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Assessing base costs at PR24: Consultation response
Ofwat
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3rd February 2022

Dear Ofwat,

Assessing base costs at PR24

Thank you for the opportunity to respond to Ofwat's discussion document "Assessing base costs at PR24".

We welcome the approach Ofwat has taken to developing the cost models for PR19. We support the principles for base cost assessment set out in the paper. Our main concern with Ofwat's approach to cost assessment is linked to our over-riding concern on risk and return at PR19 – will Ofwat be able to look through the principles, consider risks to long-term investment and services from having insufficient cost allowances, and balance this with the shorter term need to allow efficient costs.

We are concerned that on the one hand Ofwat have an aim of making PR24 simpler to navigate than PR19, and yet some of the base cost proposals risk additional complexity. Attempting to make cost adjustment claims symmetrical and introducing layers of additional data collection in an unfocused way on asset health are potential examples we highlight in our detailed response.

We have particular concerns on the potential for using forecast data in base cost assessment. Our analysis suggests this can be expected to produce a much wider range of efficiency outcomes. It increases the challenge already faced of trying to make sure the link between service and costs is reflected in base cost allowances, particularly where bespoke allowances for enhancement expenditure varies. We suggest keeping these issues under review. For forecast data we believe there would need to be more scrutiny of outliers and in particular capital maintenance expenditure, using unit cost comparisons. The more detail we need to go into, the less exogenous the approach to cost assessment becomes. Ofwat will need to consider the overall strength of the incentives, and given the maturity of using cost sharing rates, there is a real question as to the value of comparative efficiency given the request on water companies to protect the public health and wellbeing of society to threats to the climate and environment.

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Clearly Ofwat do need to protect customers from any sense that they are being asked to fund investment more than once, the benefits having been eroded through management action. Equally, regulatory decisions have always driven past enhancement decisions unequally across the country, reflecting that risk from the environment, topography and other exogenous factors varies and in the short term is often outside of management control. This is difficult to unpick, as the CMA found in leakage costs at PR19. Ultimately the increasing cost trend in the water service, in response to investment targets, was compelling evidence even though the CMA found there was no one correct service approach or cost base from the evidence. We encourage Ofwat to apply any modelling in a proportionate way by ensuring it reflects underlying investment needs and logic, agreeing bespoke solutions where it protects customers better than a one size fits all modelling approach.

We do not in any way criticise Ofwat exploring these topics at this stage of the process, and we welcome the engagement that Ofwat has carried out. For this consultation response we have tried wherever possible to support our response through modelling evidence. In the timescale for this response this process is unfinished, and we have further work to do to explore the Monte Carlo "forward variable selection" approach to variable identification, forecast cost allowance and service-cost exploration we highlight in our response. We are happy to engage further on this work and share it with Ofwat through the Cost Assessment Working Group if our work delivers new options and insight.

We have also considered at a high level the practicality of assuming that base cost can deliver increased performance, that past enhancement cost has not impacted service targets (or is reflected in base costs) and future enhancement can be added onto "what base buys" in a company specific way. We struggled to identify in time a consistent data set to explore this, but we find through the limited analysis that was possible that these assumptions are unfeasible, particularly if extrapolated forward as suggested in section 6 of the consultation. Given the importance of future industry investment to society in an uncertain world, we would caution against extrapolation for comparative regulation. We would encourage Ofwat to consider again our challenges to the approach and process to PR24 that we set out in our previous responses which we think will help to provide a clear and realistic framework about the limits of analysis to regulatory judgement given the circumstances faced by the water sector.

We have set our remarks and points of clarity required in response to the discussion paper in the pages overleaf.

Yours faithfully,

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Principles of PR24 base cost assessment
1. Do you agree with our principles of base cost assessment?

We welcome the approach Ofwat has taken to developing the cost models for PR19 and the effort that has been taken to develop a quality data set. Overall, we agree with the principles for base cost assessment.

We agree with the distinction made on time frame between whether factors are exogenous or within management control – network length is a good example where the degree of management control over the period of data being used in the modelling is minimal to exclude such a factor as endogenous.

Whilst we agree with the principle that a stretching, but achievable cost efficiency challenge should be included, there is more judgement in this principle. In our view it is not an objective that is limited to how the base cost assessment is carried out, but also how it is applied in the context of the overall risk and return at the price review. We comment below on one overall aspect of the consultation where we have particular concerns around this.

Whilst we broadly support the overall consultation approach to cost assessment, the funding of performance scenarios section seems overly complicated. Ultimately a company should be funded in price limits for the efficient cost of the planned service levels it is delivering. If the cost of this is not included within the base cost allowances, then adjustments to these allowances must be made, whether this is because the industry data in setting base cost allowances does not reflect a good estimate of future base costs, or where the planned service level means an adjustment to the base cost is required. Where there is uncertainty about cost allowances, and to avoid disincentivising efficient and necessary investment, cost sharing rates, uncertainty mechanisms and the way outcome incentives are defined ODIs should be available.

This is the existing framework used at recent price reviews. What was of concern at PR19 was where Ofwat had a fixed view of a level of efficiency challenge, compared to company plans, which should be imposed even as elements were removed from those plans, and as the cost and performance evidence shifted from Ofwat's early PR19 perceptions. On the water service, this ignored the increasing cost trend ultimately seen in the data over the five-year period, because service levels were improving. This trend may continue, and if there is a cost trend apparent, it should be taken into account in econometric modelling before considering the potential for innovation and frontier shift.

We suggest a scenario approach and explicit connection made to risk and return (Appendix 5), in order to reduce the risk of information asymmetry. Whilst symmetric adjustments can be considered, there needs to be evidence to support a positive adjustment for one company having an offsetting factor in the base modelling for others, which generally has not been

evidenced when such adjustment might have been considered at previous price reviews, including PR19 most recently. This can usefully be added to the "coherent cost assessment approach principle"

2. Do you consider any important principles are missing?

We think it is an important principle that costs are set at an efficient level that reflect the planned level of service being expected from the company. The principles should therefore recognise that there is a service/cost relationship. The principles should also recognise that the form of base cost assessment also reflects assumptions on cost trends and frontier shift. These factors become more important when considering, as the consultation does, whether to include forecast costs in the modelling and/or using forecast efficiency rankings to set catch ups.

Approach to wholesale base cost modelling at PR24 - Scope of wholesale modelled base costs

3. Do you consider the scope of wholesale modelled base costs should be amended at PR24? If so, please explain how the potential amendment/s to wholesale modelled base costs can be justified based on our proposed assessment framework.

Whilst in principle we should favour totex models, we agree that the scope of base cost modelling for PR24 is appropriate.

There are other costs, such as leakage, lead pipe costs and metering where there is the potential to extend base cost modelling, in a similar way to low pressure costs at PR19. Experience suggests it is better to keep these costs as enhancement for additional costs, given the link to specific proposals and context of company Water Resource Management Plans. On-going base leakage costs is an area which, whilst inevitably included in base costs, requires a clear model application approach that takes into account the service-cost relationship, as the CMA found in adopting the approach we suggested at the time for our PR19 re-determination. Some degree of leakage total cost modelling (base and enhancement) may be required, although the CMA preferred a bespoke company specific assessment due to the very different historic performance levels and leakage strategies between companies.

Generally, the aggregated models perform better than disaggregated data, and this is likely to remain the case as we identified in our 2018 PR19 cost model consultation. Whilst disaggregated models should be tested, Ofwat should not ex ante reject the hypothesis that greater weighting should be placed on aggregated models. For disaggregated models, we

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agree that water resources specific models are, as in the past, unlikely to be robust. The approach taken at PR19 for water resources plus (including treatment) was logical given the evidence.

We believe ex-post model adjustments can also be appropriate – abstraction licence fees and business rates which have no particular cost driver are good examples of this. Traffic management act costs have a mixture of values and cost drivers, so may need to be separately identified as at PR19. We also consider that water purchase agreement costs may also better be dealt with outside of the models – we believe this is a better way of considering the Gloucester & Sharpness Canal costs given the challenges in calculating a relatively small implicit allowance adjustment. The CMAs findings could be used to provide a basis for an implicit allowance adjustment given that it may not be proportionate to recalculate for something that may not vary significantly for PR24, until the point that new strategic resource schemes have variable cost charges which will then require a new modelling approach to develop.

4. Would you recommend collecting additional data in relation to growth expenditure (cost and/or cost driver data) to improve cost assessment at PR24? If so, what additional data would you recommend collecting? Please provide definitions alongside suggested data additions.

We think that growth costs can be included within base cost modelling, given the similar contracting approach to other base costs. We think it would be worthwhile Ofwat testing the scope of developer services costs that should be included in this modelling. It may be possible to assess network reinforcement through separate enhancement econometric modelling, whilst site mains and service connection developer service costs sit more within a base cost model. The main driver may be length of mains (if using a unit cost approach) or property numbers growth for testing an econometric model.

Overall, the case for an exclusion of growth costs in total based on the table 3.2 criteria does not appear to be met, although it may be for network reinforcement where companies have particularly large scale, perhaps driven by water resource issues. For specific companies in high growth areas, where this is driving exceptional resilience reinforcement costs, then we would suggest following the cost adjustment claim criteria. Bristol Water for instance is a high population growth area, but existing resilience generally means that off-site network reinforcement costs have not historically been an exceptional model issue, whether separately modelled or included in base costs (once adjusting for different property growth assumptions between ONS and local plans dealt with through DSEAR at PR19).

We are not clear that there is a significant issue between capital maintenance / overhead allocation for growth costs that is material. The SIA analysis on developer services charges looked at these issues and made recommendations on overhead allocation which companies

should be following in any case. We do not think it will be feasible to back cast data, certainly not prior to 2018, given the change in developer services charging approaches that were introduced from 1 April 2018, and then changes in income offset from 1 April 2020.

Approach to wholesale base cost modelling at PR24 - Sample period selection

5. Do you agree that we should utilise the full historical data series available to develop the wholesale base cost models at PR24 (from 2011-12 onwards) unless there is clear justification for using a reduced time series (eg structural break that cannot be addressed through other remedies)?

Whilst there is value in using the full historical data set, we think it is in particular worth considering the value of pre 2014/15 data. Given the introduction of totex/outcomes framework at PR14, and the potential for this to be a break point with industry data, including allocation between base and enhancement, we would expect the post 2015 data to have greater value. This can be tested by considering structural breaks, but also sensitivity testing of whether including earlier data has a material impact on the model outcomes. We would in particular want to avoid a regulatory burden of backcasting data to historical periods where there are data gaps for modelling.

6. Should we consider including business plan forecasts in our wholesale base cost models at PR24?

We are not convinced that including business plan forecasts in the wholesale base cost models will be appropriate. To include forecast data would require additional testing of structural break points and outliers. The advantage of including such data is that it may better reflect the industry expectations of costs (e.g. power price projections), capital maintenance needs and performance levels that are assumed to be in base. The disadvantage of using such data is that these factors interact, and companies may carry a different level of need or risk in their own planning. Ultimately Ofwat would need to scrutinise these cost projections before using the plan data in forecast modelling. This is relatively straightforward for power prices (which ultimately though are then better dealt with through RPE/frontier shift assumptions as at PR19). Wage projections were considered within the RPE/frontier shift assumptions (and power, even if no adjustment was made). Clearly there is an impact of Brexit/Covid etc on labour, power, materials and chemical prices which could not be anticipated at PR19 and will not be fully reflected in the base cost series at PR24.

For capital maintenance, which we could anticipate with an ageing asset base may be a significant driver of why costs in the future could vary across the industry, using forecast data in the modelling would require measures of drivers of capital maintenance changes

that were consistent across companies. Other than through specific company adjustments, as we note later in the consultation responses there do not appear to be any obvious candidate metrics to support a process that tested capital maintenance cost changes (linked to need) across the industry.

Overall, we think forecast data and efficiency provides a useful cross-check, particular to explore whether recent cost trends (whether driven by pricing, service levels or an ageing asset base) are projected to continue from company plans, and also to identify outliers – are dramatic increases or reductions in cost affecting allowances and has the scrutiny of this in company plans been proportionate.

For these reasons wholesale appears to be different from retail, where nominal prices are assumed and forecast data could be considered (helping to offset short term one-off costs in IT not reflected in depreciation used in the modelling at the start of establishing a separate retail business unit at PR14, or for bad debt provisions).

Whilst we need to be careful so that companies do not have perverse incentives with changing forecast data to make them appear more efficient, we have tried to test whether this would have been the case at PR19. If the relationship (in terms of model results: R2 and variable significance) remains the same between the historical data and forecast data, this may suggest that using forecast data would be acceptable to use within the sample period. The results of this comparison between model performance is illustrated in table 2. However, the spread of efficiency scores is much wider, with the upper quartile being lowered. This suggests that using forecast data carries risk, particularly where companies have varying level of enhancement expenditure and we are not using long-term totex modelling. The outcome is also skewed by the exclusion of Thames conditional allowance expenditure, and there may be other similar adjustments.

The data also suggests that company forecast data includes frontier shift and RPE assumptions, which are better dealt with outside of cost projections as standard industry forecasts – there is a risk that this will be double counted with forecast data.

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We included forecast data within the PR19 econometric models and input these results into feeder model WW2 to assess the difference in efficiency scores. The data used for this analysis was the Ofwat feeder model WW1, available on the Ofwat website, rather than the latest CMA version of the same data, which includes 2019/20 data. We used the Ofwat data as this is the data that was made available at the same point in time where the forecast data was estimated. This is an additional challenge in using forecast data during the extended price review process when new base data becomes available, illustrated by the difference the 2018/19 and 2019/20 data had on the base cost allowances. The results are shown in the table below. The left-hand side table uses historical PR19 data, 5 years between 2017-2021, with the right-hand side table, which includes forecast data of a sample period of 8 years between 2017 to 2025. The results in table 1 below demonstrate that using forecast data is of concern, because the spread of efficiency rankings represent implausible catch ups.

Table 1: Comparison of Efficiency Scores using historical PR19 and Forecast data

With only historical PR19 data	
Catch up efficiency challenge	0.987
UQ	0.996
Wholesale (triangulated)	
Company	Efficiency Score
PRT	0.787
SSC	0.925
SWB	0.938
AFW	0.987
NWT	0.999
YKY	1.036
NES	1.058
SEW	1.065
SVT	1.096
TMS	1.098
WSX	1.103
ANH	1.115
BRL	1.116
SRN	1.151
WSH	1.153
SES	1.241

Including forecast data	
Catch up efficiency challenge	0.918
UQ	0.930
Wholesale (triangulated)	
Company	Efficiency Score
PRT	0.769
SWB	0.879
NWT	0.880
SVT	0.918
NES	0.934
SSC	0.955
AFW	0.982
TMS	1.001
WSX	1.007
YKY	1.017
WSH	1.029
SEW	1.031
SES	1.088
BRL	1.131
ANH	1.137
SRN	1.160

Table 2: Comparison of model performance when using historical PR19 and forecast data

	Using Historical PR19 Data					Using Forecast Data				
	RE1	RE2	RE3	RE4	RE5	RE1	RE2	RE3	RE4	RE5
Dependent Variable	WRP	WRP	TWD	WW	WW	WRP	WRP	TWD	WW	WW
No. Properties (log)	1.007***	1.007***		1.034***	1.020***	1.007***	1.009***		1.044***	1.031***
% Water Treated in WTW with complexity levels 3-6	0.008***			0.005***		0.008***			0.005***	
Weighted average population density (log)	-1.647***	-0.981**	-3.120***	-2.220***	-1.789***	-1.972***	-1.353***	-3.402***	-2.409***	-1.986***
Weighted average population density^2 (log)	0.103***	0.056	0.248***	0.156***	0.125***	0.127***	0.083***	0.266***	0.168***	0.138***
WT complexity index (log)		0.486***			0.568***		0.463***			0.527***
Lengths of main (log)			1.049***					1.071***		
No. of booster pumping stations per lengths of main (log)			0.455***	0.231**	0.256***			0.24	0.153	0.189*
Constant Term	-4.274**	-6.607***	5.686***	-1.106	-2.725**	-3.168*	-5.336***	5.683***	-0.844	-2.338**
No. of observations	141	141	141	141	141	171	171	171	171	171
R_squared	0.934	0.921	0.967	0.975	0.977	0.932	0.917	0.962	0.974	0.976
RESET_P_value	0.542	0.159	0.124	0.229	0.148	0.525	0.253	0.109	0.179	0.129

At face value the models using historic and forecast data are fairly similar. The issue with forecast data appears to be that as enhancement spend increases forecast treatment works complexity, it implies a lower base cost and therefore a worse efficiency position for companies with more complex base treatment. On the other hand, as population density does not in itself drive changes in forecast spend, the coefficients imply that higher spend is attributed to population growth – this may be an issue with including forecast growth spend in the base cost model. Booster pumping stations become insignificant with forecast data as a result. We conclude that for wholesale including forecast data would require different variables that took into account base cost changes from variables, and different scaling variables.

Another alternative is to calculate the relative efficiency position based on forecast rather than historic data. This could be applied to modelling either on historic data or on forecast data. In our view it is worth showing the sensitivity of applying this impact. When using forecast data, if there is a larger spread of efficiency outcomes as there was with retail costs at PR19, it may be that it would be riskier for wholesale costs to apply an upper quartile efficiency in those circumstances – an efficiency score of 66% or even median efficiency might then need to be applied. Although this can be tested in practice, incentive properties and the application of RPE and frontier shift may mean that historic data and historic efficiency to set benchmarks is an easier to justify position, particularly when faced with different service levels and different company programmes for base vs enhancement cost.

Approach to wholesale base cost modelling at PR24 - Target modelling suite

7. Do you agree with our proposed target wholesale base cost modelling suite at PR24?

We agree that the water target wholesale base cost modelling suite may not change from PR24. We consider this can be tested through the modelling but accept that some mixture of aggregated and disaggregated modelling over water resources plus, water distribution and in aggregate is likely to be appropriate.

Approach to wholesale base cost modelling at PR24 - Cost drivers and explanatory variables

9. Do you think we should reconsider the inclusion of APH in the wholesale water base cost models at PR24? If so, should it be a substitute for, or additional to, booster pumping stations per length of mains?

We agree it is worth considering APH as a variable alongside the PR19 booster pumping stations per length of mains. We support investigating data quality improvements, although

ultimately it may just be that APH is more variable from year to year as water source use changes, but costs do not vary quite as much as APH because of water resource, treatment and distribution optimisation by companies. This however is being investigated as part of an industry study, with support from an external consultancy to work with subject matter experts from the individual water companies to ensure the data quality for the APH variable is of the highest quality.

We propose a potential piece of research that could explore a way of capturing the topography element within base cost models as an alternative to current topography proxies. Through using geographic information system (GIS) data, of which the Ordnance Survey provide open-source data – OS Terrain 50, the topography of the water network could be modelled in 3D, capturing the extra cost required to pump water up steep terrain.

11. Please provide detailed proposals for any additional / alternative cost drivers and explanatory variables we should consider at PR24, including clearly defined data requirements that would need to be collected from companies.

We have also considered what alternative variables could be used at PR24, including through using a Monte-Carlo variable selection process similar to the approach that NERA developed for us at PR19.

- Treatment work complexity variables should be tested – as it may be that levels 3-6 should be compared against 4-6 or 5-6 and the most significant model variable for treatment complexity used.
- Mains age cohorts should be considered as a variable – this is largely exogenous within the time horizon for the modelled data, and depending on model formulation may be a significant factor. Testing pre-1940 mains proportion and pre-1980 mains proportions against models without this variable may be worthwhile.
- Scale factors should also be tested (number of sources/Distribution Input) which has been used as a variable in the past, alongside ensuring the disaggregated and aggregated models imply the same returns to scale.
- Average pumping head should be considered against the booster pumping station/length of main variable, in order to identify the best explanatory variable for topography

We also believe a time trend should be considered, more from the perspective of the service/cost relationship rather than considering technological change specifically.

For enhancement opex – we also consider that this could be considered as part of the service-cost relationship rather than necessarily applied as an implicit allowance adjustment within base costs as attempted at PR19. We did not persuade the CMA of a number of alternative approaches including taking a cautious view where companies proposed

enhancement opex fell below the adjusted level – the CMA supported Ofwat's approach and an improved data set should make this adjustment more reliable. We think though that the level of enhancement expenditure since PR14 should be considered as part of the service-cost relationship, which may form part of the way enhancement opex in base historic opex expenditure is considered.

We have considered additional data and variables through a forward variable selection technique, which we describe further below. At this stage the outputs are preliminary and require further exploration.

Approach to wholesale base cost modelling at PR24 – Model estimation method

12. Do you agree that we should maintain the use of random effects to estimate our wholesale base cost models at PR24?

We support the use of random effects to estimate the wholesale base cost models at PR24, as long as the diagnostic testing such as the Hausman Test suggests that random effects is more suitable than fixed effects estimation.

We do also consider Thames' suggestion of the use of Dynamic panel data modelling has its strengths in modelling the irregular and lumpy pattern of investment we experience for enhancement costs, such as growth. In practice however we think that the separate modelling of enhancement from base limits the logic of using dynamic panels because most of the irregular investment comes from enhancement, which can have a knock on impact on capital maintenance. Given the length of data available (2011 or 2015 onwards) it may be that lumpy investment may be less of an issue in historic data, than improvements in service levels and testing of cost trends and the service cost relationship.

Approach to wholesale base cost modelling at PR24 – Model selection process

13. Do you agree with our proposed model selection process?

We agree with the overall model selection criteria, but have an addition based on applying Monte Carlo search to the data set, including variables that meet the variable selection criteria.

In terms of statistical testing, we note that VIF was not specified in the consultation, despite it being discussed during PR19 model selection and in support of the models Ofwat had selected at the CMA.

In terms of the criteria – we agree with the consultation list for selection of whether a model is suitable. However, we think additional criteria are needed when choosing between different models. Whilst a range of models (aggregated and disaggregated) should be used,

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there is a set of criteria required when choosing between them. We believe the set we used in the PR19 cost model consultation remain relevant. Mostly the final PR19 models met these tests, but we should not presume that they automatically will at PR24 unless considered against alternative models:

Statistical validity – the criteria used in model selection (such as CEPA did for Ofwat at PR19) can indicate which models should be preferred, as well as used for screening appropriate models.

Better model – is there clearly a better, more statistically significant model that improves explanatory power or model logic, for instance by including additional variables. There should be a higher hurdle for excluding statistically significant variables than for including insignificant variables, where there is a question of engineering logic or overall statistical model validity.

Appropriateness – do the results make the model useful for the purposes of cost assessment at PR19 (in particular, is the spread of efficiency results plausible?). Where the presumption of a sign of a variable result in an implausibly wide range of efficiency outcomes, we would question whether the variable should be preferred just because of assumed signage.

Rationale – does the variable make sense at an aggregated or disaggregated model level, particularly if it is absent as a variable from the alternative level of aggregation.

Consequences – Is there any obvious bias in either the explanatory variables included or excluded in a model, or adverse implications for the future efficiency and effectiveness of the industry should this driver of cost be used. An example could be a model that assumed more metering resulted in lower on-going cost, which could imply a disincentive to meter more properties. Another example would be where the form of the model appears to be trying to reflect a company specific situation without explaining why this logic applies across the industry, for instance in geographic area or population variables.

We have experimented with a statistical technique called forward variable selection where, based on an elimination criteria (in our analysis we used adjusted R^2), you begin with one variable and subsequently iterate through a list of explanatory variables and drop the variable if it doesn't increase the adjusted R2 and maintain it within the model if it does. This is an updated version of the approach that NERA carried out for us at PR19.
To provide the most current results, we use the CMA version of FM_WW1, and initially use the Stata syntax provided[1] to manipulate the data into the correct format (i.e. transform

[1] Syntax available on Ofwat website - https://www.ofwat.gov.uk/wp-content/uploads/2019/12/Stata-do-files_Regressions-Wholesale-water_FD.txt

necessary variables by natural log, convert to real prices using adjusted CPIH and drop rows such as HDD or SVE for 2017/18 or 2018/19). The Stata syntax also creates the dependent variables and cost drivers. We then separate the dataset into the different parts of the supply chain: water resources, treated water distribution, wholesale water, network plus water and water resources plus. Then, to ensure multicollinearity within the modelling is not introduced unnecessarily, the subcomponents of the cost drivers are dropped from the datasets as variables to test (i.e. **length of main** =, **Total length of potable mains as at 31 March** + **Total length of non-potable and partially treated main for supplying customers**, so the two variables that create the length of main cost driver are dropped from the dataset). At this point the disaggregated datasets have approximately 190 columns to iterate through, where the code provides a list of final variables. Before the model results are finalised we perform VIF tests on the variables to ensure multicollinearity is not present in the models, and drop variables from the final selection that have a VIF score above 10.

The initial results include individual spend lines as a proxy for costs that could be excluded from the modelling as costs that are not related to the explanatory variables, such as EA abstraction charges. We would recognise the need to refine the modelling approach to avoid spend as an explanatory variable but it helps to identify potentially significant variables, which can then be considered in wider modelling. Similarly time trends and year dummy variables may not be appropriate for efficiency modelling, but identify limitations in variable selection if such factors are not explored in selecting potential explanatory variables that we would expect to see in a final model. Other insignificant variables may also be dropped through a refinement process, but it appears to suggest that the aggregated models are better at explaining industry base costs than the disaggregated models, because the disaggregated models suffer more from fixed costs independent from the explanatory variables and lumpy spend suggested by year dummy variables.

The results of this analysis is displayed below:

Forward variable selection analysis results

Water resources			
Dep. Variable		LnrealBotexWR	
No. of Obvs		158	
Adj. R-Squared		0.813	
Variable Code	Variable Name	Coefficient	P-Value
Intercept	Intercept	1.3111	0.000
lnBN2350	Ml/d, Water delivered (non-potable) (log)	-0.0651	0.006
lnBN11090	nr, Number of water towers (log)	0.1671	0.000

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lnW3034WR	£m, Water resources, environment Agency service charges/discharge consents (log)	0.4025	0.000
lnWS1008WR	£m,Water resources - Local authority and Cumulo rates (log)	0.3319	0.000
lnW3003WR	£m, Water resources - Improving taste / odour / colour (log)	-0.1486	0.004
timetrend	Time Trend	0.0244	0.098

Treated Water Distribution			
Dep. Variable		LnrealBotexTWD	
No. of Obvs		158	
Adj. R-Squared		0.899	
Variable Code	Variable Name	Coefficient	P-Value
Intercept	Intercept	1.3901	0.000
lnW3027TWD	£m, Treated water distribution - Improvements to river flows (log)	0.5377	0.079
dummyyear2	Dummy variable for year 2	0.1179	0.184
lnW3003TWD	£m, Treated water distribution - Improving taste / odour / colour (log)	0.0525	0.141
dummyyear1	Dummy variable for year 1	0.0859	0.349
lnWS1010TWD	£m,Treated water distribution - Third party services (log)	0.1151	0.000
lnW3008DO	Ml/d, Total demand side enhancements to the supply demand balance (dry year annual average conditions) (log)	0.0193	0.444

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dummyyear9	Dummy variable for year 9	0.0016	0.987
lnBN2350	Ml/d, Water delivered (non-potable) (log)	-0.1031	0.000
lnBN4849	nr, Number of pumped storage reservoirs (log)	0.0716	0.061
lnW3028OPTTWD	£m, Treated water distribution - Optant residential metering (log)	-0.0075	0.833
dummyyear7	Dummy variable for year 7	-0.0564	0.721
lnBN4830	nr, Number of impounding reservoirs (log)	0.0195	0.484
lnBM3011TWD	£m, Treated water distribution, employment costs - indirectly attributed (log)	0.2376	0.000
lnWTW003PN	%, Proportion of Total DI band 3 (log)	0.0904	0.003
lnwac	Weighted average level of treatment complexity (WAC) (log)	1.1202	0.000
lnBN2327	Ml/d, Water taken unbilled (log)	0.2962	0.000
lnWS1014TWD	£m,Treated water distribution - Other capital expenditure – infra (log)	0.1983	0.000
lnBN1765	000s, Number of household meters renewed (log)	-0.0013	0.957

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Wholesale Water			
Dep. Variable		LnrealBotexWW	
No. of Obvs		158	
Adj. R-Squared		0.933	
Variable Code	Variable Name	Coefficient	P-Value
Intercept	Intercept	2.9963	0.000
dummyyear2	Dummy variable for year 2	0.0122	0.857
dummyyear5	Dummy variable for year 5	-0.0896	0.188
lnBN1204	km, Total length of mains relined (log)	0.0281	0.209
dummyyear1	Dummy variable for year 1	-0.0036	0.959
lnBN4847	Propn 0 to 1, Proportion of distribution input derived from aquifer storage and recovery (ASR) water supply schemes (log)	0.0396	0.199
lnBN4849	nr, Number of pumped storage reservoirs (log)	0.2861	0.000
lnBN10898	nr, Total number of GW5 works (log)	0.1965	0.000
lnBN10590	nr, Total number of SW3 works (log)	0.4363	0.000
lnWTW007NR	Nr, WTWs in size band 7 (log)	0.1676	0.003
lnWTW007PN	%, Proportion of Total DI band 7 (log)	-0.2909	0.000
lnW3007DO	Ml/d, Total demand side enhancements to the supply demand balance (dry year critical / peak conditions) (log)	0.0529	0.277
lnW3008DO	Ml/d, Total demand side enhancements to the supply demand balance (dry year annual average conditions) (log)	0.0095	0.833
lnBN4848	Propn 0 to 1, Proportion of distribution input derived from boreholes, excluding managed aquifer recharge (MAR) water supply schemes (log)	0.0965	0.018
lnBB13000	km, Total length of mains laid or structurally refurbished pre-1880 (log)	0.037	0.006
lnBN10897	nr, Total number of GW4 works (log)	0.2797	0.000
lnBN1231	nr, Number of lead communication pipes replaced for water quality (log)	0.0127	0.283
lnWTW003PN	%, Proportion of Total DI band 3 (log)	0.0189	0.436
lnBN10902	m.hd, Average pumping head – treatment (log)	-0.0059	0.820

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Network Plus Water			
Dep. Variable		LnrealBotexNPW	
No. of Obvs		158	
Adj. R-Squared		0.838	
Variable Code	Variable Name	Coefficient	P-Value
Intercept	Intercept	3.1313	0.000
dummyyear2	Dummy variable for year 2	0.0536	0.620
dummyyear6	Dummy variable for year 6	0.027	0.810
dummyyear7	Dummy variable for year 7	-0.1369	0.240
lnBN10490	nr, Total number of SW2 works (log)	-0.4104	0.140
lnBN4849	nr, Number of pumped storage reservoirs (log)	0.2271	0.000
lnWTW008PN	%, Proportion of Total DI band 8 (log)	0.1106	0.099
lnBN4833	Propn 0 to 1, Proportion of distribution input derived from impounding reservoirs (log)	-0.058	0.029
lnBN10898	nr, Total number of GW5 works (log)	0.3142	0.000
lnBN4830	nr, Number of impounding reservoirs (log)	0.2484	0.000
lnpopsparsity	Population sparsity (log)	-0.1774	0.000
lnWTW007NR	Nr, WTWs in size band 7 (log)	0.2842	0.001
lnrwasoc2	Regional Wage variable	-0.0055	0.870
lnW3008DO	Ml/d, Total demand side enhancements to the supply demand balance (dry year annual average conditions) (log)	0.0369	0.597
lnWTW007PN	%, Proportion of Total DI band 7 (log)	-0.3365	0.000
lnW3007DO	Ml/d, Total demand side enhancements to the supply demand balance (dry year critical / peak conditions) (log)	0.0208	0.783
lnBN10902	m.hd, Average pumping head – treatment (log)	-0.0932	0.019
lnBN1231	nr, Number of lead communication pipes replaced for water quality (log)	0.0383	0.039

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Water Resources Plus			
Dep. Variable		LnrealBotexWRP	
No. of Obvs		158	
Adj. R-Squared		0.834	
Variable Code	Variable Name	Coefficient	P-Value
Intercept	Intercept	2.3643	0.0000
dummyyear5	Dummy variable for year 5	-0.0737	0.4890
lnQEBW0180	%, Mean Zonal Compliance (log)	0.0512	0.6000
dummyyear2	Dummy variable for year 2	0.0179	0.8680
dummyyear9	Dummy variable for year 9	0.0707	0.5580
lnW3008SO	Ml/d, Total supply side enhancements to the supply demand balance (dry year annual average conditions) (log)	0.0838	0.0430
lnBN10490	nr, Total number of SW2 works (log)	0.126	0.6420
lnBN1711	000s, Number of selective meters installed (log)	0.0191	0.1570
lnBN4849	nr, Number of pumped storage reservoirs (log)	0.0964	0.0300
lnWTW008PN	%, Proportion of Total DI band 8 (log)	0.0275	0.6810
lnWTW007NR	Nr, WTWs in size band 7 (log)	0.1712	0.0360
lnBN10890	nr, Total number of GW3 works (log)	0.1561	0.0020
lnWTW007PN	%, Proportion of Total DI band 7 (log)	-0.2898	0.0000
lnBN10902	m.hd, Average pumping head – treatment (log)	0.0263	0.4760
lnW3008DO	Ml/d, Total demand side enhancements to the supply demand balance (dry year annual average conditions) (log)	-0.01	0.8900
lnW3007DO	Ml/d, Total demand side enhancements to the supply demand balance (dry year critical / peak conditions) (log)	0.0775	0.3220
lnBN11610	nr, Number of galvanised iron communication pipes (log)	-0.0167	0.2660
lnBN10790	nr, Total number of GW2 works (log)	-0.0394	0.3860
lnBN10190	nr, Total number of water reservoirs (log)	0.254	0.0000
lnBN2200	000s, Non-households billed unmeasured water (log)	0.2472	0.0000

The preliminary results demonstrate that there could be additional variables to include within the model specification, however we have not compared these results against the model inclusion criteria set out in table 3.2 in the consultation.

Whilst this experimental and exploratory analysis provides insight into different model specifications than those used in PR19, it should be noted that this analysis is a work in progress and requires further effort to provide more robust results, for example updating the code to perform forward selection using random effects. Once the updated results are available, we are happy to also share these with Ofwat.

Cost adjustment claims

14. Do you agree that the cost adjustment claim process at PR24 should be separated between base (wholesale and residential retail) and enhancement claims?

We agree that base and enhancement claims represent a different cost adjustment claim process. We are not clear what enhancement claims will be relevant at PR24 from the methodology currently, although we assume this will apply for leakage, metering and supply demand expenditure. We note that these areas overlap with the service cost relationship, in particular for leakage.

Our assumption is that the service-cost relationship evidence is considered separately to base and/or enhancement claims. Clearly based on our leakage performance at PR19, as found by the CMA, and projected for PR24, this could apply as modelled enhancement cost (which was not really in dispute to any quantum of magnitude at PR19, including through the CMA process). Whether base costs should be adjusted for leakage performance was disputed, and the CMA ultimately adopted our suggested methodology. We assume this will be considered as part of service-cost relationship, but if it was not considered this way it could also be included as a base cost adjustment. This could also potentially apply to other levels of service, but we assume from the consultation that Ofwat will consider these factors in a standard way, rather than requiring base cost adjustments, or separate enhancement claims.

15. What base cost adjustment claims (wholesale and residential retail) would you consider submitting if the PR19 base cost models were used to assess efficient costs at PR24?

Based on the PR19 base cost models this would only be the water purchase costs from the Canal & Rivers Trust for the Gloucester Sharpness canal. As mentioned above, if the base cost models were applied as at PR19, we could anticipate other base cost adjustment claims for leakage performance. Ofwat raised this with the CMA as a cost adjustment claim we

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should have raised, although we did raise the issue of leakage costs during the process it wasn't clear (as with this consultation), whether it should be through a cost adjustment claim rather than through alternative model tests (which is something Ofwat did apply at the Final Determination).

16. What additional cross-sector data should be collected to support the submission of the claims indicated in response to the previous question? Please describe and explain the rationale behind the additional data that you consider should be collected and provide a draft definition.

We do not believe it is proportionate to collect additional company data in order to calculate an implicit allowance for the Gloucester & Sharpness canal adjustment. We think it would be more proportionate to follow the CMA's PR19 findings and calculate the implicit allowance using this data. More data on bulk supplies is currently being collected in APRs, however without separate water resource modelling it will remain difficult to calculate an exact implicit allowance. We do not believe a symmetrical adjustment is warranted (as we showed it was immaterial in our PR19 submissions). There is a stronger argument for treatment the purchase costs as equivalent to abstraction licence charges, but believe it is reasonable to apply an implicit allowance at the same amount as the CMAs findings.

Symmetrical claim adjustment was an ambition of both the PR14 and PR19 methodologies. In practice the cost adjustment claims that were accepted did not lend themselves to such adjustments, often due to data limitations. Given the maturity of the models, we are not convinced that symmetrical adjustments will work in practice at PR24, but we are happy for Ofwat to test this as part of the process. It should not be a criterion for company specific adjustments to costs in of itself. An example of the risks from symmetrical adjustments is growth – if models put higher weight to high growth areas and lower allowances for low growth areas, not only is that a model complexity, but it may be averaging a specific regional factor as a variable to a low growth area with underlying (fixed) ongoing growth costs. Symmetrical adjustments would potentially require moving away from Fixed or Random effects to other techniques such as Stochastic Frontier Analysis, because the symmetrical adjustment could change the degree to which the residual represents inefficiency. The question must be made as whether additional complexity in adjusting costs and in the modelling will overall improve the cost assessment?

At the least, the nature of the adjustment needs to be understood (e.g. is it timing if it is driven by assets for instance, or a permanent exogenous difference such as the G&S canal supply?). If topography, then a model variable should be preferred to adjusting costs being used in modelling.

For service-cost relationship claims, data on mains age cohorts and works complexity, alongside leakage data, is already collected in APRs. Some of this data has also been used

(works complexity) for past C&RT cost assessment claims, although it is not needed if the CMA approach to calculating an implicit allowance is followed.

17. How can the cost adjustment claim guidance be enhanced to improve the quality of cost adjustment claim submissions?

We believe the cost adjustment claim guidance Ofwat has proposed in the consultation and in particular in discussion at the Cost Assessment Working Group is appropriate.

We do not believe that there is a single approach to calculating implicit allowances, and the consultation is correct to identify a number of alternatives. What was not accepted by the CMA at PR19 for the G&S adjustment was that offsetting lower costs in other service aspects, in addition to an implicit allowance that we had calculated, were both required. Ultimately, we believe implicit allowance rather than an estimate of potentially offsetting (but unrelated) savings should be the criteria. This would avoid some of the dispute concerning the G&S at PR19 (noting it was not disputed at PR14).

We also do not believe that difficulties in calculating an allowance, or making it symmetrical as an adjustment, should be used as an argument for rejecting a cost adjustment claim. Whilst best endeavours should be used to calculate adjustments, ultimately the rationale for a claim (including where accepted in the past) should override these criteria.

18. Would an early cost adjustment claim submission be welcome at PR24?

We do not think that an early submission process should be necessary at PR24, given the only claim we think that is likely should be straightforward and could, as a recognised adjustment at previous reviews, have a proportionate approach compared to novel claims. We do not think therefore that an early submission at PR19 had any benefit, given Ofwat accepted the claim but originally (later stated as an error) accepted the adjustment as an outside modelling adjustment. We expect for CRT an early submission for this claim would not necessarily aid the process, as 2022/23 cost and bulk supply data would be needed to assess the claim value. The principle of the claim should not be under dispute after PR19, and therefore we suggest that a proportionate approach could just consider the data and apply the PR19 methodology.

Capital maintenance and asset health

19. Do you agree with the different elements / approaches to introducing more of a 'forward look' into our approach to assessing capital maintenance expenditure? Are there other elements / approaches we could consider?

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We are not convinced that a consistent, forward-looking approach to capital maintenance expenditure is possible for PR24. As we have highlighted before and as part of the AMMA process, there is not currently a single forward-looking measure of asset health that can reliably be used to compare companies – too much is predicated on past enhancement investment, geography and topography. The proposals in the UKWIR Future Asset project confirms this – all of the potential alternative measures appear to be optional and situational rather than necessarily reflecting the whole industry.

Our view is that for the water service, a hazards base approach in Drinking Water Safety Plans, supported by the DWI's RARI measure, with clear evidence of how this links into asset risk register and investment plans is our aim. We believe there may be some appropriate minimum asset output standards (e.g. km mains relined/replaced), but these should be based on company specific modelling. Our evidence for this approach stretches beyond the UK to our European Benchmarking Co-operation data which we referred to at PR19. Bristol Water has the oldest water mains in this survey but upper quartile leakage performance, with only the Netherlands where the systems were designed from scratch with lower leakage. However, some of our techniques such as Active Leakage Control which have not been used in the Netherlands are becoming more prevalent as their water network ages. Asset health remains bespoke and context dependent, in our view, and the more we can link to long term outcomes and hazard management, the more that the criticality of asset health approaches will be understood.

20. Do you have any comments on the proposed long list of asset health measures in Table 5, particularly in relation to their suitability and how feasible they are to collect? Please include any reporting or definition changes you would like us to consider and provide suggestions for other measures not included in this list.

We note that Ofwat has collated a long list of potential measures for review from a variety of information sources including: PR19, previously reported measures, companies' AMMA submissions and the ongoing UKWIR research to identify potential candidates for additional asset health measures.

We think serviceability and asset health is important – but forward-looking measures have proved difficult to develop. This is because asset health measures the harm to service from shocks (e.g. third party, weather, Beast from the East). Avoiding the worst impact on customers and service recovering quickly is the best measure of long-term asset health. We split out service and operational resilience to help close the gap between asset health and long-term risks and opportunities. Companies with persistent service failures that are not resolved are where the asset health is not resilient. But forward-looking challenges mean this is not enough. It is difficult to define but ingredients are:

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- Ability to predict events
- Resilience – local duplication measured in terms of population at risk
- Relevance of past asset health to future challenges – e.g. local infrastructure and needs planning such as in the Bristol One City Plan
- Customers, stakeholders, culture, values – importance of Social Purpose and public value to asset health and world class asset management
- Resilience Action Plans – a welcome and useful addition to track progress
- Transparency – our commitment to mid-year reporting rather than a focus on year end (i.e. before year is finished). For example, our latest mid-year report included an update on our resilience action plan.

As per our response in January to the discussion paper on PR24 performance commitments for future price reviews, an appropriate measure not listed would be the DWI's Risk Assessment Risk Index (RARI).

We do not agree that asset condition grade across the industry is a good measure of asset health, and is unlikely to be sufficient on its own to support capital maintenance need assessment. There is too much judgement involved for what is a very costly process and this option should only be targeted on a company specific basis at assets where performance is dependent on understanding condition, which depends on resilience and may alter with technology.

Similarly for the maintenance activity volumes – these are not useful predictions of resilience or performance. This is data, not metrics useful for either cost assessment, without going back to cost base and other types of assessment the rest of the consultation rightly rules out.

One question we raise is how Ofwat separate pure asset health measures from asset resilience and operational measures that are reflected in outcomes or outputs. We do not believe there is a widespread and clearly practical measure for comparison purposes. Again, EBC data gives us some wider perspective that even beyond England & Wales, there is no single asset management approach and metrics used in the Global water sector because it is a local service, mostly at a scale of operation generally smaller than the largest WaSCs. Sub-company data may have some benefit in order to make better capital maintenance assessments, but this is not an area we believe has been explored recently. In Bristol Water's case a single company view of assets and their performance reflects our relatively strong water supply resilience with an integrated network, but relatively small areas of network control and measurement which benefit our leakage performance in particular.

In our view, we either have an outcomes led approach (with bespoke metrics), or an outputs led that include some specific deliverables and metrics such as on asset management – we

risk having a muddle that collects data without having a purpose, a role in price setting, or being relevant to long term strategies or risk and return. We do not support a view that the industry has under-spent on capital maintenance and resilience has therefore suffered, as it does not reflect our experience. However, we do see a risk of insufficient financial headroom or from outcomes assumed to be delivered from base costs – hence our support for bespoke asset health modelling and commitments that are longer term – our resilience ODI and mains length commitment at PR19 were part of a plan package for the long term.

Ofwat should be considering RARI rather than CRI – CRI is a short-term operational measure and not specifically isolated as an asset health measure (it may be zero but not indicate a systemic risk). The two may evolve over time, as continuous network monitoring develops and supplements point sampling, something that remains a key part of our long-term ambition.

Whether overall equipment effectiveness and other measures are useful depends on context – resilience is across the whole network (e.g. measuring resilience risks such as modelled through our PR19 proposed bespoke ODI), rather than individual asset measures. It is the context – what one company monitors and measure (e.g. Overall Equipment Effectiveness) depends on many other factors – hazard awareness, drinking water safety plans, effectiveness of picking up future issues into asset interventions.

Cost-service link

21. Do you agree with the high-level approach to determine 'what base buys'? Can you define any additional analysis or information that could support this process?

Any views on "what base buys" will have implications for both ODI calibration and the overall balance of risk faced by companies in delivering future service changes potentially in AMP8 and periods beyond. We would like to highlight two factors for consideration.

Our first point relates to establishing factors within management control. Company performance against certain measures may be a function of a number of factors, other than investment, that have a direct impact on performance, including those outside of management control. It is difficult to establish between year-on-year performance change that directly arises from investment and that which arises from other factors.

Water companies are geographically distinct and cannot be treated as a single seamless whole. This is because Ofwat (and the CMA) have allowed companies different levels of expenditure historically to achieve different levels of service. Further, companies have implemented extensive, in-depth customer engagement strategies which have demonstrated that priorities and valuations vary from region to region. So, there should be

no presumption that all companies should be starting at the same level of performance (even if they are all efficient).

In addition, as noted by the CMA: "*The approach taken by Ofwat is likely to mean that not all companies can achieve all targets without additional investment, and that it is for company management to decide how best to achieve an optimal outcome for that company and its customers across all the PCs by reference to its own circumstances. The ODIs have been designed on the basis that some companies may choose to underperform on some ODIs, if they conclude that the investment cost associated with achieving the targets is disproportionate*"[2].

We therefore question the starting assumption, namely that "*on average we consider that efficient companies will deliver their PR19 performance commitment*". Those companies who do not achieve the performance commitment level for 2024-25 ('year 0') should not be considered inefficient and likewise, the year 0 target will not necessarily be appropriate in determining what base buys for the 2025-30 regulatory period.

Our second point relates to the link between historical spend and diminishing economic benefits. We note Ofwat's starting assumption, "*that companies will continue to improve performance over the long-term from base expenditure, as they have been doing over previous periods.*" In our view, this assumption is a fallacy of inductive reasoning. Simply put, this assumption ignores diminishing returns. This is a major risk to the industry – assuming that past trends predict the future locks companies into cost targeting solutions – even though we don't agree that companies have been underfunded for efficient capital maintenance for long term resilience in the past (and if this was true, then why did they not appeal to the CMA who would consider the strength of the evidence).

This assumption is particularly problematic when considering greenhouse gas emissions. Both Bristol Water, and the sector as a whole, have made considerable progress in achieving operational emissions reductions. However, it is important to note this progress to date has been greatly assisted by the decarbonisation of the UK electricity grid and green tariff purchases. To achieve further progress towards decarbonisation will require a step change in operations and considerable additional effort by the sector – just because there has been historical success does not mean that further progress is inevitable without implications for costs. Indeed, there is a difference between the costs of improving service quickly rather than a gradual service improvement. To improve service in the very short term may require more expensive operational solutions compared to a more long-term best whole life cost approach or ongoing productivity gains.

[2] Competition and Markets Authority, 'Anglian Water Services Limited, Bristol Water plc, Northumbrian Water Limited and Yorkshire Water Services Limited price determination, final report', March 2021, page 630

We have responded on the risk and return consultation separately, but assumptions that extrapolate from the past rather than from company own plan assessments of cost and service risk skewed and risky incentive frameworks, as the CMA found for the water service at PR19. We particularly dispute the logic in figures 6.3, 6.5 and 6.7. Enhancement varies by companies, and we worked with KPMG to evidence the areas of cost and performance that saw some companies making improvements through enhancement and others delivering similar improvements through base at PR19. The analysis was difficult and at best illustrative. However, to assume that future enhancement will increase performance for individual companies (and perhaps the industry if standardising common performance levels) as in figure 6.7, whilst also not assessing the impact of past enhancement on service levels and base costs is a contradiction that will be difficult to defend. The assumption that common service levels for asset driven performance (such as leakage and mains bursts) as opposed to customer facing and operational driven responses (such as supply interruptions and CRI) is a useful distinction that may assist Ofwat.

We think figure 6.5 has more value – but we question why it is improving asset health and resilience for the sector to consider one metric at a time. A bespoke long-term plan rather than comparisons is likely to be less costly and less risky. Companies should explain why their plan has the best value, including from modelling of asset health service measures.

22. Do you consider it would be feasible to assess the 'efficient' baseline performance level for each company for individual PCs such as leakage and PCC through econometric modelling? Are there any other PCs where you consider this could feasibly be attempted?

With the data that is currently available, we couldn't find a service-cost relationship for leakage, using the proposed SES methodology of an outside-model approach. For the outside-model approach, we included variables of leakage, leakage lagged, drivers such as length, age and material of pipe (research suggested that galvanised pipes were more likely to leak[3]) and a control variable for whether the reporting year fell within Covid-19. With the new data lines included in the APR from 2021 (maintaining and reducing leakage) this relationship will be able to model much more accurately, and we deduce that the statistical relationship will be apparent.

We also estimated the within model approach, as suggested by Thames at the Cost-Service CAWG session. By generating an additional variable, *Efficient Water Delivered*, which equates to total water delivered (Potable, non-potable, billed measured household and billed measured non-household) subtract total leakage. We found no statistical relationship between efficient water delivered as shown in table 3 below.

[3] Effective Factors in Causing Leakage in Water Supply Systems and Urban Water Distribution Networks (Saghi and Ansariaval, 2015)

Table 3: Results of within model approach of Service-Cost relationship

Model Name:	Water resources plus		Treated water distribution	Wholesale water	
Dependent Variable	WRP1	WRP2	TWD1	WW1	WW2
Coefficient for Efficient Water Delivered	0.0000127	-0.0000166	0.0000275	-0.0000192	-0.0000537
P-Value	{0.793}	{0.603}	{0.540}	{0.132}	{0.170}
Difference in R_Squared	-0.002	-0.004	-0.005	-0.001	-0.001
Difference in Constant	1.071	1.267	0.243	0.316	0.400

We believe the CMA approach (as we proposed) will be the best option for service-cost relationship estimation. Ofwat will need to consider whether an upper quartile approach should be used, but if standardising performance levels for ODIs (see our other consultation responses), it may be that an average metric will be required because of the impact on the risk and return balance overall for the industry. As the CMA found, if ODIs are skewed towards penalties and are vulnerable to exogenous factors such as the weather, this should either be dealt with through ODI design of "aiming up" on the cost of equity will be required. We prefer this approach than detailed data collection and believe that a basket of measures and other individual common service metrics can be tested. Our testing to date however retains the view that the CMA found (as we did at PR19) that a clear service-cost relationship can only be identified for leakage.

The CMA's findings and bespoke assessment on leakage costs (through a deep dive) is therefore also likely to remain appropriate. Bristol Water's position at the leakage frontier with what is acknowledged as a low-cost, high-performance service level makes it more likely that future leakage costs have an exponentially higher enhancement cost to lower and then higher base cost to maintain. This in part reflects the significant increase to customer supply pipe losses as a proportion of total leakage. Technology can play a role in finding leaks, but little impact on fixing supply side or small leaks without risking future asset health. This may change in the future, which can be reflected in an adaptive pathway. But a bespoke service cost relationship for both enhancement and base cost for leakage is likely to require judgement and scrutiny, rather than relying on modelling and incentives.

23. The need to collect further granular data to elucidate the cost-service relationship was highlighted by companies in response to our PR24 May consultation. Can you propose any data it would be proportionate to collect to support the high-level approach outlined in this chapter?

We do not agree that it will be proportionate to collect further data, based on the CMAs findings. The enhancement opex data being collected and additional data for leakage may be worthwhile. For other activities and areas of performance, there is no clear data gap other than understanding marginal totex costs of further improvements which should form part of an enhancement investment case and can be modelled and scrutinised accordingly.

There is the complexity point here about the overall framework, going back to the principles of RPI-x – we seem to have moved a long way from measuring relative inefficiency, applying catch up and a frontier shift. There is a risk of double or treble counting service and cost trends, when we have performance and cost sharing, plus five-year resets, which protect customers. Clearly there are concerns that this approach is too short-term, but there is a risk that in trying to stretch base cost to consistency and future targets, we also stretch complexity and ultimately risk from greater short-term focus. It's not clear what the gains here for customers and the long term of the industry is? Are we effectively targeting lower maintenance spend, when the concern is that we should be worried about long term resilience to external factors and unknowns that should increase maintenance spend for the long term? So whilst Ofwat should explore performance trends and what base cost delivers, we should recognise the dynamic incentive effects of doing so, both the potential positive and the negative. If we end up with more price control deliverables and specific outputs to ensure outcomes are not too short term, then we won't have a clear base cost to service relationship in any case.

24. What are your views on attempting to use of a composite variable to investigate the cost-service relationship, in the context of the methodological issues and complexities we outlined?

Having attempted this at PR19 and subsequently for our valuation research we provided with our response to the initial PR24 consultation, we believe the cost-service relationship is too context dependent to other variables of history and topography. Source to tap water service is different to CVA approaches used by Ofgem, for instance.

The difficulty with using composite variables in the water sector is endogeneity – for instance the cross over between mains condition and leakage, discolouration, CRI etc is a mixture of exogenous and operational approaches and very long term past investment and enhancement policies and decisions. Regulation has often done this and in the past applied

different standards and expectations to different companies – in such a regulated environment this cannot merely be dismissed as inside management control, otherwise what has regulation been doing since it first started to be formalised, particular after 1945.

25. Do you have any proposals for how to make adjustments where a performance commitment level differs from that expected to be delivered from base costs?

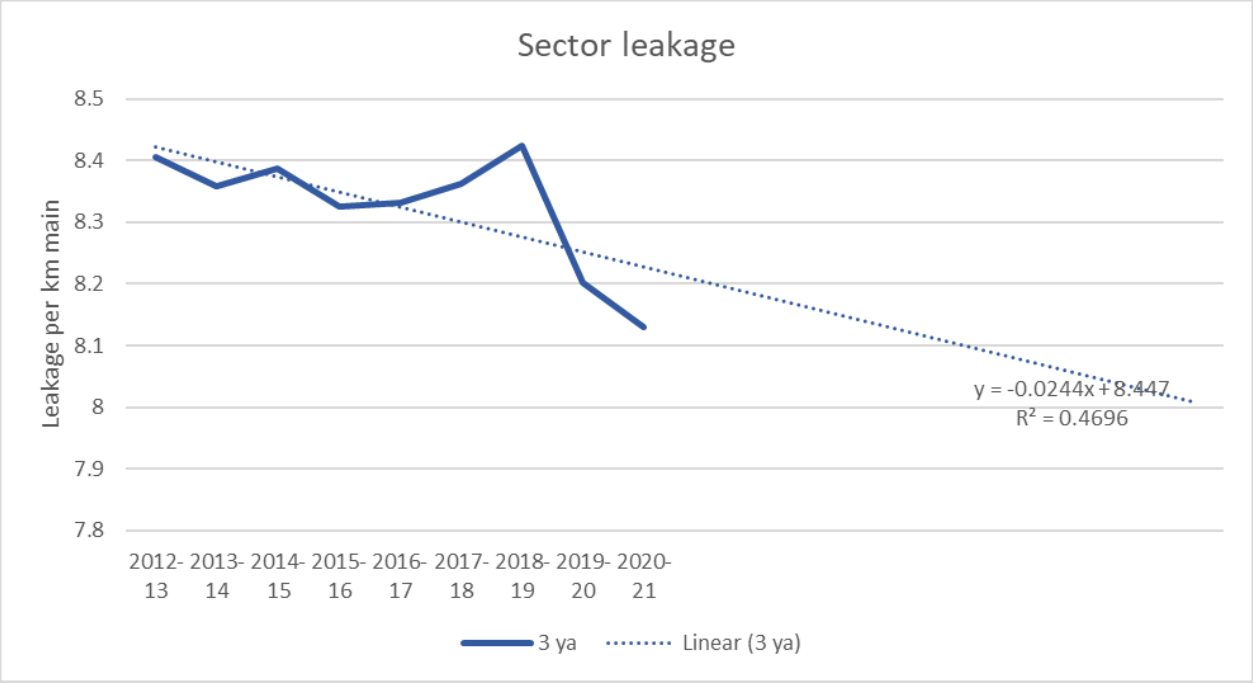
We disagree that Ofwat will be able to standardise performance commitment levels in the way set out in the consultation. Ofwat will need to either a) set outcome incentives and targets in a standard way, to match base costs, b) make more cost-service relationship adjustments for any metric where companies vary (either high or low performance, which could be quartiles, or from the average, or other boundaries, or c) change cost incentives, through changing the benchmarking for catch up away from upper quartile to 66% or average, and/or d) change cost sharing rates.

Our preference remains to allow for a looser standard of common performance, but then allow for bespoke ODIs that balance risk and return across plans. Clearly Ofwat will argue rightly that this defeats the objectives of simpler common performance commitments. We agree, but the consequences for risk and return balance and industry resilience may be unpalatable. The logic for customers of standardising service levels in incentives may also fail to be easy to explain – our submission Regulating for Consensus and Trust explored this, but Ofwat has reversed position recently on the value of customer participation, research and engagement as central to price review decisions, which we fundamentally disagree with for all of these reasons.

We have attempted service cost trends based on actual data below – we do not believe forecast target performance can be used, as at PR19 there were some heroic standardised assumptions imposed and we do not yet know whether companies will meet these targets within the PR19 base cost envelope. For the water service based on 2020/21 this would appear unlikely that cost and service outperformance will provide a clear pattern, as for the PR14 period outturn once 2019/20 data was available. There is an added complication that for four companies, PR19 reflected the CMA findings which for the water service base costs were different, noting the CMA did not include for Bristol Water the leakage base service-cost relationship, as we did not want the totex allowance to go beyond our PR19 draft determination response plan supported by customers. Adjustments reversing outcome incentive changes (including the higher incentives for leakage underperformance which we supported) were made by the CMA instead.

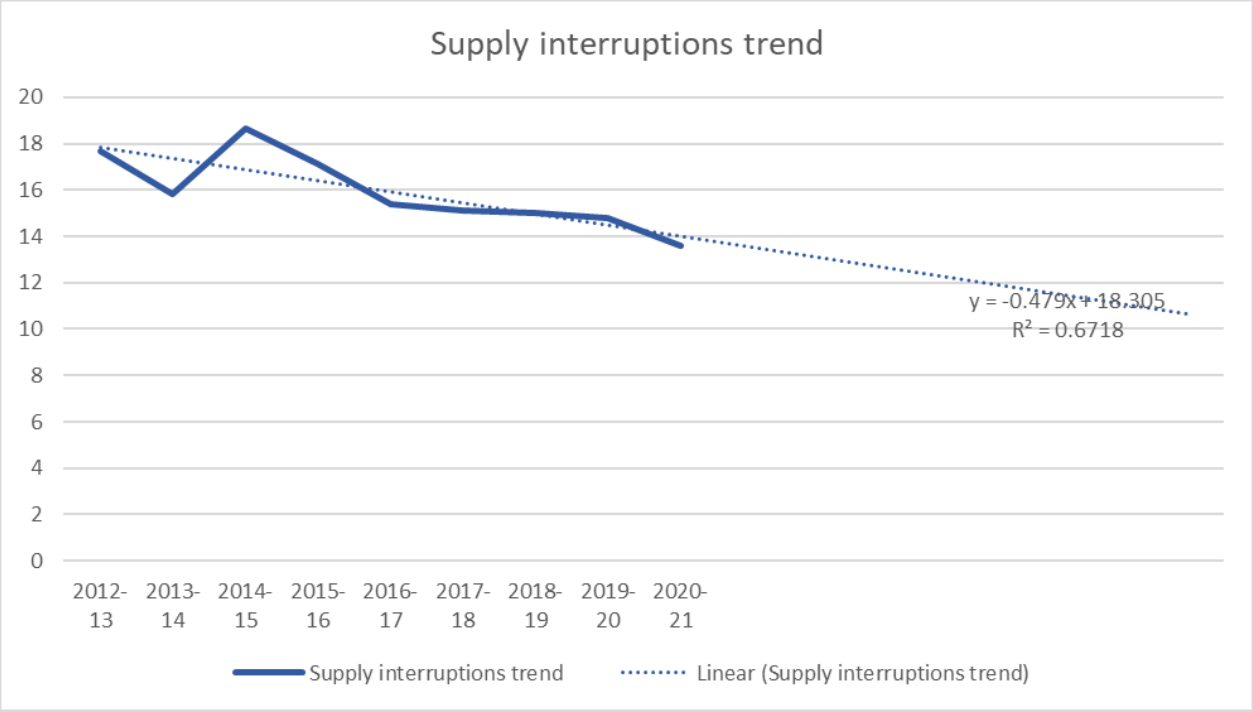
For each area where we could readily obtain sector trend data for common performance commitments over a suitable historic period of time, we show a simple trend line extrapolated to 2027/28, as a PR24 average forecast.

'Cabot' Created by Bex Glover

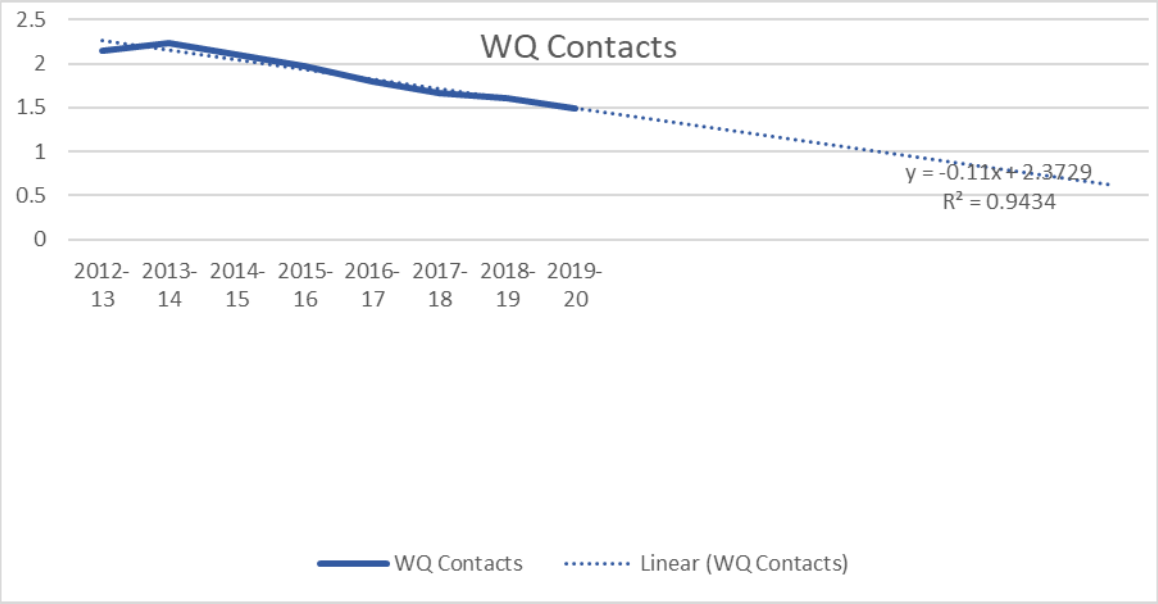


For leakage, the trend is less than PR24 target reductions, which therefore will reveal very little. Extrapolating more recent performance after the early sector flatline is unlikely to be valid.

'Cabot' Created by Bex Glover



Supply interruptions show a reasonable trend, but this masks wide sector performance and is a far higher target on average than the sector is being challenged with. Therefore, this is unlikely to be informative. An improvement in performance would reveal little on base cost and future performance risk.



'Cabot' Created by Bex Glover

Water quality contacts has a more useful trend line, but as we illustrated to the CMA some improvements are from enhancements and some are from past base costs. It is likely therefore that enhancement spend allowances should be made for companies that would need to make a step change of performance from past levels. This may not be economic, as contacts are in part exogenous to the nature of water sources (discolouration being naturally higher in the west than the east of England).

Residential retail cost assessment

26. Do you have any comments regarding our proposal to ask companies to separate out the part of their provision of bad debt costs to do with Covid-19 that was made outside of their standard methodology in the PR24 business plan tables?

We disagree with this approach. The provision for bad debt costs for COVID-19 was made using a standard methodology for bad debt. What was uncertain was the impact of COVID-19 – we used as a reference point the 2008 financial crisis so there was a standard historical basis for estimating COVID-19. It remains too early to tell, but it will not be possible to separate COVID-19 from other consequential impacts (e.g. energy price changes) which may impact bad debt.

27. What guidance would aid companies to provide appropriate data related to the provision of bad debt costs to do with Covid-19?

The data collected from companies periodically which considered aged debt cohort analysis (e.g. during the Walker review and in 2014 and 2017) would be appropriate data. We do not believe that Covid-19 reflects a specific event that will have meaningful data at this stage, although we are happy to keep this under review, but is it possible to isolate Covid-19 from other impacts affecting household budgets such as energy and food price inflation?

Another key retail aspect not considered above is inflation. Whilst Ofwat assumed no indexation in the retail base costs or form of control at PR14 and PR19, this should be considered fresh at PR24 based on the underlying cost and economic pressures on retail businesses, particularly in other utilities.