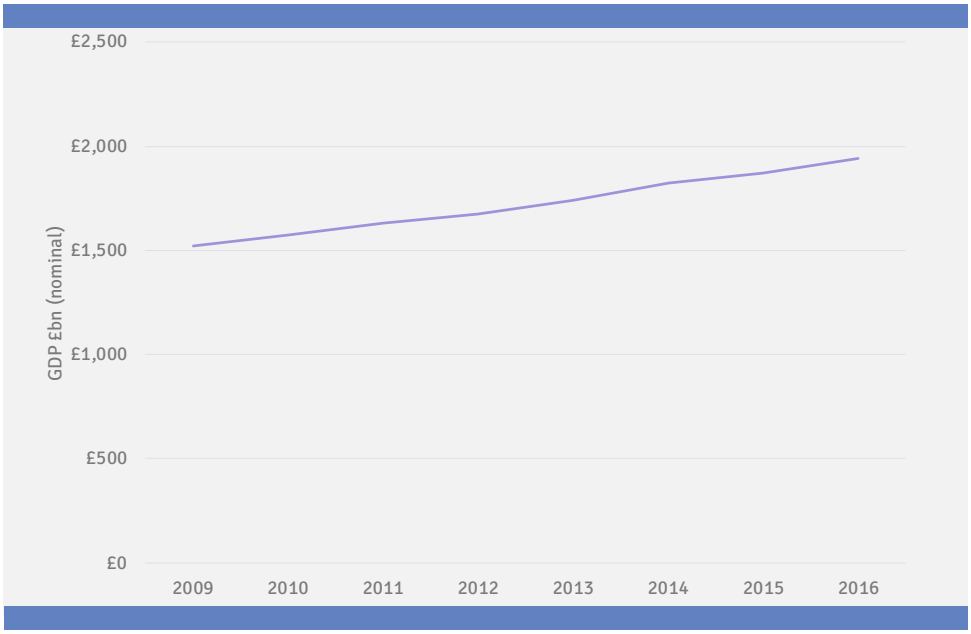
Figure 17: Evolution of bad debt from 2009 to 2016, total industry and Northumbrian Water



Source: Regulatory accounts data

The following figure shows nominal UK GDP has been rising at a steady rate from 2009 onwards. This upward trend in the national economy, compared to the total bad debt figure demonstrates that the relationship between the health of the economy and bad debt is not straightforward. For example, it shows that at times of economic growth – between 2009 and 2012 - bad debt continued to rise. This suggests that other factors also affect bad debt. Our subsequent analysis – consistent with previous studies – suggests that bill size and other metrics of the health of the economy – especially benefits expenditure – also influence overall bad debt levels.

Figure 18: Evolution of GDP from 2009 to 2016



Source: ONS

6.2 Econometric modelling

As mentioned previously, we use historical data (between (2010/11 and 2016/17) to estimate the relationship between bad debt per unique customer, bill size and benefits expenditure:

- **Bad debt per unique customer** is estimated by dividing the sum of debt management and doubtful debts by the number of unique customers. Both were provided to us by Northumbrian and were obtained from companies' regulatory accounts and the company Datashare.

- **Average wholesale bill size** is estimated by diving the total wholesale bill size by the number of unique customers for each company. The source is the same as above.

- **Benefits expenditure** is obtained from the ONS / DWP. For each company, we have applied a regional weight that most closely matches with its supply area in order to obtain regional benefits expenditure.

We have selected a double-log functional form, as this appears to fit the data well, helps account for any non-linearities in the data and, also, allows for 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 account for unobserved differences between the companies that, if not controlled for, could bias the coefficients on bill size and regional benefits expenditure.

The following table shows the results of our preferred model.

Table 27: Preferred model results

Variable	Coefficient	Standard error	z-statistic	p-value
Average wholesale bill size	0.358	0.120	2.98	0.003
Benefits expenditure	0.249	0.076	3.29	0.001

R^2: 0.60, constant not shown

The coefficients have economically intuitive signs and are of sensible order of magnitude. For example, the above suggests that – other things being equal – a 1% increase in average wholesale bill size leads to a 0.4% increase in bad debt; and a 1% increase in benefits expenditure leads to a 0.3% increase in bad debt.

6.3 Forecasts of average wholesale bill size and regional benefits expenditure

The subsequent step in our analysis was to forecast average wholesale bill size and regional benefits expenditure over PR19.

6.3.1 Wholesale bill size

As wholesale water will be indexed to CPIH, in the following we have assumed that Ofwat would set a 0 K-factor for wholesale water, and that the wholesale water bill would rise in line with CPIH inflation.

In order to project CPIH inflation forward, we have applied the historical wedge between CPI and CPIH (-0.2% over the last ten years) to the OBR's CPI projections. The table below sets out our projections for Northumbrian's bill size over PR19 (assuming a 0 K-factor).

Table 28: Bill size projections (nominal) in PR19

	2017/18	2018/19	2019/20	2020/21	2021/22	2022/23	2023/24	2024/25
Bill size projections	2.8%	2.0%	1.7%	1.8%	1.8%	1.8%	1.8%	1.8%

Source: Economic Insight analysis of ONS and OBR data

6.3.2 Benefits expenditure

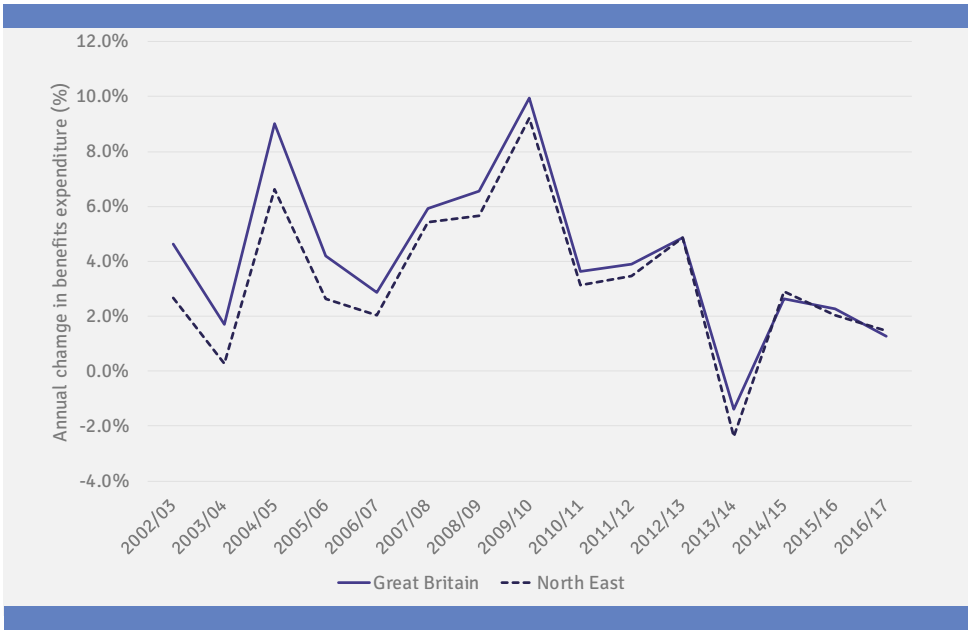
We have used two methods for forecasting Northumbrian's regional benefits expenditure increases in PR19.

- The first is to assume it rises in line with DWP national benefits forecasts, shown in the first row of the table overleaf. This is our **national approach**.

- The second is to assume that the average historic percentage point gap between national benefits expenditure and North East's benefits expenditure persists into PR19 (latest 15 years of data available), shown in the second row of the table below. This is our **regional approach**. We have selected the wedge to the North East region of the UK, as this most closely aligns to Northumbrian's supply area.

The figure below shows the average annual percentage change in benefits expenditure (nominal) for Great Britain and the North East. It shows that they are highly correlated over time and that the North East has lower rates of growth than Great Britain as a whole. The difference is 0.8% on average over the entire period. Accordingly, we use this figure to reduce the UK projections.

Figure 19: Evolution of benefits expenditure from 2002/03 to 2016/17



Source: Economic Insight analysis of DWP data

The results of these two approaches are shown in the following table. There are advantages and disadvantages to both. For example, we note that the regional approach generally results in somewhat lower forecast bad debt inflation for Northumbrian than the national approach. This is primarily driven by an expectation that benefits expenditure will be lower in the North East than for the UK overall.

Table 29: Benefits expenditure projections (nominal) in PR19

	2017/18	2018/19	2019/20	2020/21	2021/22	2022/23	2023/24	2024/25
National benefits expenditure projections (GB)	1.6%	1.8%	1.4%	2.2%	3.9%	2.5%	2.9%	3.1%
Regional benefits expenditure projections (NE)	0.8%	1.0%	0.6%	1.4%	3.1%	1.7%	2.1%	2.3%

Source: Economic Insight analysis of DWP data

6.4 Forecasting bad debt

The final step is to combine the econometric results and the forecasts above to project the '*gross IPP*' associated with bad debt over PR19. To estimate the impact of bill size and benefits expenditure we do the following:

- First, multiply each of the forecasts in the tables set out above by the coefficients from the econometric model (Table 27). For example, the impact of a 1.6% increase in national benefits expenditure on bad debt is estimated to be 1.6% x 0.249 = 0.4%. 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 average wholesale bill size and benefits expenditure on bad debt. This, then, gives us our projected bad debt gross IPP forecast, based on our preferred econometric model.

The table below set out our projections, using both the UK-level and the regional-level forecasts for benefits expenditure.

Table 30: Bad debt gross IPP for PR19, UK- and regional-level forecasts

	2017 / 18	2018 / 19	2019 / 20	2020 /2 1	2021 / 22	2022 / 23	2023 / 24	2024 / 25	Avg
National econometrics approach									
Average bill size	1.0%	0.7%	0.6%	0.7%	0.7%	0.7%	0.7%	0.7%	0.7%
Benefits expenditure	0.4%	0.5%	0.4%	0.5%	1.0%	0.6%	0.7%	0.8%	0.7%
Total bad debt inflation	**1.4%**	**1.2%**	**0.9%**	**1.2%**	**1.6%**	**1.3%**	**1.4%**	**1.4%**	**1.4%**
Regional econometrics approach									
Average bill size	1.0%	0.7%	0.6%	0.7%	0.7%	0.7%	0.7%	0.7%	0.9%
Benefits expenditure	0.2%	0.3%	0.2%	0.4%	0.8%	0.4%	0.5%	0.6%	0.4%
Total bad debt inflation	**1.2%**	**1.0%**	**0.7%**	**1.0%**	**1.4%**	**1.1%**	**1.2%**	**1.2%**	**1.2%**

Source: Economic Insight calculations

6.5 Conclusions

NATIONAL FORECASTS ARE MARGINALLY MORE CHALLENGING FOR COMPANIES.

On the basis of the analysis set out above, we conclude that Northumbrian's bad debt will increase over PR19 – albeit by a rate that is less than CPIH inflation. Our analysis suggests that an estimate between 1.2% and 1.4% per annum is reasonable. For the purpose of our gross IPP analysis, we therefore suggest using the estimate based on the national analysis if companies want to challenge themselves more, whereas the use of the regional estimate would be less challenging overall, although by a very marginal amount.

7. Annex B: labour cost index

This annex provides more detail on our approach to generating the labour cost indices for Northumbrian's retail functions.

Our approach was as follows:

- Northumbrian 'mapped' specific job roles to the most relevant SOC code, as recorded by the ONS in the ASHE. SOC code are available at different levels of disaggregation. As set out in the main report, we focused our analysis on 2 and 3 digit SOC codes.
- We collected wage inflation data from 2003 to 2016, using historical publications from the ASHE for each relevant SOC code. While ASHE data is available for years before 2003, changes in the structure of SOC codes mean that it is not possible to align these early data with the 2003 – 2016 data to produce a consistent index over time.
- To construct a retail labour cost index for Northumbrian, we calculated the weighted averages of the SOC code-level inflation at both 2 and 3 digits. Weights are calculated based on 2016 average wages for each SOC.

The following table shows the **2 digit** SOC codes that were used in the construction of Northumbrian's HH retail labour cost index.

Table 31: SOC codes used in Northumbrian Water's labour cost index - 2 digit

SOC	SOC 2010	SOC 2000	NES retail
Customer service occupations	72	72	649
Corporate managers and directors	11	11	8
Administrative occupations	41	41	196

Source: Economic Insight

The next table shows the **3 digit** SOC codes that were used in the construction of Northumbrian's HH retail labour cost index.

Table 32: SOC codes used in Northumbrian Water's labour cost index - 3 digit

SOC	SOC 2010	SOC 2000	NES retail
Customer service managers and supervisors	722	114	36
Customer service occupations	721	721	613
Managers and directors in retail and wholesale	119	116	8
Administrative occupations: Office managers and supervisors	416	415	196

8. Annex C: econometrics for forecasting other input costs

This annex provides more detail on our approach for forecasting other input costs (other than bad debt).

We have used econometric models to forecast other input costs, specifically:

- staff cost inflation;
- IT cost inflation; and
- postage cost inflation.

We note that these statistical approaches work best for staff cost inflation, less well for IT cost inflation, and do not provide a good insight into postage cost inflation.

8.1 Labour cost econometrics

We use historical data (between 2002 and 2016) to estimate the relationship between Northumbrian's labour cost index and (i) nominal GDP; (ii) and average UK wages:

- **Northumbrian's labour cost index** is estimated by matching Northumbrian's actual labour mix data with the ONS's ASHE data. More details on this are set out in the preceding Annex B.

- **Nominal GDP** is calculated from the ONS's series for nominal GDP (series YBHA PN2).

- **UK wage index** is calculated from the National Accounts. This is to ensure consistency between the data used to measure historical relationships and that used to derive forecasts (as the OBR bases its forecast of average earnings on the National Accounts).

Variables such as GDP and wages are generally *non-stationary*, meaning that simple regressions of wage levels on GDP can lead to spurious findings of relationships. We addressed this non-stationarity in two ways:

- First, we developed regression of the *percentage changes* in the Northumbrian HH retail labour cost index on changes in nominal GDP / average UK wages.

- Second, we regressed levels of the Northumbrian HH retail labour cost index on the level of nominal GDP / average UK wages (both expressed as an index) *and lagged values of the Northumbrian Water HH retail labour cost index.*

Our overall preference is for the former method, as this allows for easier comparisons to be made between the R^2 of the regressions – since the presence of lagged values of the labour cost index in the levels regression results in high R^2 values across the board. We also found that, in practice, the models for nominal GDP in *levels* performed poorly overall. However, the regressions for Northumbrian's labour cost

indices to percentage changes in UK average wages performed less well, with the ones in levels performing better.

The results of our models in levels and in percentage changes are set out in the subsequent sections.

8.1.1 Regression in levels

The labour cost regression in levels had the following functional forms:

1) $Northumbrian\ Water\ labour\ cost\ index_t = constant + \beta \cdot UK\ nominal\ GDP\ index_t + \gamma \cdot Northumbrian\ Water\ labour\ cost\ index_{t-1} + \varepsilon_t$
2) $Northumbrian\ Water\ labour\ cost\ index_t = constant + \beta \cdot UK\ average\ wage\ index_t + \gamma \cdot Northumbrian\ Water\ labour\ cost\ index_{t-1} + \varepsilon_t$

The tables below show estimation results for these models.

Table 33: Econometric estimates of the relationship between Northumbrian Water labour cost index and nominal GDP (levels) – 2 and 3 digit SOC

Model type	2 digit SOC	3 digit SOC
Constant	15.3799	18.3780
Standard error	7.6795	8.3747
P-value	0.0705	0.0506
Nominal GDP	0.2117	0.1838
Standard error	0.0762	0.0755
P-value	0.0180	0.0332
Lag	0.6261	0.6307
Standard error	0.1397	0.1472
P-value	0.0009	0.0013
R-squared	96%	96%
F statistic	145.5428	127.0892

Source: Economic Insight

Table 34: Econometric estimates of the relationship between Northumbrian Water labour cost index and average UK wage (levels) – 2 and 3 digit SOC

Model type	2 digit SOC	3 digit SOC
Constant	10.1372	15.8902
Standard error	6.3341	7.0217
P-value	0.1378	0.0449
Average UK wage	0.4998	0.4578
Standard error	0.1514	0.1528
P-value	0.0071	0.0121
Lag	0.3766	0.3688
Standard error	0.1902	0.2041
P-value	0.0733	0.0981
R-squared	97%	96%
F statistic	171.2379	151.0796

Source: Economic Insight

8.1.2 Regression in percentage changes

Our regressions in *percentage changes* had the following functional forms:

3) *Northumbrian Water nominal wage growth$_t$ = constant + β · UK nominal GDP growth$_t$ + ε_t*

4) *Northumbrian Water nominal wage growth$_t$ = constant + β · UK average nominal wage growth$_t$ + ε_t*

The tables below show the estimation results for these models.

Table 35: Econometric estimates of the relationship between Northumbrian Water labour cost index and nominal GDP (percentage changes) – 2 and 3 digit SOC

Model type	2 digit SOC	3 digit SOC
Constant	0.0126	0.0099
Standard error	0.0132	0.0124
P-value	0.3589	0.4373
Nominal GDP	0.1599	0.1901
Standard error	0.3093	0.2894
P-value	0.6146	0.5238
R-squared	2%	3%
F statistic	0.2672	0.4312

Source: Economic Insight

Table 36: Econometric estimates of the relationship between Northumbrian Water labour cost index and average UK wage (percentage changes) – 2 and 3 digit SOC

Model type	2 digit SOC	3 digit SOC
Constant	0.0005	-0.0011
Standard error	0.0149	0.0138
P-value	0.9718	0.9353
Average UK wage	0.6938	0.6993
Standard error	0.5212	0.4858
P-value	0.2079	0.1756
R-squared	13%	15%
F statistic	1.7720	2.0717

Source: Economic Insight

8.2 Postage econometrics

We use historical data (between 2002 and 2016) to estimate the relationship between a postage cost index and nominal GDP:

- **Postage cost index** is calculated from the ONS's RPI series, specifically the series relating to the postage component of RPI (CDID: CZDK)
- **Nominal GDP** is calculated from the ONS's series for nominal GDP (DCID: YBHA PN2).

As per above, we addressed issues of non-stationarity of variables in the same way and we set out the regression results overleaf.

8.2.1 Regression results

The postage cost regression in levels had the following functional form:

1) $Postage\ cost\ index_t = constant + \beta \cdot UK\ nominal\ GDP\ index_t + \gamma \cdot postage\ cost\ index_{t-1} + \varepsilon_t$

Our postage costs regression in *percentage changes* had the following functional form:

2) $Nominal\ postage\ cost\ growth_t = constant + \beta \cdot UK\ nominal\ GDP\ growth_t + \varepsilon_t$

The table below shows the estimation results for these two models.

Table 37: Econometric estimates of the relationship between the postage cost index and UK GDP – levels and percentage changes

Model type	Levels regression	Percentage changes regression
Constant	-47.9107	0.0915
Standard error	35.0930	0.0294
P-value	0.1994	0.0090
Nominal GDP	0.5797	-0.6004
Standard error	0.3978	0.6891
P-value	0.1730	0.4007
Lag	0.8657	
Standard error	0.1408	
P-value	0.0001	
R-squared	98%	6%
F statistic	234.2383	0.7592

Source: Economic Insight

8.3 IT IPP

We use historical data (between 2002 and 2016) to estimate the relationship between an IT cost index and nominal GDP:

- **IT cost index** is calculated from the ONS's Producer Price Indices series, specifically the series relating to the inputs used in the manufacture of computer, electrical and optical products (CDID: MC3G)
- **Nominal GDP** is calculated from the ONS's series for nominal GDP (DCID: YBHA PN2).

As per above, we addressed issues of non-stationarity of variables in the same way and we set out the regression results overleaf.

8.3.1 Regression results

The IT input cost regression in levels had the following functional form:

1) $IT\ cost\ index_t = constant + \beta \cdot UK\ nominal\ GDP\ index_t + \gamma \cdot IT\ cost\ index_{t-1} + \varepsilon_t$

Our IT costs regression in *percentage changes* had the following functional form:

2) $Nominal\ IT\ cost\ growth_t = constant + \beta \cdot UK\ nominal\ GDP\ growth_t + \varepsilon_t$

The table overleaf shows the estimation results for these two models.

Table 38: Econometric estimates of the relationship between Northumbrian Water IT cost index and UK GDP – levels and percentage changes

Model type	Levels regression	Percentage changes regression
Constant	10.9037	0.0292
Standard error	9.6288	0.0140
P-value	0.2815	0.0588
Nominal GDP	0.1308	-0.5313
Standard error	0.0712	0.3271
P-value	0.0934	0.1303
Lag	0.7344	
Standard error	0.1535	
P-value	0.0006	
R-squared	92%	18%
F statistic	67.1248	2.6379

Source: Economic Insight

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