Annex A: Oxera – Overall impact

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South West Water

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Summary

Ofwat's approach to the economic regulation of the water industry in England and Wales relies on making comparisons between water companies in a number of performance indicators. A merger between water companies that reduces the pool of comparators available for use by Ofwat has the potential to be detrimental to the way in which it carries out its regulatory duties. However, this depends on the specifics of the merger (e.g. the companies involved) and how regulation and the industry are likely to evolve.

The water industry in England and Wales is undergoing an unprecedented period of changes. In PR14, Ofwat introduced changes to the tools it uses to regulate water companies. While cross-company comparisons remain central to its approach, some of the new tools (e.g. outcomes regulation) are likely to be less reliant on comparisons. In addition, Ofwat has introduced separate price controls for wholesale and retail business, which will also have an impact on its regulatory toolkit.

From April 2017, non-household customers in England and Scotland will be able to choose their supplier. More reforms may follow, such as the development of upstream (water resources and treatment) markets.

In this context, Oxera has developed the water merger assessment framework adopted and consolidated by the Competition Commission (CC) during the last two merger inquiries to consider the changes to the Ofwat regulatory toolkit and potential implications of market changes. The analysis has focused on the potential impact of the merger on key regulatory tools used at PR14 bearing in mind potential market developments.

To assess the implications of these developments for regulation, the guiding principle has been that, to the extent that a business unit of a water company is subject to effective competitive pressure, Ofwat may take a more light-handed approach to regulation, or withdraw from regulating that business unit altogether. In this scenario, Ofwat would not rely on comparative tools, and its regulatory action would be more focused on monitoring market outcomes (e.g. the degree of switching, prices/service offers observed in the market).

These market scenarios represent a somewhat simplified version of how markets and regulation might evolve, and are unlikely to capture exactly how the market, industry and regulation will develop. However, the broad range of outcomes considered should provide an indication of the likely range of impacts arising from the development of competition in the water sector.

In light of the greater uncertainties around how the market will develop over the next 30 years, the analysis has assessed the implications of the merger over five- and ten-year periods for the comparative regime. In doing so, it is necessary to compare the counterfactual scenario (i.e. no merger occurring) with the scenario in which the merger occurs. The latter will need to take into account any synergy savings that the merger will create, and their impact on the comparative regime. This is a corollary of considering the overall impact of the merger on comparative regulation, rather than simply looking at the removal of the target company in isolation.

Taking into account such synergies results in a benefit to the comparative regime, primarily through the creation of a more efficient comparator. As a conservative assumption, in the assessment we have considered only 25% of the synergies identified by the Pennon Group in its business case. These

synergy savings are a key driver of the net benefit resulting from the merger to the regime. Indeed, the results of the Oxera analysis show that:

- **over a 30-year period, the overall impact of the merger is a net benefit to the comparative regime. Indeed, across different market scenarios the merger results in overall benefit between £43m and £50m;**
- **over a ten-year period, the overall impact of the merger is a net benefit to the comparative regime. Indeed, across different market scenarios the merger results in overall benefit between £28m and £31m;**
- **over a five-year period, the overall impact of the merger appears relatively immaterial across the market scenarios.**

In summary, the analysis shows that:

- the impact of this merger on water industry customers in England and Wales is a benefit, and this result is consistent over the different time horizons considered;
- this result is driven in particular by the fact that the merger will lead to the creation of a better comparator (and, thus, a more challenging benchmark) for wholesale activities and a more challenging benchmark for retail activities;
- the merger is beneficial to the comparative regime, even without considering the potential direct benefits to the customers of the merging companies.

If one makes the assumption of a lack of synergy savings and therefore excludes the synergies from the calculation, this would result in a smaller benefit of between £7m and £13m over 30 years in net present value terms. However, given that a key objective of the merger is the achievement of synergy savings, this scenario cannot be considered plausible. Even under this implausibly conservative assumption, the merger is a benefit.

This finding therefore reinforces the conclusion that the overall impact of the merger is a net benefit to the comparative regime in England and Wales.

1 Background

Ofwat has traditionally relied on a comparative approach to carry out its regulatory duties. For example, in comparing companies' performance, it has established the level of relative cost efficiency and scope for improvements.[1]

In this context, a merger between two water companies reduces the number of comparators, which, in turn, may affect the reliability of a comparative assessment and therefore the strength of the cost-efficiency challenge assessed using comparisons. In other words, a merger between two water companies may adversely affect the regulatory framework. The extent, if any, to which this might be the case depends on the circumstances—for example, the relative significance and efficiency of the merging companies and the likely efficiency of the newly formed company, and the effectiveness of mitigating measures such as separate reporting.

A useful framework to assess the potential implications of a merger between two water companies was set out by the CC during the merger between South East Water and Mid Kent Water.[2] The CC developed and adopted this framework in the subsequent merger case between South Staffordshire Water and Cambridge Water. A key aspect of this framework was an assessment of the potential impact on 'Ofwat's ability to use comparisons when setting price limits'.[3]

To establish whether the SST/CAM merger could be expected to have an impact on Ofwat's use of comparisons when setting price limits, the CC undertook three separate assessments:

- **the impact of the merger on the econometric models** used to assess the relative efficiency of operating expenditure (OPEX). This was deemed to have two key effects: the loss of precision as a result of the reduced number of observations available to Ofwat; the impact on the benchmark determined by the loss of a company and the forming of the merged company;
- **the impact of the merger on Ofwat's use of the cost base analysis of capital expenditure (CAPEX) relative efficiency**. The cost base was based on a comparison of standard CAPEX (i.e. CAPEX assessed for hypothetical investments that companies were asked to cost); and
- **the impact of the merger on Ofwat's use of informal comparisons** to challenge assumptions and projections in water companies' business plans.

In PR14, Ofwat introduced changes to the tools it uses to regulate water companies. While cross-company comparisons remain central to its approach, some of the new tools (e.g. outcomes regulation) are likely to be less reliant on comparisons. In addition, Ofwat has introduced separate price controls for wholesale and retail business, which will also have an impact on its regulatory toolkit.

The framework for assessing the impact of water mergers, which has been consolidated over the last two merger inquiries, therefore needs to be adapted to the new context, and to consider the key regulatory tools currently used.

[1] Ofwat has used econometric tools to compare companies' OPEX and set efficiency targets for the less efficient companies to close the gap with the more efficient companies ('catch-up').
[2] See, for example, Competition Commission (2007), 'South East Water Limited and Mid Kent Water Limited- A report on the completed water merger of South East Water Limited and Mid Kent Water Limited', May, p. 4, point 11.
[3] Competition Commission (2012), 'South Staffordshire Plc/Cambridge Water PLC merger inquiry- A report on the completed acquisition by South Staffordshire Plc of Cambridge Water PLC', May, p. 4, point 9.

In the PR14 regulatory context, it is appropriate to focus on the potential impact on those areas where horizontal comparisons are still made, namely:

- the total expenditure (TOTEX) approach to cost assessment, focusing the analysis on the implications for precision and benchmark effects;
- the average cost to serve (including bad debt adjustments) approach to assess retail costs and prices;
- the Service Incentive Mechanism (SIM) to incentivise improvements to the quality of services provided to customers; and
- outcome delivery incentives (ODIs) to provide companies with incentives to deliver services that customers want.

Oxera has analysed these aspects separately, seeking to identify the incremental impact of each. This report focuses on the potential impact of the merger, whether detrimental or beneficial (particularly when account is taken of efficiencies derived from the merger).

In assessing the impact of the merger on the comparative regime, it is necessary to compare the counterfactual scenario (i.e. no merger occurring) with the scenario in which the merger occurs. The latter will need to take into account any synergy savings that the merger will create, and their impact on the comparative regime. This is a corollary of considering the overall impact of the merger on comparative regulation, rather than simply looking at the removal of the target company in isolation. Taking into account such synergies in this case results in a benefit to the comparative regime, primarily through the creation of a more efficient comparator.[4]

Moreover, there are further benefits to the merged company's customers (beyond the benefits to all customers through enhancement of the comparative regime, as discussed above). In the analysis in this report, we have not considered such direct benefits to customers, as this element is generally considered at a subsequent stage—i.e. when remedies are discussed, if such a stage is reached.

In past cases, water merger impacts have been assessed over a long time horizon (30 years). However, the likely degree of change in the industry for competition and consolidation means that counterfactual analysis that assumes industry stability and Bournemouth Water's independence for the next 30 years is either unlikely or at least less likely than assumed in previous merger investigations.

In addition, at a time when the trend in regulation under the Water Act 2014 is towards more competition and less reliance on direct comparative regulation, the prospect that an independent Bournemouth Water—a very small WOC with quite distinct characteristics (coastal, very large individual commercial customer)—will be of material importance (in a context of 17 other WASC/WOCs) seems less likely.

[4] In the Mid Kent Water/South East Water merger, both companies were assessed to be average performers, and thus unlikely to affect the benchmark. As such, the synergy benefits did not affect the benchmark. In the SST/CAM case, no definitive numbers were discussed or accounted for. However, as part of the inquiry, it was shown that, along with creating a larger comparator (which was important in determining the benchmark under the PR09 rules), if indicative synergies of a certain size were achieved, the likelihood of creating a better benchmark would be increased. Thus, from a conceptual perspective, it was recognised in SST/CAM that such synergies should be taken into account in the comparative analysis, if applicable.

The analysis has therefore focused on the implications of the merger over a shorter time period (five and ten years), over which the impacts of the merger are less uncertain, as well as the longer timeframe.

Over the longer timeframe, the implications for the Ofwat regulatory regime arising from the merger will evolve in the context of a potentially changed industry structure as a result of the development of competition and potential regulatory and industry responses to it.

The changes to consider are the extent to which:

- retail competition will develop for non-household customers after April 2014,[5] and if it will be extended to household customers;
- upstream markets (i.e. resource and treatment activities) will be opened to competition in the foreseeable future.

To consider the changing competitive landscape and its implications for the impacts of the merger, Oxera has developed scenarios that vary in the extent of competition and, correspondingly, reduce the scope for regulation. In other words, the scope of activities over which the existing regulatory tools are applied will reduce when competition is effective in delivering outcomes for customers.

This annex is structured as follows.

- Section 2 describes in more detail the key areas of impact considered and how these evolve in different market scenarios.
- Section 3 reports the key results for the scenarios considered, and the sensitivities considered.
- The appendix provides a high-level description of the model used to summarise the results (the 'overarching model').

[5] As indicated in the Water Act 2014, retail competition for non-household customers will be introduced in England and Wales from April 2017.

2 Areas of impact and market scenarios

The extent to which a detriment arises depends on how the loss of the merging companies and their substitution with the merged entity affects the stringency of the incentives set by Ofwat. In addition to this is the scope of the regulatory tools employed by Ofwat going forward, which is likely to change with the development of competition in the water sector. The scope and pace of competition and, simultaneously, the withdrawal of economic regulation from competitive parts of the value chain are uncertain at this stage. Therefore, in order to capture how competition might affect the scope of regulation, Oxera has developed a number of market scenarios.

In this section, we first describe the key areas of impact considered, followed by the rationale and assumptions underpinning the market scenarios.

2.1 Overview of the areas of impact

The potential areas of detriment examined in this section are as follows.

- Ofwat's cost assessment
  - **Wholesale benchmark**[6]—a merger may affect customers if Ofwat's analysis of the benchmark using the wholesale cost models is adversely affected such that efficiency targets are more lenient. For example, the efficiency challenge may be weakened if an upper-quartile company is 'lost' and as a result the upper-quartile benchmark level becomes less stringent. Oxera has developed three approaches:
    - a static approach (looking at the impact in AMP6, which is more certain);
    - a deterministic approach, using Ofwat's analysis developed for assessing the small company premium,[7] but focusing on the forecast position of companies (i.e. not considering the historical position as this is not relevant for forecasting their position in future price controls); and
    - a dynamic approach, which considers changes (shocks) to the relative position of efficient and inefficient companies (efficiency ratios).
  - **Precision**[8]—a merger might affect customers if Ofwat's wholesale cost models become less precise and, as a result, Ofwat has reduced confidence in its models, which could translate into a less challenging benchmark for companies. In relation to water-only companies' small company premium (SCP), Ofwat has stated that its models will remain fit for purpose and considers that it will continue to use an upper-quartile threshold. We have examined this further in the context of previous CC approaches. Oxera has considered the theoretical approach more carefully and sought to assess this in a way that is more coherent with the PR14 approach.
- **Retail benchmark**[9] **(average cost to serve and bad debt adjustment)**—a merger might adversely affect Ofwat's approach to setting retail prices for household customers through an impact on the retail cost assessment

[6] See Oxera (2015), Annex C: Oxera – Wholesale cost benchmark', June.
[7] See Ofwat 2014 value of comparator calculation available at Hhttp://www.ofwat.gov.uk/pricereview/pr14/pap_tec201412pr14uplift.xlsxH.
[8] See Oxera (2015), Annex B: Oxera – Precision', June.
[9] See Oxera (2015), Annex D: Oxera – Retail average cost to serve', June.

methodology. That is, the cost to serve may be affected, resulting in a higher-than-otherwise average level for the industry. It is also of note that Ofwat may consider different approaches to setting retail tariffs for households by setting those at, for example, the upper-quartile levels. The changes to the approach taken are considered as sensitivities.

- **SIM**[10]—a merger may affect Ofwat's approach to setting incentives to improve quality of service. In particular, losing a company may reduce the stringency of the quality of service targets set through the SIM. However, Ofwat has signalled that it could use comparators from outside the sector in future, thus the detriment may be limited over time. In the run-up to PR14, Ofwat developed a model quantifying the impact on the SIM of the loss of Bournemouth Water. Oxera has developed this analysis further to consider the impact of convergence and considered the impact of the merger as a whole against the counterfactual (i.e. comparing an industry in which South West Water and Bournemouth Water are a merged company with one where the two companies remain separate).

- **ODIs and other service metrics**[11]—a merger may adversely affect the way in which Ofwat uses the comparison of outcomes and commitments adopted by companies and the relative penalties and rewards. However, Ofwat may use alternative ways of determining appropriate service levels, and indeed did so for the majority of performance commitments at PR14.

2.2 A description of the market scenarios

We have developed five distinct scenarios in our analysis, which are considered in assessing the overall impact of the merger using the overarching model. These are described below, with further details provided in the appendix.

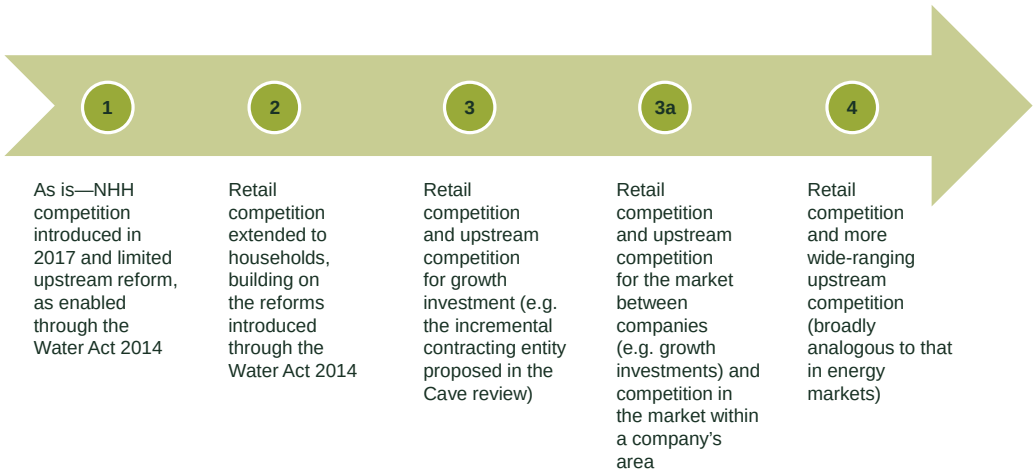
In assessing the implications of market and industry changes on regulation, the guiding principle is that, to the extent that a business unit of a water company is subjected to effective competitive pressure, Ofwat may take a more light-handed approach to regulation or withdraw from regulating that business unit altogether. In this context, Ofwat would not rely on comparative tools and its regulatory action would be more focused on monitoring market outcomes (e.g. degree of switching, prices/service offers observed in the market).

These scenarios represent a somewhat simplified version of how markets and regulation might evolve, and are unlikely to capture exactly how the market, the industry and regulation will develop. However, the broad range of outcomes considered should provide an indication of the likely range of impacts arising from the development of competition in the water sector.

The scenarios considered are summarised in Figure 2.1 below.

[10] See Oxera (2015), Annex E: Oxera – The Service Incentive Mechanism', June.
[11] See Oxera (2015), Annex F: Oxera – Outcome delivery incentives', June.

Figure 2.1 Market scenarios



Note: NHH, non-household.

Source: Oxera.

In summary, the following applies.

- The **'as is' (the 'base case')** scenario assumes that the only relevant market development is the introduction of retail competition for non-household customers in 2017 in England. As a result, the scope of Ofwat regulation would be substantially unchanged compared with PR14, and comparative tools would be used for wholesale and household retail businesses.

- The '**retail competition'** scenario assumes that following the introduction of non-household retail competition, Ofwat and government will decide to extend competition to household customers. An effective retail market is assumed to be in place by the beginning of PR19 and, as a result, Ofwat will cease to use comparative tools for retail activities (average cost to serve and bad debt adjustments, as well as the SIM, will no longer be relevant to the Ofwat regulatory regime).

- The **upstream competition for growth investments and activities** (the **'Retail competition and partial upstream markets'**) scenario assumes functioning retail competition (see above) and that a degree of competition will become established for the developing new sites (through inset appointments or competitive tendering strategies by the incumbent company). In this context, Ofwat may decide not to apply comparative tools to growth investments (in essence, supply and demand balance investments and solutions), thereby reducing the cost base for which cost models are used to assess the comparatively efficient level of TOTEX from the start of PR29, when competition to carry out growth investments is assumed to be well developed.

- The **upstream competition for the market** (the **'Retail competition and more extensive competition for the market'**) scenario assumes functioning retail competition (see above) and that a degree of competition for the market will develop. For example, companies could compete to provide bulk supplies and a system operator (deciding on which water resources to use) would be formally constituted. In summary, in this scenario, upstream outcomes would be driven by competition for the market, and through the choices of the system operator. In this context, Ofwat may decide not to apply comparative tools to upstream assets and activities (i.e. water resource and treatment) ,

thereby reducing the cost base for which cost models are used to assess the comparatively efficient level of TOTEX from the beginning of PR29, when competition is assumed to be well developed.

- The **upstream competition in the market** (the **'Retail competition and more extensive competition for and in the market')** scenario assumes a functioning retail competition (see above paragraph) and that a degree of competition in the market will develop. This scenario would require more radical changes (e.g. to enable a fully functioning water resource market). Ultimately, however, the outcomes would be similar to the previous scenario. In other words, Ofwat might decide not to apply comparative tools to upstream assets and activities (i.e. water resource and treatment), reducing the cost base for which cost models are used to assess the comparatively efficient level of TOTEX from the start of PR29 when competition is assumed to be well developed.

3 Overarching model: analysis, results and sensitivities

This section sets out how Oxera has used different strands of work to assess the overall impact of the merger under the different future regulatory and market scenarios. First, the modelling strategy is presented, followed by the results and sensitivities.

3.1 Overview of the modelling approach

To assess the likely impact of the merger on Ofwat's comparative regime, a number of models have been developed. The modelling principles adopted are:

- **impacts over time**: the impacts of the merger are assessed over 5-, 10- and 30-year time horizons (given that the shorter-term impact could be considered more certain);
- **use of the counterfactual**: for each area of potential impact and each market scenario, the analysis compares the situation with the merger against what would happen without the merger—i.e. the costs and benefits of the merger are incremental to what would happen without the merger.

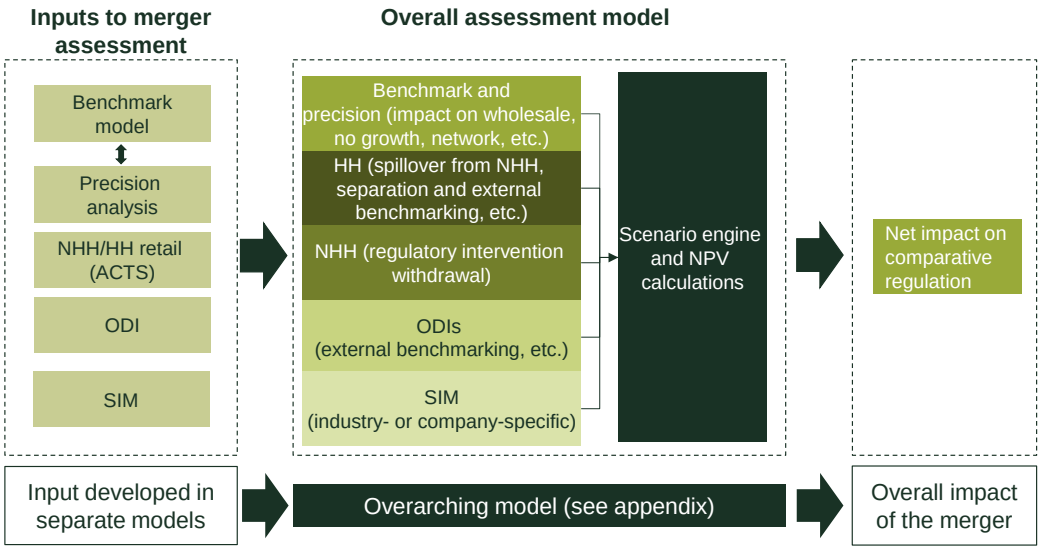
The models for each area of potential impact provide net cost or benefit cash-flow streams over the entire 30-year period of analysis. These feed into the overarching model as the model inputs.

The overarching model allows for:

- **assessment at price controls**: the implications of the merger are assessed separately and can be modified at each price control. For example, this allows developments in market reform over time to be considered and effects on a specific regulatory tool to be consistently accounted for (e.g. effects on average cost to serve could be changed from PR29 onwards if the retail competition scenario is considered);
- **scenario analysis**: the overall impact of different market scenarios can be modelled by selecting the relevant stream of net benefits and costs over time.

Figure 3.1 presents a high-level overview of the mechanics of the overarching model (see Appendix 2 for more details).

Figure 3.1 Overarching model to assess merger impacts



Note: ACTS, average cost to serve; ODIs, outcome delivery incentives; SIM service incentive mechanism; HH, household; NHH, non-household; NPV, net present value.

Source: Oxera.

This section presents the base-case results.

3.2 Key assumptions for the base case

Under the base-case assumption, it is assumed that upstream markets will develop over the years up to PR29 and will affect the scope of regulation and potentially companies' cash flows only from PR34 onwards.

As regards the key implications of the merger on Ofwat regulatory tools, the main considerations and assumptions are described in the following paragraphs.

3.2.1 Household retail costs: ACTS and bad debts

In PR14, for retail costs, Ofwat used an average cost to serve benchmark in setting cost allowance.

The implication for household retail costs stemming from the merger are assessed using a static approach that estimates the immediate impact of the merger on PR19, and a probabilistic approach that assesses the impact in future price reviews.[12] In both approaches the core benchmark assumption is the average cost to serve. However, considering Ofwat's expectations of convergence in costs over time, a more stringent benchmark, the upper quartile, was also examined.

The analysis was carried out for unmetered costs to serve and additional metered water-only costs to serve.

Results of this analysis show that even adopting different approaches to probabilities, benchmark and level of convergence; the merger results in a net

[12] The probabilistic approaches are used to derive the probability that a company will end up in a specific rank in future price reviews, and therefore its probability of exceeding the benchmark in the future. Two types of probabilistic approach were implemented: the changes approach and transitions approach. The changes probabilistic approach follows previous CC approaches and was used by Ofwat in its PR14 cost of capital uplift paper, which examined the value of comparator for WOCs, while the transitions probabilistic approach follows an alternative approach used previously by the CC.

benefit for water customers (i.e. on average, the level of retail prices will be lower than it would have been without the merger).

In particular, under the **static approach**, there is a **net benefit of £17m for combined costs**.

Under a **probabilistic approach**, and where Ofwat's expectations for cost convergence at future reviews are considered, there could be a **benefit of about £20m** (30-year NPV).

The net benefit arising from the merger is due to a combination of two impacts: the relative average/inefficient performance of the two merging entities (so that removing one company improves the benchmark); and/or the merged entity being less of an outlier on the external drivers of bad debt such that the merger results in a reduction in the uncontrollable company-specific cost adjustment (doubtful debt adjustment).

In the synthesis of the result we use the upper quartile benchmark and probabilistic approach. Under this approach, over five- (and ten) year periods, there is a detriment (and benefit) of £9m (£13m).

3.2.2 Benchmark

At PR14, Ofwat undertook a TOTEX assessment and set companies cost allowance based on an upper quartile efficiency challenge.

In the run-up to the PR14 final determinations, Ofwat carried out an analysis of the value of SBW as a comparator. In that context, Ofwat assessed this to be £25m.[13]

While that analysis might be a useful starting point, it is not suitable for assessing the impact of a merger involving SBW. In particular, the Ofwat analysis looked at the 'loss' of SBW at PR14, whereas the impact of the current merger will occur at PR19. In addition, the Ofwat analysis looked at the 'loss' of SBW only and did not consider the counterfactual. To assess the impact of a merger between two water companies, it is essential to consider that the merger results in the 'loss' of SWW and SBW but the creation a new merged company. As shown in the South Staffordshire/Cambridge merger, the substitution of the merging companies with the merged entity has the potential to benefit the Ofwat comparative cost efficiency by providing a better comparator.[14]

The benchmark analysis examines the potential impact of the merger on the upper quartile efficiency challenge that Ofwat will be able to set in future reviews. The analysis compares the outcomes of an industry with 18 companies and one with 17 where the merging companies are substituted by the merged entity.

The variables assumed to be determining the impact of the merger were:

- the probability that the merging companies could affect the benchmark. In assessing how likely a company is to affect the efficiency challenge applied to the industry, we have examined different approaches, including transition probabilities and Ofwat's changes probabilities;

[13] See Ofwat (2014), 'Calculating company specific uplift' excel file.
[14] See for example Competition Commission (2012), 'South Staffordshire plc/ Cambridge Water plc merger inquiry (CC)- A report on the completed acquisition by South Staffordshire Plc of Cambridge Water PLC', available at: Hhttp://webarchive.nationalarchives.gov.uk/20140402141250/http://www.competition-commission.org.uk/assets/competitioncommission/docs/2012/south-staff-cambridge-water/final_report_excised.pdfH, p. 4, para 11 (a).

- companies' efficiencies and convergence: the companies' relative efficiency is defined around the AMP6 starting point in PR19 and some minor convergence in efficiency over time is assumed. (The top and bottom efficiency scores disappear in PR24);

- synergies: the merger creates a better comparator, in that the identified synergy savings results in the merged company being even more efficient than the current frontier company, SWW. To establish the likely outcome of the merger on the wholesale cost benchmark, we have taken into consideration the impact of the synergy savings arising from the merger in improving the efficiency challenge. (However, as we are only examining the impact on Ofwat's comparative regime at this stage, we have excluded the impact of these synergy savings on the merged company's customers). The expectation is that the merger will result in significant synergy savings. For illustrative purposes, this analysis includes, on a conservative basis, only 25% of the expected and identified synergy savings.[15]

Under the above assumptions, the expected impact of the merger is a net benefit of £30m over 30 years. The expected impact over a shorter time horizon is still a net benefit—of £12m over the first five years and £19m over ten years. These benefits would be more significant still if more than 25% of the expected synergy benefits were included.

3.2.3 SIM

Oxera has followed Ofwat's approach to examining the impact on SIM as set out in its decision on the uplift to the cost of capital in its final determinations.[16] Ofwat assessed that the loss of SBW would result in a detriment of £6m–£11m with respect to SIM.

However, Oxera has (i) extended Ofwat's approach and examined the impact of the merger in terms of comparing two scenarios (one with the merged company and one with SWW and SBW operating separately), and (ii) reconsidered some of the assumptions/inputs for the analysis. (In particular, the appropriate length of time to consider that SIM will remain a valid metric.)

The impact of the merger depends on the implications for the SIM score of substituting the merging companies with the merged entity. The assumptions with regard to the merged entity performance therefore become central.

We have modelled the merged entity simply having a weighted average score of both companies' SIM scores (i.e. no service-level synergy), and having the higher of the two companies' SIM scores (i.e. adopting better practice). Values within this range reflect the varying extent to which better practice could be adopted.

The future scores used in the analysis have been based on the SIM scores forecast by Ofwat, and, as an alternative, by using companies' performance commitment SIM scores.

The assumption about the future performance of merging companies and, therefore, of the merged entity determines the impact. This ranges between a benefit of approximately £8m (assuming that the merged entity will align to the

[15] The synergy savings are, in 2012–13 prices, [⤱]. These are lower if applied to the scenarios where upstream competition is fully functioning and upstream activities are outside the scope of regulation using comparisons. We also model the case where no synergy savings are assumed to occur, so that the impact of the synergy savings only can be quantified.
[16] Ofwat (2014) 'Benefits of comparators', available at: http://www.ofwat.gov.uk/content?id=9d01e438-8542-11e4-8fe5-b9bb2e8303f4

best scores and these scores are derived from companies' performance commitments) to a detriment of between £1m and £4m (assuming that the merged entity will achieve average scores or the higher of Ofwat's forecasts).

The impacts over the three time horizons considered coincide. This is to be expected since, due to significant convergence and the potential to use comparators outside of the water sector,[17] SIM impacts are assumed to last only during AMP6 (i.e. five years).

The range of estimates that provides a detriment is likely to provide an upper bound to any detriment, as:

- Ofwat has already acknowledged that it could draw on comparators from other sectors to assess retail service quality; hence, water companies have relatively less value as comparators; [18]
- both SBW and SWW will need to maintain separate reporting of their SIM scores during AMP6, as part of the final determinations. This should further decrease the impact of a loss comparator over AMP6.

3.2.4 ODI

In its PR14 final determinations, Ofwat took the view that that there would not be quantifiable costs from the loss of one or more WOCs in terms of Performance Commitments and ODIs. In our assessment, this position is still valid. The loss of a comparator due to the merger is unlikely to have any impact for a number of reasons:

- Ofwat has managed with ten comparators for determining sewerage ODIs and PCs;
- few (only two) of the outcome areas required any comparative analysis for the setting of upper quartile targets;
- convergence implies that there is limited scope for further improvement in those few areas where comparisons were undertaken;
- it is questionable how much further improvement customers want to pay for. As the majority of ODIs are based on company-specific customer engagement, their customers have already indicated how they value service levels;
- local factors affect comparability as well as companies' ability to improve service levels. Moreover, SBW may have unique factors that affect its relevance as a comparator, such as a highly seasonal population with a high peak to average-demand ratio;
- performance against ODIs/PCs for both SWW and SBW will need to be reported in order to monitor performance against commitments at final determinations.

In light of the above, Oxera considers that no prejudice will arise on ODI as a result of the merger, and has undertaken its modelling on this basis.

[17] The difference between the maximum and minimum SIM scores in the industry is forecast to fall below a single point by the start of AMP7.
[18] Ofwat (2014), 'Final price control determination notice: policy chapter A7 – Annex 3: benefits assessment of an uplift on the cost of capital', p. 8.

3.2.5 Precision

Oxera assessment follows three approaches, considered by the CC in the South East Water/Mid Kent (2007) and South Staffordshire/Cambridge Water (2012) merger inquiries:

- **statistical approach**: the level of precision with one less comparator on the PR14 water models does not reduce to that of the wastewater models, which have only ten comparators, and for which Ofwat has deemed an upper quartile challenge appropriate. Moreover, precision can be improved to mitigate any possible impact by extending the timeframe of analysis;
- **theoretical approach**: there is no clear-cut impact of the merger on cost-reduction targets. This approach was developed in the context of PR09 models. In contrast, the PR14 BOTEX and TOTEX models have complex cost–cost driver relationships with up to 26 cost drivers; as such, the application of this approach is not suitable. For the cross-sectional unit cost models, the analysis suggests a marginal detriment on precision. Nevertheless, applying the CC's bootstrapping approach to all unit cost and econometric models indicates that, on average, precision improves;
- **specific approach**: this is the most direct assessment of the impact of this particular merger as it takes into account the specifics of SBW, SWW and the merged entity. Replacing SBW and SWT in the modelling[19] with the merged entity shows that the merger does not materially affect the fit of the models (R^2) and the relative accuracy of the cost predictions (as given by the confidence widths) marginally improves. Furthermore, the merger improves the performance of the SDB model, since SBW represents an outlier and the merged entity would be a better comparator.

Overall, the evidence indicates that there is no material impact on precision from the merger and thus there is no prejudice to Ofwat's comparative regime. That is, Ofwat can continue to use an upper quartile efficiency challenge following this merger.

3.3 Overall result

The results for the different areas of impact are brought together in this section to provide an indication of the likely magnitude of the overall impact of the merger. Some of the implications of the merger are likely to be long-lasting. For example, the cost efficiency achieved, such as reduced overheads, are incremental, merger-specific and long term in nature, and unlikely to be eroded by general efficiency improvements. However, other impacts (e.g. on the SIM) may be considered more certain over a relatively short time horizon (e.g. five to ten years) and less certain in the medium to long term. To account for this, the analysis has been carried out over three different periods (30, ten and five years). The results are reported separately in the following tables.

[19] We have assumed no synergies between SBW and SWT.

Table 3.1 Overall impact of the merger over 30 years

Scenario		ACTS: bad debt (£m)	Benchmark (£m)	SIM (£m)	ODI (£m)	Precision (£m)	Net impact
1.	'As is'	20	30	-1 to -4	0	n/a	46–49
2.	Retail competition	20	30	-1-to -4	0	n/a	46–49
3.	Retail competition and partial upstream markets	20	31	-1 to -4	0	n/a	47–50
3.a	Retail competition and more extensive competition for the market	**Same results as 4.**					
4.	Retail competition and more extensive competition for and in the market	20	27	-1 to -4	0	n/a	43–46

Note: Positive represents a benefit and negative a detriment.

Source: Oxera analysis.

The analysis over a 30-year period shows that the overall impact of the merger is a benefit. Indeed, across different market scenarios the merger results in overall benefit of between £43m and £50m.

Table 3.2 Overall impact of the merger over ten years

Scenario		ACTS: bad debt (£m)	Benchmark (£m)	SIM (£m)	ODI (£m)	Precision (£m)	Net impact
1.	'As is'	13	19	-1 to -4	0	n/a	28–31
2.	Retail competition	13	19	-1 to -4	0	n/a	28–31
3.	Retail competition and partial upstream markets	13	19	-1 to -4	0	n/a	28–31
3.a	Retail competition and more extensive competition for the market	**Same results as 4.**					
4.	Retail competition and more extensive competition for and in the market	13	19	-1 to -4	0	n/a	28–31

Source: Oxera analysis.

The analysis over ten years shows that the overall impact of the merger is a benefit. Indeed, across different market scenarios the merger results in overall benefit between £28m and £31m. It is of note that as upstream markets changes would affect the scope of regulation from PR29 onwards, the results do not change across scenarios 1 to 4.

Table 3.3 Overall impact of the merger over five years

Scenario		ACTS: bad debt (£m)	Benchmark (£m)	SIM (£m)	ODI (£m)	Precision (£m)	Net impact
1.	'As is'	-9	12	-1 to -4	0	n/a	-1–2
2.	Retail competition	-9	12	-1 to -4	0	n/a	-1–2
3.	Retail competition and partial upstream markets	-9	12	-1 to -4	0	n/a	-1–2
3.a	Retail competition and more extensive competition for the market	**Same results as 4.**					
4.	Retail competition and more extensive competition for and in the market	-9	12	-1 to -4	0	n/a	-1–2

Source: Oxera analysis.

The analysis over five years shows that the overall impact of the merger is relatively immaterial. It is of note that as upstream markets changes would affect the scope of regulation from PR29 onwards, the results do not change across scenarios 1 to 4.

In summary, the analysis shows that:

- the impact of this merger on the water industry customers is a benefit;
- this result is driven in particular by the fact that the merger will lead to the creation of a better comparator (and, thus, a more challenging benchmark) for wholesale activities and a more challenging benchmark for retail activities;
- the merger is beneficial to the comparative regime, even without considering the potential direct benefits to the merging companies' customers;
- this result is consistent over the different time horizons considered: the longer timeframe and the more certain shorter time periods.

If no synergy savings are assumed to occur, the merger impact is a smaller benefit, of £7m–£13m (see Appendix 3 for details). However, a focus of this merger is the achievement of synergy savings; as such, this scenario is highly implausible. Indeed, benefits from the merger would be even more significant if more than 25% of the expected synergy benefits were included in the analysis.

A1 Description of the overarching model

A1.1 Overarching model inputs and assumptions

The overarching model created by Oxera is able to take into account the undiscounted expected streams of the following potential benefits and detriments:

- retail synergies;
- whole synergies;
- average cost to serve/bad debt adjustment;
- benchmark;
- precision of Ofwat's models;
- ODIs; and
- SIM.

The 'core inputs' used in the benchmark simulation are based on transition probabilities that are derived from the five-year smoothing of the TOTEX results. The transition probabilities, which are based on observed movements, are meant to indicate that the rankings of the companies are relatively sticky. Oxera has also considered Ofwat's probabilities in the simulation, which indicate that the transition probabilities are less sticky.

The overarching model has a base setting in which it assigns 50% weight to the transition probabilities and a 50% weight to Ofwat's probabilities. The model allows these weights to be changed by the user. In the overarching model, the choice of weights on the settings determines the streams from the benchmark simulation.

The overarching model incorporates scenario switching, which allows the user to choose the price review period in which the switch to a new scenario is assumed to occur. The switches allow the overarching model to move the potential regime change in the water industry to different price review periods, thereby allowing the user to examine the expected streams under each scenario and to take into account any changes in expected streams due to a change in the regime. Note that the model assumes that the industry is in the 'base case' initially and that the switch between scenarios will involve a switch from the 'base-case' scenario to the chosen scenario.

For example, the user can choose that the water industry moves to scenario 2 in PR24, which can be fed into the model, and the model is able to provide the discounted streams assuming the industry was at the 'base case' until PR24 and then switched to scenario 2 for the remainder of the time period.

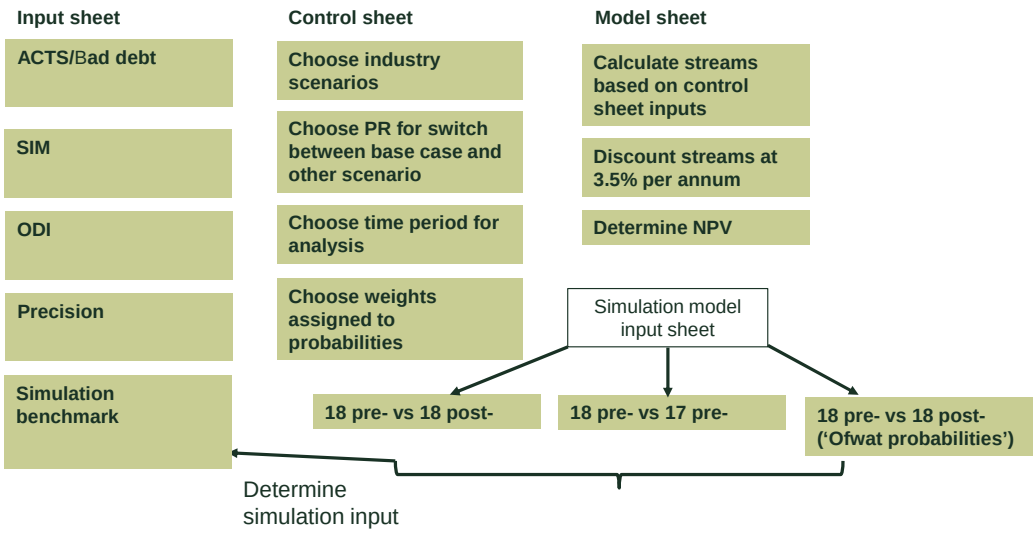
The overarching model also incorporates price review switching, which allows the user to choose the time period to examine. The model allows the user to examine the expected streams for the entire time period (until PR39), or for a different time period. The model allows the user to examine both scenario and price review switching simultaneously.

Finally, the overarching model uses the 3.5% discount rate to calculate the NPV of the combined streams and the present value of each stream.

A1.2 Overarching model: model mechanics

The mechanics of the model and the way in which the various sheets interact with each other is shown in Figure A1.1.

Figure A1.1 Overarching model: relationship between the sheets



Source: Oxera.

The overarching model is constructed as follows.

- Simulation Model input sheet: this sheet has the inputs from the simulation model for each of the three cases noted above. The sheet incorporates the expected streams for each case according to the four scenarios being examined. The weights assigned to each probability are determined in the Control Sheet.
- Input Sheet: this sheet has the inputs from the various input calculations and incorporates the expected streams according to the four scenarios being examined.
- Control Sheet: this sheet allows the user to change the scenarios to be analysed by using the dropdown menu. It also allows the user to vary the assumptions about the weights attached to the benchmark simulation, which are then filtered into the Simulation Model input sheet and the model itself. The Control Sheet also allows the user to choose the time period for the analysis by using the dropdown menu for the 'Time Period for NPV' calculation button. Finally, the Control Sheet allows the user to change the assumption about the PR switch period by manually entering the chosen PR period in the corresponding boxes for the inputs. For example, by choosing 3 in C30, the user can change the scenario switch from the base assumption of PR29 to PR24.
- Model: the model uses the inputs from the input sheet according to the settings determined in the Control Sheet. Any change in the Control Sheet, such as a change in scenario or PR switch, is reflected in the model's inputs. The model incorporates the inputs according to the assumptions from the Control Sheet and calculates the present value of the stream using a 3.5% discount rate.

Model output sheets

- Water-fall: this chart is linked to the present-value calculations of the model and is updated every time the Control Sheet is amended. This chart shows the discounted value of each of the streams.
- Slide 32-33: this sheet is linked to the model and shows the present values of the streams based on the base case of the switch in scenario occurring in PR29.
- NPV by PR: this sheet is linked to the model and shows the present values of the streams based on the time period chosen for the analysis.
- NPV by Switch: this sheet is linked to the model and shows the present values of the streams based on the PR chosen for the switch.

Figure A1.2 Overarching model: example

Stream	PR14	PR19	PR24	PR29	PR34	PR39	PR44
ACTS/bad debt	Use scenario 1	Use scenario 1	Use scenario 2	Use scenario 2	Use scenario 2	Use scenario 2	Use scenario 2
Benchmark	Use scenario 1	Use scenario 1	Use scenario 2	Use scenario 2	Use scenario 2	Use scenario 2	Use scenario 2
SIM	Use scenario 1	Use scenario 1	Use scenario 2	Use scenario 2	Use scenario 2	Use scenario 2	Use scenario 2
ODIs	Use scenario 1	Use scenario 1	Use scenario 2	Use scenario 2	Use scenario 2	Use scenario 2	Use scenario 2
Precision	Use scenario 1	Use scenario 1	Use scenario 2	Use scenario 2	Use scenario 2	Use scenario 2	Use scenario 2

Source: Oxera.

Figure A1.2 gives an example in which the overarching model assumes that a switch begins in PR24. The industry is assumed to move from the 'base case' scenario to the 'Retail competition' scenario beginning in PR24.

The switch allows the user to change the timing of the scenario from scenario 1 to scenario 2, or from scenario 1 to scenario 3, etc. The switch date assumption allows the user to incorporate the various inputs associated with the scenario for each time period shown above. The example assumes that the entire time period is chosen (up to PR39[20]).

[20] PR39 implies until 2044/45 in the model.

A2 Description of the market scenarios

A2.1 Scenario 1: 'Base case'

This scenario assumes that the water industry structure remains unaltered for the foreseeable future. Following the enactment of the Water Act 2014, retail competition for non-household customers is introduced in 2017 in England. No other major changes to the competitive landscape and the industry structure are assumed. No legislative initiatives are taken to promote further retail competition (i.e. for household customers). Provisions in the Water Act on access and upstream trading (i.e. bulk supply) have limited effects. The key implication is that the scope of application of the regulatory regime as introduced at PR14 remains in place substantially unchanged for a number of price control periods.

Overall, the scenario is therefore focused on Ofwat's application of regulatory tools to the wholesale business and retail household. In terms of retail services to non-households, outcomes are likely to be driven by competition and therefore Ofwat is assumed to cease controlling prices and quality of service.

A2.2 Scenario 2: 'Retail competition'

This scenario is the same as scenario 1, except that, following the outcomes of the non-household retail competition, government/Ofwat are assumed to make all water customers eligible (i.e. to give the entire customer base a choice of retailer).

Under this scenario, retail outcomes might be driven more by retail markets, and Ofwat might stop using comparative tools for retail businesses altogether. However, a key aspect to consider is timing. The assessment of NHH retail competition, deciding whether to introduce it for households, and the legislative process to make this possible, would require a few years. Once the legislation has been introduced, there would be a lead time before the market is actually opened (e.g. the Water Act was in 2014, and the non-household retail market will open in 2017). It could take another few years (in energy it took approximately four[21]) to decide that competition is sufficiently intense for Ofwat to be confident that the market dynamics will deliver for customers and therefore withdraw price regulation in retail. Thus, the implications of full retail competition on the regulatory regime might not materialise before ten years or more after 2017—i.e. price controls for retail are assumed to remain until PR29 or beyond.

A2.3 Scenario 3: 'Retail competition and partial upstream markets'

This scenario is the same as scenario 2 for retail competition. In addition, it involves initiatives building on the existing regime and on certain new provisions in the Water Act 2014 to develop upstream (i.e. resource and treatment of water) competition. New regulatory measures and Water Act provisions would lead to more competition 'for the market' through, for example, intensified use of bulk supplies[22] between existing water companies and water companies' areas (with water markets emerging between regions). In this scenario, there would be an

[21] See National Audit Office (2008), 'Protecting consumers? Removing retail price controls', Report By The Comptroller and Auditor General, HC 342 Session 2007-2008, 28 March, Appendix 4.
[22] Water companies may trade with one another and when faced with the need to enhance its water outputs, for example, decide whether to 'make' (i.e. develop) new resources or 'buy' (i.e. sign long-term agreements to import water from neighbouring companies). At the same time, a company may decide to sell bulk water to large customers in neighbouring companies inputting water into the incumbent company's network and use the water in the network to supply the end-customer.

increased number of greenfield inset appointments,[23] and more use of outsourcing models for investment undertaken to meet growth in demand (e.g. new developments, towns, etc.).

Some outsourcing opportunities might be identified by a network management or system operator business function within the incumbent water company. The system operator activities and resources would not be formally separated from the incumbent water company (e.g. through functional or legal separation), but they would be regulated separately. Together, these changes might create competitive pressure on companies when deciding how to meet growth in demand (i.e. planning for water SDB). If enough competitive pressure is exerted on the incumbent, Ofwat might decide to reduce the regulatory control on these activities. This, in turn, might result in Ofwat removing growth investments from the cost base subjected to comparative efficiency assessment.

A2.4 Scenario 3a: 'Retail competition and more extensive competition for the market'

This scenario is as scenario 2 for retail competition. As in scenario 3, this scenario would also rely on 'competition for the market' to drive outcomes for growth investments. In addition, the system operator could become established formally, as a functionally separate entity, to drive the selection in both short- and long-term upstream solutions (in fact, the entity might be equivalent to 'single buyer').

There would also be further scope for bulk supplies and interconnection (as facilitated by regulatory changes and the Water Act 2014). The Water Act provisions for upstream entry (bilateral trading between upstream entrants and downstream retailers) would also be enabled, coupled with new rules on access charging.

The system operator would then:

- decide which resources to use on a daily, weekly or monthly basis (this is close to what happens in energy regarding call-up of capacity);
- in the longer term, procure efficiency enhancements and maintenance investments (incumbents and new entrants could bid in competition) through the bulk supplies regime and the new wholesale authorisations;
- through the access regime, honour bilateral trades between upstream entrants and downstream retailers (competition in the market) established through the new wholesale authorisations (this is the current regime in energy).

In contrast to scenario 4 (see below), in this scenario there would not be extensive within-region competition in the market. Rather, the regime would be enabled, and entry through competition for the market might occur, with some limited bilateral trading within the water company's area. Upstream outcomes would be driven more by competition for the market, and through the choices of the system operator. Similar to scenario 4, if successful, Ofwat might decide to reduce or stop the use of comparative tools for upstream assets (i.e. water resources and treatment), and instead oversee the upstream markets that emerge while regulating the system operator function at the network level.

[23] Inset appointments are an existing competition tool where a customer (e.g. a new development) currently not connected (a greenfield) requires to be served by a new entrant (i.e. not the incumbent water service provider).

A2.5 Scenario 4: 'Retail competition and more extensive competition for and in the market'

This scenario is as per scenario 2 for retail competition. In addition, the system operator could become established more formally, as a functionally separate entity, and would drive the selection in both the short and longer term of upstream solutions. There would also be further scope for bulk supplies and interconnection (as facilitated by regulatory changes and the Water Act 2014). The Water Act provisions for upstream entry (bilateral trading between upstream entrants and downstream retailers) would come into full force, coupled with new rules on access charging (replacement of the Cost Principle). These assumptions are as in scenario 3a.

In this scenario, there would also be provisions for abstraction trading (which would require new legislation), which is assumed to provide important signals as to the cost of raw water and therefore incentivise efficient location of new resource development

In this scenario, the system operator would:

- decide which resources to use on a daily, weekly or monthly basis (this is close to what happens in energy regarding call-up of capacity);
- in the longer term, procure efficiency enhancements and maintenance investments (incumbents and new entrants could bid in competition) through the bulk supplies regime and the new wholesale authorisations;
- through the access regime, honour bilateral trades between upstream entrants and downstream retailers (competition in the market) established through the new wholesale authorisations (this is the current regime in energy).

In this scenario, more within-region entry through competition in the market is assumed to occur than in scenario 3a (and abstraction trading is assumed to provide locational signals that spur this market). The regulatory framework is also assumed to be designed to 'push' market entry.

In this case, upstream outcomes might be driven more by upstream markets (both competition in the market within regions, and competition for the market within and between regions), and through the choices of the system operator. Similar to scenario 3a, Ofwat might rely on market outcomes and stop using comparative tools for upstream assets. Ofwat would instead oversee the upstream markets that emerge while regulating the system operator function at the network level.

It is envisaged that this model would require more substantive changes to the legislative and regulatory framework. Hence, building on the retail reforms in scenario 2, it is likely that this scenario could be introduced only from or after PR24.

A3 Overarching model: with no synergy savings

In this section, we present the results when no synergy savings are assumed to occur from the merger.

In this scenario, we do include synergy savings in the calculation of the impact on the benchmark. SIM would in a detriment of around £1–4m over 30years in all four market scenarios. Summary results are presented below in Table A3.1.

Table A3.1 Worse-case scenario with no synergies assumed in Benchmark

Scenario		ACTS: bad debt (£m)	Benchmark (£m)	SIM (£m)	ODI (£m)	Precision (£m)	Net impact
1.	'As is'	20	-9	-1 to -4	0	0	7–10
2.	Retail Competition	20	-9	-1 to -4	0	0	7–10
3.	Retail competition and partial upstream markets	20	-8	-1 to -4	0	0	8–11
3.a	Retail competition and more extensive competition for the market	**Same results as 4.**					
4.	Retail competition and more extensive competition for and in the market	20	-6	-1 to -4	0	0	10–13

Source: Oxera analysis.

As noted previously, given that a key objective of the merger is the achievement of synergy savings this scenario cannot be considered as plausible.

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Annex B: Oxera – Precision

Prepared for
South West Water

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Contents

Tables and figures

Summary

The analysis presented in this annex shows that the SBW/SWW merger has no material impact on the precision of Ofwat's cost models, such that **there is no prejudicial impact on Ofwat's ability to use the upper quartile efficiency challenge**. Indeed, Ofwat agrees on this point, stating in PR14 that, with respect to the loss of a WOC:

> the models continue to be fit for purpose to enable an upper quartile efficiency challenge; that is, there would be no need to set a less stringent efficiency challenge to compensate for any lack of precision in our models.[1]

In PR14, the main modelling used a panel dataset to assess companies' performance.[2] Compared with a cross-sectional approach, such as that used in PR09, a panel dataset can substantially improve the statistical precision of econometric modelling as it increases the sample size of the models.

Our assessment follows three approaches considered by the CC in the South East Water–Mid Kent (2007) and South Staffordshire–Cambridge Water (2012) merger inquiries:[3]

- **statistical approach**: the level of precision with one fewer comparator in the PR14 water models does not reduce to that of the wastewater models, where there are only 10 comparators, and for which Ofwat has deemed an upper quartile challenge appropriate. Moreover, precision can be improved by extending the timeframe of analysis to mitigate any possible impact;
- **theoretical approach**: there is no clear impact of the merger on cost-reduction targets. This approach was developed in the context of PR09 models—in contrast, the PR14 BOTEX and TOTEX models have complex cost–cost driver relationships,[4] with up to 26 cost drivers; as such, the application of this approach is not suitable. For the cross-sectional unit cost models, the analysis suggests a marginal detriment on precision. Nevertheless, when the CC's statistical approach ('bootstrapping')—which it used in previous mergers to assess the bias in Ofwat's econometric cost models—is applied to all unit cost and econometric models, bias is, on average, reduced;[5]
- **specific approach**: **the most direct approach to assessing the impact of this merger**, this takes into account the specifics of the merging companies, SBW and SWW, and the merged company. Replacing SBW and SWW in the

[1] Ofwat (2014), 'Final price control determination notice: annex 3 – benefits assessment of an uplift on the cost of capital', December, p. 8, available at: https://www.ofwat.gov.uk/pricereview/pr14/det_pr20141212riskrewardbenefits.pdf
2 That is, the modelling approach used data on companies over time.
3 Competition Commission (2007), 'South East Water Limited and Mid Kent Water Limited- A report on the completed water merger of South East Water Limited and Mid Kent Water Limited', May, available at: http://webarchive.nationalarchives.gov.uk/20130704020426/http://www.competition-commission.org.uk/assets/competitioncommission/docs/pdf/non-inquiry/rep_pub/reports/2007/fulltext/525.pdf. Competition Commission (2012), 'South Staffordshire plc/ Cambridge Water plc merger inquiry (CC)- Appendices and Glossary', May, available at: http://webarchive.nationalarchives.gov.uk/20140402141250/http://www.competition-commission.org.uk/assets/competitioncommission/docs/2012/south-staff-cambridge-water/final_appendices_and_glossary.pdf, pp. E9-E10.
[4] Ofwat used a translog model in its analysis where some of the cost drivers (length of mains, density and usage) were included in the models in translog form that includes second-order terms (i.e. cross-products and squared terms).
[5] In its report for Ofwat on the impact of mergers and approaches to valuing them, Europe Economics argues that bootstrapping provides a sensible cross-check on the estimates of loss in precision derived from the general and specific approaches. See Europe Economics (2015), 'Valuing the Impact of Mergers and Identifying Undertakings in Lieu', May, p. 53.

modelling[6] with the merged entity shows that the merger does not materially affect the fit of the models (R^2), and the relative accuracy of the cost predictions (as given by the confidence widths) marginally improves. Furthermore, the merger improves the performance of the supply–demand balance (SDB) model, since SBW represents an outlier and the merged entity would be a better comparator.

Overall, the evidence indicates that there is no material impact on precision from the merger and thus there is no prejudice. That is, Ofwat can continue to use an upper quartile efficiency challenge following this merger.

[6] In generating the data for the merged company, we have combined the data for SWW and SBW without synergies.

1 Background

The water cost modelling in PR14 differs significantly from that undertaken in PR09 in a number of ways (for further details, see Appendix 1).

- In PR09, econometric modelling examined OPEX,[7] focusing on four separate cost items (business activities, distribution, power, and resources and treatment), based on simple cross-sectional data. The sample size was limited to 21 observations.[8] Model residuals[9] were reduced by 10% (20% for sewerage models) to account for possible noise in the data and potential uncertainty in the model estimates.[10] In addition, CAPEX was modelled using the cost base approach, comparing the unit costs across a large number of CAPEX projects, from which an average benchmark was used.

- In PR14, total expenditure (TOTEX) and base expenditure (BOTEX) were subject to econometric modelling using a **panel data approach**. This approach allowed an **increase in sample size from 21 to 90 observations** (18 companies, observed over five years). Enhancement expenditure was also assessed separately through unit cost analysis. In PR14, **Ofwat applied the same efficiency challenge to the water and wastewater models**[11] by benchmarking predictions to the upper quartile of the efficiency scores.[12]

The **precision of econometric models improves significantly when using a panel dataset**, all else being equal. The main advantage of using panel data is that 'the sample size is significantly larger, allowing for a more precise estimation of coefficients, and strengthening the power of the test statistics'.[13] A 2010 academic paper showed empirically how modelling accuracy can be improved using panel data analysis (and a system approach) with evidence based on the Ofwat models used in PR09. The paper concluded that:

> joint estimation of all the sub-models using the 'seemingly unrelated regression' (SUR) procedure in a cross-section and/or **panel data framework** can **dramatically improve the accuracy of the modeling**. Based on these results, we recommend that Ofwat and other regulators adopt SUR and/or panel data analysis and thereby reduce their reliance on having insufficient numbers of independent companies. [14]

The impact of the merger on the precision of the PR14 models can therefore be assessed empirically. Such an assessment can shed light on several issues. For example, it enables the change in precision of the PR14 water models when replacing data on SBW and SWW with the merged entity to be quantified. The same approach can be used to compare water and wastewater models. In addition, it can show whether SBW and SWW are outliers in any of the models used, and if the merged entity could result in a better comparator.

[7] Capital maintenance assessment was based on standardised cost estimates and did not involve any econometric analysis.
[8] See Ofwat (2009), 'Cost base feedback report: December 2009', available at: http://www.ofwat.gov.uk/pricereview/pr09phase3/pr09phase3letters/ltr_pr0940costbasereport.pdf.
[9] The difference between actual costs and the costs predicted by the models.
[10] Ofwat (2009), op. cit., p. 12.
[11] For wastewater, costs were assessed at a more disaggregated level (by value chain).
[12] Under Ofwat's approach, efficiency scores are defined as the ratio of modelled (or predicted) costs to submitted costs of companies.
[13] Kumbhakar, S. and Horncastle, A. (2010), 'Improving the Econometric Precision of Regulatory Models', *Journal of Regulatory Economics*, **38**:2, October. Both authors of this paper are associated with Oxera.
[14] Ibid., p. 144.

1.1 How the impact is examined

This annex presents an assessment of the potential impact of the merger between SWW and SBW on the precision of Ofwat's PR14 cost models. To this end, Oxera has examined three alternative approaches:

- the **theoretical approach** provides an assessment of attrition in the precision of the model estimates from the loss of *a* comparator. Based on this approach, we show that the potential worsening in precision due to the loss of a comparator is not severe compared with the loss in precision estimated under this approach for the wastewater models. Moreover, results indicate that extending the panel datasets used at PR14 will lead to a benefit in precision that will more than offset the loss of a comparator;
- the **general approach** is used to quantify the theoretical impact of losing *a* comparator on cost-reduction targets. This approach is not suitable for the PR14 BOTEX and TOTEX models, which assume a complex cost–cost driver relationship[15] and are characterised by a high number of insignificant variables. Overall, the analysis of unit costs gives a marginal detriment in three models out of four. Applying bootstrapping as an alternative to the unit cost and econometric models, and comparing the results in the counterfactual (with 18 companies) and factual (with 17 companies) case, indicates that the bias, as measured by this approach, improves marginally post-merger;
- the **specific approach** is used to evaluate the specific impact of the SBW/SWW merger on confidence widths and other measures of statistical and economic performance. Thus, it is the only approach that can account for the characteristics of the two merging companies and the impact on real cost and cost driver data. Empirical evidence shows that the SBW/SWW merger could lead to an improvement in the confidence widths of the econometric and unit cost models. Moreover, the merger improves the fit of the (log) SDB model, since SBW is shown to represent a statistical outlier.

The assessment follows the modelling principles adopted in the context of previous merger cases, along with Ofwat's recent merger consultation.[16] In particular, Oxera has applied the modelling principles adopted in the South East Water-Mid Kent (2007) and South Staffordshire–Cambridge Water (2012) merger inquiries, and the recommendations in Europe Economics' 2015 report for Ofwat on approaches to valuing the impact of the merger on precision.

1.2 Structure of this annex

- Section 2 explains why the merger has no material impact on the fit and accuracy of Ofwat's unit cost and econometric models.
- Section 3 shows that the merger has no material impact on precision using the general approach. The bootstrapping approach shows that the bias in the PR14 models generally improves post-merger.
- Section 4 shows the results based on the empirical approach, which can assess the specific impact of the merger between SBW and SWW.
- Appendix 1 describes the econometric modelling undertaken by Ofwat in PR14, and how it differs from that undertaken in PR09.

[15] Ofwat used a translog model in its analysis where some of the cost drivers (length of mains, density and usage) were included in the models in translog form that includes second-order terms (i.e. cross-products and squared terms).
[16] Ofwat (2015), 'Consultation on Ofwat's approach to future mergers and statement of method', May, available at: http://www.ofwat.gov.uk/regulating/pap_con201505mergers.pdf?download=Download.

- Appendix 2 describes the theory of the statistical approach, and shows that precision improves when the modelled period is extended.
- Appendix 3 describes the general approach used and shows why it is not appropriate for the PR14 econometric models.
- Appendix 4 describes further empirical evidence, including statistical tests based on an extended panel dataset (covering the period 2009/10–2014), the proportion of intuitive implied elasticities when SBW and SWW are replaced with the merged entity, and added variable plots under the log SDB model (where SBW is an outlier).
- Appendix 5 provides a glossary of technical terms.

2 Statistical approach: the hypothetical loss of an observation

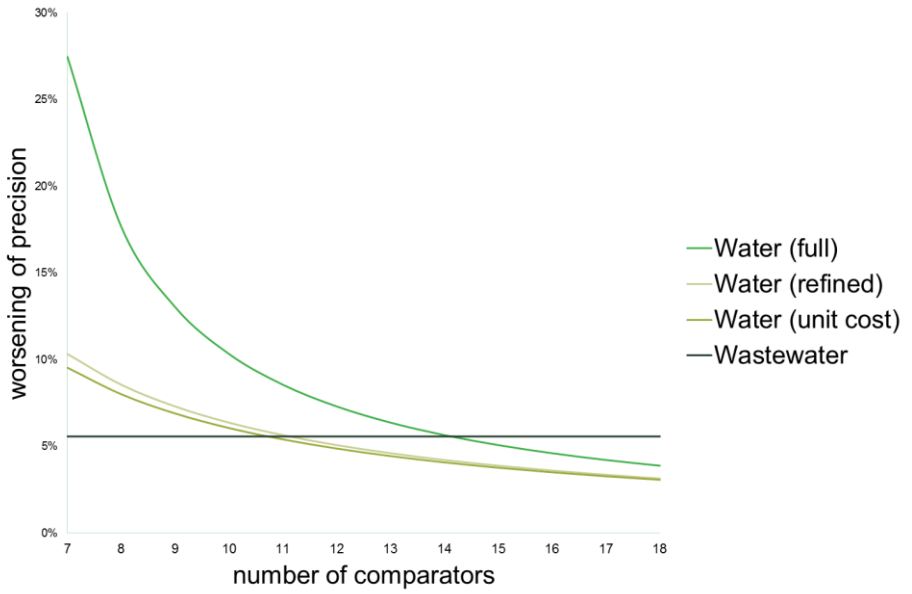
The statistical approach examines the level of precision with one fewer comparator. This approach cannot be used to quantify the impact of this specific merger. Indeed, for a given number of cost drivers, any econometric model with less data has fewer 'degrees of freedom'. It follows that 'the precision of the results from a statistical model increases with its "degrees of freedom"'.[17]

In a merger of two companies, two independent companies are lost and a new one is created. While not equivalent to a merger situation, the CC has used the standard econometric approach of the loss of an observation to provide *a high-level theoretical view about the 'loss' of any observation*.[18] The downside of this approach is that it ignores all characteristics of the merging parties and issues in relation to the models and dataset in question.

2.1 A comparison of the rate of attrition across PR14 cost models

To assess the extent to which precision worsens after the loss of a comparator, we have adopted the theoretical approach used in previous merger cases (see Appendix 1). Figure 2.1 compares the attrition in precision due to the loss of a comparator for the Ofwat models.

Figure 2.1 Worsening in precision due to loss of a comparator (PR14)



Note: The unit cost models are based on a sample size of 18. For wastewater, the figure shows the worsening in precision due to the loss of a comparator that resulted in the current number of comparators; in other words, the 'hypothetical' loss in precision that would have been estimated under this approach on the current wastewater models if there were one additional comparator and a merger resulted in the loss of one observation resulting in the current number of comparators. The attrition rate is defined as the percentage change in the standard error of a coefficient following the loss of a comparator.

Source: Oxera analysis.

[17] Competition Commission (2007), op. cit., p. 44.
[18] Ibid., p. 45.

Figure 2.1 shows that with one fewer comparator for water (17 companies), the rate of worsening in the models' precision (3.9%, 3.2% and 3.1%) is less than for sewerage (5.6%), on which an upper quartile is deemed appropriate.

As such, Ofwat should be able to continue using the upper quartile and there is no impact on precision. This is consistent with Ofwat's view in its PR14 Value of Comparator analysis for WOCs.

Even if any detriment were thought to occur, it would be simple to offset it by: i) extending the dataset (see appendix 3 for a description of improvement in precision under this approach due to the inclusion of one additional year of data); or ii) reducing the number of cost drivers.

3 General approach: the hypothetical loss of an observation from Ofwat's models

3.1 Precision impact of the econometric and unit cost models

Unlike the statistical approach, the 'general approach' (used in the SEW/MKT and SST/CAM inquiries) follows how the results of Ofwat's econometric modelling are used to set cost-reduction targets. Under this approach, the CC calculated the cost difference of all companies when the slope of each cost model was increased or decreased by one standard error. The same procedure was repeated using one fewer degree of freedom,[19] with a view to capturing the hypothetical impact of one fewer observation. Comparing the average deviations with and without one fewer degree of freedom was deemed to give the impact in model accuracy.

In PR09, Ofwat used simple cross-sectional models with one of two explanatory variables at most in each. The main (BOTEX and TOTEX) models used at PR14 impose a complex cost–cost driver relationship. For example, WM3 has 27 variables, while WM5/6/9/10 have 12 variables (including the constant). The (translog) functional form of the models complicates the implementation of this approach in this case due to the presence of cross-products and squared terms. Moreover, the models are characterised by very high standard errors, which would impose unrealistic shocks to model coefficients. Finally, in Ofwat's translog models, due to collinearity (apart from high standard errors), the model coefficients are not all positive, and not all coefficients have a direct interpretation.[20] As such, a perturbation by increasing (decreasing) the coefficients by one standard error will not necessarily increase (decrease) cost. The general approach, as applied in previous merger inquiries, cannot therefore be mechanically employed in the translog case. As such, **it is questionable whether this 'general' approach is valid with respect to the PR14 TOTEX and BOTEX models.**

3.1.1 Results

Applying the general approach to the TOTEX and BOTEX econometric models is inappropriate[21] (see Appendix 3[22]). Since Ofwat had indicated that its models will continue to be fit for purpose to set an upper quartile challenge, the precision impact on these models of removing a company from the sample can be seen to be minimal.[23]

The general approach can instead be applied to the cross-sectional unit (enhancement) cost models. The estimated precision impact under the general approach is shown in Table 3.1.

[19] The degrees of freedom can be defined as the number of independent data points used to estimate the relationship between costs and cost drivers. These are equal to the sample size less the number of estimated parameters.
[20] This is because the company-specific elasticities for the cost drivers introduced in translog form have to be derived from the translog terms.
[21] Our approach has involved perturbing the scale variables of the econometric models: length of mains, property density and usage in WM3; length of mains and property density in all other BOTEX/TOTEX models.
[22] Length of mains, property density and usage under WM3; length of mains and property density under WM3/5/6/9/10.
[23] Moreover, this approach assumes that the loss of an observation affects only the degrees of freedom, and does not account for changes in the spread of the data caused by the merger.

Table 3.1 General approach: precision impact (unit cost models)

Model	Total cost difference (% deviation)
Log SDB	8.4%
Linear SDB	-20.0%
Log new development	2.9%
Linear new development	3.4 %

Note: Under the log SDB model, SBW is a statistical outlier, as will be seen in the next section. The results showing a detriment can therefore be dismissed as it can be shown that the merged entity represents a better comparator for assessing SDB expenditure. Per annum SDB expenditure subject to unit cost analysis in PR14 is 16 times greater than lead-reduction expenditure and 1.8 times greater than new development expenditure.

Source: Oxera analysis.

The results show that the general approach gives a detriment under three models, and a precision benefit under the (linear) new development model. The highest percentage change in mean deviation resulting from the loss of a degree of freedom is 8.4% (log SDB). The benefit figure is based on a 20% decrease in the mean deviation of total allowances.

The downside of this approach is that it is theoretical in nature and does not involve re-estimation. In contrast, the bootstrapping approach can be applied to the counterfactual and factual case with 17 companies, and to all PR14 cost models.

3.2 Bootstrapping as an alternative to the general approach

In the SEW/MKT *and* SST/CAM cases, the CC determined whether Ofwat's OPEX econometric models were 'fit for the purpose' to determine the companies' relative efficiencies and thereby their catch-up targets with the pre-merger dataset.[24]

3.2.2 Results

In this case, we compare Ofwat's results with bootstrapped standard errors for the BOTEX/TOTEX models and the enhancement unit cost models estimated through regressions.[25] Table 3.2 shows that the bias of standard errors generally decreases in the post-merger scenario.

Table 3.2 Comparison of Ofwat's standard errors and bootstrapped standard errors

Model	Number of cost drivers	% cost drivers where bias/SD>25% (pre-merger)	% cost drivers where bias/SD>25% (post-merger)	Does bias increase after the merger?
Unweighted average, SDB	1	100%	100%	-
Unweighted average, ND	1	100%	100%	-
Linear, SDB	1	0%	0%	-
Linear, ND	1	100%	0%	Decrease
Log, SDB	1	0%	0%	-
Log, ND	1	0%	0%	-

[24] The CC did not undertake this modelling on the post-merger dataset.
[25] Standard errors (i.e. the variability around the point estimates) are estimated using bootstrapping, a statistical re-sampling technique. Any 'bias' (departure from the 'true' value) is simply defined as the difference in the standard errors estimated in the four econometric models compared with bootstrap-estimated standard errors. The estimated bias is then compared with the dispersion of the standard errors estimated using the bootstrap procedure (i.e. the standard deviation of the bootstrap standard errors). The smaller the bias, the better; if the estimated bias is less than 25% of the standard deviation of the bootstrapped estimate, the bias is not considered to be a serious issue.

Model	Number of cost drivers	% cost drivers where bias/SD>25% (pre-merger)	% cost drivers where bias/SD>25% (post-merger)	Does bias increase after the merger?
Full TOTEX (OLS)	26	88%	92%	Increase
Refined TOTEX (OLS)	11	82%	64%	Decrease
Refined TOTEX (RE)	11	64%	36%	Decrease
Refined BOTEX (OLS)	11	73%	91%	Increase
Refined BOTEX (RE)	11	64%	45%	Decrease
Average[1]		**74%**	**66%**	**Decrease**

Note: ND, new development; OLS, ordinary least squares; bootstrapped standard errors are based on 1,000 replications. [1] This average excludes results from the unit cost models. Results are directionally similar if the unit cost models are considered.

Source: Oxera analysis.

The bootstrapping analysis shows that four models improve and two deteriorate:

- under three unit cost models (linear SDB, logged SDB, and logged new development expenditure), there is no impact.[26] Under the linear new development model, there is an improvement;[27]
- under the full TOTEX model, there is a marginal deterioration with the number of cost drivers subject to bias increasing from 23 to 24 (out of 26) following the merger. The two refined TOTEX models improve;[28]
- the standard error bias of BOTEX models increases under OLS (from 73% to 91%), but decreases under RE (from 64% to 45%).

Overall, fewer cost drivers are biased relative to the pre-merger scenario (55 compared with 50); thus model precision improves as a result of the merger.

[26] As the bias is not more than 25% of the standard deviation (either before or after the merger).
[27] The bias in standard error decreases from 27% to 17% after the merger, and therefore falls below the 25% threshold.
[28] There is a decrease in bias, with the proportion of biased cost drivers going from 64% to 35% under RE.

4 Specific approach: the empirical impact of the SBW/SWW merger on precision

This section examines the possible impact of the merger on the statistical performance and overall robustness of the econometric models used by Ofwat in PR14. The assessment builds on relevant regulatory precedents. For example, Appendix E of the CC's technical report in the SST/CAM merger examined the 95% confidence width of predictions and R^2 of OPEX regressions models.[29] Oxera used a similar set of statistical tests in the same merger inquiry.[30, 31]

Overall, the results strongly indicate that the merger has a beneficial impact on the precision of the models:

- the average confidence widths, both historical and forecast, are narrower in the post-merger period;
- of all econometric and unit cost models, only one is characterised by a very low R^2: the log version SDB model. In that case, SBW is assessed to be a statistical outlier, and the merged entity represents a much better comparator. Replacing SBW and SWW with the merged entity gives tighter confidence widths and higher R^2 generally. For the unit cost models, the confidence widths improves post-merger.

4.1 The empirical impact on the econometric models

The current TOTEX and BOTEX econometric models use data between 2008/09 and 2012/13.

4.1.1 Confidence widths

Confidence widths in the post-merger scenario are obtained by running the TOTEX and BOTEX models under a smaller sample, where SWW and SBW observations are replaced with those of the merged entity. The impact of the merger on the accuracy of the PR14 econometric models over the historical period is shown in Table 4.1.

Table 4.1 Confidence widths pre and post-merger (econometric models, historical period)

Model	Pre-merger (CW, %)	Post-merger (CW, %)	Does CW increase/decrease in the post-merger scenario?
WM3	3.5	3.3	Decreases
WM5	3.5	3.6	Increases
WM6	5.9	6.0	Increases
WM9	3.7	3.7	Decreases
WM10	6.5	6.4	Decreases
Average	**4.62**	**4.59**	Decreases

Note: Confidence width (CW) defined as the ratio of the logarithm of the confidence width to the logarithm of the predicted costs. The table presents the unweighted industry average for each model.

Source: Oxera analysis.

[29] Competition Commission (2012), op. cit., pp. E8–E9.
[30] See Oxera (2012), op. cit., section 3.
[31] In addition, tests can be used to examine precision-related issues of particular relevance to PR14, such as the theoretical correctness of the translog coefficients of the TOTEX and BOTEX econometric models and the correctness of the models' functional specification (see Appendix 4.1).

Average confidence widths are expressed as a proportion of the point estimate. Table 4.1 indicates that confidence widths decrease under the full TOTEX model (WM3) by around two percentage points. In other words, the uncertainty of historical predictions narrows as a result of this merger. Similarly, the merger results in an improvement in Ofwat's historical model predictions from the BOTEX models (WM9 and WM10). In contrast, the average confidence width of the refined TOTEX models, WM5 and WM6, increases by around one percentage point after the merger.

Before looking at other measures of statistical performance, we compare the confidence widths in water and wastewater in Table 4.2 (PR14).

Table 4.2 Comparison of confidence widths in water and wastewater (PR14, historical period)

Water model	(CW, %)	Wastewater model	(CW, %)	Average difference (CW, percentage points)
WM3	3.5	SW1	11.0	
WM5	3.5	SW5	13.0	
WM6	5.9	SW6	2.4	
WM9	3.7	SW9	7.7	
WM10	6.5	SW10	2.1	
Average	**4.6**	**Average**	**7.3**	**3.1**

Note: Confidence width defined as the ratio of the logarithm of the confidence width to the logarithm of the predicted costs. The table presents the unweighted industry average for each model.

Source: Oxera analysis.

In PR14, Ofwat applies an upper quartile adjustment to the wastewater and water models. As can be seen, water confidence widths are much tighter on average than the sewerage confidence widths, for which Ofwat also uses the upper quartile. The average confidence width as a proportion of predicted costs is 4.6% for the water model, and 7.3 for the wastewater model. **This implies that Ofwat can continue to use an upper quartile challenge on the water models post-merger.**

4.1.2 Other measures of statistical performance

In the 2012 Oxera report for the SST/CAM merger[32] and in the CC Mid Kent inquiry, other measures of statistical performance were also examined. For example, the adjusted R^2 measures the overall fit of the models.[33] In addition, below, we examine two important diagnostic tests to assess whether the functional form of the models improves or worsens as a result of the model.

Table 4.3 Main diagnostic tests (econometric models)

	WM3		WM5/6		WM9/10	
	Pre-	Post-	Pre-	Post-	Pre-	Post-
RESET test for omitted variables	x	x	x	x	x	x
Link test for model specification	✓	✓	✓	✓	✓	✓
Adjusted R^2 (OLS)	99.5%	99.6%	98.9%	98.8%	98.8%	98.7%

Note: All statistical tests were undertaken at 5% significance. Source: Oxera analysis.

[32] Oxera (2012), ibid., pp. 16–17.
[33] The larger the R^2, the better the model.

The R2 of the TOTEX and BOTEX models are not materially affected by replacing SWW and SBW with the merged entity. While the fit of the models improves marginally under WM3 (from 99.5% to 99.6%), it decreases slightly under WM5/6 and WM9/10. With regard to the outcomes of the diagnostic tests (RESET and Link tests), again the merger does not have a material impact on model performance.

4.1.3 Intuition of elasticities

Another feature of the PR14 econometric models is the flexible functional form given by the partial translog specification. Appendix A4.1 examines whether the intuitive appeal of the implied elasticities before and after the merger is affected. On balance, **the models are largely unaffected by the merger**. Under WM3, density and usage become less often intuitive. However, the refined models are on average more intuitive, with the density variable being more often within the expected range.

4.2 The empirical impact on the unit cost models

This section looks at the statistical performance of unit cost models.

4.2.1 Confidence widths

Given the mixed results in the general approach, the analysis of confidence widths under an empirical approach becomes crucial to understand the true observed impact of this specific merger on the spread of model predictions. The results are summarised in Table 4.4.

Table 4.4 Confidence widths pre- and post-merger (unit cost models, historical period)

Model	Pre-merger (CW, %)	Post-merger (CW, %)	Does CW increase/ decrease in the post-merger scenario?
Log SDB	41	31	Decreases
Linear SDB	134	128	Decreases
Log ND expenditure	27	28	Increases
Linear ND expenditure	251	158	Decreases
Average	**113**	**86**	**Decreases**

Note: Confidence width defined as the ratio of the logarithm of the confidence width to the logarithm of the predicted costs. The table presents the unweighted industry average for each model.

Source: Oxera analysis.

These results stand in contrast to those based on a simpler theoretical approach without re-estimation, and show an improvement in confidence widths. On average, the 95% confidence widths as a proportion of predicted costs decrease by around 27 percentage points, from 113% to 86%. Moreover, a similar conclusion based on Table 4.4 can be drawn for the unit cost models. The confidence widths of the water unit cost models (133%) are indeed much tighter than the wastewater ones. Based on 22 unit cost models (S1 to S11, in linear and log form), the sewerage unit cost confidence widths are 290% (linear models) and 1008% (log models). The water results are therefore more robust and precise. This stands as additional evidence that the merger cannot make the precision of water models worse than the wastewater ones, where the same benchmarking rule (upper quartile) is currently applied.

4.2.2 Other measure of statistical performance

The results of the main diagnostic tests for the unit cost models are shown in Table 4.5.

Table 4.5 Main diagnostic tests (unit cost models)

	SDB		ND		Log SDB		Log ND	
	Pre-	Post-	Pre-	Post-	Pre-	Post-	Pre-	Post-
RESET test for omitted variables	✓	✓	x	x	✓	✓	✓	✓
Link test for model specification	✓	✓	x	x	✓	✓	✓	✓
Adjusted R^2	58.1%	56.6%	82.9%	82.1%	37.0%	46.1%	85.4%	84.6%

Note: All statistical tests were undertaken at 5% significance.

Source: Oxera analysis.

The outcomes of the main statistical tests remain unaffected, as does the adjusted R^2, which increases under the ND models and decreases under the SDB models. Indeed, the merger could contribute to improving the performance of the SDB model, and in particular the log version, which has a much lower R^2 than the other unit cost models. Under the log SDB model, SBW is a clear outlier[34], as the added variable plots show (see Appendix A4.2).

[34] It is also a statistical outlier based on the student-t and normalised residuals.

5 Conclusions

Based on the three approaches (theoretical, general and specific) examined in previous merger inquiries, it is possible to conclude that the SBW/SWW merger has no material impact on model precision, and that there is no prejudicial impact on Ofwat's ability to use the upper quartile efficiency challenge. Table 5.1 summarises the outcome of each modelling technique examined.

Table 5.1 Summary of the impact of the merger

Approach	Technique	Description	Overall assessment of the merger impact
Theoretical approach	Attrition in precision	Examines the extent to which a decrease in the sample size leads to a decrease in the standard errors of the estimates	The level of precision with one fewer comparator does not reduce to that on the wastewater models, for which Ofwat has deemed an upper quartile challenge appropriate. Extending the panel models with additional years leads to a benefit in precision
General approach	Theoretical loss of an observation	Assesses a model in which coefficients are perturbed based on the standard error and fewer degrees of freedom	Unit cost models show a marginal detriment. The approach is not appropriate for complex econometric models
Theoretical/ general approach	Bias in unit cost and econometric models	Checks whether the models remain fit for purpose and whether the merger creates further possible bias	Bootstrapping shows that, on average, the potential bias in the standard error decreases post-merger
Specific approach	Empirical loss of an observation	Assesses the confidence widths before and after the SBW/SWW merger	Confidence widths decrease marginally post-merger
Specific approach	Statistical performance	Measures of the goodness of fit of the model (R^2) and functional form tests	The merger has no substantial impact on model fit and the outcomes of functional tests. In the log SDB model, replacing SBW (an outlier) with the merged entity improves the model fit

Source: Oxera analysis.

The statistical approach shows that the loss of a comparator can lead to limited attrition issues for the models used at PR14. Extending the number of years used in a panel dataset can not only mitigate attrition issues, but also lead to benefits in precision.

The theoretical results stemming from the general approach lead to a marginal overall detriment. The same approach is not appropriate for econometric models with complex cost–cost driver relationships. Bootstrapping is a feasible alternative approach and indicates that there is no substantial worsening of the model bias.

The specific approach is considered to be the most robust, and enables an assessment of the specific characteristics of the merger of SWW and SBW. The merger has no substantial impact on the models' fit and other measures of statistical performance.

As such, there is no prejudicial impact on Ofwat's ability to use the upper quartile efficiency challenge. This aligns with Ofwat's view on precision in its Value of Comparator analysis.[35]

[35] Ofwat (2014), 'Final price control determination notice: annex 3 – benefits assessment of an uplift on the cost of capital', December, p. 8, available at: https://www.ofwat.gov.uk/pricereview/pr14/det_pr20141212riskrewardbenefits.pdf

A1 Ofwat econometric modelling in PR14

Ofwat's approach to the cost-efficiency modelling for PR14 is significantly different from that undertaken at PR09. In relation to the impact of this merger on the precision of Ofwat's wholesale cost modelling compared with its cost modelling in PR09, the most pertinent points are as follows.

- Wholesale and retail costs were examined separately (retail costs are examined in a separate annex[36]).
- An econometric approach was used for both.
- The models were far more complex than those used in PR09, with a large number of cost drivers.
- The econometric models were estimated using a panel dataset. In particular, for water services, a five-year period was used (2008/09–2012/13), and seven years for wastewater services (2006/07–2012/13). Ofwat examined 2013/14 but did not use it.[37]
- Costs were modelled at an aggregate level, either:
  - TOTEX—OPEX, capital maintenance and capital enhancement; or
  - BOTEX—OPEX and capital maintenance, with capital enhancement expenditure considered separately.

  Where capital enhancement expenditure was considered separately, it was assessed using cross-sectional 'unit cost' models (either simple unit cost comparisons or econometric models with only one cost driver), with expenditure averaged over five years;
- Several models were used and the results 'triangulated' (or averaged) to produce one cost prediction.
- An efficiency overlay was then applied based on the upper quartile over the historical period.

To understand the possible impact of this merger on precision, it is crucial to note that a number of these changes have greatly reduced the possibility that the merger will have an adverse impact on precision:

- as shown in the 2010 academic paper[38] and 2012 Oxera report[39], **using panel data significantly improves modelling accuracy**;
- in PR14, **Ofwat used the same upper quartile efficiency challenge for the water and wastewater models**. It can be shown that the confidence widths of the water models are much tighter than those of the sewerage models.[40] It follows that Ofwat can continue to use the upper quartile efficiency challenge for **the water models, even if the merger leads a reduction in precision, as long as the water models remain at least as accurate as the wastewater ones.**

[36] Oxera (2015), 'Annex D: Oxera - retail average cost to serve', June.
[37] Companies that merged during the period examined had their data merged.
[38] Kumbhakar and Horncastle (2010), op. cit.
[39] Competition Commission (2012), op. cit.
[40] While, on average, confidence widths are 7.3% of wastewater cost predictions, the same ratio for water models is 4.6% (see section 4).

With this in mind, we have provided a set of sensitivities based on one (or two) additional years in the modelled period of the econometric models, and compared the degree of statistical precision of the water and wastewater models. All tests and modelling techniques used are based on three approaches (theoretical, general and specific), as described and further developed in the next three appendices.

A2 Statistical theory approach

In line with the CC approach, we examine the theoretical rate of attrition in precision using a simple formula, assuming constant SSR (sum of squared residuals) and SSX (sum of squared deviations in the independent variable):

$$Standard\ Error = \sqrt{\frac{1}{N-k-1}}$$

where N is the sample size (the number of entities × the time periods), and k is the number of control variables. The attrition rate is defined as the rate of change in the standard errors of a model when a comparator is dropped.

For example, the full TOTEX model has N – k – 1 = 90 – 26 – 1 = 63 degrees of freedom. The loss of a comparator would reduce the number of observations by 5. As a result, the degrees of freedom would fall to N – k – 1 = 85 – 26 – 1 = 58. The resultant standard errors are defined as the square root of the reciprocal of the degrees of freedom—that is, 0.126 in the theoretical pre-merger case and 0.131 in the post-merger case. This implies a 4.2% increase in the standard errors, which determines the rate of attrition.

The full set of attrition rates for all PR14 water models is shown in Table A2.1, and forms the basis for Figure 2.1 in section 2.

Table A2.1 Rate of attrition of PR14 models

N. comparators	Full TOTEX	Refined TOTEX/BOTEX	Unit cost (18 companies)
18	4.2%	3.4%	3.3%
17	4.6%	3.6%	3.5%
16	5.1%	3.9%	3.8%
15	5.7%	4.2%	4.1%
14	6.4%	4.6%	4.4%
13	7.3%	5.1%	4.9%
12	8.6%	5.7%	5.4%
11	10.3%	6.4%	6.1%
10	13.0%	7.3%	6.9%
9	17.7%	8.6%	8.0%
8	27.5%	10.3%	9.5%

Source: Oxera analysis.

In addition, Table A2.1 shows that precision could improve if, concurrently with the loss of a comparator, the modelled period were extended. For example, under WM3, the degrees of freedom would increase from 18 * 5 – 26 – 1 = 63 to 17 * 6 – 26 – 1 = 75, with one additional year of outturn data. This would result in an 8% decrease in standard errors, and therefore an increase in precision. This is further discussed below.

A2.1 Extending the timeframe of panel cost models leads to a net benefit in precision

As noted, as a mitigating strategy, it is possible to offset model attrition by extending the modelled period. For example, the availability of 2013/2014 and 2014/2015 outturn data enables Ofwat to increase the sample size, and thereby reduce the standard error (i.e. improve the accuracy) of the model regression. Kumbhakar and Horncastle (2010) recommended that 'Ofwat and other regulators adopt SUR and/or panel data analysis and thereby reduce

their reliance on having sufficient numbers of independent companies'.[41] A panel data approach was adopted at PR14.

If Ofwat were simultaneously to drop a comparator and extend the modelling period by one year (for example, adding 2013/14 outturn data[42]), the standard error of WM3 would reduce from 0.13 to 0.12 (and from 0.113 to 0.105 in the refined models), thereby improving theoretical precision by 8% (see Table A2.2). The benefit would increase further to as much as 17% under the full model if two years were added.

Table A2.2 Improvement in precision following: i) the loss of a comparator, and ii) an increase in the number of years modelled

	Water (full)	Water (refined)	Wastewater
Standard error (PR14)	0.13	0.11	0.11
Standard error (+ 1 year, loss of a comparator)	0.12	0.11	0.10
Standard error (+ 2 years, loss of a comparator)	0.10	0.10	0.10
Benefit in precision (+ 1 year, loss of a comparator)	8%	7%	7%
Benefit in precision (+ 2 years, loss of a comparator)	17%	15%	14%

Source: Oxera analysis.

Given that the standard error is positively related to the number of model parameters, it is also possible to increase precision by reducing the number of explanatory variables. For example, WM3 has 26 model parameters, 17 of which do not align with economic theory and operational expectations.[43]

[41] Kumbhakar and Horncastle (2010), op. cit.
[42] In December 2014, Ofwat published updated model results based on an extended dataset including 2014. See Ofwat (2014), 'Final price control determination notice: policy chapter A3, wholesale water and wastewater costs and revenues', available at: https://www.ofwat.gov.uk/pricereview/pr14/det_pr20141212wholesale.pdf.
[43] See CEPA (2014), 'Cost assessment – advanced econometric models', March, p. 65, available at: http://www.ofwat.gov.uk/pricereview/pr14/pap_tec1402feederbasiccostappb.pdf.

A3 Precision impact (general approach)

The general approach used by Oxera has been adapted to reflect the characteristics of PR14. Before PR14, the general approach was applied to simple OLS models with a limited number of covariates. Moreover, Ofwat used a 10% residual adjustment factor to take some account of possible errors in the data and in its statistical process. In PR14, Ofwat used an upper quartile adjustment, undertaking the following steps:

1. the estimated coefficients were applied to the observed historical volumes to generate model predictions;
2. efficiency scores and the upper quartile benchmark were derived based on the model predictions from step 1;
3. the historical upper quartile-adjusted allowances of companies performing worse than the upper quartile benchmark were summed to derive the total allowance of inefficient companies;
4. steps 1, 2 and 3 were repeated when the model slopes were perturbed by plus or minus the coefficients' standard errors;
5. step 4 was implemented under a revised set of standard errors, characterised by lower degrees of freedom (1 for the unit cost models, 5 for the BOTEX/TOTEX models);
6. the absolute mean deviation from the total allowance due to perturbation of model coefficients were derived under current and reduced degrees of freedom;
7. the percentage change in the mean deviation under reduced degrees of freedom was subtracted from the upper quartile benchmark;
8. the sum of total inefficiency under the shifted benchmark was derived.

Under the general approach, the results based on the BOTEX/TOTEX models give outlying results with no direct interpretation, as shown in Table A3.1.

Table A3.1 General approach: precision impact (econometric models)

Model	Total cost difference (% deviation)
WM3	4.9%
WM5	4.1%
WM6	1,094.2%
WM9	-44.2%
WM10	9.1%

Note: Under WM6 and WM10 (random effect models), the degrees of freedom are assumed to be based on the simple OLS formula. Under the BOTEX/TOTEX models, we perturb the scale variables only (mains, property density and usage).

Source: Oxera analysis.

These outlying results are due to the complex cost–cost driver relationship underlying these cost models, alongside the presence of an excessively high number of statistically insignificant variables—such a variable is characterised by high standard errors. WM6 and WM9, for example, have six and nine such variables.[44]

[44] See CEPA (2014), 'Cost assessment – advanced econometric models', March, available at: http://www.ofwat.gov.uk/pricereview/pr14/pap_tec1402feederbasiccostappb.pdf.

As a result, the shocks imposed on the coefficients may be too high, leading to outlying, uninterpretable results. For example, when the standard errors are added to their respective scale coefficients, the company-specific elasticity for length of mains is 2.5 and 2.3 for SBW and SWW under WM6. This would imply that a 1% increase in mains length is associated with a percentage increase in TOTEX greater than 2%. This would imply very large diseconomies of scale that are out of line with economic and operational intuition.

Another example can shed light on the unsuitability of this approach. When the standard errors with lower degrees of freedom are added to the default model coefficients in WM6, the resultant upper quartile efficiency score is 2,540%. This would imply that the predicted costs are around 26 times higher than the observed costs for the company in the upper quartile of the efficiency distribution. When standard errors are added to the WM9 coefficients, the upper quartile becomes as high as 707%.

For these reasons, these results must be dismissed. The bootstrapping analysis can be used as an alternative approach and can be applied to all PR14 models.

A4 Specific approach: further results

As we have shown in section 2, statistical theory suggests that extending the timeframe of historical analysis leads to a benefit in precision, even upon losing a comparator. Tables A4.1 and A4.2 show the effects on confidence widths and diagnostic tests when SBW and SWW are replaced with the merged entity and 2013/14 outturn data is added.

Table A4.1 Comparison of confidence widths pre-merger (2008/09–2012/13 data) and post-merger (2008/09–2013/14 data) (PR14, historical period)

Pre-merger (2009/2013)	(CW, %)	Post-merger (2009/2014)	(CW, %)	Average difference (CW, percentage points)
WM3	3.5	WM3	3.0	-0.4
WM5	3.5	WM5	3.5	-0.1
WM6	5.9	WM6	6.2	0.3
WM9	3.7	WM9	3.4	-0.3
WM10	6.5	WM10	6.6	0.1
Average	**4.62**	**Average**	**4.59**	**-0.1**

Note: Confidence width defined as the ratio of the logarithm of the confidence width to the logarithm of the predicted costs. The table presents the unweighted industry average for each model.

Source: Oxera analysis.

For completeness, we show the main model diagnostics in the pre- and post-merger cases, based on an extended modelled period (2008/09–2013/2014).

Table A4.2 Main diagnostic tests (econometric models, modelled period: 2008/09–2013/14)

	WM3		WM5/6		WM9/10	
	Pre-	Post-	Pre-	Post-	Pre-	Post-
RESET test for omitted variables	x	x	x	x	x	x
Link test for model specification	✓	✓	✓	✓	✓	✓
Adjusted R^2 (OLS)	99.5%	99.5%	98.8%	98.6%	98.7%	98.6%

Note: All statistical tests were undertaken at 5% significance.

Source: Oxera analysis.

The R^2 of the TOTEX and BOTEX models are not materially affected by replacing SWW and SBW with the merged entity. While the fit of the models improves marginally under WM3 (from 99.5% to 99.6%), it decreases slightly under WM5/6 and WM9/10. With regard to the outcomes of the diagnostic tests (RESET and Link tests), **again the merger does not have a material impact on model performance.**

A4.1 Intuition of elasticities

Another feature of the PR14 econometric models is the flexible functional form given by the partial translog specification. Translog models are more flexible than Cobb–Douglas models, since they allow for varying returns to scale. For this reason, implied elasticities are company-specific. To assess whether the translog coefficients are intuitive, it is necessary to calculate the implied elasticities for each company. The proportion of intuitive implied elasticities before and after the merger is compared in Table A4.3, using the same

specifications adopted by Ofwat. We conduct this assessment over the sample period 2008/09–2012/13.

Table A4.3 Proportion of intuitive implied elasticities

Model	Scale variable	Historical (2009-2013)		Do company-specific elasticities become more intuitive?
		Pre-merger	Post-merger	
WM3	Mains	100%	100%	No change
WM3	Density	28%	18%	Less intuitive
WM3	Usage	56%	47%	Less intuitive
WM5	Mains	100%	100%	No change
WM5	Density	44%	47%	More intuitive
WM6	Mains	100%	100%	No change
WM6	Density	44%	47%	More intuitive
WM9	Mains	100%	100%	No change
WM9	Density	67%	65%	Less intuitive
WM10	Mains	100%	100%	No change
WM10	Density	67%	71%	More intuitive

Note: Company-specific implied elasticities are deemed intuitive if strictly positive . The last column compares the pre-merger with post-merger average proportion of intuitive elasticities across all models.

Source: Oxera analysis.

Based on the results in Table A4.3, it is possible to conclude that:

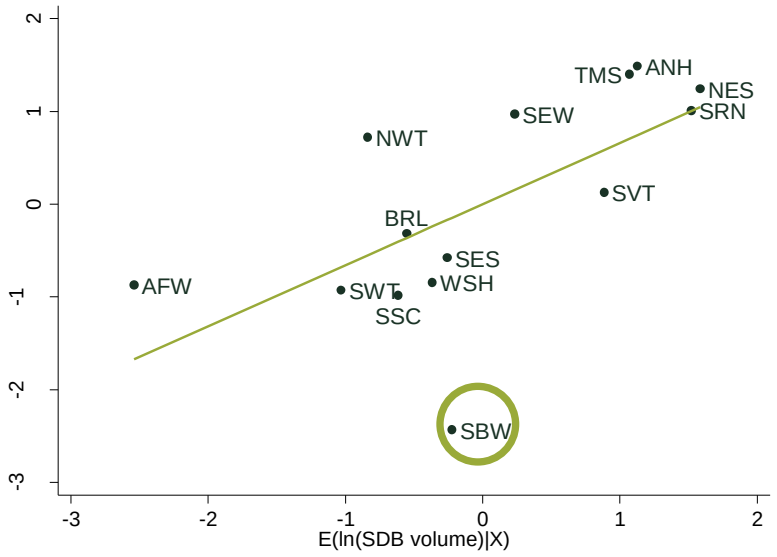
- the merger does not materially affect the length of mains coefficients, which always remain positive and in line with operational expectations. This is valid for all models;
- the merger generally leads to more sensible property density coefficients, which improve under all models with the exception of WM3;
- the usage coefficient is less often intuitive. The usage variable is used in the full TOTEX model (WM3) only.

On balance, the models are largely unaffected by the merger. Under WM3, density and usage become less often intuitive. However, the refined models are more intuitive on average, with the density variable being more often within the expected range.

A4.2 SBW is an outlier in the (log) SDB model, whereas the merged company is not

The added variable plots below show that, under the log SDB model, SBW is an outlier, whereas the merged company is not.

Figure A4.1 SBW is an outlier in the (log) SDB model, while the merged entity is not (pre-merger)



Source: Oxera analysis.

SBW falls below the line of best fit. However, as it is unique in many respects, a simple unit cost model may not be sufficient to explain what drives its performance. The following plot shows the post-merger scenario, where SBW and SWW are dropped and replaced with the merged entity:

Figure A4.2 SBW is an outlier in the (log) SDB model, while the merged entity is not (post-merger)

Source: Oxera analysis.

The distance between the merged entity and the regression line is visibly mitigated in the post-merger scenario, and the results give a more homogeneous representation of the (positive) relationship between the SDB volumes and expenditure. In this case, the merged entity is not a statistical outlier based on student-t and normalised residuals.

A5 Glossary of technical terms

Term	Description
Bootstrapping	Statistical technique that uses the data from the models to evaluate whether the standard errors are biased by selecting data points at random and re-estimating the model a large number of times. This gives an indication of the extent of the statistical uncertainty
Coefficient (of regression)	The estimate of the slope of the line. Where a statistical relationship is y = a + bx, the coefficient of the regression is the estimate of b. A positive coefficient represents an upward-sloping relationship; a negative coefficient represents a downward-sloping relationship
Confidence interval	Measure of the reliability of a statistical estimate. Given a predefined confidence level (most commonly 95%), confidence intervals of repeated estimates will include the true line being estimated in 95% of cases. A narrower confidence interval means that an estimate is more reliable. Larger standard errors tend to increase confidence intervals; more observations tend to reduce confidence intervals
Confidence width	Measure of the uncertainty of a model prediction in terms of TOTEX. Confidence widths represent the sum of the difference between the upper and lower (95%) confidence interval for each company's predicted cost
Degrees of freedom	Number of independent data points used to estimate a statistical relationship. The number is equal to the number of observations less the number of estimated parameters
Model standard error	Measure of how spread out the data is around the line of best fit. It differs from a standard error of a coefficient—a coefficient standard error is the uncertainty around the relationship of one variable. For example, where the statistical relationship is y = a + xb + zc, b will have a standard error and so will c. The model standard error captures the general spread of the data in the whole model
Panel data	Data from a cross-section of companies for a number of years. Data for all water companies for 2008/09 is a cross-sectional dataset, whereas data from all companies for each year 2005/06–2008/09 is a panel dataset
R^2	Measure of the overall fit of the model. It varies between zero and one, where a value close to zero represents a very bad fit, and a value close to one represents a very good fit. Adjusted R^2 is a similar measure of model fit, but is a better measure where the number of degrees of freedom is changing
Regression coefficient	See coefficient (of regression)
Residual	The amount of y that is unexplained by a + xb. It is the vertical difference between a data point and the regression line. In Ofwat's efficiency models, the residual is interpreted as representing efficiency (if the data point is below the line), or inefficiency (if the data point is above the line)
Standard error	The standard error of a coefficient is the amount of statistical uncertainty around an estimate. More spread in the data away from the regression line tends to increase standard errors, as does having fewer observations

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Annex C: Oxera – wholesale cost benchmark

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South West Water

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Contents

Tables and figures

Summary

In PR14, Ofwat undertook a TOTEX assessment of wholesale costs and set companies' cost allowance based on an upper quartile efficiency challenge. The SWW/SBW merger results in the 'loss' of SWW and SBW, and the creation of the new merged entity. In this annex, we examine the impact that the merger may have on Ofwat's comparative regime through the wholesale cost benchmark efficiency challenge that Ofwat will be able to set in future reviews.

While Ofwat has not published its estimated assessment of the impact of a specific merger, in PR14 it quantified its view of the impact of 'losing' SBW in the context of whether it should provide a company uplift on the cost of capital. In its final PR14 determinations, it provided its Value of Comparator analysis for the WOCs.[1]

While that approach can be considered a useful starting point, it is not suitable for assessing the impact of the SWW/SBW merger, given that the impact will occur at PR19. As such, while Ofwat was interested in the efficiency ranking of SBW at PR14, we are interested in the most likely efficiency ranking of SBW at PR19.[2] In addition, the Ofwat analysis looked at the 'loss' of SBW only, and did not consider the counterfactual. As such, Oxera has built on this framework to assess the impact of the SWW/SBW merger on the industry cost allowance by considering the factual (merger) and the counterfactual (no merger) case. In monetary terms, this reflects the impact of the merger on the benchmark at future price reviews.

If the merger results in the loss of a non-upper quartile company, the upper quartile efficiency challenge faced by all companies post-merger will be more stringent, resulting in a net benefit to the comparative efficiency regime.[3] This is the most likely situation with regard to SWW and SBW at PR19, since, under Ofwat's PR14 assessment, SWW is ranked 1st and SBW 9th based on their business plan projections. The benchmark improves post-merger as the merged company is ranked 1st.

The longer-term impact of the merger depends on what happens to the rankings in future. If, for example, both merging parties are likely to be upper quartile performers or both non-upper quartile, the likely impact of the merger is a detriment under the former and a benefit under the latter case. However, if one of the merging parties is more likely to perform significantly better than the other and influence the upper quartile benchmark, the merged entity's performance relative to the upper quartile determines the effect of the merger. As such, a key question in determining the likely impact on Ofwat's wholesale cost comparative regime in the longer term is the likely future ranking of the merged company.

On this question, the impact of merger-specific synergy savings is critical. In terms of the merged entity being more efficient, such cost savings have the potential to create a better comparator than either of the merging parties, thereby setting a more challenging benchmark on the rest of the industry in the post-merger case. As such, it is essential to take into account the impact of such

[1] Ofwat (2014), 'Final price control determination notice: benefits assessment of an uplift on the cost of capital', December.
[2] As well as that of SWW and the merged company.
[3] This is because, in the counterfactual case with 18 companies, the upper quartile lies between the 5th and 6th ranked companies' scores. In the event of a loss of an upper quartile company due to a merger, the benchmark in the factual case with 17 companies improves to the 5th ranked company, thereby setting a more stringent challenge on the industry.

synergy savings as they could produce a benefit for Ofwat's comparative efficiency regime. This is the situation in the case of this merger.

The overall results on the impact of the merger on the wholesale benchmark are presented in the table below.

The impact of the merger on the benchmark under static, deterministic and dynamic approaches

Approach	Impact at PR19 over five years	NPV impact over 30 years [1]
Static	Benefit of £60m	-
Deterministic	-	Benefit of about £23m
Dynamic	-	Benefit of about £30m

Note: [1] Under the deterministic and dynamic approaches, the net impact of the merger at PR19 to PR39 is converted to present values using a 3.5% discount rate. All monetary values reported in this annex are in 2012/13 prices unless otherwise stated.

Source: Oxera, using Ofwat's PR14 wholesale data.

Under the **static approach**, which looks at the immediate impact of the merger on the benchmark at PR19, there is a **benefit of about £60m** due to the upper quartile benchmark becoming more stringent, even without considering synergy savings in the analysis. The upper quartile benchmark improves by about 0.4% due to the 'loss' of SBW, a non-upper quartile company. Similar to SWW's position in PR14, the merged company remains the frontier company at PR19, even without synergy savings.[4] Thus, the expected synergies will not shift the benchmark in the post-merger case.[5] As we are only interested in the impact of the synergies on the rest of the industry, given that the benchmark does not shift with the inclusion of synergies, the benefit under the static case remains at £60m even when the expected synergies are considered.

The **deterministic approach** quantifies the potential longer-term impact of the merger over future price reviews, and follows Ofwat's Value of Comparator approach in PR14. In its analysis, Ofwat quantified the value of losing SBW on wholesale costs to be £25m.[6] To quantify the impact of this merger, this framework needs to be extended to assess a particular factual. That is, the approach needs to be repeated for three entities: SBW, SWW, and the merged entity.

The impact of the merger is the difference in the expected value of the wholesale cost allowances under the scenario with the merged entity less the wholesale cost allowances under the scenario with SBW and SWW as two separate companies. On this basis, the merger is assessed to result in a small detriment of £1m (30-year NPV) under the changes approach used by Ofwat, and a benefit of about £46m (30-year NPV[7]) under the transitions approach. Both changes and transitions methods have been used by the CC in previous merger inquiries to estimate the likelihood of movements in rankings over time.[8] As

[4] We have included only 25% of expected synergy savings in the analysis. In particular, the synergy savings, in annual non-cumulative terms and in 2012/13 prices, are assumed to be [≫]. The merged entity's efficiency score very closely matches that of SWW's under these synergy savings.
[5] In the post-merger case with 15 companies, the benchmark is determined by the efficiency score of the 5th ranked company.
[6] Ofwat (2014), 'Final price control determination notice: policy chapter A7–Annex3: benefits assessment of an uplift on the cost of capital', December, Table A7A.3.
[7] In other words, the impact at PR19 up to PR39 is converted into present values using a 3.5% discount rate.
[8] Oxera's transition probabilities are based on observed changes in TOTEX rankings conditional upon the starting ranking. (Appendices 1 and 2 describe the approach in more detail.) Ofwat's modelled changes method uses historical OPEX and CAPEX, assumes normally distributed ranking movements, and calibrates the variance of these movements to the observed movements. Under Ofwat's approach, starting rankings are taken into account in a limited sense, in that, a priori, a starting ranking of 1 implies fewer small

such, taking an unweighted average of the impact from these results in a benefit of about £23m (30-year NPV).

In five-year NPV terms,[9] the impact is a small benefit of £1.5m under Ofwat's changes approach and a benefit of £41m under Oxera's transition probabilities (giving an average benefit of £21m). In ten-year NPV terms,[10] these numbers are a small benefit of £0.4m under Ofwat's probabilities and a benefit of £53m under Oxera's transition probabilities (an average benefit of £27m).

In this approach, with the exception of alternative probability assumptions, we have used Ofwat's inputs in terms of probabilities and efficiency ratios as used in its Value of Comparator analysis in both the factual and counterfactual cases. As noted in the static case, the merged company is at the frontier at PR19 even without the expected synergies. As such, by construction, the expected synergy savings cannot shift the benchmark in the post-merger (factual) case, and thus the benefit under the deterministic approach is estimated to be about £23m (30-year NPV).

As an alternative to the deterministic approach, Oxera has developed a **dynamic simulation model** to simulate the comparative efficiency exercise a large number of times in order to capture different possibilities over the course of future price reviews. Under this approach, the merger results in a potential benefit of about £30m (30-year NPV) when the synergy savings are considered in the analysis. In addition, the likelihood of the merged company being an upper quartile company at future reviews, and thereby resulting in a benefit to the wider comparative regime, is at least equal to, or higher than, the likelihood of either merging companies.[11] In five-year NPV terms, the benefit is around £12m, and in ten-year NPV terms, it is about £19m.

In summary, the merger results in a company that is likely to be a better comparator, benefiting Ofwat's comparative efficiency regime on the wholesale cost, in terms of setting a more stringent efficiency challenge on the rest of the industry.

movements (i.e. with high probability under normality), while a starting ranking of 8, say, implies many small movements.

[9] In other words, the impact at PR19 is converted into present values using a 3.5% discount rate.

[10] In other words, the impact at PR19 and PR24 is converted to present values using a 3.5% discount rate.

[11] This is the case when synergies are considered, with or without convergence in performance, and whether Ofwat's modelled changes probabilities or Oxera's transition probabilities are used.

1 Background

The assessment in this report follows the modelling principles adopted in the context of previous merger cases along with Ofwat's recent merger consultation.[12] That is, Oxera has applied the modelling principles adopted in the South East Water/Mid Kent (2007) and South Staffordshire/Cambridge Water (2012) merger inquiries, [13] and the high-level recommendations stemming from the 2015 consultation process. In particular, this model follows the concepts of the model developed by Oxera to examine the impact on the benchmark in the South Staffordshire/Cambridge Water (2012) merger inquiry. The same model has not been used as Ofwat's regulatory rules changed between PR09 and PR14. Nevertheless, many of the modelling concepts from our previous work are incorporated in the dynamic simulation model.

In PR14, Ofwat undertook a TOTEX assessment and set companies' cost allowance based on an upper quartile efficiency challenge.[14] The upper quartile lies between the 5th and 6th ranked companies' scores in the 18 companies industry structure, and is the 5th ranked company's score in the 17 companies industry structure. The merger results in 'losing' SWW and SBW, and the creation of the new merged company. In this annex, we examine the potential impact of the merger on the upper quartile efficiency challenge that Ofwat will be able to set in future reviews.

Where relevant, we have also used elements of Ofwat's approach to examining the impact on benchmark, as set out in its decision on the uplift to the cost of capital in its PR14 final determinations, and that from previous CC cases, as summarised in Europe Economics (2015).[15]

In assessing the impact of the merger on the comparative regime, it is necessary to compare the counterfactual scenario (i.e. no merger occurring) with the factual scenario (i.e. with the merger occurring). The latter will need to take into account the synergy savings that the merger will produce, and their impact on the comparative regime.

Taking such synergies into account results in a benefit to the comparative regime, primarily through the creation of a better comparator. In addition, there are further benefits to the merged company's customers; these are not included in the analysis that follows as they tend to be considered at a subsequent stage (i.e. when remedies are discussed, if such a stage is required).[16] In any event,

[12] Ofwat (2015), 'Consultation on Ofwat's approach to future mergers and statement of method', May, available at: http://www.ofwat.gov.uk/regulating/pap_con201505mergers.pdf?download=Download.
[13] Competition Commission (2012), 'South Staffordshire plc/ Cambridge Water plc merger inquiry (CC)- Appendices and Glossary', May, available at: Hhttp://webarchive.nationalarchives.gov.uk/20140402141250/http://www.competition-commission.org.uk/assets/competitioncommission/docs/2012/south-staff-cambridge-water/final_appendices_and_glossary.pdfH, pp. E9-E10. Competition Commission (2007), 'South East Water Limited and Mid Kent Water Limited- A report on the completed water merger of South East Water Limited and Mid Kent Water Limited', May, available at: http://webarchive.nationalarchives.gov.uk/20130704020426/http://www.competition-commission.org.uk/assets/competitioncommission/docs/pdf/non-inquiry/rep_pub/reports/2007/fulltext/525.pdf.
[14] Similar to Ofwat, Oxera assumes that the upper quartile is calculated using Excel's percentile function.
[15] Europe Economics (2015), 'Valuing the Impact of Mergers and Identifying Undertaking in Lieu', p. 37.
[16] In the Mid Kent/South East case, both were assessed to be average performers, and thus unlikely to have an impact on the benchmark, so the synergy benefits did not affect the benchmark. In the South Staffordshire/Cambridge Water case, no definitive numbers were discussed or accounted for. However, as part of the inquiry, it was shown that, along with creating a larger comparator (which was important in determining the benchmark under the PR09 rules), if indicative synergies of a certain size were achieved, the likelihood of creating a better benchmark would be increased.

the latter benefits are different from the *system benefits* to the wider comparative regime that are discussed here.

Benchmarking to the upper quartile implies, as a matter of definition, that losing an upper quartile company is more significant than losing a non-upper quartile company (as the upper quartile benchmark is closer to the 5th ranked company than the 6th). Measuring the impact of a loss of comparator by looking at this particular benchmark skews the odds somewhat in favour of finding a detrimental effect. As stated in Ofwat's merger consultation document:

> It is possible to mitigate the impact of the merger by considering alternative benchmarking rules. For example, in assessing the benchmark effect, the starting point could be adjusted such that the impact of losing a valuable comparator, and a company that was not a valuable comparator, were equalised.

Based on the forecast positions of SWW and SBW at PR19, the merger is likely to result in the loss of a non-upper quartile company. This is an example of a merger benefit cited in Ofwat's merger consultation document.[17] SWW's relative size and efficiency mean that the merged entity is predicted to outperform the upper quartile benchmark, and results in a frontier position. The long-term impact of the merger depends on the likely future movements in these rankings.

Oxera has developed three approaches to quantify the impact of the merger on the benchmark:

- a **static approach**, looking at the impact at PR19, which is more certain;
- a **deterministic approach**, using Ofwat's analysis developed for assessing the small-company premium,[18] but focusing on comparing the factual and counterfactual scenarios, and the forecast position of companies (i.e. not considering the historical position, as this is not relevant for forecasting their starting position at PR19); and
- a **dynamic approach**, which considers changes (shocks) to the relative position of efficient and inefficient companies (efficiency ratios).

The results from these approaches are presented in the sections below.

[17] Ofwat (2015), 'Consultation on Ofwat's approach to future mergers and statement of method', May, available at: Hhttp://www.ofwat.gov.uk/regulating/pap_con201505mergers.pdf?download=DownloadH, p. 22.
[18] See Ofwat (2014), 'Final price control determination notice: benefits assessment of an uplift on the cost of capital', December.

2 Static approach

2.1 Description

To assess the potential 'immediate' impact of the merger at PR19, the static approach involves comparing the industry allowance determined by following Ofwat's PR14 ACTS methodology for the current industry structure with 18 companies (the counterfactual) and the expected industry allowance post-merger with 17 companies (the factual).

In the static approach, Ofwat's PR14 cost models were not re-estimated post-merger with 17 companies as this would involve a number of (potentially incorrect) assumptions in allocating ex post modelling adjustments, referred to as 'deep dives', estimated (on an incremental basis) by Ofwat in the context of the 18 company to the 17 company industry case. Hence, the efficiency of the merged company is estimated as a cost base weighted average of the efficiencies of SWW and SBW with and without potential merger-specific synergies.

In the static approach, the impact of the merger at PR19 is assessed (i.e. over five years only). This approach does not take into account the potential longer-term impact of the merger. Nevertheless, the short-term impact of the merger is more certain than its longer-term impact. Following Ofwat's PR14 approach, our analysis focuses on the allowance set on the industry at the overall TOTEX level.

At PR14, Ofwat assessed SWW to be a frontier company and SBW to be an average company (being ranked 9th). Using a cost base weighted average of SWW and SBW's efficiency, even without synergies, the merged entity ends up as a frontier company post-merger. Hence, the merger results in an improvement to the upper quartile benchmark, and thereby a reduction to the overall industry allowance. The results from the static approach are set out in Table 2.1.

Table 2.1 Summary of the merger impact calculation on the static approach

	Pre-merger results	Post-merger results	Net impact
SWW's rank	1	-	**-**
SBW's rank	9	-	**-**
Merged company rank	-	1	**-**
Upper quartile efficiency benchmark	96.9%	96.5%	**0.4%**
Industry allowance	£18,858m	£18,772m	**£86m**
Industry allowance following basic cost threshold of 105%	£18,853m	£18,772m	**£80m**
Industry allowance following basic cost threshold and 75:25 interpolation	£19,007m	£18,947m	**£60m**

Note: The monetary values are in 2012/13 prices. Positive impacts represents benefits.[19]

Source: Oxera analysis, using Ofwat's PR14 wholesale data.

The analysis indicates that the merger improves the upper quartile benchmark from 96.9% to 96.5%[20] due to a losing SBW, a non-upper quartile company.

[19] Note that the accompanying model reports benefits as negative values.
[20] As the upper quartile score is applied to the model predictions, the smaller the upper quartile score, the smaller is the industry allowance.

This results in industry-wide benefits in the form of a reduction in industry allowance by about £86m at PR19. This reduction would be about £60m if Ofwat's PR14 policy decisions are applied in relation to capping the efficiency score or basic cost threshold (BCT) to 105%, and deriving the menu baseline by combining efficient costs with companies' submitted costs in the ratio of 75:25.

Separately, the efficiency scores for SWW and SBW pre-merger are estimated to be about 109% and 99% respectively.[21] Post-merger, and without accounting for merger synergies, the efficiency of the merger company is estimated to be 107% using the cost base weighted average approach. If the synergy savings are considered in the analysis, the efficiency of the merger company matches closely that of SWW. If Ofwat's BCT of 105% is applied, both SWW and the merged company are assessed to have a capped score of 105%, even without synergies.

Lastly, similar to SWW's position in PR14, the merged company remains the frontier company at PR19, even without synergy savings. Thus, the expected synergies will not shift the benchmark in the post-merger case.[22] As we are only interested in the impact of the synergies on the rest of the industry, given that the benchmark does not shift with the inclusion of synergies, the benefit under the static case remains at £60m even when the expected synergies are considered.

[21] Where a figure greater than 100% implies better than upper quartile efficiency; while a score below 100% represents worse than upper quartile efficiency.
[22] In the post-merger case with 15 companies, the benchmark is determined by the efficiency score of the 5th ranked company.

3 Deterministic approach

3.1 Description

This approach, which we have called the 'deterministic' approach, follows Ofwat's approach in its PR14 Value of Comparator analysis for the WOCs,[23] a different assessment to that required for considering the impact of a specific merger. While Ofwat has quantified the impact of losing SBW as a comparator, it did not examine the factual of a particular merger relative to the counterfactual of no merger. Nevertheless, the framework has elements that are relevant to assessing the impact of a specific merger.

To assess the effect of the merger, the loss as comparators of the merging entities need to be assessed against the Value of Comparator of the merged company. Application of the deterministic approach requires that the Values of Comparator of the merging companies and of the merged company are estimated in each price review, and the impact of the merger is obtained by subtracting the merged entity's value from the sum of the merging entities' values.

Because the approach is based on considering the loss of either an outperforming or an underperforming company (relative to the upper quartile benchmark), the expected value calculations are based on only two possible shifts of the benchmark: a downwards shift (detriment) results if an upper quartile company is lost as a result of the merger, and an upwards shift (benefit) results otherwise. This approach is therefore an extension of the static approach, which uses PR19 forecast positions of companies, and requires an assessment of the probabilities that each of the companies is in the upper quartile at future price reviews.

3.2 Methodology

The potential effect of the merger is estimated using:

- efficiency ratios as predicted by Ofwat at PR19 for AMP6—i.e. using forecast rank positions;
- the likelihood of companies affecting the benchmark (i.e. being in the upper quartile or otherwise) at future reviews. The latter is derived using the 'changes approach' used by Ofwat in its PR14 Value of Comparator analysis for the WOCs.[24]

Oxera estimates the merger counterfactual without re-estimating the cost models. The PR14 models are the not re-estimated in the 17-companies industry case for the reasons set out in section 2. The Value of Comparator of the merged entity is based on the effect of losing a company in the pre-merger industry, and the merged entity's rank in the post-merger industry. The probabilities used to assess the Value of Comparator of the merged entity are also based on the pre-merger industry. In other words, the analysis uses inputs in terms of probabilities and efficiency ratios as used by Ofwat in its Value of Comparator analysis in the factual and counterfactual cases.

This approximation provides a rough guide to the likely impact of the merger. While it is possible to adapt the deterministic approach to capture more closely

[23] Available at http://www.ofwat.gov.uk/pricereview/pr14/pap_tec201412pr14uplift.xlsx
[24] Ofwat (2014), Setting price controls for 2015-20 Final price control determination notice: annex 3 – benefits assessment of an uplift on the cost of capital', December, available at: http://www.ofwat.gov.uk/pricereview/pr14/det_pr20141212riskrewardbenefits.pdf.

the features of the post-merger industry, the alternative is to assess the impact of the merger by moving to a full dynamic approach, which is discussed in section 4.[25]

3.3 Intuition of impact and results

The upper quartile benchmark is asymmetric. The detriment from the loss of an upper quartile company in the industry is estimated at £52m, and the benefit from losing a non-upper quartile company at £17.5m.[26] Given these monetary values, a company will be judged to have positive value as a comparator in a particular price review if it has a greater than 25%[27] chance of being an upper quartile company.

SWW is ranked first, and therefore has a greater than 25% chance of being an upper quartile company—in particular, in PR19, it had an 86% chance based on Oxera's transition probabilities, and a 51% chance based on Ofwat's modelled changes probabilities.[28]

Likewise, the merged entity is ranked first, and therefore has the same probability as SWW of remaining in the upper quartile. If Ofwat's inputs in its Value of Comparator analysis are used in the factual and counterfactual cases, the merged company (in the same frontier position) has the same value as a comparator as SWW. Quantifying the impact of the merger is thus equivalent to quantifying the impact of the loss of SBW on the upper quartile[29] (noting that the loss of a non–upper quartile company is a benefit to the comparative regime).

SBW is assessed to be a non-upper quartile company. More specifically, it is assessed as an average company. It is ranked 9th, and in PR19 has a 10% chance of making it to the upper quartile under Oxera's transitions probabilities and a slightly higher, 24% chance, under Ofwat's modelled chances probabilities. This probability increases to 28% under Oxera's transitions and to just above 25% under Ofwat's changes in subsequent price reviews. Therefore, the loss of SBW will evolve, from having a benefit to the comparative regime at PR19 to eventually being a detriment under Oxera's probabilities, and from having virtually no impact to a slight detriment under Ofwat's probabilities. Table 3.1 below details the impact at each price control review.

[25] Oxera notes that Ofwat's 'modelled' rank movement probabilities are given for the pre-merger industry only. Separate consideration for the post-merger industry would therefore not be feasible with Ofwat's published probabilities.
[26] Note that there is an asymmetry here, as discussed further in section 4.
[27] In other words, 17.5/(52.4+17.5).
[28] Oxera's transition probabilities are based on observed changes in rankings conditional upon the starting rank. Ofwat's modelled changes assume normally distributed rank movements and calibrate the variance of these movements to the observed movements. Starting ranks are only taken into account in a limited sense in Ofwat's approach, in that, *a priori*, a start rank of 1 implies fewer small (i.e. high probability under normality) movements, while a start rank of 8, say, implies many of them.
[29] If SBW's Value of Comparator was ruled out of consideration, the merger would have zero impact, under either Ofwat's modelled changes probabilities or Oxera's transitions probabilities, *in all price* reviews. In the deterministic approach, the case of no merger may therefore be treated as the counterfactual, and we may simply look at the value of SBW as a comparator.

Table 3.1 Values as comparator of the merging entities and of the merged entity under different probability assumptions (AMP discounted terms, £m in 2012/13 prices)

	Transition probabilities			Ofwat's modelled probabilities		
	Value of merged company	SWW+SBW	Impact	Value of merged company	SWW+SBW	Impact
PR19	166	125	**41**	70	68	**2**
PR24	91	79	**12**	21	22	**-1**
PR29	50	50	**0**	7	8	**-1**
PR34	29	33	-3	2	3	**0**
PR39	18	22	**-4**	1	1	**0**
Total			**46**			**1**

Note: Based on Ofwat's forecast (AMP6) TOTEX positions, and Ofwat's Value of Comparator analysis. Positive impacts represents benefits.

Source: Oxera analysis, using Ofwat's wholesale cost data.

In NPV terms, over 25 years this implies a benefit under Oxera's transition probabilities of around £46m and a detriment under Ofwat's modelled changes of around £1m. Both changes and transitions methods have been used by the CC in previous merger inquiries to estimate likely movements in rankings over time. As such, taking an unweighted average of the impact from these results in a benefit of about £23m (30-year NPV).[30] **Over the more certain five- (and ten-) year periods, there is a benefit of £41m (£53m) under Oxera's transition probabilities, and a benefit of £1.5m (£0.4m)[31] under Ofwat's modelled changes.**

Lastly, in this approach, with the exception of alternative probability assumptions, we have used Ofwat's inputs in terms of probabilities and efficiency ratios as used in its Value of Comparator analysis both in the factual and counterfactual cases. As noted in the static case, the merged company is at the frontier at PR19 even without the expected synergies. As such, by construction, the expected synergy savings cannot shift the benchmark in the post-merger (factual) case, and thus the benefit under the deterministic approach is estimated to be about £23m (30-year NPV).

[30] The £1m detriment due to the loss of SBW differs slightly from its Value of Comparator (£0.6m) quantified by Ofwat (with AMP6 starting points) owing to a slightly different discounting rule. Oxera discounts the NPV streams to 2019, and therefore applies a further four years of discounting to the NPVs assumed to start at 2015. Ofwat's finding of a £25m value is based on averaging between results obtained with the historical cost base (where SBW is an upper quartile company) and the forecast cost base (where it is a non-upper quartile company).
[31] Values do not appear to tally with the table, due to rounding.

4 Dynamic approach

The objective of the dynamic approach is to simulate the wholesale cost framework exercise a large number of times to capture different possibilities over the course of the next five price reviews, and to assess the potential impact on the benchmark (and thereby the wholesale cost allowance set for the industry) of 'losing' two companies (SWW and SBW) and 'gaining' a new one (the merged company).

The dynamic approach takes into account that the industry may change over a number of price reviews (in terms of rankings, efficiencies etc.). It quantifies the effect of the merger over a large number of simulations, based on observed information in the industry, and averages the results across these possible outcomes. A detailed description of the simulation model is discussed in Appendix 2 of the report.

4.1 Intuition of the likely impact in a 'general' merger context

As in Ofwat's Value of Comparator analysis, the outcome is beneficial if the merger results in a loss of a non-upper quartile company, and detrimental if it results in a loss of an upper quartile company.[32]

The direction of the outcome therefore depends on the likelihood of the three entities (SSW, SBW and the merged company) influencing the benchmark at future price control reviews.

The direction of the outcome therefore depends on:

- the rankings of the merging parties and the merged company in future price reviews;
- the likelihood and impact of merger synergy savings on the merged company.

With regard to the latter, we have assumed a synergy saving scenario.[33] Taking into account such synergies results in a benefit to the comparative regime, primarily through the creation of a better comparator. The synergy savings also result in direct benefits to the merged company's customers through price reductions. However, we have not included the latter element in the impact assessment as the focus of this report is the impact on Ofwat's wholesale cost comparative regime.

With regard to the former, if both merging parties are upper quartile companies in a price review, the impact is detrimental, and if both are non-upper quartile companies, the impact is beneficial. If one is an upper quartile company and the other is not, the impact depends on the position of the merged entity in the post-merger industry.

The merger is therefore more likely to result in a benefit than a detriment if the merging companies are inefficient (with respect to upper quartile), or if one company performs much better than the other, and the merged entity's performance is closer to the performance of the more efficient party.

[32] The number of possible outcomes is higher than two even if the approach is implemented with fixed efficiency scores. This is because it is possible that the merged entity's efficiency coincides with the benchmark efficiency.
[33] We have only included 25% of expected synergy savings in the analysis. In particular, the synergy savings, in annual non-cumulative terms and in 2012/13 prices, are assumed to be around [⁜].

The direction of the expected merger impact depends on the probability of benefit and detriment, as well as the magnitude of the upwards shift (in the case of benefit) and downwards shift (in the case of detriment) in the benchmark.

If these shifts are *asymmetric*, the expected merger impact will not be zero, even if there is an equal probability of benefit and detriment. This is because the expected merger impact is given by the *difference* in the shifts,[34] which will be non-zero because of the asymmetry. This is the case with the use of an upper quartile benchmark.[35] As stated in its merger consultation,[36] Ofwat could use a different methodology (e.g. in this case, potentially a different benchmark definition to offset this impact).

As explained above (and in Appendix 2), the shift of the benchmark in the case where an upper quartile company is lost following the merger is different from the shift that occurs when a non-upper quartile company is lost. In particular, due to the particular method used to determine the upper quartile efficiency, improvements in the benchmark in possible industries where benefits occur are lower (in monetary terms) than where detriments occur. This benchmarking rule sets a demanding standard for the merger. It means that, for the benchmark to improve on average following the merger, industry rankings that result in benefits must be *more likely* than industry rankings that result in detriments. The magnitude of this asymmetry is determined by the spread of efficiencies in the industry.[37]

4.2 Intuition of the likely impact in this merger

On the basis of AMP6 efficiency scores, SWW is ranked first, and SBW eighth. The relative sizes of the companies' cost bases mean that the merged entity will be ranked first in the post-merger industry (even where no synergies are assumed). If the rankings were perfectly 'sticky', such that the companies remained in their AMP6 positions in all future price reviews, then the effect of the merger would be to reduce the industry allowance, and thereby result in a benefit to the wider comparative regime.

This merger is more likely to result in a benefit than a detriment throughout the horizon. This is because the probabilities employed in the simulation imply a degree of stickiness with respect to the AMP6 rankings. The outcome therefore resembles the outcome at AMP6 to some extent. However, this resemblance reduces over time as the rank movements become less sticky. This reflects the intuitive notion that today's information is more relevant in the immediate than the not so immediate future.

The SWW/SBW merger results in a loss of a non-upper quartile company, and thereby an improvement to the industry benchmark such that it can benefit the wider comparative efficiency regime.

4.3 Results of the dynamic approach

The direction of the expected merger impact depends on the probability of benefit and detriment as well as the magnitude of the upwards (in case of benefit) and downwards (in case of detriment) shift in the benchmark.

[34] Strictly speaking, expected value is given by the difference in shifts times the probability of benefit or detriment which are assumed to be equal in this scenario.
[35] While there is no universally accepted definition of 'upper quartile' for discrete probability distributions, Ofwat's approach using Excel's percentile function results in an asymmetric benchmark shift.
[36] Ofwat (2015), 'Consultation on Ofwat's approach to future mergers and statement of method', May, available at: Hhttp://www.ofwat.gov.uk/regulating/pap_con201505mergers.pdf?download=DownloadH, p. 30.
[37] The efficiency scores, and not just the rankings, influence both the direction and magnitude of the merger impact. A flexible simulation approach, as adopted by Oxera, aims to address the numerous possibilities.

If slight convergence in performance occurs in the industry from PR24 onwards, and when synergy savings are considered in the analysis,[38] the merger produces a benefit of around £12m over a five -year period, £19m over a 10-year period, and £30m over 30 years (in NPV terms).[39]

If no convergence is assumed to occur and when synergies are considered in the analysis, the merger produces a benefit of around £12m over five years, £14m over 10 years, and £5m over 30 years (in NPV terms).

4.4 Likelihood of merging companies and merged entity being upper quartile-efficient

Even in cases where a potential detriment is identified in the expected value calculation, the merger is likely to be beneficial, as explained below.

Table 4.1 gives the probability that each company outperforms the upper quartile benchmark by price review, under alternative probability assumptions. These results suggest that the merged company is more likely to outperform the benchmark than either of the merging companies individually, thus indicating that a benefit from the merger is more likely.

Table 4.1 Probability (%) that each company outperforms the benchmark, by price review

	Transition probabilities			Ofwat's modelled probabilities		
	SWW	SBW	Merged company	SWW	SBW	Merged company
PR19	87	10	88	54	26	57
PR24	64	21	75	38	28	52
PR29	50	27	65	32	29	46
PR34	43	27	58	30	27	44
PR39	38	28	54	29	28	43

Note: Results are presented for 10,000 replications, under assumptions of efficiency shocks, convergence, and synergies.

Source: Oxera analysis, using Ofwat's PR14 wholesale data.

The intuition of likely benefit from the merger is confirmed by the probabilities shown in Table 4.2.

[38] This scenario assumes relatively limited convergence, in that the extremes of the efficiency scores observed in PR14 disappear by PR24. This is further discussed in Appendix 2.
[39] As discussed in Appendix 2, this assessment does not include possible synergy savings passed on to the merged company's customers, but does include the effect of synergy savings on the benchmark efficiency challenge on the rest of the industry.

Table 4.2 Probability (%) of benefit from the merger by price review, with and without the effect of synergy savings on the benchmark

	Transition probabilities		Ofwat's modelled probabilities	
	No synergies	Synergies	No synergies	Synergies
PR19	80	88	65	71
PR24	69	83	65	77
PR29	65	80	65	77
PR34	66	79	67	78
PR39	65	78	66	77

Note: Results are presented for 10,000 replications, under assumptions of efficiency shocks, convergence, and synergies.

Source: Oxera analysis using Ofwat's PR14 wholesale data.

Under Oxera's transition probabilities, a benefit becomes gradually less likely, while under Ofwat's probabilities, it becomes more likely over time. Thus, under Ofwat's probabilities, the relatively less beneficial impact early on is given more weight than the more beneficial impact occurring in the less immediate future.

Lastly, the merger is predicted to have a beneficial effect on the benchmark, except at horizons of more than ten years when no synergies are considered; when the synergies are considered, the merger is predicted to have a beneficial impact across all horizons (see Table 4.3).

Table 4.3 Expected NPV impact on the benchmark (£m)

	No synergies	Synergies
5 years	2	12
10 years	-1	19
30 years	-9	30

Note: Averages of results obtained with Ofwat's modelled changes probabilities and Oxera's transition probabilities, each based on 10,000 replications, efficiency shocks, and convergence. Positive impacts represents benefits.

Source: Oxera analysis using Ofwat's PR14 wholesale data.

To assess the robustness of these results, Oxera has tested a number of sensitivities, as discussed in sections 4.5 to 4.8 below. These sensitivities do not change the conclusion that the merger produces a benefit on the benchmark when the synergies are considered in the analysis.

4.5 No efficiency shocks

Oxera has tested the sensitivity of the results to the absence of noise in the efficiency scores. The results confirm that the use of efficiency shocks, as implemented by Oxera, does not change the conclusions qualitatively. The shocks are a device that makes the calculation more likely to reflect reality, as it may not be reasonable to assume that companies will have known and constant efficiency scores up to PR39.

Table 4.4 Expected NPV impact (£m) on the benchmark at fixed efficiency scores

	No synergies	Synergies
5 years	4	11
10 years	1	18
30 years	-6	28

Note: Averages of results obtained with Ofwat's modelled changes probabilities and Oxera's transition probabilities, each based on 10,000 replications, efficiency shocks, and convergence. Positive impacts represents benefits.

Source: Oxera analysis using Ofwat's PR14 wholesale data.

4.6 No convergence

For a given direction in the benchmark shift, the impact of the merger on the industry allowance depends on the spread of the efficiency scores. Convergence generally reduces the impact of the merger, whether a benefit or detriment.[40] Oxera has tested a sensitivity where no convergence occurs.

The results, presented in Table 4.5, indicate that the impact of the merger is dampened by convergence, but the impact of synergies is exacerbated to some extent. This happens because the benchmark shift is more likely to be affected when dispersions are more marginal—i.e. the companies' performance is more similar.

Table 4.5 Expected NPV impact (£m) on the benchmark when convergence is not considered

	No synergies	Synergies
5 years	2	12
10 years	-5	14
30 years	-26	10

Note: Averages of results obtained with Ofwat's modelled changes probabilities and Oxera's transition probabilities, each based on 10,000 replications with efficiency shocks. Positive impacts represents benefits.

Source: Oxera analysis using Ofwat's PR14 wholesale data.

Table 4.6 shows results from a sensitivity where neither efficiency shocks nor convergence are considered.

[40] In the simulation setting, such convergence means that distances between the midpoints of the intervals from which efficiency scores are drawn are reduced. In the absence of efficiency shocks, Oxera assumes that, in PR24, the second-highest PR19 efficiency score becomes the highest efficiency score in the industry, and the second-lowest efficiency score becomes the lowest, while the percentage gaps between efficiency scores are kept constant. This PR24 spread is then assumed to prevail in PR29 up to PR39. In the case of efficiency shocks, the non-overlapping intervals from which scores are drawn are defined around the converged point estimates.

Table 4.6 Expected NPV impact (£m) on the benchmark using fixed efficiency scores and when convergence is not considered

	No synergies	Synergies
5 years	4	11
10 years	-3	12
30 years	-25	4

Note: Averages of results obtained with Ofwat's modelled changes probabilities and Oxera's transition probabilities, each based on 10,000 replications without efficiency shocks. Positive impacts represents benefits.

Source: Oxera analysis using Ofwat's PR14 wholesale data.

4.7 Alternative benchmarking rule with symmetric merger benefits and detriments

As explained above, application of the upper quartile benchmark rule results in an asymmetric effect, with considerably different magnitudes of impact from removing an upper quartile company and removing a non-upper quartile company. On this point, as noted previously, Ofwat made the following observation in its merger consultation document:

> It is possible to mitigate the impact of the merger by considering alternative benchmarking rules. For example, in assessing the benchmark effect, the starting point could be adjusted such that the impact of losing a valuable comparator, and a company that was not a valuable comparator, were equalised.[41]

To illustrate the extent to which this asymmetry by design drives the results of the assessment, Oxera has implemented a sensitivity in which the benchmark shift is symmetric—i.e. the shift has the same magnitude (but in the opposite direction) whether an upper quartile company or a non-upper quartile is removed from the industry.[42] The results from this sensitivity are presented in Table 4.7.

Table 4.7 Expected NPV impact (£m) on the benchmark with symmetric benchmark shift

	No synergies	Synergies
5 years	48	58
10 years	60	79
30 years	84	123

Note: Based on 10,000 replications, efficiency shocks, convergence, pre-merger benchmark adjusted to give symmetric impact. Positive impacts represents benefits.

Source: Oxera analysis using Ofwat's PR14 wholesale data.

The results indicate that, even when synergies are not considered in the analysis, the merger leads to a benefit when the benchmark shift is assumed to be *symmetric*, such that a positive and a negative impact of the merger on the benchmark are valued equally. This (indirectly) confirms the result in section 4.4 that the merged entity is more likely to outperform the upper quartile benchmark and result in a net benefit to the comparative regime than either of the merging companies individually.

[41] Oxera notes, however, that assigning a fixed position as the benchmark would imply, as a matter of definition, that the merger could never be judged beneficial in expectation. At most, it could be found not to have an effect on the benchmark.
[42] In practice, this is implemented by adjusting the pre-merger 75th percentile benchmark downwards slightly.

5 Conclusion

In this report, Oxera has assessed the potential impact of the SWW/SBW merger on the wholesale benchmark challenge that Ofwat will be able to set in future reviews. As merger-specific synergy savings have the potential of creating a better comparator, we have to take into account the impact of merger-specific synergy savings as they could produce a benefit for Ofwat's comparative efficiency regime.

Under the **static approach**, which looks at the immediate impact of the merger on the benchmark at PR19, there is a benefit of about £60m due to the upper quartile benchmark becoming more stringent. The result holds even without considering synergies in the analysis.

The **deterministic approach** quantifies the potential longer-term impact of the merger over future price reviews, and follows Ofwat's Value of Comparator approach in PR14. In its analysis. On this basis, the impact of the merger is assessed to result in average benefit of about £23m (30-year NPV). The result holds even without considering synergies in the analysis.

Under the **dynamic simulation model** that simulates the comparative efficiency exercise a large number of times to capture different possibilities over the course of the future price reviews, the merger results in a potential benefit of about £30m (30-year NPV) when the synergy savings are considered in the analysis. Oxera has assessed the robustness of the core results from this approach using a large number of sensitivities. Our results indicate that the sensitivities do not change the conclusion that the merger produces a benefit on the benchmark when synergies are considered in the analysis.

In conclusion, the merger results in a company that is likely to be a better comparator, benefiting Ofwat's comparative efficiency regime in terms of setting a more stringent efficiency challenge on the rest of the industry.

A1 Inputs to the simulation model

A1.1 Efficiency scores

AMP6 efficiency scores, as given by Ofwat in its Value of Comparator calculation spreadsheet[43] (Totex.Inputs -tab), are used to determine the starting ranking of each company, to which the ranking shocks applied in the simulation are anchored.

The transition probabilities calculation is based on smoothed year-on-year forecast positions. Oxera computes the scores for these as ratios of triangulated predicted and company-submitted (or actual) costs.

- Actual costs. Over the historical period (2009-2015), actual (TOTEX, BOTEX, enhancement and unmodelled) costs are triangulated following Ofwat's weighting method. Over the forecast period (2016-2020), actual costs are defined as the company menu baseline representation, net of (the company view of) menu exclusions.
- Predicted costs. Over the period 2009-2015, predicted costs follow the triangulation approach used by Ofwat and are benchmarked to the historical upper quartile (upper quartile). Over AMP6, cost thresholds include deep dives and are net of (Ofwat's view of) menu exclusions.[44]

Oxera then constructed the efficiency ratios by dividing the five-year running sum of the predictions by the five-year running sum of the company-submitted or actual costs (i.e. five-year smoothed averages). This smoothing was necessary to even out any year-by-year fluctuations that may not be reflective of efficiency. Smoothing has the effect of losing the first four years of data (2009–12).

A1.1.1 Range of ratios associated with each rank

The range of efficiency ratios for TOTEX was constructed using Ofwat's point estimates. For each rank, an interval was defined around the point estimate such that the lower (upper) end of that interval was exactly halfway between the point estimate and the next-lower (higher) point estimate. The combined length of these intervals then covers the entire range of efficiencies in the industry, except for small wedges driven between the limits so that the intervals are non-overlapping. For each rank, the simulation involves drawing an efficiency ratio uniformly from the resulting interval.

A1.1.2 Convergence

Oxera computes a scenario where point estimates of the efficiencies remain at AMP6 level until PR39. However, a more reasonable scenario is one where the extremes disappear over time. In this scenario, convergence occurs at PR24. Convergence is taken to mean that the extremes of the efficiency scores observed in the industry disappear—i.e. the second-highest efficiency score in PR19 becomes the highest efficiency score in PR24, and the second-lowest becomes the lowest. The remaining efficiency scores are assigned to rank positions such that the percentage of the total gap represented by the gap between any two efficiency scores in PR19 remains the same. The scenario is therefore conservative, as it implies that the information about the spacing of the scores in AMP6 is retained, while the total range shrinks once between PR19 and PR24. No further convergence is assumed in this scenario.

[43] Available at http://www.ofwat.gov.uk/pricereview/pr14/pap_tec201412pr14uplift.xlsx
[44] To construct the AMP6 ratios, the cost thresholds include post-upper quartile triangulated predictions, post-upper quartile deep dives, and are net of (Ofwat's view of) menu exclusions.

When efficiency shocks are applied in the convergence scenario, the distributions from which the new efficiencies are drawn are defined on the basis of the converged point estimates.

A1.1.3 Rank movement probabilities

Oxera uses two specifications of five-year rank movement probabilities, as follows.

- Transition probabilities based on smoothed year-on-year movements in companies' rankings. For all possible starting positions (1–18), these probabilities quantify the frequency with which companies have been observed to move to particular positions.[45] The starting position of companies is explicitly taken into account when the probabilities are computed. Oxera has additionally applied an adjustment to the conditional rank movement probabilities for the 18th company. Although no movement is observed at the position in the data that is used to compute the probabilities, a small chance (5%) is given to the 18th company moving up in the rankings.

- Ofwat's modelled probabilities are based on the assumption that rank movements are normally distributed.[46] Oxera understands that, in order to compute these probabilities, Ofwat's uses OPEX and CAPEX rankings data (with 60% weight on CAPEX, and 40% on OPEX). It used observed changes in ranking to quantify the likely spread of movements in rankings (the standard deviation of the assumed normal distribution; the mean is zero because a change in one company's ranking implies an offsetting change in another company's ranking). A company's starting position determines how many ranking positions it can move up or down. This implies that different probabilities are defined for the same movement for different starting positions. The starting position of companies is therefore taken into account indirectly, but is not directly linked to the observed movements starting from any given rank.

[45] A consequence of this is that if a particular rank movement is not observed, it will not be considered possible. For example, if the 18th company always stays 18th, transition probabilities do not give a chance to move to another position. Oxera mitigates this by tweaking the transition probabilities to give the 18th company a small chance of moving up in the rankings from PR19 onwards.
[46] This is, even in theory, an approximation because the normal distribution is continuous while rank movements are discrete.

A2 Description of the simulation model

[✂]

A3 Simulation model: a glossary

Oxera has enclosed a copy of its simulation model. This produces results for the TOTEX cost base using Oxera's transition probabilities or Ofwat's changes probabilities.[47] A glossary of terms used in the model is provided below.

Term	Description
Allowed cost	**Ofwat's view of a company's required costs in a realised industry and the company's submitted costs are interpolated in the ratio 75%:25%**
Benchmark	The upper quartile of efficiencies (not rebased or capped) in the industry—the 5th highest efficiency in an industry of 17 companies and between the 5th and 6th efficiency in an industry of 18 companies
Capped efficiency	The maximum of 1.05 and the company's rebased efficiency
Cdfs (cumulative distribution functions) (set out in reverse order)	Alternative representation of the transition probabilities. For instance, a cell with row title '1' and column title '2' gives the probability that a company moves from the first position to the second position *or higher* between now and the price review to which the probability matrix pertains
Delta_1	Difference in industry allowance before and after the merger in year 1 (similar definition for Delta_j, j=2,…,25, where j represents a year). A negative value indicates that the industry allowance has decreased as a result of the merger
Deltas_1	Additional effect on the post-merger industry allowance OPEX through synergy savings via other companies' allowances (excludes any change in the merged entity's allowance)
Efficiency distribution	Upper and lower bounds of the uniform distribution by rank order based on AMP5 and AMP6 efficiencies. Efficiencies for the rankings are drawn from this distribution
Efficiency score	Ratio of predicted to actual costs
Implied efficiency of merged company	Ratio of the summed predicted and summed actual costs of SWW and SBW; arithmetically equivalent to the cost base-weighted average of SWW's and SBW's efficiency scores
Industry allowance	Sum of the allowed costs of the companies in the industry (18 before the merger and 17 after it)
NPV of merger effect	Net present value of the annualised stream of merger effects (changes in industry allowance as a result of the merger), discounted at the user-chosen rate (here, 3.5%), and further discounted by four years to account for the fact that the effects would be realised from 2019 onwards (further discounting by four years is done outside of the simulation model)
Pmfs ('probability mass functions')	Transition probabilities. For instance, a cell with row title '1' and column title '18' gives the probability that a company moves from the first position to position 18 between now and the price review to which the probability matrix pertains
Rebased efficiency	Company's efficiency score divided by the industry benchmark (equal to 1 for a company with an efficiency score equal to the benchmark efficiency)
Replications	Number of possible futures for the industry generated in the course of the simulation
Re-shuffle for tiebreaking	Preference order drawn randomly for each company that determines the relative ranking of companies within any ties
Run	Specific possible industry (ranges from 1 to 1,000 if replications are set to 1,000)
Seed	Initialisation provided for the pseudo-random number generator in VBA. For exact replication of the results, the seed should not be altered
Transition frequencies	Alternative term for transition probabilities.

[47] Ofwat's probabilities are derived for TOTEX based on PR09 OPEX and CAPEX models.

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Annex D: Oxera – Retail Average Cost to Serve

Prepared for
South West Water

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Tables and figures

Summary

In PR14, Ofwat set separate efficiency challenges for unmetered costs and metered costs in the household retail sector. Its methodology is based on companies' costs to serve (CTS) in 2013–14. In particular, for each customer type, a company with a CTS per customer above the industry average cost to serve (ACTS) is deemed inefficient, and has to reduce its CTS gradually to reach the ACTS by the end of AMP6.

In its PR14 determination of whether it should provide a company uplift on the cost of capital, Ofwat published the value of comparator analysis for the WOCs.[1] In its assessment, Ofwat concluded 'there was insufficient evidence to establish that a merger would result in a detriment to customers through an impact on the retail cost assessment methodology.'[2] This assessment did not consider a specific counterfactual. As such, Oxera has built on this framework to assess the impact of the SWW/SBW merger on the industry cost allowance by considering the factual (merger) and the counterfactual (no merger) case.

For this merger, two types of ACTS are of relevance:[3] the unweighted average of companies' unmetered CTS; and the unweighted average of companies' CTS for additional metering costs for water service. We have estimated the impact of the merger on the benchmark for these separately, and combined the results from these to determine the combined impact.

The impact of the merger on the benchmark largely depends on the efficiency rankings of the two merging companies and the doubtful debt adjustments on unmetered CTS.[4] If SWW and SBW are both inefficient relative to the benchmark, overall the merger would result in the removal of one inefficient company and the benchmark would improve; this would benefit the wider comparative regime in terms of reduction in the industry allowance. Conversely, if one of the companies is efficient relative to the benchmark, the merger would effectively remove one efficient company from the industry, and the benchmark could worsen.

When assessing the longer-term impact, the likelihood of SWW, SBW and the merged entity to be efficient relative to the benchmark needs to be considered, alongside any expected convergence in cost performance.

Oxera assessed the impact of the merger on the benchmark using two approaches:

- **static approach**: this considers the immediate impact of the merger at PR19 using the PR14 methodology. It is examined by comparing the impact on household revenue in the counterfactual (18-company industry structure) and factual (17-company industry structure) case through the impact on the ACTS benchmark;
- **deterministic (probabilistic) approach**: this considers the longer-tem impact of the merger by examining the likelihood of the merging companies

[1] Ofwat (2014), 'Final price control determination notice: benefits assessment of an uplift on the cost of capital', December.
[2] Ibid., p. 32.
[3] This is because SBW being a WOC does not affect ACTS for sewerage only, and water and sewerage customers.
[4] Ofwat excludes adjustments for company-specific factors such as doubtful debt before computing companies' unmetered CTS. Given that one of the merging companies, SWW, was allowed a doubtful debt adjustment in PR14, the impact of the merger on this adjustment at PR19 (and possibly beyond) must also be considered.

and the merged company to influence the benchmark, and thereby the efficiency challenge set for the industry. This approach uses Ofwat's PR14 value of comparator analysis for the WOCs as a basis, and information on Ofwat's expectations of how the retail efficiency challenge could evolve at future price controls, as stated in its merger consultation and statement of method paper.[5] The framework has been adapted in a merger context by focusing on the factual and counterfactual scenarios to assess the net impact on the wider comparative regime.

Under the static approach, for unmetered customers, there is a benefit of about £18m driven by a reduction in the doubtful debt adjustments owing to the merger,[6] which lowers the overall industry allowance. For metered CTS, there is a marginal detriment as SWW is a better-than-average company in the counterfactual case. However, this detriment is more than offset by the benefit for unmetered customers such that, at the combined level, there is an overall benefit of about £17m over five years.

If the doubtful debt adjustments are not re-estimated in the post-merger case, and Ofwat's PR14 adjustments are used, the static approach results in a benefit of about £7m over five years. This is driven by SWW and SBW's relative positions at PR14. Both are assessed to be worse than the average company on unmetered costs (with rankings of 16 and 13 respectively).[7] The merger overall results in the loss of an inefficient company, which improves the industry ACTS benchmark for unmetered customers. Taking into account the detriment of £2m for metered customers, the net impact at the combined level is a benefit of about £5m over five years.

As the PR14 ACTS analysis is undertaken on a historical cost basis, we have used information in the base-year period considered in the PR14 analysis, 2013/14, to examine the impact of the merger in PR19.[8] We have also considered the PR14 projected costs of companies over AMP6 in the analysis in order to assess the impact. Regardless of the information used in the static analysis, the merger results in a net benefit (as shown in the table below).

Net impact of the merger under the static approach using historical and forecast information at PR19 (£m)

Information used	Unmetered customers	Metered customers	Combined impact
Historical	18	-1	17
Forecast	7	-2	5

Note: The results are presented for the case where the doubtful debt adjustments are re-estimated in the post-merger scenario. As noted, under this approach the merger results in a net benefit, even where the adjustments are not re-estimated. Merger-specific synergies are not considered in the analysis.

Source: Oxera, using Ofwat's PR14 published data on household retail. All in 2013/14 prices.

In its PR14 final determinations, Ofwat stated that its approach to setting allowed retail household revenue will evolve over time, and it is likely to consider a more stringent benchmark in future.[9] This is because it expects companies' CTS to

[5] 'This convergence in performance is imposed in a deterministic manner as well'. See Ofwat (2015), 'Consultation on Ofwat's approach to future mergers and statement of method', May, p. 70.
[6] This is because the merged entity has less extreme characteristics on drivers of doubtful debt (i.e. deprivation levels and bills) than SWW, for which Ofwat allowed a doubtful debt adjustment in PR14.
[7] The ranking are based on companies' CTS net of (i.e. excluding) company-specific adjustments for doubtful debt, input price pressure and new costs.
[8] This is in contrast to the PR14 wholesale cost assessment, which focused on assessing companies' cost projections over AMP6 using historical information.
[9] Ofwat (2014), 'Final price control determination notice: policy chapter A5–household retail costs and revenues', December, p. 3.

converge over time, such that differences in CTS are minimised at future price reviews.

As such, the deterministic approach was also applied in conjunction with the upper quartile benchmark and cost convergence over time.[10] Under this approach, the benefits due to the reduction in doubtful debt adjustments as identified under the static approach are not considered.

The analysis indicates that, for unmetered costs, there is a benefit of around £38m. This is offset by a detriment of about £17m for metered customers, such that there is a net benefit of about £21m at the combined level.[11] The results are directionally similar to those under the static approach, and the rationale is also similar, although the overall benefit marginally reduces owing to cost convergence. In particular, the benefit in unmetered CTS is due to losing a non-upper quartile company, while the small detriment on metered CTS is due to losing a upper quartile company in SWW such that there is a net benefit at the overall level. The results under this approach in future price controls are presented in the table below.

NPV of the merger under the deterministic (probabilistic) approach over 30 years (£m)

	Unmetered customers	Metered customers	Combined impact
Benchmark set at the upper quartile (or lower quartile of companies' CTS)	38	-17	21

Note: The results are presented for the case where Ofwat's changes approach was used to determine the likelihood of companies being upper quartile-efficient or otherwise at future controls. The probabilities were derived using information from 2013/14 onwards, as this data was deemed more robust by Ofwat. Merger-specific synergies are not considered in the analysis.

Source: Oxera, using Ofwat's PR14 published data on household retail. All in 2013/14 prices.

In summary, Oxera's analysis indicates that the merger of SWW and SBW results in a more challenging benchmark that will benefit the wider comparative efficiency regime on household retail, and thereby customers. This result holds even without considering any merger-specific savings. To the extent that the expected merger synergies would be included, the comparative benefit could be yet more significant.[12]

In terms of the immediate impact of the merger at PR19, there could be a benefit of about £17m over five years. Under a probabilistic approach, and where Ofwat's expectations for cost convergence at future reviews are considered, there could be a benefit of about £21m (30-year NPV).[13]

[10] In particular, following Ofwat's expectations on cost convergence, convergence was implemented in a deterministic manner by assuming that the average gap in CTS between the frontier company and the rest of the industry is closed by about 75% within 20 years.

[11] At PR14, Ofwat has considered actual CTS in the penultimate year of AMP5 as the base year for setting the benchmark; to address potential uncertainty surrounding projected costs over the next 25 years, under the deterministic approach, we have used the average CTS over a price control period to determine the benchmark at each price review. Results are directionally similar—i.e. benefit for unmetered customers and a small detriment to metered customers, such that there is a net benefit at the combined level—when the CTS in the penultimate year of a price control period is used to set the benchmark instead.

[12] Given the relative positions of SWW and SWB in the retail ACTS models, and the relatively smaller size of retail synergy savings compared with wholesale, the impact of merger synergies may not be as significant as it is for wholesale costs.

[13] Under the probabilistic approach with benchmark set at the upper quartile, and where Ofwat's expectations for cost convergence at future reviews are considered, there appears a detriment of £9m over five years, and a benefit of £13m over ten years.

1 Introduction

In PR14, Ofwat set individual price controls for retail and wholesale services. Retail price controls cover customer-related services provided by the companies, such as sending customer bills and responding to customer enquiries. Within retail services, separate price limits were applied to household and non-household customers.

For household retail, Ofwat set allowed revenue based on benchmark CTS per retail customer, multiplied by each company's total number of customers. While company-specific adjustments (or special factors) relating to exogenous factors such as doubtful or bad debt, debt management, input prices and new costs, were excluded where relevant, depreciation and modification for new costs were included in calculating companies' CTS. There are two main customer types: customers that are not metered, and those that are. Ofwat required companies to forecast their customer numbers and CTS for these both these customer types over AMP6.

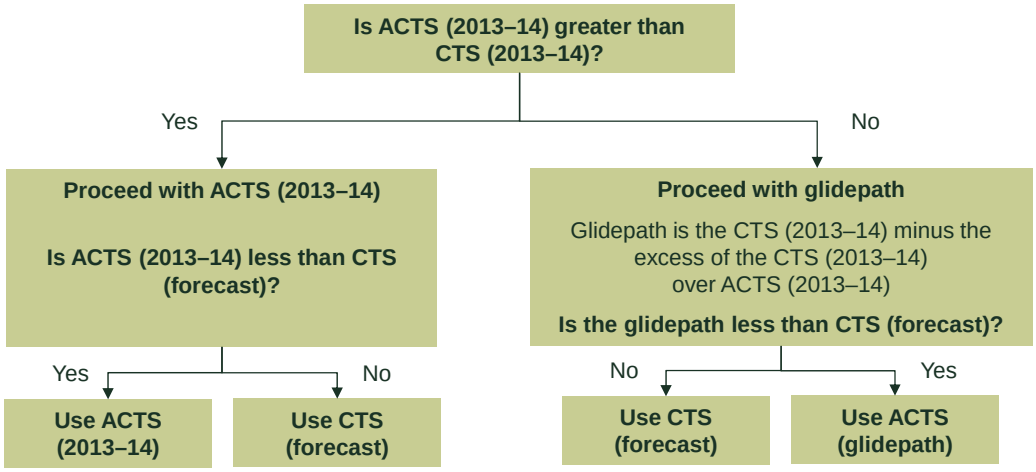
To apply an efficiency challenge in setting household revenue, Ofwat used the industry ACTS as the benchmark. The ACTS is the unweighted average of all companies' CTS for each customer type.

Two types of ACTS are of relevance to the merger[14]:

- an unweighted average of all companies' unmetered CTS; and
- an unweighted average of CTS for metered water-only customers.

The ACTS for each of the metered and unmetered costs is calculated using data from the year 2013–14. The ACTS is compared against a company's forecast CTS in each year of the AMP6 price control period (2015–20). If a company's CTS (in 2013–14) is above the ACTS, it would have to reduce its CTS by a certain proportion each year (called a 'glidepath') until it eventually reaches the ACTS by the end of PR14. Conversely, if its forecast CTS is below the ACTS, the forecast CTS is used to set allowed revenue. This approach applies to metered and unmetered customers, as illustrated in Figure 1.1.

Figure 1.1 Illustration of the glidepath



Source: Oxera, using Ofwat's PR14 methodology.

[14] This is because SBW being a water only company does not affect ACTS for sewerage only, and water and sewerage customers.

For metered customers, the relevant metering costs are divided by the appropriate customer numbers (and dual-metered customers are adjusted for economies of scope). Ofwat's method for calculating the different types of CTS is illustrated in Figure 1.2.

Figure 1.2 Calculating the CTS of relevance to the merger

$$\text{Unmetered CTS} = \frac{\text{retail costs} - \text{metering costs} - \text{doubtful debt adjustment}}{\text{water-only customers} + \text{sewerage-only customers} + (\text{water and sewerage customers})*1.3}$$

$$\text{CTS metered water-only customers} = \frac{\text{water-only metering costs}}{\text{water-only customers}} + \text{unmetered CTS}$$

Source: Oxera, using Ofwat's PR14 methodology.

2 Impact of the merger on the benchmark in PR14: the static approach

The transition from an 18-company industry (counterfactual) to a 17-company industry (factual) could alter the industry ACTS. This would result in a change in the efficiency challenge given to the industry.

To assess the potential 'immediate' impact of the merger at PR19, Oxera developed 'the static approach'. This involves comparing the industry allowance determined using Ofwat's PR14 ACTS methodology for the current industry structure with 18 companies (the counterfactual) with the expected industry allowance post-merger with 17 companies (the factual). As the ACTS analysis is based on historical cost,[15] we have used information in the base-year period considered in the PR14 analysis, 2013/14, to examine the impact of the merger in PR19. We have also considered the PR14 projected costs of companies over AMP6. Under the static approach, the benchmark is fixed at the average of companies' CTS.

The impact of the merger on unmetered ACTS and allowed revenue was examined through changes in doubtful debt adjustments.[16] Prior to the merger, South West Water was eligible for a doubtful debt adjustment due to the higher-than-average levels of deprivation and unemployment in the area it serves. Post-merger, the characteristics of the merged entity are less extreme, and the doubtful debt adjustment therefore decreases.

The decrease in doubtful debt adjustment in turn increases the unmetered ACTS, but lowers overall revenue. This is because doubtful debt adjustments reduce the retail OPEX of the companies, such that the CTS (OPEX divided by customers) also decreases. However, adjustments are added back to the allowed CTS, and, as these costs are now lower than before, overall industry revenue decreases.

The impact of doubtful debt due to the merger is similar regardless of whether forecast or historical doubtful debt adjustments are used. At PR19, the net benefit (in terms of reduction in the adjustments) is around £14m. If the benefits were assumed to continue into future price reviews, the net impact would be around £39m (30-year NPV).

On metered CTS, there is a marginal worsening of £1m–£2m at PR19, as SWW is an efficient company and the benchmark ACTS worsens post-merger on this account. The lower end uses historical actuals in 2013/14, and the upper end uses forecast projections over AMP6.

Combining the impact on unmetered and metered CTS, regardless of the base-year data considered in this approach (i.e. historical actuals or projected costs), at the overall household retail CTS level for water customers, there is a combined benefit of £5m–£17m at PR19, as the significant benefit to unmetered CTS offsets the marginal detriment in metered CTS.

If the doubtful debt adjustments are not re-estimated in the post-merger case, and Ofwat's PR14 adjustments are used, the static approach results in a benefit of about £7m over five years at PR19. This is driven by SWW and SBW's

[15] This is in contrast to the PR14 wholesale cost assessment, which focused on assessing companies' cost projections over AMP6 using historical performance data.
[16] This is estimated using the economic framework developed by Oxera in PR14. See, for example, Oxera (2014), 'Assessment of South West Waters' proposed levels of non-household doubtful debt over PR14', April. Ofwat allowed an adjustment for bad debt for SWW of about £6.7m per annum (in 2012/13 prices).

relative positions at PR14. Both are assessed to be worse than average companies on unmetered costs with rankings of 16 and 13 respectively. The merger results in the loss of an inefficient company, which improves the industry ACTS benchmark for unmetered customers. Taking into account the detriment of £2m for metered customers, the net impact at the combined level is a benefit of about £5m over five years.

Ofwat has stated that its approach to setting allowed retail household revenue will evolve over time, and it is likely to consider an upper quartile benchmark in the future. This is because it expects companies' CTS to converge over time, such that differences in CTS are minimised in future price reviews. A more stringent efficiency challenge is thus required. This is examined under the deterministic (probabilistic) approach discussed below.

3 Impact of the merger in future price reviews: deterministic (probabilistic) approach

To assess the potential longer-term impact of the merger, we have examined the likelihood of the merging companies (SWW and SBW) and the merged company affecting the benchmark at future reviews between PR19 and PR34. This 'deterministic approach' follows Ofwat's methodology in its PR14 VOC analysis for the WOCs.[17] However, we have extended the VOC framework to assess a particular 'factual' in this case. That is, the approach needs to be repeated for three entities: SBW, SWW, and the merged entity. Under this approach, the impact of the merger is the difference in the expected value of gaining the merged entity, less the sum of losing the merging companies.

To assess the likelihood of the merging and merged companies affecting the average (or upper quartile) benchmark at future price reviews, information was used based on the changes probability method. The transitions probabilistic approach was also implemented, but owing to limited data in this case, the resultant probabilities were deemed less reliable. We have also considered the permutations approach to deriving the changes probabilities to make best use of the limited information that is available in this case. The results under the permutations method was directionally similar (i.e. there is a net benefit from the merger) to those under the changes method.

The probabilities of movements between rankings are derived using information on the efficiency ratios and ranking order of companies on unmetered and metered customers between 2013/14 and 2019/20. While data on household retail may be more robust from 2013/14 onwards, as a sensitivity we also considered information from 2010/11 onwards to derive the probabilities.

Further information on the implementation of Ofwat's PR14 VOC analysis in the merger context is given in Box 3.1.

[17] The approach is 'deterministic as the impact is examined under the assumption of fixed efficiency ratios—i.e. the ratio of companies' CTS to ACTS is assumed fixed, and as determined by Ofwat in PR14 over future reviews.

Box 3.1 Implementing Ofwat's PR14 VOC analysis in a merger context

The PR14 VOC analysis was set out in Ofwat's documentation on assessing the loss of a comparator, and has been suggested in Ofwat's recent merger consultation to assess the impact of a merger. Prior to the merger, SWW and SBW each bring value (positive or negative) in terms of the company's impact on the industry benchmark. Post-merger, the merged entity will have its own unique value as a comparator. The difference in the VOCs of these companies in the counterfactual and factual cases provides an estimate of the net impact of the merger on the benchmark.

Specifically, the VOC is assessed in terms of a company's impact on allowed household revenue. Suppose we lose an efficient company (relative to the benchmark). The industry benchmark would worsen, resulting in a weaker efficiency challenge. This would lead to higher allowed household revenue. The impact of losing an efficient company (i.e. the value of an efficient company) is thus:

(revenue without the efficient comparator - revenue with the efficient comparator)

This would be a positive value, as revenue without an efficient performer would be higher than that with the efficient performer in the industry.

Conversely, if we remove an inefficient company (relative to the benchmark), the efficiency challenge would increase and industry revenue would decrease. Hence the value of an inefficient comparator would be:

(revenue without the inefficient comparator - revenue with the inefficient comparator)

This would be a negative value, as revenue without an inefficient performer would be higher than that with the efficient performer in the industry. An inefficient operator has negative value as a comparator.

After calculating the monetary impact of removing an efficient and inefficient comparator, the likelihood of companies positively and negatively influencing a benchmark over future price controls are considered in order to obtain an expected value given that there is some uncertainty about the future movements of the companies. Specifically, the expected VOC value is derived as below:

impact of losing an efficient comparator × probability (ranking at or better than benchmark) + impact of losing an inefficient comparator × probability (ranking worse than benchmark).

Source: Oxera, using Ofwat's PR14 methodology.

Two types of benchmarks were tested: average and upper quartile. Initially, the benchmark is fixed at the average of companies' CTS for metered and unmetered customers over future reviews as well. Under this assumption, the efficiency ratios (i.e. companies' CTS to ACTS), as determined at PR14, are fixed over future reviews. In other words, no convergence in cost performance is assumed under the scenario.

In an extension to the deterministic approach, we adjusted the efficiency ratios by imposing convergence in the estimated efficiency gap (between CTS to the frontier costs) at future reviews.[18] This was following Ofwat's expectations on how the retail efficiency challenge could evolve at future price controls, as stated in its merger consultation and statement of method paper in May 2015.[19] In particular, convergence was implemented in a deterministic manner by assuming that the average gap in CTS between the frontier company and the rest of the industry is closed by about 75% within 20 years (2020/21 to 2039/40). Under convergence, as performance between companies are more clustered and cost differences minimise over time, an upper quartile benchmark was used to set a more stringent benchmark.

Under this approach, the company-specific adjustments for exogenous factors such as bad debt, input price pressure and new costs are excluded prior to

[18] This convergence in cost performance is imposed in a deterministic manner as well.
[19] See Ofwat (2015), 'Consultation on Ofwat's approach to future mergers and statement of method', May, p. 70.

deriving companies' CTS. As such, the benefits estimated under the static approach due to the reduction in doubtful debt adjustments are not considered.

3.1 Results under the deterministic approach

The net impact of the merger on the benchmark under the probabilistic approach depends on a number of factors, as explained below.

- **Likelihood of companies positively and negatively influencing the benchmark**—the likelihood of SWW, SBW and the merged companies being ranked better or worse than the benchmark at future price reviews. We have considered two datasets and three methods to derive the probabilities. In terms of the dataset, we have used information over the period 2013/14 to 2019/20 that is deemed more robust. As a sensitivity, we have also considered information published by Ofwat from 2000/01 onwards. The three methods used to derive the probabilities are changes, permutation and transition. The core results are based on probabilities derived using the changes approach and with data limited to the period between 2013/14 and 2019/20.

- **The impact on the benchmark as a result of losing an efficient and inefficient company**: this is the monetary impact of losing an efficient and an inefficient company on the industry allowance. In the factual case, the impacts can be based on the 17-company industry structure or the counterfactual impacts could be considered relevant as well. With convergence, however, the (positive and negative) impacts tend to reduce over time.

- **Convergence rates**: the convergence in cost performance is imposed in a deterministic manner such that, following Ofwat's expectations on this point, the average gap in CTS between the frontier company and the rest of the industry is closed by about 75% within 20 years. To enable this, we have made some simplifying assumptions—in particular, that the inefficient companies converge faster than the efficient companies, and middling companies converge at a rate between the two. The frontier company's CTS is assumed to remain constant in real terms over the period. The same convergence rates apply in the factual and counterfactual scenarios.[20] When convergence is implemented, the monetary impacts of losing an efficient and inefficient company changes at each price review.[21]

As illustrated in Table 3.1 below, the upper and lower quartiles of companies' costs will alter due to the merger. In the case of unmetered costs, the upper quartile improves due to the removal of an inefficient company (both SWW and SBW are assessed to be worse than average at PR14). For metered water-only costs, the upper quartile has increased due to the removal of an efficient company (SWW is an upper quartile company at PR14).

Convergence rates are set at 0.5% per annum for efficient companies (better than upper quartile) in both the pre- and post-merger cases. For inefficient companies (worse than lower quartile), the rate is set at 1% per annum. Middling companies converge at a rate between the two, at 0.75% per annum. The

[20] However, as the benchmark alters in the 17-company industry scenario, not all companies will experience the same rate of convergence pre- and post-merger.
[21] At PR14, Ofwat has considered actual CTS in the penultimate year of AMP5 as the base year for setting the benchmark; to address potential uncertainty surrounding projected costs over the next 25 years, under the deterministic approach, we have used the average CTS over a price control period to determine the benchmark at each price review. Results are directionally similar—i.e. benefit for unmetered customers and a small detriment to metered customers, such that there is a net benefit at the combined level—when the CTS in the penultimate year of a price control period is used to set the benchmark instead.

frontier company's CTS is assumed to remain constant in real terms over the period.

Table 3.1 Upper and lower quartiles of companies' costs over AMP6, and convergence rates assumed

Upper and lower quartile CTS per customer, pre- and post-merger		
	Customer type	
	Unmetered	Water
Upper quartile pre-merger	17.03	3.66
Upper quartile post-merger	16.89	4.32
Lower quartile pre-merger	20.64	6.35
Lower quartile post-merger	20.63	6.44
Convergence rates		
Efficient companies (better than upper quartile)	0.5%	
Middling companies (within the inter-quartile range)	0.75%	
Inefficient companies (worse than lower quartile)	1.0%	

Note: We have used the same convergence rates on unmetered and metered such that on unmetered CTS, which is the more material of the two ACTS, the industry average gap to frontier costs is closed by about 75% in 20 years. Results are directionally similar if a different convergence rate is applied to metered CTS such that the average gap on metered CTS to frontier costs is also reduced by about 75% in 20 years.

Source: Oxera analysis, using household retail data published by Ofwat.

The impact of the merger on future price reviews is the combined impact of the change in the upper quartile benchmark, the probabilities and the monetary impacts.

The results under the average and upper quartile benchmarks are discussed below.

3.2 Average benchmark[22]

For **unmetered costs**, there is a benefit as an inefficient comparator is lost and the benchmark improves post-merger. The VOC of both SWW and SBW are negative (as they are ranked worse than average). Post-merger, the merged company's VOC is still negative (with a value similar to that of SWW), but there is the net benefit of losing an inefficient comparator. The companies are ranked similar pre- and post-merger, and all have similar chances to influence the benchmark positively and negatively.

For **metered water-only costs**, there is a detriment because SWW has a positive VOC (ranked 3 at PR14), while SBW (ranked 10 at PR14) has a VOC that is close to zero. The VOC of the merged entity (ranked 7) is still positive, but smaller than SWW's VOC, as SWW is ranked higher. There is thus a detriment, driven by SWW's high likelihood of being at or better than the average benchmark over future price reviews.

At the **combined level**, there is a net benefit, as the benefit for unmetered customers more than offsets the small detriment to metered customers.

[22] Under the average benchmark—as in the UQ case—we have removed the extremes (i.e. most and least efficient CTS) to determine the monetary impact of losing an efficient and inefficient comparator. This could be considered to provide an upper-end of the impact of the merger under this scenario.

3.3 Upper quartile benchmark

The impact of the merger on the upper quartile benchmark in the presence of convergence is a net benefit overall. However, the mechanics are slightly complicated owing to the imposition of convergence, asymmetry of the upper quartile benchmark, and the spread in the efficiency scores (in particular, between the 5th and 6th company in the counterfactual case, and between the 4th, 5th and 6th company in the factual case).

For **unmetered costs**, there is an overall benefit from the merger owing to a more stringent benchmark as the merger results in a loss of a non-upper quartile company. Under unmetered costs, there is a benefit of £38m. For **water-only costs**, the impact of the merger results in a detriment of £17m, but its value reduces gradually over time due to convergence. [23] At the **combined level**, the benefit is about £21m (30-year NPV).

[23] Under the probabilistic approach with benchmark set at the upper quartile, and where Ofwat's expectations for cost convergence at future reviews are considered, there appears a detriment of £9m over five years, and a benefit of £13m over 10 years.

4 Conclusion

Oxera has reviewed the potential impact of the SWW/SBW merger on household retail costs at PR19, and over future price reviews. Merger-specific synergies are not considered in the analysis undertaken in this report.

Under the static approach, which looks at the immediate impact of the merger at PR19, there is a combined benefit of about £17m over five years on metered and unmetered water customers.

Under the probabilistic approach, and Ofwat's expectation that there will be convergence in companies' performance at future reviews such that the benchmark can be set at the upper quartile, there is a combined benefit of about £21m (30-year NPV) on metered and unmetered customers. This approach excludes the impact of the merger on doubtful debt adjustments.[24]

In summary, our analysis indicates that the merger of SWW and SBW results in a more challenging benchmark that will benefit the wider comparative efficiency regime on household retail and thereby customers.

[24] At PR19, the reduction in doubtful debt adjustments across the industry due to the merger is estimated to be around £14m.

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Annex E: Oxera – The Service Incentive Mechanism

Prepared for
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Contents

Summary

With regard to the potential impact of the merger on the Service Incentive Mechanism (SIM), the quantitative analysis carried out by Oxera suggests that if there is a detriment, it may be, at most, between £1m and £4m.

We consider these figures to be an upper bound of the likely range for the following reasons:

- there is strong evidence that there has been (and will continue to be) significant convergence in companies' SIM scores—this will limit the usefulness of the SIM going forward;
- the difference between the maximum and minimum SIM scores in the industry is forecast to fall below a single point by the start of AMP7;
- the analysis to quantify any impact is very sensitive to the assumptions made. For example, assuming some service improvements are achieved through the merger significantly reduces the detriment, and for some scenarios show a net benefit;
- Ofwat has already acknowledged that it could draw on comparators from other sectors to assess retail service quality and, therefore, water companies have relatively less value as comparators; [1]
- furthermore, as part of the final determinations, both SBW and SWW will need to maintain separate reporting of their SIM scores during AMP6. This should further decrease the impact of a loss comparator over AMP6.

[1] Ofwat (2014), 'Final price control determination notice: policy chapter A7 – Annex 3: benefits assessment of an uplift on the cost of capital', p. 8.

1 Background

The SIM is a comparative performance assessment introduced in AMP5 to encourage companies to improve their customers' experience. It replaced Ofwat's previous performance incentive, the Overall Performance Assessment (OPA), which only incentivised companies to improve performance against specific measures defined by the regulator, and companies' OPA scores had converged, reducing the scope for further significant service improvements.

The SIM comprises a quantitative measure (reflecting the number of different customer contacts the company receives) and a qualitative measure (reflecting customer satisfaction). When combined, these two measures give a composite score out of 100. Companies' comparative performance is then assessed, with incentives being applied in the range of -1.0% to +0.5% of regulated revenue, depending on the relative distance (standard deviations) from the industry average.

The first year of the 2010–15 control period was not used for SIM incentives, so companies could refine data and have a chance to respond to the new incentive. Therefore, the SIM assessment at PR14 reflected data from 2011–12 to 2013–14. Over this period, on average, SWW was ranked 17th, and SBW 3rd.

As the incentive is set relative to the industry average, with regard to the possible impact of a merger, there may be a concern that the loss of a high-performing company could reduce the level of challenge applied to the rest of the industry by lowering the average score. This is the issue examined in this annex.

During PR14, Ofwat undertook an assessment of whether to provide a company-specific uplift to the allowed cost of capital. With regard to the SIM, Ofwat stated that it did:

> not consider that there would be a continuing benefit from individual WoC comparators in terms of SIM that would extend beyond the current control period.[2]

This was largely due to observed convergence in SIM scores to date, and an expectation that such convergence would be likely to continue. It was noted (both by Ofwat and the CC[3]) that there had been convergence in Ofwat's previous OPA. We have used Ofwat's predicted rate of convergence in SIM in the analysis in this annex.

Ofwat also noted that it could:

> draw on comparators from other sectors to assess retail service quality and therefore water companies have relatively less value as comparators4

Indeed, in its consultation on its approach to mergers, Ofwat reconfirmed that:

> water companies are unlikely to provide as much value as retail comparators beyond 2015–20 as Ofwat could offset the loss of a water company benchmark by greater reference to other sectors.[5]

[2] Ofwat (2014), 'Annex to technical appendix A6 – benefits assessment from a company-specific uplift on the cost of capital', p. 28.
[3] Competition Commission (2012), 'South Staffordshire plc/Cambridge Water plc merger final report', May, para. 4.22.
[4] Ofwat (2014), 'Final price control determination notice: policy chapter A7 – Annex 3: benefits assessment of an uplift on the cost of capital', p. 8.
[5] Ofwat (2015), 'Consultation on Ofwat's approach to future mergers and statement of method', p. 71.

Furthermore, the retail business is in a very different position to when the OPA was used. Competition is being introduced in retail non-household water in England from 2017,[6] and one would expect spillover effects (from non-household to household), and specific comparison with other utilities' retail activities to make the SIM somewhat less relevant even sooner than was the case for the OPA.

As part of the final determinations, both SBW and SWW will need to maintain separate reporting of their SIM scores during AMP6.

[6]The Water Act 2014

2 Oxera's analysis

We have followed Ofwat's approach to examining the impact on the SIM, as set out in its decision on the uplift to the cost of capital in its final determinations.[7] However, we have:

- extended Ofwat's approach to examine the impact of the merger in terms of comparing two scenarios (one with the merged company and one with SWW and SBW operating separately, whereas the uplift analysis looked only at the loss of SBW); and
- reconsidered some of the assumptions/inputs for the analysis.

Key assumptions underlying the value of the SIM are the appropriate time period over which the impact is measured (section 2.1), and the likely scores for the companies involved in the merger as well as the merged company (section 2.2).

2.1 Significant convergence in the SIM will limit the time period over which any impact of a merger occurs

Ofwat's analysis included the SIM impact over half of AMP6 (2017 to 2020) and AMP7 (2020 to 2025). However, Ofwat stated that it does not consider that there would be a continuing benefit from individual WOC comparators in terms of the SIM that would extend beyond the current control period (AMP6). For example:

> It could be argued that WoCs are unlikely to provide as much value as retail comparators beyond 2015-20 as Ofwat could offset any loss of a WoC benchmark by greater reference to other sectors, as the separation of controls leads to sharper focus on the relevant activities and services.[8]

As well as using benchmarks from other sectors, the SIM's usefulness is dependent on the degree of convergence of companies' performance. Ofwat also stated:

> Moreover, we identified a catch-up effect, where underperforming companies improved their scores by more than their better-performing peers... As a result, we estimated that, if such trends were to continue with the SIM, the differences between companies could all but disappear by the start of the 2020-25 period. This was consistent with our experience with the predecessor of the SIM, the overall performance assessment (OPA).[9]

Despite this, Ofwat noted: 'while our modelling continues to show a high degree of convergence after 2020, we assumed that the SIM would continue to exist until 2025.'[10]

In light of the caution expressed by Ofwat about whether WoCs are of value for SIM purposes beyond 2020, the analysis presented below assesses the degree of forecast SIM convergence in order to determine whether it is appropriate to assume that the SIM will continue to apply beyond 2020.

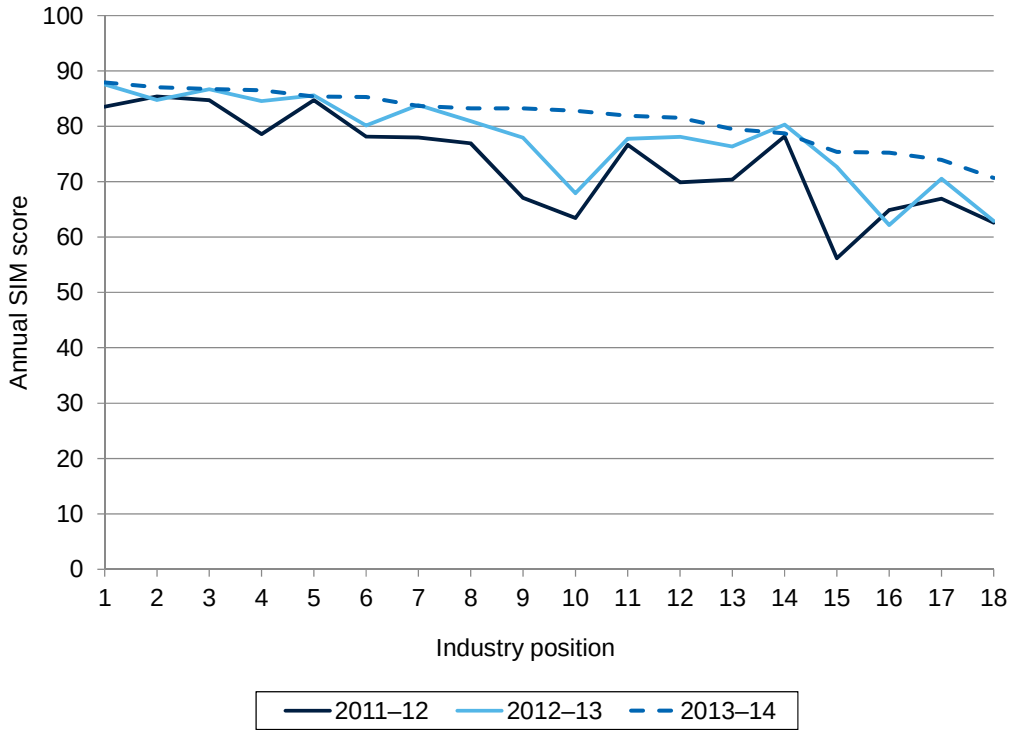
Between 2011–12 and 2013–14, the standard deviation of industry scores reduced from 8.8 SIM points to 5.0 points. There was also a significant improvement in performance of the worst-performing company in the industry. In 2011–12 the worst-performing company had a SIM score of 56; by 2013–14 the

[7] Ofwat (2014), 'Benefits of comparators', available at: http://www.ofwat.gov.uk/content?id=9d01e438-8542-11e4-8fe5-b9bb2e8303f4.
[8] Ofwat (2014), 'Final price control determination notice: policy chapter A7 – Annex 3: benefits assessment of an uplift on the cost of capital', p. 35.
[9] Ibid., p. 32.
[10] Ibid., p. 36.

worst-performing company had a SIM score of 71. During this time, the industry frontier also shifted, but to a lesser degree. In 2011–12, the best-performing company had a SIM score of 85; by 2013–14, the best-performing company had a SIM score of 88.

The degree of SIM convergence to date is illustrated below.

Figure 2.1 SIM scores in rank order for 2011–12 to 2013–14

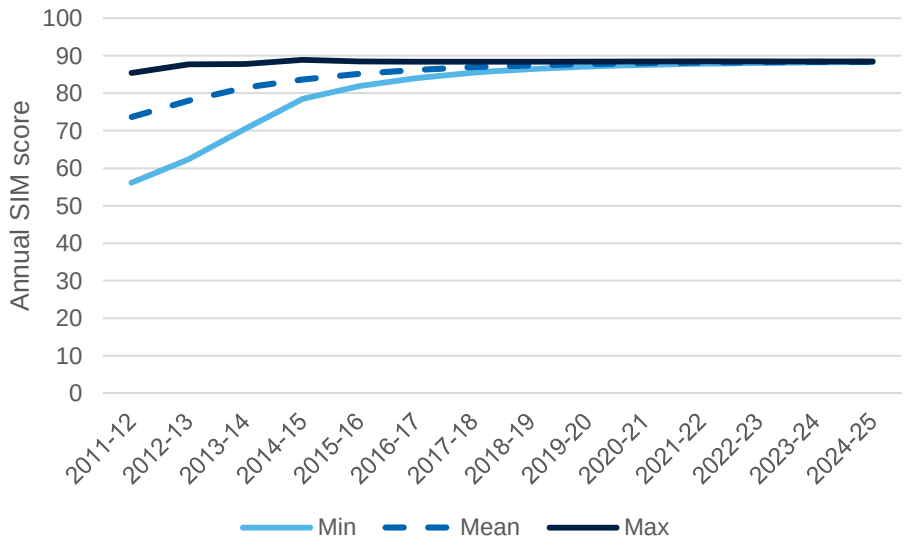


Source: Oxera analysis of Ofwat (2014), 'Benefits of Comparators'.

As can be seen in Figure 2.1, the industry has already converged to a considerable degree. If the SIM were to remain in place over AMP7, comparisons would need to be drawn in ten years' time, despite the majority of the variance across in the industry having already been driven out over a three-year period.

A combination of historical SIM convergence and Ofwat's forecast is shown in Figure 2.2 below.

Figure 2.2 SIM score industry convergence



Source: Oxera analysis of Ofwat (2014), 'Benefits of Comparators'.

As can be seen from the above, not only has there been significant convergence to date, but Ofwat forecasts that scores will converge further. By the start of AMP7 the difference between the highest and lowest SIM score is forecast to fall to below a single point.

Ofwat's analysis forecast the standard deviation of the industry's SIM score over a number of years, as shown in Table 2.1.

Table 2.1 Standard deviation of SIM scores

Year	Standard deviation (SIM points)	Control period
Outturn data		
2011–12	8.8	AMP5
2012–13	7.8	
2013–14	5.0	
Forecast data		
2014–15	4.0	
2015–16	3.0	AMP6
2016–17	2.3	
2017–18	1.7	
2018–19	1.3	
2019–20	1.0	
2020–21	0.8	AMP7
2021–22	0.6	
2022–23	0.4	
2023–24	0.3	
2024–25	0.2	

Source: Ofwat (2014) 'Benefits of comparators'.

As can be seen from Table 2.2, using Ofwat's' changes probabilistic approach[11] implies a significant degree of convergence, with the standard deviation of the

[11] An analytical method to assess the likelihood of changes in future performance based on changes in past performance.

industry's SIM score falling below a single SIM point from the start of AMP7. The average standard deviation over AMP7 is forecast to be 0.47 SIM points. Thus, if SIM penalties were to still be used, Ofwat would be applying the maximum penalty to companies whose SIM scores fell only 0.47 points below the industry mean. This raises two questions: will such an approach be proportionate, given the diminishing returns to customers of improved services? Is the SIM measure accurate enough to enable meaningful incentives to be set on such a small margin of difference? The qualitative component of the SIM (which makes up 75% of the overall assessment) is based on a sample of 800 customers across each company, and so may be subject to some degree of measurement inaccuracy. McCallum Layton (2014) estimated that the accuracy for individual qualitative scores was +/- 3.5% for a sample size of 800.[12]

As the OPA before it, such convergence will limit the SIM's usefulness going forward. Given the significance of convergence on the impact of a merger on the SIM, a key question is whether Ofwat's forecast rate of convergence is reasonable. We examine this below.

2.1.1 Ofwat's forecast of significant convergence is reasonable

Companies' price control performance commitments

To assess whether Ofwat's forecast (and thus its forecast convergence) is appropriate, we cross-checked it against companies' price control performance commitments (PCs).

Four companies committed to being in the upper quartile of the industry; one committed to being in the top five companies; one committed to being in the top three WASCs for the qualitative component; and five committed to scores above the upper quartile score in 2013–14. However, no company directly committed to a SIM score above 90. *These commitments strongly suggest that there will be a significant degree of convergence in SIM scores over AMP6*.

The SIM is likely to surpass the historical convergence in the OPA shortly

We have compared the forecast convergence of SIM scores with the observed convergence in OPA scores.

The OPA was discontinued at the end of AMP4. Ofwat has previously stated that the bunching of companies' OPA scores suggested that the OPA would not drive further significant service improvements.[13] In the last year that the OPA was formally reported (2009–10), the OPA scores had an overall standard deviation of 4.8.[14] This is close to the standard deviation of SIM scores today. *Given the focus of the industry to improve further, it seems unlikely that the standard deviation of SIM scores will remain above the final position of the OPA for long.*

2.1.2 Impact

Given this evidence, we consider it to be appropriate to examine the impact of the merger on the SIM over AMP6 only

Adjusting Ofwat's analysis to reflect this gives a net impact of losing SBW as a comparator for the SIM of £4.9m. However, this does not represent the impact of

[12] McCallum Layton (2014), 'Ofwat SIM Survey 2013/14 Annual Report: Summary', available at: http://www.ofwat.gov.uk/regulating/aboutconsumers/sim/rpt_com201408simrptsummary.pdf, p. 3.
[13] Ofwat (2010), 'Putting water consumers first – how can we challenge monopoly companies to improve?', p. 5.
[14] Oxera analysis of Ofwat (2010), 'Service and delivery – performance of the water companies in England and Wales 2009–10'.

the merger on the SIM, as all three companies (SWW, SBW, and the merged entity) need to be considered. (The analysis required is discussed in section 2.3.)

2.2 SIM score of the merged entity

As stated above, Ofwat's analysis calculated the industry mean score by completely removing SBW as a comparator. In reality, SBW's operations would not cease to exist; they would eventually merge with SWW's. Thus, the analysis required to assess the impact of the merger is somewhat different from Ofwat's, as undertaken at PR14—i.e. two scenarios need to be compared: one with SWW and SBW as separate entities, and one with the merged company only.

We would expect the new entity to have a different SIM score to that of SWW without the merger. The business case for the merger stated that one of its key benefits is expected to be an optimised customer service package from the best of both companies.[15] We would therefore expect the merged entity to have a positive impact on the SIM score relative to that which SWW would have without the merger.

By combining operations, it is possible for the merged entity to achieve a higher or different SIM score:[16]

- in between the SIM scores of the two previous entities had the merger not occurred. If no operational benefits or issues were realised from the merger then, all else being equal, the new SIM score would be a simple weighted average of the two previous entities had the merger not occurred;
- in line with the higher of the SIM scores of the two previous entities had the merger not occurred due to the lower performer adopting the better practice techniques of the higher performer; or
- to be greater than the SIM scores of the two previous entities had the merger not occurred due to the company's management developing a 'best of both' approach to customer service.

There is no definitive way to predict which of these three scenarios would occur. On a conservative basis, to model the SIM score of the merged entity we have used figures in a range between: i) being a simple weighted average of the two previous entities combined; and ii) the higher of the SIM scores of the two previous entities had the merger not occurred.

2.3 Impact of the merger on the SIM following an Ofwat estimation approach

Given the different assumptions that could be made in forecasting the impact of the loss of a comparator, we have assessed several options. We have modelled the merged entity simply having a weighted average score of both companies' SIM scores (i.e. no service-level synergy), and having the higher of the two companies' SIM scores (i.e. adopting better practice). Values within this range reflect the varying extent to which better practice could be adopted.

[15] Pennon plc (2015), 'Acquisition of Bournemouth Water – The rationale and business case', p. 5.
[16] Given the regulatory incentives and clear statements regarding improvement in the business case for the merger, we do not consider it appropriate to assume a deterioration in SIM—i.e. that the merged company would have a SIM score: i) below the SIM scores of the two previous entities had the merger not occurred; or ii) in line with the lower of the SIM scores of the two previous entities had the merger not occurred.

We have also modelled this using the SIM scores forecast by Ofwat, and by using companies' performance commitment SIM scores. While the latter is a departure from the approach used by the CC in the past and Ofwat's final determination analysis, we consider that it provides a useful sensitivity, and addresses (to an extent) the issue of Ofwat's analysis being entirely reliant on past performance and not taking into account company-specific features that may affect a firm's performance (both issues identified by Europe Economics[17]). As per our findings in section 2.1, we have assessed the impact over AMP6 only.

Table 2.2 Impact of the merger on SIM

Net present value of industry SIM penalties (£m)	Using Ofwat's forecast SIM scores	Using SWW's and SBW's performance commitment SIM scores[1]
1) No merger	17.6	9.6
2) Merged entity has a weighted average of SIM scores[2]	14.0	7.7
3) Merged entity has SBW's SIM score forecast	16.7	17.8
Impact of merger range (£m)	**-0.8 to -3.5**	**-1.9 to +8.2**

Note: [1] A flat glide path has been used from 2013–14 to 2019–20. [2] Weighted by retail revenue.
Source: Ofwat analysis adapted by Oxera.

As would be expected, the greater the SIM score used for the merged entity, the greater the industry-wide SIM penalties—as the industry average score is increased. Indeed, assuming that the merged entity is able to achieve SBW's performance commitment score results in a net benefit from allowing the merger of around £8m.

The greatest detriment of the merger is found in the scenario that assumes that Ofwat's SIM forecast scores are correct, and that there are no synergy benefits of the merger occurring in AMP6. This would lead to a lower industry average score, and a total detriment of £3.5m.

This wide range of results illustrates how sensitive the analysis is to the assumptions made, and that it may not be possible to determine definitively whether the merger would result in a negative or a positive impact on SIM. (For example, using Ofwat's forecast SIM scores, the merger starts to show a net benefit if the merged company achieves a score of only 2% above the weighted average scores of SWW and SBW.)

2.4 Separate reporting on SWW and SWB SIM scores during AMP6

In addition, SWW and SWB's SIM scores during AMP6 would be reported separately—indeed, the SIM scores for the two regions would have to be provided in order to monitor performance against the final determinations. This could further reduce the impact of the merger on the industry SIM scores.

2.5 Comparisons outside the sector are possible and would more than mitigate any loss of a water comparator

Further market and regulatory reforms may also require some restructuring of the SIM in any case. For example, if it is most efficient to have shared services for retail between households and non-households then wider business separation between wholesale and retail may occur by the next price review.

[17] Europe Economics (2015), 'Valuing the Impact of Mergers and Identifying Undertakings in Lieu', p. 37.

The SIM could provide some information, but is limited to being a water and sewerage sector survey on household retail including the wholesale customer services. As an alternative to the SIM, cross-sector customer surveys may be more useful, owing to both changing industry structures and SIM convergence.

The Institute of Customer Service publishes sectoral and individual company scores for customer satisfaction using a wide range of criteria. This survey requires a suitable scale of company (for example, for comparisons to the Big Six energy suppliers for customer service). Currently, only nine WASCs are reported in the results, including SWW. As SWW is at the lower end of the size scale for companies in the survey, some of the detailed questions are not currently reported. Mergers in the water sector therefore have the potential to allow this cross-sector source of customer service comparisons to be used as an alternative to the SIM.

This further suggests that the merger would not be detrimental to Ofwat undertaking service-level comparisons.

2.6 Conclusion

We do not consider it appropriate to assume that the SIM will remain as a useful metric beyond the next five years. In reaching this conclusion we have:

- assessed the degree of SIM convergence to date;
- considered companies' future performance commitments and other factors that might affect convergence;
- assessed the previous rate of convergence in the OPA; and
- examined the role of other benchmarks.

We have adjusted Ofwat's analysis to reflect this, and to reflect a clear counterfactual between SWW and SBW operating separately, and a factual of the merged entity. Our quantitative analysis suggests that if there is a detriment, it may be, at most, between £1m and £4m. These results are sensitive to the assumptions made, and that it may not be possible to determine definitively whether the merger would result in a negative or a positive impact on SIM.

Moreover, given that SWW and SBW will maintain separate reporting of their SIM scores during AMP6, and Ofwat could draw on comparators from other sectors to assess retail service quality, we consider our estimated range to be an upper bound of the likely range.

A1 Background analysis and methodology

A1.1 Ofwat's analysis and conclusions in the final determinations

In the final determinations of PR14, Ofwat undertook an assessment of whether to provide a company-specific uplift to the allowed cost of capital. In its risk and reward guidance, Ofwat set out the following criteria for a company-specific uplift to the weighted average cost of capital (WACC).

> To justify a company-specific uplift in the WACC, companies will need to demonstrate both that they face a higher cost to raising finance and that there is an offsetting benefit to customers.[18]

In considering whether the WOCs provided any offsetting benefit to customers, Ofwat considered whether they provided any benefits to the comparative regime. As such, Ofwat considered the impact of the loss of each WOC that had put forward a case for a company uplift.

It is important to note that this is a different assessment to that required for considering the impact of a merger. Since Ofwat was not considering a particular merger, it did not examine the counterfactual of the impact of a particular merger relative to the counterfactual of no merger. Nevertheless, some of Ofwat's analysis is conceptually relevant to the current merger.

With regard to the SIM, Ofwat's final position was as follows.

> we consider that we can draw on comparators from other sectors to assess retail service quality and therefore water companies have relatively less value as comparators.[19]
>
> It could be argued that WoCs are unlikely to provide as much value as retail comparators beyond 2015-20 as Ofwat could offset any loss of a WoC benchmark by greater reference to other sectors, as the separation of controls leads to sharper focus on the relevant activities and services.[20]
>
> However, taking account of representations, we have quantified potential benefits of WoCs as SIM comparators. We concluded that Sembcorp Bournemouth Water, South Staffordshire Water, and Sutton & East Surrey Water have benefits to customers as SIM comparators. (See section A7A.2.3.) **However**, **such benefits are not large enough to change our provisional conclusions in the draft determination**[21] [emphasis added]

In its provisional conclusions, Ofwat stated that:

> we consider that there is insufficient evidence of an impact on customers as a result of the loss of one or more comparators from the SIM scheme. Consequently **we not consider that there would be a continuing benefit from individual WoC comparators in terms of SIM that would extend beyond the current control period**.[22] [emphasis added]

This was largely due to observed convergence in SIM scores to date, and an expectation that such convergence would be likely to continue. It was noted (by

[18] Ofwat (2014), 'Setting price controls for 2015–20 – risk and reward guidance'.
[19] Ofwat (2014), 'Final price control determination notice: policy chapter A7 – Annex 3: benefits assessment of an uplift on the cost of capital', p. 8.
[20] Ibid., p. 35.
[21] Ibid., p. 8.
[22] Ofwat (2014), 'Annex to technical appendix A6 – benefits assessment from a company-specific uplift on the cost of capital', p. 28.

both Ofwat and the CC[23]) that there had been convergence in Ofwat's previous OPA.

To inform its view, Ofwat undertook an analysis of the potential impact on customers due to removing SBW as a comparator. The analysis suggested a total impact of between £6.1m to £11.0m due to SBW being lost as a SIM comparator. The analysis assumed that the SIM would remain in place for AMP7 (2020 to 2025) as well as for the remainder of AMP6.[24]

Ofwat stated that:

> We consider that this is likely to represent an upper limit to the benefits of comparators for retail service quality, given the ability to use benchmarks in other sectors.[25]

Ofwat's analysis calculated the industry mean score by completely removing SBW as a comparator. In reality, SBW's operations would not cease to exist; they would merge with SWW's. Therefore, we would expect the new entity to have a different SIM score to SWW's score in the absence of the merger.

A1.2 Ofwat's merger consultation

In its consultation on its approach to mergers, Ofwat reconfirmed that 'water companies are unlikely to provide as much value as retail comparators beyond 2015–20 as Ofwat could offset the loss of a water company benchmark by greater reference to other sectors.'[26]

Accompanying the consultation was a supporting report by Europe Economics, which reviewed the approaches that the CC had used to examine the loss of a comparator in previous water industry mergers. The CC used probabilistic approaches to assess the future comparative positions of companies. The report considered that, in general, the probabilistic approaches have the following disadvantages:[27]

- they are entirely reliant on past performance to infer likely performance in the future;
- it is not possible to take into account company-specific features that may affect a company's performance;
- they assume independence in the data across time and across companies.

Europe Economics supported Ofwat's approach, but noted 'there could be even faster convergence in performance of SIM due to spill-over effects from the development of competition,' and that 'Ofwat's approach is likely to represent an upper bound of the likely detriment, as Ofwat could make use of quality of service benchmarks from other sectors.'[28]

[23] Competition Commission (2012), 'South Staffordshire plc/Cambridge Water plc merger final report', May, para. 4.22.
[24] See http://www.ofwat.gov.uk/content?id=9d01e438-8542-11e4-8fe5-b9bb2e8303f4.
[25] Ofwat (2014), 'Final price control determination notice: policy chapter A7 – Annex 3: benefits assessment of an uplift on the cost of capital', p. 36.
[26] Ofwat (2015), 'Consultation on Ofwat's approach to future mergers and statement of method', p. 71.
[27] Europe Economics (2015), 'Valuing the Impact of Mergers and Identifying Undertaking in Lieu', p. 37.
[28] Ibid., p. 47.

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Annex F: Oxera – Outcome delivery incentives

Prepared for
South West Water

22 June 2015

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Contents

Summary

Based on the findings of its analysis, presented in this report, Oxera agrees with the view presented by Ofwat in the final determinations that there will not be quantifiable costs from the loss of one or more WOCs in terms of performance commitments (PCs) and outcome delivery incentives (ODIs). In particular:

- Ofwat has carried out effective comparisons with ten comparators for determining sewerage ODIs and PCs;
- few (only two) of the outcome areas require any comparative analysis for the setting of upper quartile targets;
- convergence implies that there is limited scope for further improvement in those few areas where comparisons were undertaken;
- it is questionable how much further improvement customers want to pay for—as the majority of ODIs are based on company-specific customer engagement, their customers have already indicated how they value service levels;
- local factors affect comparability as well as companies' ability to improve service levels. Moreover, SBW may have unique factors that affect its relevance as a comparator, such as a highly seasonal population with a high peak to average-demand ratio, and around 80% of the supply to customers coming from only two water treatment works;
- performance against ODIs/PCs for both SWW and SBW will need to be reported in order to monitor performance against commitments at final determinations. Given that there are no plans to remove local operational staff (particularly as SWW and SBW are not contiguous and a local presence is essential for the efficient running of any water company), the separate reporting of PCs over AMP6 by SWW and SBW should provide sufficiently independent data points for comparison purposes.

Therefore, we conclude that there is no net impact of the SWW/SBW merger on Ofwat's ability to make comparisons between water companies.

1 Background

For PR14, Ofwat moved from a predominantly *output*-based framework (for example, setting targets for the length of pipes replaced) to a more *outcome*-based framework (for example, setting targets to limit the number of interruptions to customers' supply).

Companies were given considerable freedom to develop outcomes that reflected their customers' needs. They were also able to propose their own ODIs, PCs, and the associated rewards/penalties, following engagement with their customers.

Where Ofwat considered that companies had taken a conservative approach in their proposed performance levels and associated incentives, it intervened to ensure that customers' interests were protected. To do this, Ofwat performed comparative analysis across the companies, but this was limited to analysis of those areas where companies had proposed similar measures. Due to the level of freedom given to companies in developing their proposals, a wide range of measures and approaches were proposed.

In total, Ofwat performed 'horizontal checks' across six outcome areas:

- duration of supply interruptions;
- number of contacts from customers regarding water quality;
- compliance with Drinking Water Inspectorate (DWI) water quality standards;
- number of sewerage pollution incidents;
- number of properties affected by internal sewer flooding;
- leakage.[1]

For the first five, Ofwat set a target and a glidepath for improvement, whereby (in a number of cases) companies would be required to achieve upper quartile performance by 2017–18. For leakage, Ofwat did not set a comparative target due to there being localised cost differences; nor did it set one for drinking water quality, with PCs (for all 'non-enhanced' companies) set at 100%.[2]

Since two of the other outcome areas relate to the sewerage service only, **of all the ODIs proposed by companies, only two are relevant to the merger** (the first two listed above). For the two relevant water service outcomes, Ofwat determined the upper quartile based on a three-year average of companies' historical performance. The relative performance of SWW and SBW is presented below.

Table 1.1 Outcome historical performance (industry rank out of 18)

	Duration of supply interruptions	Number of contacts from customers regarding water quality
SWW	15	18
SBW	1	4

Source: Oxera analysis of Ofwat (2014), 'Final determinations upper quartile comparative assessments', https://www.ofwat.gov.uk/pricereview/pr14/prs_web201412pr14uq.

[1] Ofwat (2014), 'Final price control determination notice: policy chapter A2 – outcomes', p. 23.
[2] Not only can this score not be improved upon, but should companies achieve this target, there would be significant convergence in the industry. Should companies not achieve their PCs, Ofwat could consider setting the same target at subsequent price reviews.

As the industry-wide target was set relative to the upper quartile, in terms of possible impact on Ofwat's comparative regime, there may be a concern that the loss of a high-performing company could reduce the level of challenge applied to the rest of the industry at subsequent price reviews. We examine whether this may be the case in the next section.

2 Oxera analysis

Oxera agrees with the view presented by Ofwat in the final determinations that there will not be costs from the loss of one or more WOCs in terms of PCs and ODIs.

2.1 Ofwat has managed with ten comparators for determining sewerage ODIs and PCs

Ofwat has carried out effective comparisons with ten comparators for determining sewerage ODIs. (This is similar to its wholesale cost assessment, where it has stated that it has been able to use an upper quartile efficiency challenge for wholesale costs and that, as such, in its final determinations, it considered no impact on precision from the loss of a WOC in that area). In the draft determinations Ofwat stated that it does:

> not consider that the loss of one or more WoCs would make these comparisons any less valid as there would still be a number of companies to use for comparisons (and are used for wastewater PCs and ODIs) and comparisons do not use statistical techniques.[3]

In the final determinations, Ofwat concluded that it would be inappropriate to include a quantitative estimate of the impact on customers,[4] but that there may be some qualitative impact.

2.2 Few of the outcome areas required any comparative analysis

In PR14, Ofwat set 522 PCs in total. Therefore, there is strong evidence that PCs and ODIs can be set without the need for comparators.

Indeed, Ofwat did not use a comparative approach in setting the PCs for SWW and one other company (Affinity Water), as their business plans were assessed as being 'enhanced'. Ofwat therefore accepted their plans 'in the round'.

2.3 Convergence implies that there is limited scope for further improvement in those few areas where comparisons were undertaken

There is also limited scope for further improvement going forward. Given that Ofwat has set an upper quartile target for all companies, we expect there to be significant convergence across the sector by 2017–18 as companies seek to deliver their stated commitments.

In many cases, companies will receive rewards for going beyond their PCs. This should further drive convergence over the next five years, thus reducing the benefit of future comparisons.

2.4 It is questionable how much further improvement customers want to pay for

There is also a more fundamental question of whether using comparative measures is the most appropriate way to set outcome targets.

Companies will be held to account for delivering upper quartile performance by 2017–18. To go above this level is likely to result in increased expenditure being incurred. It is unclear whether customers would value these higher service levels

[3] Ofwat (2014), 'Final price control determination notice: annex 3 – benefits assessment of an uplift on the cost of capital', p. 43.
[4] Ibid., p. 44.

over the possibility of lower bills due to expenditure not being incurred. Indeed, as the majority of ODIs are based on company-specific customer engagement, customers have already indicated how they value service levels.[5]

Similarly, for some metrics, customers may desire a level of service beyond that implied by a comparative metric. Therefore, there may be greater benefit in placing primary focus on targets defined through customer engagement, rather than through the use of comparative assessments.

At PR14, Thames Water (the largest water company by revenue) did not have a PC for water quality contacts. This raises the question of whether these metrics are necessarily of high importance to customers.

2.5 Local factors affect comparability and companies' ability to improve service levels

Local factors may reduce the comparability of ODIs and different customers may value different levels of service. For example, somewhat atypically, a single (industrial) customer requires c. 30% of SBW's distribution input.[6] Therefore, SBW may have a customer base that values particular levels of service differently from the customer base of other companies. Hence, setting industry-wide targets based (in part) on SBW's performance might risk setting inappropriate targets for the rest of the industry, as it might reflect the attributes of a non-standard customer base. As convergence in performance occurs and the differences between companies becomes smaller, this issue becomes more significant.

More generally, there may be company-specific factors affecting individual companies' ability to improve their service levels, which reduces the relevance of comparisons between water companies. For example, SBW has a highly seasonal population with higher peak to average-demand ratio than other companies.[7] This may affect the design and operation of its system with regard to water quality and reliability, especially as around 80% of the supply to customers comes from only two water treatment works.

In setting ODIs at PR14, Ofwat recognised the local issues affecting companies' leakage targets. While the geographical cost differences may have been more pronounced with leakage than with other outcome measures, the principle that local circumstances affect costs remains a valid concern, and could become more pronounced as performance is increased above the upper quartile level.

There may also be regional variations in customers' willingness to pay for service improvements. Even if customers were homogeneous, logic would suggest that customers with higher water bills would be less willing to pay more for an equivalent service improvement.

Six companies have non-standard PCs for water quality contacts (for example, commitments on discolouration contacts only) and three companies have non-standard interruption to supply measures. While Ofwat applied conversion factors at PR14 to translate the upper quartile metric into the non-standard

[5] As stated above, companies were given considerable freedom in developing outcomes that reflected the needs of their own customers. They were also able to propose their own ODIs, PCs, and the associated rewards/penalties, following detailed engagement with their customers. As such, customers in different regions had different priorities and attached different values to improvements in service.
[6] Oxera (2014), 'Ofwat's cost assessment: the impact of SBW's large customer', available at: http://www.ofwat.gov.uk/pricereview/pr14/res_stk201407costassesssbwoxera.pdf
[7] Ofwat, June Return 2010. SBW's peak to average-demand ratio is 1.42 compared with 1.2–1.3 for most other WASCS and WOCs.

metrics, it is unclear whether conversion rates would remain constant over time, thus reducing the comparability across the industry.

2.6 Performance against ODIs/PCs for both SWW and SBW will need to be reported over AMP6

For both SWW and SBW, performance against ODIs/PCs will need to be reported over AMP6 in order to monitor performance against commitments at the PR14 final determinations.

As the two operators are non-contiguous, local operations management will be less affected by the merger than back-office staff. With reference to Vivendi's proposed acquisition of Southern Water, four members of the CC's panel noted:

> in general these aspects—such as standards of customer service and environmental performance—are more likely to be influenced by the attitude and ability of local management than by ownership. Hence, the value of Southern as a comparator in relation to these aspects would be largely preserved despite the change of ownership resulting from the merger.[8]

Similarly, in the South Staffordshire Water/Cambridge Water merger case, the CC stated:[9]

> Because the two operations are non-contiguous, we thought that it was likely that despite the common ownership, a degree of managerial and operational independence would persist, as least in the short term. SST told us that it intended to retain a strong local management presence in CAM. However, we also noted that once a single operating licence was granted, it could be open to SST to revise those plans. We considered that over time the management features that had made CAM distinctive would be largely eroded, if not lost.

While it is Pennon's current intention to merge SBW's licence with SWW's, there are no plans to remove local operational staff (particularly as SWW and SBW are not contiguous and a local presence is essential for the efficient running of any water company). Therefore, it could be considered that the separate reporting of PCs over AMP6 by SWW and SBW would provide sufficiently independent data points for comparison purposes.

2.7 Conclusion

Given the concerns identified above, we consider that it would be more appropriate for PCs to be reached primarily through customer engagement than through the use of comparative assessments. We expect that the comparative assessments will be used even less over time, and that there may be greater benefit in placing primary focus on targets defined through company-specific customer engagement, with the regulator performing a more 'detailed dive' only where it has material concerns about the nature of a company's customer engagement.

This risk-based approach, which is in line with Ofwat's PR14 approach, would place a clear accountability on companies to understand what their customers want, and to reflect this in their business plans. This would also avoid the potential issue of setting sub-optimal targets. Furthermore, it is in line with the approach that Ofwat generally used in reaching the majority of the PCs.

More specifically with regard to this merger, Oxera agrees with the view presented by Ofwat in the final determinations that there will not be

[8] Competition Commission (2002), 'Vivendi Water UK PLC and First Aqua (JVCo) Limited', para. 2.134.
[9] Competition Commission (2012), 'South Staffordshire Plc/Cambridge Water PLC merger inquiry: A report on the completed acquisition by South Staffordshire Plc of Cambridge Water PLC', p. 66.

quantifiable costs from the loss of SBW in terms of PCs and ODIs. In particular:

- Ofwat has carried out effective comparisons with ten comparators for determining sewerage ODIs and PCs;
- only two of the outcome areas require any comparative analysis for the setting of upper quartile targets;
- convergence implies that there is limited scope for further improvement in those few areas where comparisons were undertaken;
- it is questionable how much further improvement customers want to pay for—as the majority of ODIs are based on company-specific customer engagement, their customers have already indicated how they value service levels;
- local factors affect comparability as well as companies' ability to improve service levels. Moreover, SBW may have unique factors that affect its relevance as a comparator, such as a highly seasonal population with a high peak to average-demand ratio;
- performance against ODIs/PCs for both SWW and SBW will need to be reported in order to monitor performance against commitments at final determinations.

Therefore, we conclude that the SWW/SBW merger will have no net impact on Ofwat's ability to make comparisons between water companies with respect to ODIs and PCs.

A1 Background analysis and methodology

A1.1 Ofwat's analysis in the final determinations

In the final determinations of PR14, Ofwat undertook an assessment of whether to provide a company-specific uplift to the allowed cost of capital. In its risk and reward guidance, Ofwat set out the following criteria for a company-specific uplift to the weighted average cost of capital (WACC).

> To justify a company-specific uplift in the WACC, companies will need to demonstrate both that they face a higher cost to raising finance and that there is an offsetting benefit to customers.[10]

In considering whether the WOCs provided any offsetting benefit to customers, Ofwat considered whether they provided any benefits to the comparative regime. As such, Ofwat considered the impact of the loss of each WOC that had put forward a case for a company uplift.

It is important to note that this is a different assessment to that required for considering the impact of a merger. Since Ofwat was not considering a particular merger, it did not examine the counterfactual of the impact of a particular merger relative to the counterfactual of no merger. Nevertheless, some of Ofwat's analysis is conceptually relevant to the current merger.

With regard to the ODIs, Ofwat's final position was as follows:

> we have taken account of ODI performance of WoCs as part of our **qualitative assessment**. We have therefore taken account of the potential comparator benefits from ODIs in the round. However **such benefits are not large enough to change our conclusions in the draft determinations**.[11] [emphasis added]

Where Ofwat concluded:

> **it was not possible to make a robust quantitative estimate of the likely impact on customers associated with the loss of a comparator for each of the 'horizontal' ODIs** on which we consulted in our August draft determinations, due to the significant uncertainty about use of comparators for ODIs and the absence of sufficient track record associated with the impact of ODIs.[12] [emphasis added]
>
> we do **not consider that the loss of one or more WoCs would make these comparisons any less valid as there would still be a number of companies to use for comparisons (and are used for wastewater PCs and ODIs) and comparisons do not use statistical techniques**. Consequently, **we do not consider that there would be costs from the loss of one or more WoCs in terms of PCs and ODIs**.[13] [emphasis added]

Ofwat's final decision key conclusions were:

> **by the middle of the 2015-20 period, we expect all companies to reach current upper quartile performance.** Consequently it is unclear on what basis we would set any horizontal ODIs for subsequent control periods, or the relative performance of difference companies at the start of the next period.
>
> **the basis for individual ODIs and their relative impacts on financial performance differs across companies, reflecting customer priorities for**

[10] Ofwat (2014), 'Setting price controls for 2015-20 – risk and reward guidance'.
[11] Ofwat (2014), 'Final price control determination notice: policy chapter A7 – Annex 3: benefits assessment of an uplift on the cost of capital', p. 9.
[12] Ibid.
[13] Ofwat (2014), 'Annex to technical appendix A6 – benefits assessment from a company-specific uplift on the cost of capital, p. 29.

> **each company, which makes cross-sector comparisons difficult and reduces the potential benefits from additional comparator companies.**
>
> **We have therefore concluded that it would be inappropriate for us to include a quantitative estimate of the impact on customers as the result of a lost comparator in the area of ODIs**. Instead, we have taken into account each company's performance to date against each of the three 'horizontal' ODIs qualitatively, when weighing the overall costs and benefits associated with a company-specific WACC uplift.[14] [emphasis added]

A1.2 Ofwat's merger consultation

In its consultation on its approach to mergers, Ofwat stated that, while it is unclear on what basis it would set any horizontal ODIs for subsequent control periods at the start of the next period, it could use 'horizontal' ODIs in a new way going forward.[15] However, the potential impact of losing a comparator on such an approach was not quantified.

In the PR14 final determinations, Ofwat used the comparators set out below across water companies to set the ODIs:

- duration of supply interruptions;
- number of contacts from customers regarding water quality;
- compliance with DWI water quality standards;
- leakage.

For the first three, **Ofwat set an upper quartile target to be achieved by 2017–18**, and companies were given a glidepath to attain this.

Accompanying the consultation was a supporting report by Europe Economics (EE).[16] This recommended a probabilistic approach to assessing the impact of the loss of a comparator on Ofwat's ability to set ODIs. However, **EE noted that the results of such analysis should be treated with caution**, for the following reasons:

- forecasting rankings based on changes in rankings in the past may not be reliable (in particular, because financial incentives have been introduced only recently);
- **as Ofwat assumes that companies will meet or exceed the current upper quartile performance level, the basis on which it would set any horizontal ODIs for subsequent control periods is unclear**.

The first point is also pertinent to the other areas of potential impact where a probabilistic approach is used. However, the second point is particularly pertinent to ODIs.

[14] Ofwat (2014), 'Final price control determination notice: policy chapter A7 – Annex 3: benefits assessment of an uplift on the cost of capital', p. 44.
[15] Ofwat (2015), 'Consultation on Ofwat's approach to future mergers and statement of method', p. 71.
[16] Europe Economics (2015), 'Valuing the Impact of Mergers and Identifying Undertakings in Lieu', http://www.ofwat.gov.uk/rpt_com201505eemergers.pdf.

A2 Merger analysis

A2.1 Europe Economics' approach

Alongside its merger consultation, Ofwat commissioned EE to produce a report on valuation methods of mergers.[17]

In its report, EE set out a suggested approach for valuing the impact of the loss of a comparator for ODIs. EE suggested a probabilistic approach based on companies' historical data, with forecast changes in the upper quartile being multiplied by companies' incentive rates to derive the potential impact.

There are a number of observations with regard to this approach.

- For the reasons set out in this report, we do not consider that there would be a detriment from the loss of a comparator.
- Using companies' historical data for performance measures to predict future convergence may not be a robust approach. As companies have not had direct financial/reputational incentives for these measures, it is questionable whether historical rankings will be appropriate indicators for the future.
- Companies' ODIs include penalty and reward rates for under- or out-performing their targets. Often, these are different rates. In setting incentive rates, matters for consideration include the following:
    - penalties need to be of sufficient size to deter the company from missing its targets;
    - as improved performance is generally expected to result in diminishing returns to customers, all else being equal, rewards should not be bigger than penalties, as customers experience greater loss from a reduction in service than the benefits of an improvement in service;[18]
    - rewards should not be above the value that customers place on an improvement in service above the benchmark; otherwise customers would experience a reduction in overall utility should a company outperform its target.

As the purpose of a future upper quartile benchmark would be to drive further improvements in the industry, using the penalty rates from the final determinations to estimate the value of a higher benchmark might overstate the value. This is due to the regulator potentially setting penalties above the value to the customer of the service loss to disincentivise companies from cutting service, and potentially seeking to align the structure of penalties with the diminishing returns cost function (the first two bullet points above).

Likewise, using the reward rates might understate the value, due to the likelihood of the regulator setting these below the value to customers of the service improvement (the third bullet point above). (Although it should be noted that SWW's reward rates are towards the upper end of the company's willingness to pay survey performance levels.[19])

[17] Europe Economics (2015), 'Valuing the Impact of Mergers and Identifying Undertakings in Lieu', http://www.ofwat.gov.uk/rpt_com201505eemergers.pdf.
[18] However, there may be other policy reasons for setting higher rewards, such as the potential behavioural effect of such incentive structures.
[19] Information provided by SWW.

Either way, customers are unlikely to value a change in industry performance at either the penalty or the benefit rate of incentive.

Customers' valuation of service improvements is also unlikely to stay constant over time. As increased performance convergence occurs, the marginal benefits to customers of greater performance are likely to diminish.

It should also be noted that Ofwat did not use comparative metrics to set targets for the 'enhanced' companies. The number of companies achieving enhanced status at future price reviews would affect the coverage of any such horizontal assessment.

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