Reckon LLP
Data analysis | Economic regulation | Competition law

Advice on aspects of Northern Ireland Water's response to the PC13 draft determination

11 December 2012

Introduction

1.   In September 2012 the Utility Regulator published a draft determination on the price control for Northern Ireland Water for the two-year price control period from April 2013 to March 2015. We refer to this as the draft determination.

2.   Northern Ireland Water submitted a response to the draft determination to the Utility Regulator: *NI Water Response to the PC13 Draft Determination*, dated November 2012. As part of its response, Northern Ireland Water included a paper by Frontier Economics: *Operating expenditure efficiency targets: paper for Northern Ireland Water*, dated September 2012. Both that paper and Northern Ireland Water's response

to the draft determination refer to estimates of catch-up from a study carried out by Reckon for UK Water Industry Research (UKWIR).

3.   The Utility Regulator asked us to assess the validity of certain statements made in Frontier Economics (2012) about the findings from our report for UKWIR and to provide some further advice relating to the interpretation of that report.

4.   The remainder of document is organised into three parts:

(a)   The first part reviews the validity of the statements made in Frontier Economics (2012) about the finding of an upper bound catch-up rate of 65 per cent over five years in Reckon's 2008 report for UKWIR. It then briefly discusses the idea of an upper bound in the context of the estimates from that report.

(b)   The second part explains why any comparison between the estimates in Reckon's 2008 report for UKWIR and the Utility Regulator's assumptions about catch-up should take account of the adjustments made to residuals as part of the Utility Regulator's estimation of the efficiency gap. It then illustrates how this can be done.

(c)   The third part discusses the alternative interpretations of Reckon's 2008 report for UKWIR made as part of the Competition Commission's *Bristol Water plc* inquiry in 2010.

Review of statements made in Frontier Economics (2012)

5.   This section presents our views on the validity of statements made in Frontier Economics (2012) about Reckon's 2008 report for UKWIR. It first identifies that there is a mistake in the reference made by Northern Ireland Water to that report.

Confusion about the Reckon report referred to

6.   Frontier Economics (2012) does not specify the name of the Reckon report that it discusses.

7.   The Northern Ireland Water's response to the draft determination does include a reference to a Reckon report for UKWIR (pages 43–44):

> "In 2008 Reckon [footnote 6] undertook a study on the econometric models for UK Water Industry Research (UKWIR). They concluded that 65% represented an upper bound for the efficiency catch-up factor. However, this conclusion was based on the assumption that the cost differences identified by the models were genuine inefficiencies. This is an unrealistic assumption because not all systematic cost differences have been accounted for and which, if relaxed, implies a lower catch-up factor."

8.   Footnote 6 refers to "Review of the approach to efficiency assessment in the regulation of the UK Water Industry 2008". This reference is wrong. Reckon did carry out a study entitled *Review of the approach to efficiency assessment in the regulation of the UK water industry* (UKWIR reference 07/RG/04/2), but this was published in 2007 not 2008. We refer to this report as UKWIR (2007).

9.   Reckon carried out another study for UKWIR which was published in 2008 entitled *Application of time series analysis to relative efficiency assessment* (UKWIR reference 08/RG/04/3). We refer to this report as UKWIR (2008).

10.   Frontier Economics (2012) states that "Reckon developed a time series model based on 9 years of historical data for E&W companies". Of the two Reckon studies published by UKWIR as of October 2012, only UKWIR (2008) includes the development of time series models based on nine years of historical data. The description given in Frontier Economics (2012) of the Reckon study does not fit with the work presented in UKWIR (2007) which is referred to in Northern Ireland Water's response to the draft determination. We proceed on the basis that the reference to the Reckon study in Frontier Economics (2012) should be to UKWIR (2008).

No statement in UKWIR (2008) about 65 per cent catch-up

11.   Frontier Economics (2012, pages 11–12) summarises Reckon's approach to the study reported in UKWIR (2008) as follows:

> "The Reckon study adopted the following approach:
>
> - It measured unobserved cost differences, these being cost differences between companies that are not accounted for by explanatory variables or special factors in the model.

- It could be assumed that these unobserved cost differences in the model were inefficiencies.

- Efficiency catch-up was measured as these unobserved cost differences reducing over time.

- Reckon estimated that 65% catch-up over 5 years was implied using this measure."

12. The Utility Regulator has asked us for a validation or otherwise of the last bullet point.

13. There is no statement in UKWIR (2008) about a 65 per cent or 65% catch-up rate or catch-up estimate. The last bullet point in the quotation above is not valid.

14. As discussed below, it is possible to take one of the estimates reported in a table in the executive summary to UKWIR (2008) and apply a calculation to it that gives a figure of 65 per cent. But there is no basis for presenting that estimate or calculation as some kind of general result from the study.

No statement in UKWIR (2007) about 65 per cent catch-up

15. As identified above, Northern Ireland Water's response to the PC13 draft determination refers to a different UKWIR report than that described in Frontier Economics (2012). It refers to the report referred to above as UKWIR (2007). That report makes no statement about a 65 per cent or 65% catch-up rate or catch-up estimate.

Some speculation as to where the 65 per cent figure might come from

16. UKWIR (2008) includes results from time series panel data models that include a feature referred to in the statistical literature as an AR(1) disturbance or error term. The estimation results from such models include an estimate of a parameter we labelled "rho" which is part of the AR(1) disturbance term. The report explains the relevance of these types of models in a regulatory context in which companies deemed less efficient are assumed to gradually catch-up and close cost differences against companies deemed more efficient.

17. The executive summary to UKWIR (2008) states the following:

"If forecasts of future expenditure requirements are based on the view that companies will tend to gradually catch-up the differences in their unit expenditure that are represented by the residuals estimated from econometric models, then estimates of "rho" from time series models applied to historical data will be relevant, insofar as the past is taken as a guide to the future.

If so, estimates of "rho" from time series models, such as those reported in the table above, would represent an annualised rate of catch-up. They could be used as the basis for a forecast of the extent to which the differences between companies' unit expenditure that are represented by the residuals estimated from an econometric model would be expected to fade away over a six-years period. This conversion might be achieved as a simple compounding operation: for instance, an estimated value of "rho" of 0.81 could be used to make the forecast that, of the differences between companies' unit expenditure that are captured by the model's residuals, about 72 per cent of these differences will have faded away after six years (this proportion is calculated as $1–0.81^6$)."

18. One possible explanation for the 65 per cent figure claimed in Frontier Economics (2012) is that Frontier Economics confused the illustrative example of the simple compounding operation provided in the extract above with an estimate of the rate of catch-up. To obtain 65 per cent, rather than the 72 per cent in the extract above, would require changing the illustrative example to one that compounds over five rather than six years.

19. Another possibility is that Frontier Economics made its own calculation based on the estimates of rho from selected models reported in a table in the executive summary to UKWIR (2008). Table 1 reproduces these estimates of rho. We have applied the simple compounding operation described in the extract above to each estimate of rho and reported the results in table 1. We have used the formula $1–rho^5$ rather than $1–rho^6$ for the reasons set out below.

20. The formula $1–rho^6$ is relevant in a context in which catch-up is considered over a six-year period following the year in which operating expenditure comparisons between companies are made to determine their relative catch-up potential. At the time of the publication of UKWIR (2008), Ofwat's most recent periodic review was PR04, which proposed price limits for five years from the financial year 2005/2006. Ofwat's approach to that determination involved operating expenditure comparisons

between companies using data from the financial year 2003/2004.[1] The final year covered by that price control determination was 2009/2010, which is six years after the year used for cost comparisons between companies.

21.   The approach adopted by the Utility Regulator in its draft determination for PC13 uses a different calculation to that used by Ofwat. The Utility Regulator has considered efficiency improvements for the five years following 2010/2011, which is the year used for the operating expenditure comparisons between companies (see page 22 of Annex C to the draft determination). Under this approach, a compounding operation made over five years (i.e. using the formula $1-\rho^5$) is more relevant than one made over six years.

Table 1   Compounding operation applied to selected estimates of rho from UKWIR (2008)

Model	Estimate of rho	$1-\rho^5$
Water distribution model WD1	0.81	65%
Water resources and treatment model WT1	0.86	53%
Water power expenditure model WP1	0.72	81%
Water business activities model WB1	0.88	47%
Sewerage business activities model SB1	0.92	34%
Average for other selected sewerage models	0.63	90%

22.   The first and second columns in table 1 above reproduce the information in table 1 of UKWIR (2008). The third column of table 1 does not feature in UKWIR (2008); we have produced these figures as part of our work for the Utility Regulator.

23.   Table 1 shows that a catch-up rate of 65 per cent can be obtained by taking the estimate of rho reported in UKWIR (2008) for water distribution model WD1 and applying the compounding operation described in the executive summary to that report, but compounding over five rather than six years.

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[1] Ofwat (2004) *Future water and sewerage charges 2005–10: final determinations*, page 155

24. It is possible that Frontier's claim that "Reckon estimated 65% catch-up over five years" is related to the reported rho of 0.81 for the water distribution model WD1. If so there would be a number of points for the Utility Regulator to keep in mind:

(a) The estimates of rho reported in UKWIR (2008) are not estimates of a general phenomenon of catch-up amongst water companies. They are specific to each model. The estimate of rho obtained from an econometric model of operating expenditure with an AR(1) disturbance term will depend on factors including the functional form and explanatory factors used in the model, the time period of operating expenditure data used and the special factors and other data adjustments applied to the data before model estimation.

(b) The 65 per cent figure in table 1 is obtained from a calculation involving the estimated value of rho from a model of water distribution functional expenditure. That model does not apply to other parts of the water value chain or to areas of sewerage service expenditure. Table 1 shows reported estimates of rho for other models for which the calculation $1-rho^5$ gives values between 34 per cent and 90 per cent.

(c) The executive summary to UKWIR (2008) only reports estimates of rho from a selected subset of the models developed and estimated in the main report. This subset is described as those time series models which are most similar to the cross-sectional models used by Ofwat (at the time the report was written). For instance, the figure of 65 per cent figure in table 1 applies to the water distribution model labelled WD1 in UKWIR (2008). At Ofwat's last periodic review, Ofwat used a model for water distribution functional expenditure which is quite different to WD1 and closer to the model labelled WD2 in UKWIR (2008).[2] The estimated value of rho for model WD2 is 0.83 (UKWIR, 2008, page 73) and application of the formula $1-rho^5$ in this case gives 60.6 per cent.

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[2] Model WD2 is specified with a different dependent variable to WD1 (WD2 uses the natural logarithm of [expenditure divided by the number of connected properties] whereas WD1 uses the natural logarithm of [expenditure divided by resident winter population]) and with a different explanatory factor in additional to time dummy variables (WD2 uses the natural logarithm of [length of mains divided by number of connected properties] whereas WD1 uses the proportion of mains length over 320mm).

25.   Further to these points, the executive summary to UKWIR (2008) highlights that the use of the simple compounding operation described above for forecasting purposes "risks an over-simplified interpretation of what the time series model says about the historical data". This is explained further in the next sub-section.

Statements about an upper bound in UKWIR (2008)

26.   Frontier Economics (2012, page 11) says that: "As stated in [UKWIR (2008)], the 65% catch-up estimate is an upper bound of the true scope for efficiency catch-up". The Utility Regulator has asked us for a validation or otherwise of this statement.

27.   As identified above, UKWIR (2008) contains no statement about a 65 per cent catch-up figure. Nor does it propose or refer to any upper bound.

28.   We avoided making any proposition about an upper bound when drafting UKWIR (2008). Such a concept seems too precise given the limitations and vulnerabilities arising from the use of econometric models to make estimates about companies' potential to make efficiency improvements.

29.   Whilst it does not refer to any upper bound, UKWIR (2008) does identify an asymmetry of risks relating to any assumptions about catch-up that are obtained from the simple compounding operation described above.

30.   After explaining how a calculation of $1-\text{rho}^6$ might be used as the basis of forecasts of catch-up, the executive summary to UKWIR (2008) explains that an assumption underpinning that approach is that the totality of the expenditure differences between companies that are captured by the estimated residuals from an econometric model are susceptible to catch-up from year-to-year at the rate implied by the estimate of rho. It says that the analysis in the report indicates that this may not be the case and continues as follows:

>   "The implication that we draw is that there is a risk that the simplified model of the historical data, as outlined above [i.e. making a forecast of the differences between companies' unit expenditure that will have faded away after six years using the calculation $1-\text{rho}^6$] would overstate the extent to which differences in companies' unit expenditure will fade away over a six-year period. We have not identified a risk in the

other direction, that is to say a risk that a catch-up tendency measured on historical data would understate the amount of catch-up that it is appropriate to take into account in a six-year forecast."

31.   A simple hypothetical example might help draw these points out further. Suppose that you have a time series dataset and have estimated an AR(1) model for water power expenditure. Suppose you plan to make an assumption about the extent of catch-up that applies specifically to the estimated residuals from this model (rather than using a single catch-up rate across all areas of expenditure). Suppose that the estimate of rho for the AR(1) disturbance term is 0.7. The following points arise:

(a)   You could use the simple compounding operation described above to make an assumption that 83 per cent $(1–0.7^5)$ of each company's efficiency gap to the frontier company will be caught up over five years. But such an approach is vulnerable to the criticism that it implies too much catch-up if, as seems likely, at least some of the cost differences between companies that are reflected in the estimated residuals are not catch-up-able.

(b)   An assumption that more than 83 per cent of each company's efficiency gap to the frontier company will be caught up over five years is vulnerable to the criticism that it would require a faster annual rate of catch-up in the future than the rate implied, on average, by the results from the application of the AR(1) model to the historical data. That is not to say that an assumption above 83 per cent is inappropriate, but that it would be helpful to have a basis for rebutting this criticism — e.g. some view of why the future rate of catch-up might be different to the past or some new theory about catch-up which is not contained in UKWIR (2008).

(c)   An assumption that less than 83 per cent of each company's efficiency gap to the frontier company will be caught up over five years is not, as far as we are aware, vulnerable to any criticism based on the model estimation results so long as you accept that some (unknowable) amount of the cost differences between companies that are reflected in the estimated residuals are not catch-up-able.

32.　A qualification to point (c), not made in UKWIR (2008), is that an assumption that less than 30 per cent (1–rho) of each company's efficiency gap to the frontier company will be caught up in total over five years is vulnerable to the criticism that it would imply a larger degree of year-to-year persistence in cost differences between companies in the future than seen, on average across companies and over time, in the results from the application of the AR(1) model to the historical data. Again, that is not to say that such an assumption below 30 per cent is inappropriate, but that it would be helpful to have a basis for rebutting this criticism.

Interactions between residual adjustments and catch-up

33.　This section explains why any comparison between the estimates in UKWIR (2008) and the Utility Regulator's assumptions about catch-up should take account of the adjustments made to residuals as part of the Utility Regulator's estimation of the efficiency gap. It then illustrates how this can be done.

Implications of adjustments to residuals for comparisons with UKWIR (2008)

34.　The Utility Regulator's draft determination involves an assumption that, over the five-year period from 2010/2011, Northern Ireland Water can make efficiency improvements that would mean that 72.5 per cent of the estimated efficiency gap compared to "frontier" companies would be caught-up and thereby eliminated by the end of 2014/2015 (draft determination pages 54–55 and Annex C to draft determinations pages 20–23).

35.　This figure of 72.5 per cent is not directly comparable with the figures reported in table 1. The 72.5 per cent figure applies to catch-up in relation to an efficiency gap which is obtained using a calculation that involves a downward reduction to the estimated residuals. Pages 15–16 of Annex C to the draft determination confirm that the Utility Regulator followed the approach taken by Ofwat at previous price control reviews of scaling down the magnitude of estimated residuals from operating expenditure models (and unit cost comparisons) before applying catch-up factors:

> "The residual adjustment is a recognition that not all of the gap in costs may be due to efficiency. Other factors may be of relevance including errors in the modelling, omitted variables, sampling or measurement errors. The Utility Regulator has revised predicted

costs by 10% of the water residual and 20% of the sewerage residual for efficiency modelling purposes."

36. In contrast, the AR(1) time series models reported in UKWIR (2008) do not involve any similar residual adjustments. Any inferences drawn on the rate of catch-up from such models will relate to catch-up in terms of residuals that have not been subject to the type of adjustments made by the Utility Regulator and Ofwat. To the extent that the estimated differences in costs between companies that are reflected in the estimated residuals from a model are not catch-up-able, this will tend to be reflected in a higher (or closer to one) estimate of the rho parameter in the AR(1) disturbance term.

Illustration of calculation to put catch-up assumption on a more comparable basis

37. If a comparison is wanted between the types of figures reported in the third column of table 1 above and the catch-up assumption made by the Utility Regulator, a more like-for-like comparison can be made by removing the impact of the residual adjustment on the efficiency gap before comparing the assumed cost reduction against the estimated scale of the efficiency gap in the base year.

38. Table 2 illustrates how this can be done. Line 4 shows that the assumption of 72.5 per cent catch-up from the draft determination can be calculated by taking the cumulative reductions in cost by 2015/2016 implied by the profile of efficiency savings from page 22 of Annex C (which we calculate to be £34.89m) and expressing this as a percentage of the efficiency gap to frontier from page 18 (£48.18m). Line 6 of the table calculates an "unadjusted efficiency gap" of £54.77m as the sum of the efficiency gap to frontier and the value of the residual adjustments reported on page 18. Line 7 shows that the implied cumulative reductions in modelled costs by 2015/2016 represent 63.7 per cent of the unadjusted efficiency gap.

Table 2   Calculation of draft determination catch-up assumption before residual adjustments

Line	Item	Source	Value
1	NI Water modelled cost (£m)	Annex C page 18	126.33
2	Efficiency gap to frontier in base year (£m)	Annex C page 18	48.16
3	Cumulative impact of assumed catch-up on modelled costs by 2015/2016 (£m)	Calculation using catch-up profile from Annex C page 22, Table 5.2	–34.89
4	Percentage of efficiency gap to be caught up by 2015/2016	Calculation: –[line 3]/[100*line 2]	72.5%
5	Residual adjustments made as part of calculation of efficiency gap to frontier	Annex C page 18	6.61
6	Unadjusted efficiency gap in base year (£m)	Calculation: [line 2] + [line 5]	54.77
7	Percentage of unadjusted efficiency gap to be caught up by 2015/2016	Calculation: –[line 3] / [100*line 6]	63.7%

Figures shown in the table are for illustrative purposes only and may be subject to rounding error

39. The Utility Regulator provided us with a possible alternative set of assumptions on catch-up efficiency improvements that it is considering for the final determinations. Table 3 provides a version of table 2 that is based on these assumptions. It shows that they imply a catch-up of 62.4 per cent of the efficiency gap reported on page 18 of Annex C by 2015/2016. Table 3 shows that this represents an assumed catch-up, by 2015/2016, of 54.9 per cent of what we have called the unadjusted efficiency gap, which excludes the impact of the residual adjustments.

Table 3   Calculation of alternative catch-up assumption before residual adjustments

Line	Item	Source	Value
1	NI Water modelled cost (£m)	Annex C page 18	126.33
2	Efficiency gap to frontier in base year (£m)	Annex C page 18	48.16
3	Cumulative impact of assumed catch-up on modelled costs by 2015/2016 (£m)	Calculation using annual profile for five years from 2011/2012 as follows: 7.617%; 3.804%; 5%; 5% and 5%	−30.07
4	Percentage of efficiency gap to be `caught up by 2015/2016	Calculation: −[line 3]/[100*line 2]	62.4%
5	Residual adjustments made as part of calculation of efficiency gap to frontier	Annex C page 18	6.61
6	Unadjusted efficiency gap in base year	Calculation: [line 2] + [line 5]	54.77
7	Percentage of unadjusted efficiency gap to be caught up by 2015/2016	Calculation: −[line 3] / [100*line 6]	54.9%

Figures shown in the table are for illustrative purposes only and may be subject to rounding error

Competition Commission inquiry: Bristol Water plc (2010)

40.   This section discusses the alternative interpretations of UKWIR (2008) made as part of the Competition Commission's *Bristol Water plc* inquiry in 2010, following the reference under section 12(3)(a) of the Water Industry Act 1991.

Ofwat interpretation of UKWIR (2008)

41.   Paragraph 66 of appendix K to the Competition Commission's final report states:

> "Ofwat told us of the results of research which was described in the UKWIR 2008 report on the application of time series analysis to relative efficiency assessment [reference to UKWIR report 08/RG/04/3]. This research was carried out by consultants Reckon LLP. Ofwat pointed out that the findings from this report implied that the industry had on average met the 60 per cent target. We have considered the analysis in this report and

how it relates to our results. We noted that Reckon used the fully adjusted data and employed sophisticated time series methods. We therefore place more weight on their findings than on our own analysis described in paragraphs 63 and 64."

42. The claim that the "findings from [UKWIR (2008)] implied that the industry had on average met the 60 per cent target" is not an accurate representation of the conclusions and estimates from UKWIR (2008). We found no explanation or reference in support of this claim in either the Competition Commission's provisional findings documents or its final report. Nor could we find any explanation of Ofwat's apparent interpretation of UKWIR (2008) in its 136-page draft determinations to PR09,[3] or its 168-page final determinations to PR09,[4] or its 91-page response to Bristol Water's statement of case,[5] or its 82-page detailed response to the Competition Commission's provisional findings.[6]

Competition Commission's decision on catch-up in light of UKWIR (2008)

43. Paragraph 67 of appendix K to the Competition Commission's final report says the following:

> "We also emphasize that the main justification for having the 60 per cent catch-up rate over a five-year period is that there is noise in Ofwat's efficiency estimates. If it were not for this noise, a 100 per cent catch-up over a five-year period would not be an unreasonable target, especially for opex expenditure. This is an important point in our view. Companies can hardly afford such delay in eliminating inefficiencies in a competitive market and, in our view, it would not be appropriate to provide such protection through regulation. We therefore considered that, on balance, taking into account our analysis and the findings from the UKWIR study, and being mindful of the need to maintain an appropriate efficiency incentive, there is no justification to lower the 60 per cent catch-up target."

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[3] Ofwat (2009) *Future water and sewerage charges 2010-15: draft determinations*
[4] Ofwat (2009) *Future water and sewerage charges 2010-15: final determinations*
[5] Ofwat (2010) *Ofwat response to Bristol Water Plc Competition Commission Price Determination: statement of case dated 17 February 2010*
[6] Ofwat (2010) *Bristol Water Plc 2009 Price determination referral: detailed response to the Competition Commission provisional findings*

44. Our interpretation is that the approach used by the Competition Commission involved the following elements:

(a) The Competition Commission took the 60 per cent catch-up figure used in the past for water company price control determinations as a precedent.

(b) The Competition Commission considered whether a 100 per cent figure would instead be appropriate but decided that this was not the case because there is "noise in Ofwat's efficiency estimates".

(c) The Competition Commission, taking into account UKWIR (2008) and its own analysis, found no justification to choose a lower rate than this precedent for the purpose of the price determination for Bristol Water.

45. In respect of point (b), we interpret the view that there is "noise in Ofwat's efficiency estimates" to mean that the estimated residuals from Ofwat's analysis do not fully reflect cost differences between companies that can be caught-up. To take just one example, there may be differences in companies' operating expenditure requirements which arise from differences in the availability of water resources in each company's region and which are not fully captured by the estimated coefficients on the explanatory factors in the model for water resources and treatment model operating expenditure. On this basis, the view that the catch-up rate over five years should be less than 100 per cent seems reasonable.

46. In respect of point (c), the Competition Commission seems to have given more weight to Ofwat's apparent interpretation of UKWIR (2008) than the alternative interpretation of UKWIR (2008) provided by Bristol Water, which we turn to below.

Bristol Water's interpretation of UKWIR (2008)

47. Bristol Water's response to the Competition Commission's provisional findings argued that the Commission's use of a catch-up assumption of 60 per cent is "at the high end of the credible range" and supported this with a table that set out the

"conclusion on catch-up" from several sources, including UKWIR (2008). Bristol Water's response attributed the following conclusion on catch-up to UKWIR (2008):[7]

> "52% for water[23] without the introduction of "company-specific persistent factors". This is likely to overestimate actual catch-up"

48. The 52 per cent figure is explained in footnote 23 as follows:

> "The UKWIR report provides estimates of historical catch-up that correspond to 65% over five years for the Water distribution model; 53% over five years for the Water resources and treatment model; 81% over five years for the Water power expenditure model; and 47% for the water business activities model. This results in a simple average of 61%. As this was calculated on less than 85% of opex, with the other 15% representing largely uncontrollable opex, this corresponds to average catch-up of 52% (61% x 85%)."

49. We found no discussion in the Competition Commission's final report (including appendices) of this element of Bristol Water's response to the provisional findings.

50. The figures of 65 per cent, 53 per cent, 81 per cent and 47 per cent for water service models are the same as those reported for the water models in table 1 above. The qualification in Bristol Water's summary table that the 52 per cent figure "is likely to overestimate actual catch-up" is consistent with the points made above in the sub-section "Statements about an upper bound in UKWIR (2008)".

51. Frontier Economics, the Competition Commission (citing Ofwat) and Bristol Water have each drawn different inferences about catch-up from UKWIR (2008). As explained above, the statements made in Frontier Economics (2012) about UKWIR (2008) are not valid; we can only speculate as to how Frontier Economics might have arrived at a figure of 65 per cent. The Competition Commission neither provides nor refers to any explanation in support of the claim attributed to Ofwat that UKWIR (2008) implies that the industry had on average met the 60 per cent target. Only Bristol Water provides a logical explanation of how its interpretation of what UKWIR (2008) says about catch-up relates to the results provided in that report.

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[7] Bristol Water (2010) *Competition commission price determination: comments on provisional findings section 5: opex efficiency*, paragraphs 51–52

52.   Nonetheless, the conclusion drawn by Bristol Water is potentially subject to a number of caveats and qualifications, including the following.

(a)   Bristol Water is a water-only company and its calculation of a simple average catch-up rate using estimates from UKWIR (2008) only draws on estimates from water service models.

(b)   The results from UKWIR (2008) that Bristol Water uses in its calculation are estimated from a dataset that only runs to 2005/2006 and from a set of time series models that do not all correspond closely to the cross-sectional models used by Ofwat at the 2009 periodic review.

(c)   If an average of estimates of rho from different models is to be taken, it may make more sense to use some kind of weighted average than a simple average, to reflect differences in the scale of expenditure covered by different models.

(d)   Obtaining different estimates of rho for different models and different areas of expenditure suggests that the extent to which the cost differences between companies that are reflected in estimated residuals are catch-up-able may differ between models and areas of expenditure. Applying a simple average or weighted-average catch-up rate to aggregate residuals may require too much catch-up from those companies that perform relatively poorly in the models for which a relatively large amount of the residuals is not catch-up-able. To tackle this concern, it may be better to make separate assumptions about the rate of catch-up for each model or area of expenditure.

(e)   For the reasons explained in the sub-section above "Interactions between residual adjustments and catch-up" any comparison between the catch-up figures calculated from estimates of rho in UKWIR (2008) and Ofwat's assumption on catch-up should take account of the reductions to the magnitude of estimated residuals (10 per cent for water and 20 per cent for sewerage) made by Ofwat as part of its determination of the assessed efficiency gap.

(f)   The calculation used by Bristol Water rests on the argument that 15 per cent of operating expenditure is "largely uncontrollable". This argument may not hold

on further scrutiny. Even if there is a proportion of operating expenditure that is uncontrollable, it may vary between companies.