



Europe Economics

Valuing the Impact of Mergers and Identifying Undertakings in Lieu

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Executive Summary

Overview

This document sets out a range of approaches to assessing the impacts of a proposed merger, and recommendations on what are likely to be the best techniques to use when proposing a merger.

The Water Industry Act 2014 amended the process for the special water merger regime. In particular, under s.33B of the Water Act 1991 (as amended), Ofwat would be required to provide the Competition and Markets Authority (CMA) with an opinion on the extent to which a merger could impact on the ability to regulate comparatively, and the relevant customer benefits which could arise as a result of the merger. Ofwat can also provide recommendations on the potential remedies or mitigations that could be introduced in order to offset any detrimental impact arising from the loss of a comparator to its regulatory approach, or to pass back the benefits of the merger to the customers of the companies involved.

In the absence of competition, cross-industry comparators have been of central importance in economic regulation in the water sector.

A merger in the water and sewerage sectors could have the effect of reducing the number of comparators available to Ofwat in relation to:

- setting price limits;
- service quality; and
- monitoring, enforcement and spreading best practice.

This effect could be negative, e.g. by reducing the precision of Ofwat's econometric analyses, or it could be positive, e.g. because inclusion of the merged entity in Ofwat's datasets results in tougher benchmarks, or greater spreading of best practice. Any assessment of a proposed merger would need to consider the potential prejudice to Ofwat's ability to make use of comparisons for the purpose of regulating the sector.

The Water Act 2014 sets out the benefits that should be considered for a water merger.

Specifically, the assessment should consider lower prices, higher quality or greater choice of goods or services in any market in the United Kingdom, or greater innovation in relation to such goods or services.

If it is determined that Ofwat's ability to make comparisons is negatively impacted, then the benefits:

- which may be expected to accrue must be substantially more important than the prejudice concerned;
- must be expected to accrue within a reasonable period as a result of the merger concerned; and
- must accrue to customers of any person carrying on an enterprise which, in the merger concerned, has ceased to be, or (as the case may be) will cease to be, a distinct enterprise.

Therefore, if the assessment of the proposed merger identifies any prejudice to Ofwat's ability to make comparisons, it would also be important to consider relevant customer benefits that may arise as a result of the merger.

The merging companies may wish to propose undertakings in lieu (of a mandatory reference to the CMA) to offset any identified prejudice.

If the analysis of impacts of the merger concludes that the relevant customer benefits do not outweigh the prejudice to Ofwat's ability to make comparisons, the merging companies may wish to propose undertakings in lieu (of a mandatory reference to the CMA) to offset any identified prejudice.

These undertakings in lieu would need to be designed as a response to the harm that may arise as a consequence of a merger. This response could take many forms, including: preventing the harm arising altogether; resolving, in part or wholly, a harm that has already materialised; or generating further benefits to offset the potential harm.

It would be important to try to assess the impact of any undertaking in lieu, as this would need to offset any identified prejudice.

Summary of key impacts of a merger and approaches to valuing them

The table below sets out recommendation on the most appropriate techniques for valuing the different types of impact that may arise as a result of a proposed merger in the water and sewerage sectors. We provide further explanation of why these approaches are appropriate and more detailed methodologies, as well as consideration of alternative techniques in the main body of the report.

Impact	Recommended approach to valuing impact	Further information
Prejudice to Ofwat’s ability to make comparisons		
Ofwat’s benchmarks	We recommend that the analysis of the impact on Ofwat’s benchmarks is based on the “changes approach” (a probabilistic approach to assess the likelihood of changes in future performance based on changes in past performance) to assess changes in rankings at each price review over a 30 year period. This analysis could be carried out for at least the following: Ofwat’s wholesale cost assessment, the Average Cost to Serve (ACTS), Outcome Delivery Incentives (ODIs) and the Service Incentive Mechanism (SIM).	Chapter 3.2
Precision of econometric models	We recommend that the analysis of the impact on the precision of Ofwat’s econometric models is based on the three approaches that have typically been used by the Competition Commission: the “specific approach”, i.e. simulating the merger by re-running the models with data for the merged entity; the “general approach” based on a theoretical estimation of the impact on precision; and a cross-check based on a bootstrapping exercise.	Chapter 3.3
Ofwat’s other uses of comparators	Ofwat makes use of comparators in a number of other areas, such as customer engagement and assessment of company behavior. We suggest criteria in each of these areas to be considered in assessment of the effects of the proposed merger. The assessment would need to demonstrate why the merged entity would be a valuable comparator in each area, and why the merged entity would not pose problems to Ofwat’s ability to make these comparisons. For example, where the merging companies have not scored well against these indicators in the past, the assessment would need to demonstrate why the merged entity would perform better, how this could be secured, and how it might remedy any detriment to Ofwat’s ability to make comparisons.	Chapter 3.4
Relevant customer benefits		
Lower prices	We recommend undertaking a bottom-up exercise to estimate the potential cost savings from merging. This could be independently verified to provide assurance to Ofwat that the estimates are robust.	Chapter 4.2
Quality of service	We recommend that a bottom-up exercise is undertaken to establish specific service quality improvements that would result from the merger, and the value of these improvements could be estimated by using the results of market research on the willingness to pay for these improvements. This research could be independently verified to provide assurance to Ofwat that the estimates are robust.	Chapter 4.3
Innovation	We recommend providing quantitative estimates of the effects of innovation on a merged firm’s operations and costs and revenues using a bottom-up approach, as recommended for assessing the impact of the merger on price. If it is not possible to provide such estimates, the merging firms could provide qualitative analysis. In this analysis, the merging firms may wish to refer to key academic results, but caution should be taken in extrapolating academic findings obtained outside the water sector to the water sector.	Chapter 4.5
Undertakings in lieu of a CMA reference		
Divestiture	We recommend an assessment of the likely impact of the divestiture by following similar techniques to those that would be used to quantify the extent of prejudice in the first instance, and comparing the prejudice with and without the divestiture.	Chapter 5.2
Maintaining separate sources of information	It would not be feasible to quantify the effect of using separate accounts with some degree of dependence. The assessment of this undertaking in lieu would therefore need to provide sufficient evidence to Ofwat with regard to the independence of the two datasets so that they could continue to be used in econometric models and other comparisons.	Chapter 5.3
Price reductions	In determining the appropriate size of the price reduction, it would be appropriate to consider the interaction with efficiency sharing factors. Any expected efficiency gains from the merger would be passed on to customers in part through efficiency sharing. The price reduction offered as an undertaking in lieu would therefore need to reflect the identified prejudice to Ofwat’s ability to make	Chapter 5.3

Modular licence	<p>comparisons net of the efficiency savings expected to be passed on to customers.</p> <p>Assessment of this undertaking in lieu could draw on Ofwat's assessment of the benefits of network plus to estimate the potential impact of introducing a modular licence. This assessment would need to take into account of the nature of the modular licence being proposed (and the extent to which this differs from network plus), the timing of the changes, and whether the changes would be applied more broadly than just the merging parties.</p>	Section 5.4
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Structure of the report

The remainder of this report is structured as follows:

- Section 1 sets out Ofwat's current use of comparators and how this might change going forwards.
- Section 2 highlights the possible costs, in terms of prejudice to Ofwat's ability to make comparisons, and benefits of a merger in the water and sewerage sectors.
- Section 3 sets out techniques for valuing the potential prejudice to Ofwat's ability to make comparisons as a result of a merger.
- Section 4 sets out techniques for measuring the potential relevant customer benefits.
- Section 5 identifies a number of potential undertakings in lieu that merging parties may wish to consider, and approaches to valuing the impact of these undertakings in lieu.

Index of Acronyms

This report makes use of a series of acronyms that are commonly used in the water sector. For reference, we provide a list of these acronyms below.

Acronym	Full name
ACTS	Average Cost to Serve
AIM	Abstraction Incentive Mechanism
AMP	Asset Management Period
BCT	Basic Cost Threshold
CCG	Customer Challenge Group
CTS	Cost to Serve
KPI	Key Performance Indicator
ODI	Outcome Delivery Incentive
PAYG	Pay-as-you-go (ratio)
PC	Performance Commitment
RCV	Regulatory Capital Value
SDB	Supply-demand Balance
SELL	Sustainable Economic Level of Leakage
SIM	Service Incentive Mechanism
UQ	Upper Quartile (threshold)
WACC	Weighted Average Cost of Capital
WaSC	Water and Sewerage Company
WoC	Water only Company
WRFIM	Wholesale Revenue Forecasting Incentive Mechanism

1 Ofwat's Use of Comparators

Ofwat has made and continues to make extensive use of comparators in the regulatory process. To understand the ways in which a merger in the water and sewerage sectors could affect Ofwat's ability to make these decisions, it is important to understand the ways in which comparisons have featured in the regulatory regime, including the recent changes made at PR14, and how the use of comparators may change in the future. In this section, we provide:

- An overview of Ofwat's current use of comparators with regard to:
 - setting price limits;
 - service quality; and
 - monitoring, enforcement and spreading best practice.
- A high level review of Ofwat's potential uses of comparators in the future (in the light of expected market reform and potential regulatory change) with regard to:
 - the retail stage of the value chain;
 - the network plus stages of the value chain; and
 - other stages of the value chain.

1.1 Ofwat's current use of comparators

Ofwat has made use of comparators since privatisation and this has been an important tool in driving efficiency and service improvements. Comparators are, and will continue to be important, particularly in respect of those areas of the value chain that are not subject to market competition. In the following sections, we set out examples of areas in which Ofwat has made use of comparators at PR14. Specifically, we discuss Ofwat's use of comparators in relation to:

- setting price limits;
- service quality; and
- monitoring, enforcement and spreading best practice.

1.1.1 Setting price limits

At PR14, Ofwat made use of comparators in a number of ways to set price limits, including the following:

- wholesale water cost assessment;
- wholesale wastewater cost assessment;
- household retail cost assessment;
- cost of capital and financeability;
- accounting policies and assumptions; and
- business planning processes.

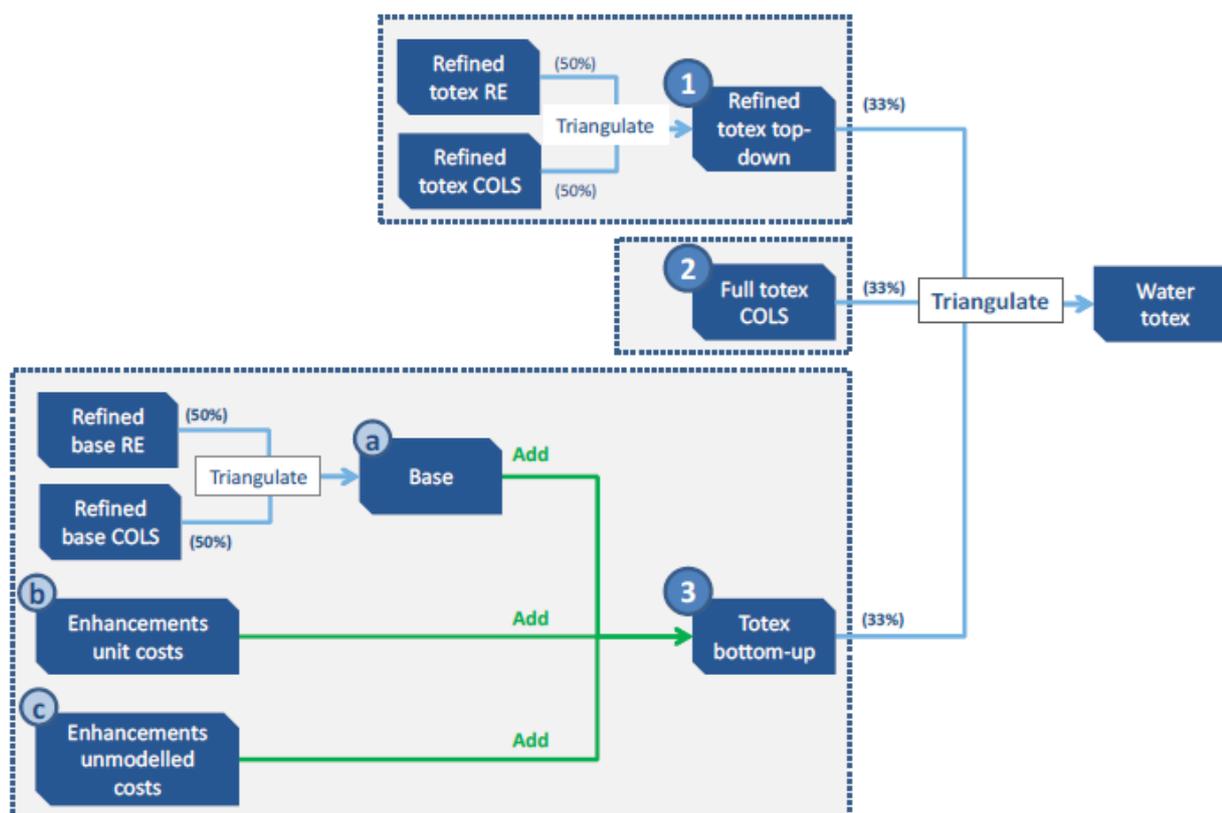
We briefly discuss these uses of comparators below.

Wholesale water cost assessment

Panel data econometric models and unit cost models for enhancement expenditure were used to estimate total expenditure (totex). These models were then used to make projections of each company's costs over the period 2015-20. An average was then taken of these projections (using a process Ofwat calls

'triangulation') to produce an overall projection of totex which Ofwat calls the basic cost threshold (BCT). Adjustments were then made for policy items (i.e. expenditure that is not likely to be predictable from historic expenditure) and allowed special cost factor claims.¹ The diagram below sets out the cost assessment process used at PR14, including the weights applied to the results of each model:

Figure I.1: Modelling approach to create BCTs for water



Source: Ofwat (2014) "Basic cost threshold models"

To ensure that the cost thresholds represent reasonably efficient costs, Ofwat adjusted the costs forecast by the PR14 models so that they reflected upper quartile efficiency. This adjustment was derived from an assessment of how far each company's actual historical expenditure was from the average costs predicted by the models for this period.

It is important to note that not all companies were used as comparators in the unit cost models. For the water cost assessment, there were three unit cost models: enhancements to supply-demand balance (SDB); lead reduction; and new development. For each, Ofwat generated four forecast unit cost models which were averaged (with equal weights applied to each result) to arrive at the final enhancement unit cost:

- Weighted average unit cost (with weights based on volumes of water).
- Unweighted average unit cost.
- Univariate regression (in Excel) using OLS which allowed for a fixed cost and constant marginal costs.
- Log-linear regression which allows marginal costs to vary across companies.

The table below shows the cost drivers in each case, and the number of data points informing the analysis:

¹ Further detail can be found at: http://www.ofwat.gov.uk/pricereview/pr14/det_pr20141212wholesale.pdf; and http://www.ofwat.gov.uk/pricereview/pr14/wholesale/prs_web140404pr14wholesalecostasses

Table I.1: Water cost assessment unit cost models

Cost	Volume driver	Number of data points in model
Enhancements to SDB	Total enhancements to the supply demand balance (dry year critical / peak conditions) unless zero then used annual/ average	Weighted and level regression = 18 data points, Unweighted and log model = 14 data points
Lead reduction	Number of lead communication pipes replaced for water quality	Weighted unit cost, level regression = 14 data points, Unweighted and log model = 11 data points
New development	Number of new connections	All methods = 18 data points

Source: Ofwat

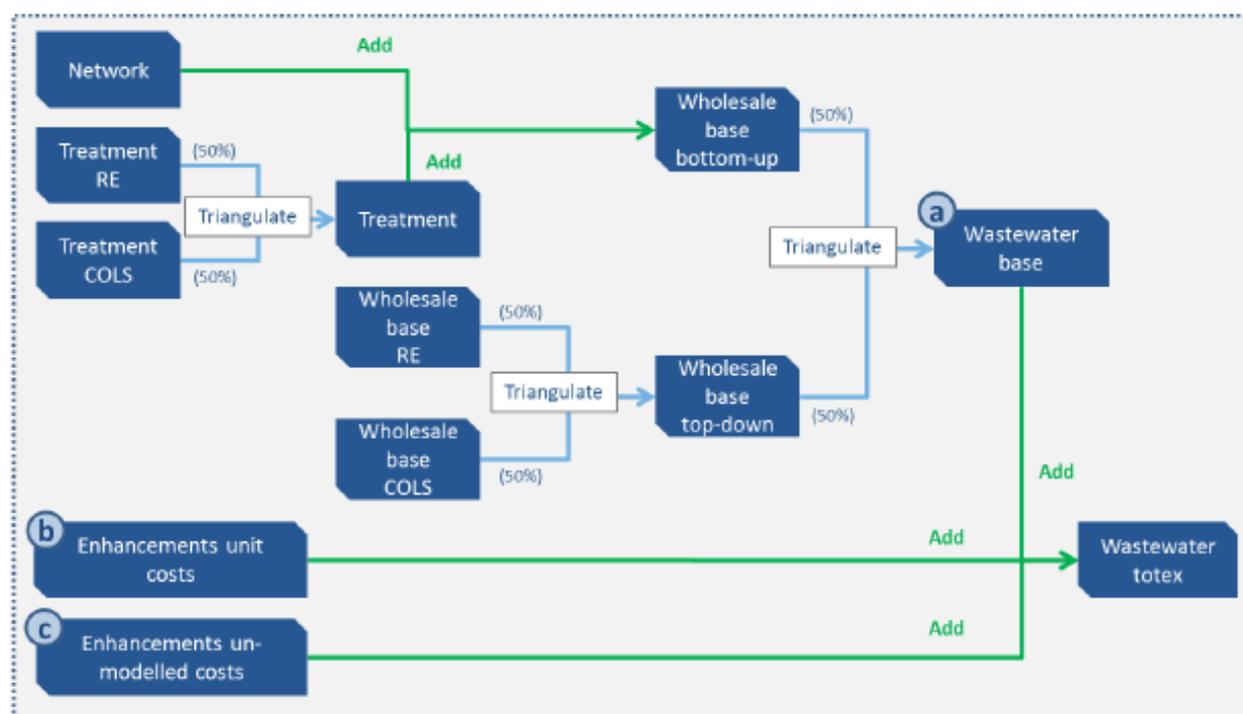
Wholesale wastewater cost assessment

For wastewater, it was not possible to construct individual totex models for PR14 that would cover all aspects of company expenditure. Ofwat calculated the BCTs as summarised below:²

- A model for base totex, based on the “triangulation” of a range of top-down and bottom up models for separate aspects of base totex (for example, network and sewage treatment).
- Aggregated unit cost models for aspects of enhancement expenditure that could be modelled.
- An un-modelled cost adjustment to account for aspects of enhancement expenditure that could not be modelled.

The diagram below sets out the cost assessment process used at PR14, including the weights applied to the results of each model:

Figure I.2: Modelling approach to create BCTs for wastewater



Source: Ofwat (2014) “Basic cost threshold models”.

² Further detail can be found at: http://www.ofwat.gov.uk/pricereview/pr14/det_pr20141212wholesale.pdf; and http://www.ofwat.gov.uk/pricereview/pr14/wholesale/prs_web140404pr14wholesalecostasses

As for the wholesale water cost assessment, not all companies were used as comparators in the unit cost models. There were 12 unit cost models for wastewater, which are set out in the table below, including information on the key cost driver and the number of data points.

Table 1.2: Wastewater cost assessment unit cost models

Cost	Volume driver	Number of data points in model
First time sewerage	Connectable properties potentially served by s101A schemes plus connectable properties potentially served by s101A schemes	Weighted unit cost and level model = 10 data points, unweighted and log model = 8 data points
Sludge enhancements	Calculated additional sludge (thousand tonnes dry solids)	Weighted unit cost and level model = 10 data points, unweighted and log model = 9 data points
Event Duration monitoring	Number of intermittent discharge sites with event duration monitoring	All methods = 6 data points
Storage at intermittent discharge sites	Volume of storage provided at CSOs, storm tanks, etc. to meet spill frequency requirements (m3)	All methods = 9 data points
Groundwater schemes	Current population equivalent served by groundwater protection schemes	Weighted and level regression = 7, unweighted and log regression= 6 data points
P removal at filter works	Current population equivalent served by filter works with tightened/new P consents	All methods = 7 data points
Reduction in sanitary determinants	Current population equivalent served by STWs with tightened/new sanitary parameter consents	All methods = 9 data points
UV disinfection	Current population equivalent served by STWs with tightened/new UV consents	All methods = 7 data points
Odour	Number of odour related complaints	All methods = 10 data points
Sewage treatment growth	Change in population	All methods = 10 data points
Sewer flooding	Number of connected properties	All methods = 10 data points
Private sewers - pipes	CSV of blockages and collapses	All methods = 10 data points

Source: Ofwat.

Household retail cost assessment

To set the household retail control, Ofwat used comparative company data to determine efficient cost levels, by adjusting a company's proposals with reference to an industry average cost to serve (ACTS) per household customer based on historic costs.³

The first step in this approach was the calculation of companies' own cost to serve (CTS) in 2013-14 per unique customer for unmetered (unmeasured) customers. The definition of "unique customers" took account of the economies of scope associated with providing joint rather than separate water and wastewater household retail services.⁴

The retail ACTS for unmetered household customers was calculated as the unweighted average CTS across all companies. A consistent process was followed to derive the additional CTS for metered household customers separately for:

- water only customers for WaSCs and WoCs;
- wastewater only customers for WaSCs; and
- water and wastewater customers for WaSCs.

³ Further detail can be found at: http://www.ofwat.gov.uk/pricereview/pr14/det_pr20141212hhretail.pdf

⁴ Ofwat used an economies of scope factor of 1.3 based on accounting data from 2009-12.

Companies which had costs above the ACTS were provided with a three year glide path to achieve the industry ACTS.

Cost of capital and financeability

Ofwat also used comparators with respect to assessing the cost of capital and elements of financeability at PR14:⁵

- Cost of capital and net margins — Ofwat made use of comparisons of listed water companies when calculating asset betas; and cross-sector comparisons in determining notional gearing levels and embedded debt costs.
- Financeability assessment — comparisons of credit ratings and financial ratios were made for the purpose of assessing the financeability of the price control.
- Pay-as-you-go (PAYG) ratios — Ofwat compared PAYG and RCV run-off rates across companies when considering the appropriateness of company proposals.

Accounting policies and assumptions

Use of comparisons have been important to Ofwat's work to ensure proper accounting and reporting of company data. For example, at PR14 Ofwat compared the level of assurance provided by companies in respect of information provided to Ofwat. Ofwat also made comparisons across companies to highlight best practice with regard to transparency of reporting.

With regard to cost allocation, Ofwat compared approaches taken by different companies with regard to allocation of costs between the household and non-household retail controls to help identify areas where companies are not following published guidance on cost allocation.

Business planning processes

Ofwat compared across companies when carrying out its risk-based review at PR14 to compare business planning processes. The risk-based review covered:⁶

- Outcomes — the company's key proposed deliverables for consumers, including current and future customers and the environment, and the incentives associated with delivering them.
- Costs — the costs, for both wholesale and retail businesses, associated with delivering the company's proposed outcomes.
- Risk and reward — how the company's proposals balance risk and the rewards for bearing those risks between consumers, including current and future customers and the environment, and the company and its investors.
- Affordability and financeability — the impact of the company's proposals on customers' bills, and its ability to finance its functions.

In Ofwat's view, the risk-based review drove competition between companies: companies with poorer, less well evidenced business plans (or with less support from customers) looked to those companies assessed as having best practice to adopt best practice across a number of areas, notably in relation to outcomes, which are discussed further below.

1.1.2 Service quality

Ofwat has made use of comparisons to drive improvements in service quality. In this section, we describe Ofwat's approach at PR14 to using comparators for setting:

⁵ Further detail can be found at: http://www.ofwat.gov.uk/pricereview/pr14/gud_tec20140127riskreward.pdf

⁶ Further detail can be found at: <http://www.ofwat.gov.uk/pricereview/pr14/review/>

- outcome delivery incentives (ODIs); and
- the service incentive mechanism (SIM).

Outcome delivery incentives

As part of PR14 Ofwat conducted comparative analysis of companies' performance commitment (PC) and ODI proposals.⁷ These "horizontal checks" identified six specific aspects of service delivery where it was possible to identify comparative performance levels:

- duration of supply interruptions;
- number of contacts from customers regarding quality of water;
- compliance with Drinking Water Inspectorate water quality standards;
- number of sewerage pollution incidents;
- number of properties impacted by internal sewer flooding; and
- leakage.

For the first five of these areas, Ofwat introduced a glide path, with appropriate financial incentives, for companies to achieve upper quartile performance by 2017-18. Upper quartile performance was based on historical performance, using three years of data where possible.

Ofwat did not determine leakage PCs based on upper quartile performance as companies' leakage proposals were based on the sustainable economic level of leakage (SELL) which can be significantly influenced by local issues such as availability of water resources and statutory abstraction reductions. Instead, Ofwat intervened to ensure that financial penalties applied to at least 10 per cent of companies' proposed PCs.

Ofwat also intervened in other ODIs to introduce financial incentives, where company proposals for reputational incentives were not consistent with the majority of other companies'.

Service incentive mechanism

The SIM is included in the household retail control (and the non-household retail control for companies operating wholly or mainly in Wales). The SIM is made up of qualitative and quantitative components.⁸

Under the SIM, companies are penalised or rewarded according to their ranking against other companies in the sector. This ranking is conducted across all companies, i.e. water only companies and water and sewerage companies. Companies are ranked based on their SIM score, which is a single score per company based on average performance between 2015 and 2019. The SIM is made up of a qualitative indicator that measures how satisfied customers are with the quality of service they receive, and a quantitative indicator (that measures things like complaints and unwanted contacts). Greater weight is placed on the qualitative measures relative to the quantitative measures (75 per cent and 25 per cent, respectively).

The number of standard deviations used to determine the limits of the rewards / penalties is not fixed in advance and will depend on the statistical spread of the companies at the time. For PR14, the scale of the financial incentive was set at +0.5 to -1.0 per cent of revenue.⁹

1.1.3 Monitoring, enforcement and spreading best practice

Beyond the use of comparators to set price limits or to improve quality of service, Ofwat also makes comparisons between the approaches taken by different firms to aid monitoring and enforcement and to

⁷ Further detail can be found at: http://www.ofwat.gov.uk/pricereview/pr14/det_pr20141212outcomes.pdf

⁸ Further detail can be found at: http://www.ofwat.gov.uk/pricereview/pr14/det_pr20141212legacy.pdf

⁹ Further details of how the SIM will apply for the next control period can be found here: http://www.ofwat.gov.uk/pricereview/pr14/pap_con201503pr14rulebook.pdf?download=Download#

identify and spread best practice, and thus facilitate improvements in performance across the sector. We discuss key areas below:

- Ofwat compares proposals across companies with regard to social tariffs to identify best practice and encourage other companies to adopt these practices.¹⁰
- Ofwat has in the past made use of comparative cost information to derive its tariff policies (particularly in relation to more innovative tariffs). Although Ofwat no longer approves charging schemes, companies have to assure Ofwat that their tariffs comply with Ofwat's policies, and comparisons are still helpful in this regard, as it is easier to identify non-compliance.
- Abstraction incentive mechanism (AIM) — comparisons on abstraction will be made to inform the reputational AIM. This will be designed to reward companies by giving them a high ranking, depending on their levels of abstraction at low flows from environmentally sensitive sites.¹¹
- Ofwat seeks to spread best practice with respect to board leadership, transparency and governance. At PR14, companies' Boards were required to provide assurance as to the quality of business plan submissions.
- In addition to the comparisons of cost allocation and accounting at PR14, the use of comparisons is also important to Ofwat's work to ensure proper accounting and reporting of company data.
- Ofwat has also previously looked at the treatment of capital expenditure for tax across the industry which has enabled it to challenge companies that appear to be in a different position to the norm.
- Ofwat derives value from obtaining a wide variety of viewpoints during consultation periods and other industry-wide stakeholder engagement.
- Ofwat requires each company to publish performance against a set of key performance indicators (KPIs) in relation to four broad areas: customer service, reliability and availability, environmental impact, and financial performance.¹²
- Ofwat has proposed an assurance framework for 2015-20 which would require companies to report information in an annual performance report, including both information specific to its customers and stakeholders and information that is comparative across the sector.¹³

1.2 Ofwat's use of comparators in the future

This section of the report presents a high-level assessment of the way in which Ofwat's use of comparators could change going forwards, if new sub-limits are introduced and market reforms continue to take place.¹⁴ This assessment is not intended to be exhaustive; rather, we aim to highlight what we consider to be some of the potential uses of comparators in the future. This is important as any framework for valuing the impacts of mergers needs to be robust to any future changes. It should be emphasised that this is our view rather than that of Ofwat.

To illustrate how Ofwat's use of comparators may change in the future we consider how the use of comparators may change once potential market reforms have been implemented, but before competition has developed sufficiently to allow competition to replace regulation for contestable parts of the value chain.

¹⁰ Ofwat also considered comparisons of affordability of bills across companies as part of PR14: http://www.ofwat.gov.uk/pricereview/pr14/det_pr20141212financeability.pdf

¹¹ Further detail can be found at: http://www.ofwat.gov.uk/pricereview/pr14/pap_pos201307finalapproach.pdf

¹² Further detail on KPIs can be found at: <http://www.ofwat.gov.uk/regulating/compliance/reportingperformance/kpi/indicator>

¹³ Further detail on Ofwat's proposed company monitoring framework can be found here: http://www.ofwat.gov.uk/regulating/compliance/pap_con02150210comon.pdf?download=Download#

¹⁴ This will require the implementation of legal changes in particular for upstream changes.

The market reforms refer to both downstream (with the potential for market entry to serve non-household customers) and upstream (with the potential for new entrants offering new water sources, water efficiency goods and services or innovative ways for dealing with wastewater and sewage sludge).

In this section we discuss, at a high level, how possible regulatory changes in the form of sub-limits and market reforms might affect Ofwat's use of comparators to regulate:

- the retail market;
- the network plus stages of the value chain (which are likely to continue to be subject to price limits); and
- the non-network plus stages of the value chain (which may become contestable in parts).

1.2.1 Retail

With regard to the contestable part of the retail market, i.e. retailing services for non-household customers, if competition does not develop as expected and/or the default tariffs that have been set for the next price control period do not provide a sufficient backstop for customers, Ofwat may wish to make greater use of comparisons of the cost of water and sewerage retailing, to inform the setting of future default tariffs.

If effective competition developed in some segments of the contestable market but not in others, Ofwat may wish to consider the use of relative price regulation. This would involve removing default tariffs but specifying the maximum permitted gap between the tariffs that firms charge customers in the more competitive and less competitive segments of the market. The size of the maximum permitted gap could be based on cost differentials, which could be assessed using simple cost comparisons between (retail) companies.

For household customers, Ofwat has stated the following:¹⁵

“We have used an ACTS approach as this price review (PR14) is the first time we have set separate price controls for retail. We made clear in July 2013 in ‘Setting price controls for 2015-20: final methodology and expectations for companies’ business plans’ (our ‘final methodology statement’) that we see this as part of an evolutionary approach that we hope will enable us to move to an efficient cost to serve over future price controls.”

Therefore, Ofwat could still make use of comparisons to identify the efficient cost of retailing for household customers in the near future (beyond AMP6), although Ofwat does not state whether this will be based on water sector comparisons or retail comparisons more generally.

With regard to comparisons of quality of service, Ofwat consulted on the design of the SIM for 2015-20 and the application of the incentives to the price controls set for 2020 onwards (based on the performance during 2015-20).¹⁶ If Ofwat were to adopt the SIM, or something similar, for the household control at PR19, comparisons of relative performance would still be required to inform the financial incentive for regulated firms. There is currently no SIM for the non-household control. However, if competition does not develop effectively following further market opening in 2017, Ofwat may wish to make use of reputational incentives for incumbent retailers (e.g. by publishing performance data).

¹⁵ Ofwat (2014) “Final price control determination notice: policy chapter A5 – household retail costs and revenues”; p3.

¹⁶ Ofwat (2013) “Service incentive mechanism (SIM) for 2015 onwards – a consultation”.

1.2.2 Network plus

In its PRI4 methodology statement, Ofwat said that it would introduce two non-binding sub-limits within the 2015-20 period:¹⁷

- one for water, covering raw water distribution, water treatment and treated water distribution, but not water resources; and
- one for sewerage, covering sewage collection and sewage treatment, but not sludge treatment, recycling and disposal.

Therefore, beyond AMP6 the use of comparators for the network plus parts of the value chain, i.e. companies' network and treatment activities, is likely to continue to have similarities with how comparators are currently used in the wholesale controls (and more broadly). The nature of those comparisons and the data required would change, as comparisons would be made at a more granular level. We discuss some key uses of comparators below.

Ofwat is likely to continue to need to make comparisons to inform the network plus cost assessment. This may entail changes to the nature of the econometric models used to carry out the efficiency benchmarking.

If, for example, it is possible to specify a cost function for separate parts of the value chain (whether this is for network plus as a whole, or separate assessment for stages of the value chain within network plus), then it may be possible to generate separate econometric models for each of these stages, and therefore, derive an industry benchmark for each of these stages.

This would require new data points at each of these stages of the value chain. Therefore, it might not be possible to continue to use a panel data approach if data have not been reported on a consistent basis at this level of granularity in the past. However, if this were to be the case, it is not clear whether the limited data for such new models for different stages of the value chain (either for network plus, or sub-stages of the value chain) would be problematic, because there is the potential for better specified models could increase the robustness of the results.

If it is possible to better specify models for separate parts of the value chain, it may be possible to produce more robust full totex models for the respective stage of the value chain, in which case it may be possible to place greater weight on the results (in the "triangulation" process) or to rely on full totex models alone (though this seems less likely for sewerage where it was not possible to specify a robust full totex model). In this case, there may be less need for unit cost comparisons of enhancement expenditure.

While water and sewerage companies might be expected to converge to the efficiency frontier over time, continued comparative efficiency analysis using econometric models could provide incentives to regulated firms to stay at the frontier, or stimulate continued improvements in the efficiency frontier over time. If costs converged to the frontier over time, Ofwat could make comparisons of total factor productivity (TFP) growth across water and sewerage companies and across comparator sectors (such as energy networks and civil engineering) to inform frontier shift assumptions. These comparisons would require data on costs and outputs to be collected from comparator sectors during water and sewerage price reviews.

If Ofwat were to continue to use an outcomes-based framework with associated ODIs within sub-limits, companies may propose outcomes that are specific to different stages of the value chain. As discussed in the section on Ofwat's current use of comparators, as part of PRI4 Ofwat conducted comparative analysis of companies' PC and ODI proposals, which identified six aspects of service delivery where it was possible to identify comparative performance levels. In the future, with sub-limits in place, if companies remain free

¹⁷ Ofwat (2014) "Setting price controls for 2015-20 – final methodology and expectations for companies' business plans"; p.28.

to propose outcomes and PCs, it may become more difficult to identify comparative performance levels, as companies propose a broader range of outcomes that relate to particular stages of the value chain. This might result in less use of financial incentives, and a greater reliance on reputational incentives.

Financial comparisons to inform Ofwat's WACC determination would still be necessary for elements of the price controls that continue to be based on a traditional RCV building block approach. This might include comparisons of equity betas, the cost of debt (including embedded debt), gearing levels, and companies' financial policies (e.g. on liquidity).

On-going financial comparisons to monitor the financial robustness of companies could be particularly important during the implementation of market and regulatory reform and in the initial years of the new regime to monitor the impact of reforms on investors. These comparisons are particularly relevant at this level of the value chain because some of the current RCV of water and sewerage companies could be allocated to the network plus stages of the value chain.

Ofwat may be able to implement processes to encourage the spread of best practice, similar to those currently used, in a more targeted way that would allow the sharing of best practice at different stages of the value chain.

1.2.3 Non-network plus

Non-network plus is a catch-all term that refers to water resources, sludge treatment, recycling and disposal. These stages of the value chain may still be subject to a sub-limit for incumbent firms, in which case the types of issues described above in relation to network plus would also apply here. In particular, Ofwat may continue to make cross-company comparisons of costs, outcomes and ODIs, and financial considerations.

However, as described earlier, upstream reforms could create the potential for new entrants to offer new water sources or innovative ways for dealing with wastewater and sewage sludge. The setting of non-network plus could therefore take on the added importance of informing upstream access pricing.

As Ofwat develops its approach to upstream access pricing, comparisons of the "internal costs" (i.e. excluding the cost of abstraction rights in the resources part of the water value chain) could be useful in informing the costs that should be allowed for in the access price that is set. While the development of upstream markets is not imminent, beyond AMP6, Ofwat may feel that the use of econometric models to assess efficient internal costs for the non-network plus stages of the value chain entails too high a regulatory burden. In this case, use of unit cost comparisons may be more appropriate.

On the other hand, given that upstream market opening will not take place before 2019, Ofwat may feel that there is a greater need for robust cost assessment to inform future access prices that send efficient price signals, but also allow recovery of efficient costs.

Comparisons of regional prices for water resources could be useful if regional upstream markets for raw water were to develop. New pricing data could need to be collected from some external agency (perhaps from a market operator if one were to be set up), rather than the companies involved in trading. These prices could be analysed alongside interconnection and bulk supply activities by companies, to see whether the market was responding to price signals in the way that might be expected. If the market were not responding as expected, Ofwat might wish to investigate whether there was some barrier preventing firms responding to regional price differentials.

2 Possible Impacts of a Merger

In this chapter, we set out the possible impacts of a merger in the water and sewerage sectors. The analysis is framed by the CMA's approach to investigating mergers — generally and specifically in the water sector. This chapter sets out the theoretical background to the assessment of these costs and benefits. The costs and benefits discussed below are hypothetical and broad ranging. The precise nature of the costs and benefits of a merger would need to be assessed on a case-by-case basis. Chapter 4 discusses the approaches to valuing these impacts.

This chapter is structured as follows:

- We first discuss potential costs of a merger in terms of the prejudice to Ofwat's ability to make comparisons. This section covers the following impacts:
 - the effect of a merger on Ofwat's quantitative benchmarks;
 - the effect of a merger on the precision of Ofwat's models;
 - the effect on Ofwat's other uses of comparators;
 - factors affecting the extent of the prejudice; and
 - prejudice to Ofwat's ability to make comparisons in the future;
- Second, we discuss the potential benefits of a merger. This is framed by the benefits that should be considered when assessing a merger, as set out in the Water Act 2014:
 - the impact on price;
 - the impact on quality of service;
 - the impact on choice;
 - the impact on innovation; and
 - how benefits may change in the future.

2.1 Prejudice to Ofwat's ability to make comparisons

As described in the previous section, comparisons are used in a number of different contexts by Ofwat in regulating the sector, and particularly in relation to setting price limits. In the following section we first consider the key areas highlighted in chapter two where Ofwat uses quantitative comparisons in setting prices and service quality:

- wholesale water and wholesale wastewater cost assessment;
- calculating ACTS in household retail cost assessment;
- setting ODIs through comparative analysis; and
- ranking performance for the SIM.

For each of these uses of comparisons, there are two key considerations in assessing the potential prejudice to Ofwat's ability to make comparisons: the impact of the merger on the benchmark (e.g. the upper quartile in the case of the wholesale cost assessment); and the impact of the merger on the precision of the benchmark derived from modelling (which is principally a concern in relation to Ofwat's use of econometric models in the wholesale cost assessment).

Following consideration of these quantitative impacts, we consider the potential impact of a merger on Ofwat's qualitative comparisons.

2.1.1 Effect of the merger on the benchmark

To identify how a merger might affect a regulatory benchmark, we first consider the simple case in which a regulator adopted a benchmark at the frontier (e.g. an efficiency frontier). Under this approach if the company taken over was the sole company operating at that frontier, then (ignoring any synergies that might result from the merger) such a takeover could result in a less challenging frontier, as the efficiency of the merged company would be a combination of the company operating at the frontier and the less efficient company that had taken it over.

At PR14, Ofwat used an upper quartile approach for wholesale costs and so the implications are less straightforward than in this stylised simple case. Under Ofwat's approach, the relative ranking of the merging firms makes a difference to the effect on the benchmark, as we shall explain below.

In PR14, the econometric and unit cost models feed into the forecast of average efficiency through triangulation across a number of different econometric and unit cost models, from which the upper quartile (UQ) threshold is derived. The UQ threshold is therefore dependent on the results of the econometric and unit cost models, and the unmodelled costs. Consequently a merger would impact on each of the models, which would then feed into the overall UQ threshold.

At a high level, there are likely to be three possible scenarios (which would apply in each of the models). These scenarios are static, i.e. they are based on the assumption that the efficiency scores assessed at the price review are unchanged during the price control period.

- “Scenario 1” where both merging parties are below (more efficient than) the UQ threshold.
- “Scenario 2” where both merging parties are above (less efficient than) the UQ threshold.
- “Scenario 3” where one merging party is above the threshold and the other party below.

The table below shows the impact of a merger on the position of the UQ threshold in each of these scenarios (where we denote the efficiency scores of the pre-merger firms E_a and E_b , the efficiency score of the merged firm E_x and the UQ efficiency threshold pre-merger E_{UQ}). To note: “efficiency scores” here are defined such that an increase in the efficiency score depicts a loss in efficiency, whereas a decrease in the efficiency score represents an increase in efficiency.

Table 2.1: Impact on UQ threshold for different merger scenarios

Pre-merger efficiency	Value of post-merger efficiency (E_x)		
	$E_a < E_x < E_b$	$E_x < E_a$	$E_x > E_b$
$E_a < E_{UQ}$ and $E_b < E_{UQ}$	Increase	Increase	Increase
$E_a > E_{UQ}$ and $E_b > E_{UQ}$	Decrease	Decrease	Decrease
$E_a < E_{UQ}$ and $E_b > E_{UQ}$	Ambiguous*	Decrease	Increase

* As E_x increases from E_a to E_b , UQ threshold first decreases as the impact of the more efficient firm dominates, then decreases as the impact of the less efficient firm dominates.

We provide below some worked examples to illustrate the generalised results above more concretely.

First scenario

In the first scenario, i.e. when the pre-merger efficiency scores of both firms are below the UQ threshold, the static impact of the merger on the benchmark is an increase in the UQ threshold, i.e. a loss in efficiency. This effect can be seen whether the merged firm has an efficiency score less than the pre-merger efficiency score of the most efficient firm, greater than the less efficient firm, or between the two. This is because there is one less firm above the pre-merger benchmark, and therefore, the upper quartile will always shift upwards (representing a loss in efficiency).

- The upper quartile for wholesale water at PR14 was calculated to be 0.9374, i.e. $E_{UQ} = 0.9374$.
- Let us assume that the efficiency score of firm A is 0.85 and the efficiency score of firm B is 0.91, i.e. $E_a < E_{UQ}$ and $E_b < E_{UQ}$.

- Whether the efficiency score of the merged firm is between that of firm A and firm B (e.g. 0.87), less than firm A (e.g. 0.83) or greater than firm B (e.g. 0.97), we will always see an increase in the upper quartile.

Second scenario

In the second scenario, i.e. when the pre-merger efficiency scores of both firms are above the UQ threshold, the opposite effect is seen: in all cases, the merger results in a more efficient UQ threshold, because there is one less firm below the pre-merger benchmark, and therefore, the upper quartile will always shift down (representing a gain in efficiency).

- The upper quartile for wholesale water at PR14 was calculated to be 0.9374, i.e. $E_{UQ} = 0.9374$.
- Let us assume that the efficiency score of firm A is 0.99 and the efficiency score of firm B is 1.04, i.e. $E_a > E_{UQ}$ and $E_b > E_{UQ}$.
- Whether the efficiency score of the merged firm is between that of firm A and firm B (e.g. 1.02), less than firm A (e.g. 0.92) or greater than firm B (e.g. 1.07), we will always see a decrease in the upper quartile.

Third scenario

In the third scenario, i.e. when one firm has a pre-merger score above the UQ threshold and another has a pre-merger score below the threshold, the results are less clear cut. If the merged entity has an efficiency score that is worse than the least efficient of the pre-merger firms, the benchmark will shift upwards representing a loss in efficiency, while the converse is true if the merged entity has an efficiency score that is better than the score of the more efficient pre-merger firm. However, if the performance of the merged entity is between the performance of the two pre-merger firms, the effect is ambiguous, and depends on where the post-merger score falls relative to the performance of the rest of the industry.

- The upper quartile for wholesale water at PR14 was calculated to be 0.9374, i.e. $E_{UQ} = 0.9374$.
- Let us assume that the efficiency score of firm A is 0.91 and the efficiency score of firm B is 1.04, i.e. $E_a < E_{UQ}$ and $E_b > E_{UQ}$.
- If the efficiency score of the merged firm is less than firm A (e.g. 0.84), we will always see a decrease in the upper quartile threshold.
- If the efficiency score of the merged firm is greater than firm B (e.g. 1.07), we will always see an increase in the upper quartile threshold.
- If, however, the efficiency score of the merged firm is between that of firm A and firm B, the effect depends on the efficiency score of the merged firm.
 - If, for example, the efficiency score of the merged firm was 0.92, the upper quartile threshold would decrease.
 - If, for example, the efficiency score of the merged firm was 0.94, the upper quartile threshold would increase.

Application to other benchmarks

The same effects on the benchmark would be found with respect to ODIs, though the parameter of interest would be performance against outcomes, rather than cost efficiency as is illustrated in the table above.

The same principles would also apply to determining the SIM. However, in the event of a merger between a “high performing firm” (i.e. one above the average) and a “low performing firm” (i.e. one below the average) where the post-merger performance was between the performance levels of the two individual companies, the point of inflexion at which the impact of the lower performing company begins to dominate would be different as calculation of the mean is not the same as ranking firms to arrive at an upper quartile.

The same principles would not hold true for the ACTS which is based on an unweighted average across companies. In this case, the performance of every company matters for the outcome of the average. The effect on the benchmark cannot therefore be generalised as it has been above.

2.1.2 Effect of the merger on the precision of Ofwat's models

Precision of econometric models

There are two key effects to consider with regard to the effect of a merger on the precision of the econometric models:

- an effect due to a loss of degrees of freedom; and
- an effect due to a change in consistency across firms.

The loss of a data point through the merger of two existing firms to form one merged party would reduce the number of data points for use in the econometric models.¹⁸ For a given number of independent variables this would reduce the degrees of freedom and, therefore, increase the standard errors in the econometric results (*ceteris paribus*). A higher standard error essentially means that the parameter estimates of the model are less precise.

With regard to consistency, the merger could have two different effects on the confidence intervals of the econometric models, depending on the nature of the two firms merging. On the one hand, a merger between two heterogeneous firms could lead to greater consistency (for the purposes of using econometric modelling for cost assessment), which could have an offsetting effect on the loss of precision owing to fewer degrees of freedom.¹⁹ On the other hand, a merger between two homogenous firms could have the opposite effect, thus amplifying the loss of precision in the models.

The loss of data points may be particularly pertinent in the case of the full totex COLS, as this includes 20 independent variables, as opposed to 11 in the four refined regression models. Further, given the modelling approach depicted in Figure 1.1, the weighting given to the full totex COLS in the final measure for water totex is 33 per cent, while for the other models it is effectively only 16.5 per cent (50 per cent of 33 per cent). This means that any given impact on the precision of the full totex COLS would feed through more into the precision of the final totex number, than any impact on precision of the other econometric models.

In practice, we may not expect any major differences in the impact on precision of a lost data point between the COLS and RE models. COLS applied to panel data is pooled OLS with a displacement of a constant, while RE in practice is very similar, as it essentially gives a different weight to the “within” variation (i.e. within firms over time) and “between” variation (i.e. across firms) in the data. In particular, when the variance of the individual firm error is small (which tends to happen when the time invariant inefficiency component in the random effects model is low), the two estimators provide very similar results in terms of parameter estimates. In the general case, the random effects estimator requires a larger number of companies than COLS; nevertheless, if the structure of the error term has precisely the random

¹⁸ Strictly speaking, given the use of panel data, Ofwat would not lose just one data point. The merger would create a new firm entering the panel with the loss of information for the two unmerged parties. Where the two firms are very different and the merged entity is likely to be closer to one of the merging firms than the other, e.g. in the case of a merger between a WaSC and a WoC, this may be akin to losing just one comparator, and therefore, five data points in the example. However, if the two firms are very similar, this can complicate matters, as it may not be appropriate in that case to assume the merged entity is the continuation of one of the merging entities. In that case, Ofwat would also lose the information in the years prior to the merger: in the case of two WoCs, this would mean the loss of nine data points (with a five year panel and the merger taking place in year 5).

¹⁹ Though, here, as noted in the footnote above, the relative size of the firms merging could also influence how significant the loss of freedom is.

effects form, the random effects estimator provides more efficient estimates than OLS (and therefore COLS). However, the statistical properties of the random effects estimator in small samples are not yet very well known, and therefore, it would not be possible to arrive at a general conclusion on the difference in the impact of losing a comparator between COLS and RE models without conducting, for example, simulations or Monte Carlo analysis.

Precision of unit cost models

As described in the previous section, there are four types of unit cost models used by Ofwat, two of which are econometric and two of which are not. All four of these unit cost models are given equal weighting (25 per cent) in estimating the enhancement unit costs.

A merger could have an impact on the precision of the non-econometric unit cost models, as a merger could make the calculation of averages more susceptible to outliers. This could be assessed by seeing if there is a difference in the standard deviation of the non-econometric unit cost models pre- and post-merger.

The econometric unit cost models would see a loss of precision due to the loss of a data point (by the same mechanisms described earlier). This may be particularly relevant in the case of assessing unit costs of enhancements to Supply-Demand Balance and, even more so, lead reduction, due to the current number of data points. The impact on the precision of the log econometric model may be greater in these cases, again due to having fewer data points in the model pre-merger. On the other hand, since univariate analysis is based on raw values (as opposed to log values in the log-linear regressions), outlying values will have a larger impact on the results — therefore, to the extent that the loss of a comparator increases the scope for outliers, there may be a greater impact on the precision of the univariate models.

Precision of ACTS, SIM and ODI models

In all of these uses of comparators, there would be no loss of precision in a statistical sense as a result of a merger — only some qualitative loss of precision in the sense that a numeric average becomes more influenced by each individual data point as the number of data points decrease. This could mean that outlying data points have a more significant impact on the benchmark:

- The calculation of ACTS uses an unweighted average. This calculation could therefore be particularly susceptible to the effect of an outlying firm.
- The rewards and penalties under the SIM are based on the number of standard deviations from the mean SIM score for each company:

$$s.d. \text{ from mean SIM Score}_i = \frac{SIM \text{ Score}_i - \text{average SIM Score}}{s.d. \text{ of SIM Scores}}$$

While the calculation of the mean SIM score could be more likely to be skewed by outlying firms in the event of a merger, the standard deviation of SIM scores could increase, which may to some extent offset the effect on the mean. However, the precise effect is ambiguous and would depend on the relative performance of all firms, including the merged entity.

- The calculation of ODIs would be less susceptible to this as performance is based on upper quartile performance.

2.1.3 Effect on Ofwat's other uses of comparators

Ofwat also makes use of comparisons much more widely, employing comparisons for monitoring and enforcement, and to identify and spread best practice. A merger could have a negative effect on Ofwat's ability to make such comparisons by making it more difficult to identify best practice or if the merger meant

that a firm previously identified as being an industry leader in a particular area no longer had best practice in that area. We discuss below some key possible impacts. The extent to which any of these impacts would materialise would depend on the context of the merger, and would need to be assessed on a case-by-case basis.

- Comparisons on abstraction will be made to inform the reputational AIM. This will be designed to reward companies by giving them a high ranking, depending on their levels of abstraction at low flows from environmentally sensitive sites. A merger could result in changes in rankings in the same way that has been described earlier in relation to the effect of a merger on Ofwat's benchmarks.
- If Ofwat were to receive an IDoK or substantial adverse effects claim following a merger, it would have less data to make industry-wide comparisons of costs to challenge submissions from the company that has submitted the claim. While this may reduce the robustness of the comparisons, it could be helpful if, for example, the merged entity had much higher costs in a particular cost area that is subject to the claim, which in turn meant that it was easier to challenge the company submitting the claim.
- It may be more difficult for Ofwat to spread best practice with respect to board leadership, transparency and governance if one of the merging parties is an industry leader in this regard. Having said this, the nature of this area means that a merger might make it easier to spread best practice, in which case there might not be any detrimental impact on Ofwat's ability to make comparisons.
- A merger could have negative impacts on Ofwat's ability to make comparisons to ensure appropriate treatment of tax. Fewer comparators might make it more difficult to compare the treatment of capital expenditure for tax across the industry, and therefore reduce the extent to which Ofwat is able to challenge companies that appear to be in a different position to the norm.
- Similarly, a merger could make it more difficult for Ofwat to compare approaches taken by different companies to help identify areas where companies are not following published guidance on cost allocation, simply because it is less evident with fewer comparators.
- As previously mentioned, Ofwat requires each company to publish performance against a set of key performance indicators (KPIs) in relation to customer service, reliability and availability, environmental impact, and financial performance. A merger could reduce the strength of the reputational incentives fostered by publication of performance against these KPIs by reducing the number of comparators. On the other hand, if the merger results in substantially improved performance for the merged firm relative to the rest of the industry, this could enhance the strength of the incentives.

2.1.4 Factors affecting the extent of prejudice

The extent to which a merger may prejudice Ofwat's ability to make comparisons in the ways described above would depend on a range of different factors, which we highlight below. This emphasises the need to judge the effect of each merger on Ofwat's use of comparators on a case-by-case basis.

The number of services merging

The greater the number of monopoly services merging, the greater the potential impact on Ofwat's ability to make comparisons because a greater number of comparators would be lost, i.e. a merger between two WaSCs would create greater scope for detriment (at the margin) than a merger between a WaSC and WoC or a WoC and a WoC.

The number of independent companies in the market segment

The number of independent companies in the market is a key driver of the marginal impact of a loss of a comparator. As the number of companies in the market falls, the marginal cost of an additional merger on the use of comparators will rise. All other things being equal, the econometric and unit cost models, would see an increasing marginal loss of precision of estimates as the degrees of freedom shrink. In theory, up to a certain point and depending on the characteristics of the companies merging, this could be potentially

offset by improvement in the consistency of the comparators. Other unit cost models and the ACTS, which rely on simple averages, would become increasingly susceptible to outliers. A reduction in the number of companies would also make UQ thresholds more susceptible to change in light of a merger — although the impact of the merger on the threshold would depend on the precise characteristics of the merged firm and the two firms pre-merger.

The extent to which the costs of the merging company are similar to the rest of the industry

As set out above, a merger could have an offsetting positive impact on the precision of Ofwat's econometric models if the merger improves the degree of homogeneity across the sector. If one of the merging firms is very different to the rest of the industry, and the proposed merger would bring its costs more in line with the rest of the industry, the merger could have a positive effect on precision. However, if the firms party to the proposed merger are similar (e.g. because they exhibit similar cost drivers as a result of, for example, similar geographies, similar operating techniques or similar technologies), then the loss of one of these firms through a merger could have a negative effect on precision.

A key factor to consider in this regard is the size of the merging firms (e.g. with respect to the length of mains, the number of customers served and, by consequence, the density of the network). In PR14, Ofwat's cost assessment tools did not treat firms of different sizes in different ways. Therefore, the potential influence of size on the potential scale of detriment may be diminished, for example, as all companies can contribute towards the benchmark regardless of size. Nonetheless size is still a relevant factor in the degree of homogeneity across the sector.

A similar consideration could apply with respect to the location of the firms. In the past, Ofwat has considered there to be greater scope for prejudice to its ability to make comparisons if the merging parties are contiguous because non-contiguous companies can retain some element of independent management. However, in practice Ofwat has not found this to be the case.

The performance of the companies pre-merger and the expected performance of the merged company

As set out earlier, the impact of the merger will also be dependent on the performance of the companies pre-merger and the expected performance of the merged company. In some instances, the benchmark may be unchanged, while in other circumstances it may increase or decrease, and will need to be considered on a case-by-case basis.

Convergence in performance

Another key factor affecting the extent to which a merger prejudices Ofwat's ability to make comparisons is the extent to which all firms' performance (with respect to cost efficiency, outcomes, service quality, etc.) is expected to converge over time. If performance is expected to converge (to the benchmark, say) in a short space of time, the extent to which Ofwat's ability to make comparisons is diminished may be more limited as firms become more homogeneous (at least with respect to performance), reducing the marginal impact of losing a comparator.

2.1.5 Prejudice to Ofwat's ability to make comparisons in the future

Going forwards, Ofwat's use of comparators may change in the face of market reforms and changes to the regulatory framework. Therefore, the impacts detailed above may materialise in different ways, or to differing degrees. In this section, we explore how these impacts might change in the future. We first explore possible Ofwat responses to a merger that leads to a change in methods within the status quo framework. Second, we consider how impacts of a merger might change under different frameworks.

Status quo

The status quo refers to the PRI4 regulatory framework and the current market structure, i.e. absent further market reforms. If Ofwat considered that the marginal impact of a proposed merger would mean that the current quantitative uses of comparators were no longer robust, it could change its approach.²⁰ For example, in relation to Ofwat's wholesale cost assessment models:

- Ofwat could opt to use a longer time series in its models, provided that data are available to allow this (e.g. if there is no change in the definition of cost drivers, data on those drivers could continue to be used). In principle, one of the benefits of using panel data is the possibility of getting more information to estimate a model's parameters. However, pooling data over time will only bring benefits in terms of more reliable parameter estimates when the variables display sufficient variation over time. As the cost drivers in Ofwat's wholesale models are mostly network variables that change slowly over time, then there will be little change in variables over time. Using a longer panel might also have some disadvantages. With panel data coefficients are usually assumed to be constant over time; however, this does not need to be the case, and the longer the time series, the less defensible this assumption. On the other hand, a recent contribution to the academic literature by Kumbhakar and Horncastle, which uses the UK water industry as a case study, states that there are benefits from using panel data.²¹ In particular, the authors do not find evidence of parameter instability over time: if this continued to be the case in the future, increasing T (i.e. the length of the time series) would allow the use of more information (provided the cost drivers display some variation across companies) and therefore more precise parameter estimates.
- A reduction in the statistical robustness of Ofwat's econometric models as a result of a merger could cause Ofwat to be less certain that the model estimates are appropriate. This could lead to Ofwat setting a less challenging benchmark, which would be a negative impact of a merger.
- A reduction in the statistical robustness of Ofwat's econometric models as a result of a merger could lead to Ofwat adopting different econometric models at the next price review. Examples might include the following:
 - Stochastic frontier analysis (SFA) estimates a production (or cost) function indicating the maximum attainable output (or minimum costs) given the particular inputs. This technique incorporates the possibility of measurement error or factors related to chance in the estimation, i.e. any lower performances can be traced back to random noise as well as inefficiency. However, SFA is generally estimated using maximum likelihood techniques, which require many data points. Moreover, with a small n (i.e. number of firms) and t (i.e. time period for which there are data), some of the algorithms that are used to compute maximum likelihood estimates of some SFA models can fail to converge in real empirical applications. Therefore, SFA may not be an appropriate response to the loss of data points in Ofwat's current models, particularly for sewerage.
 - Data envelopment analysis (DEA) is a non-parametric technique that uses linear programming to calculate the efficient frontier of a sample. DEA can also be very sensitive to the number of data points. In particular, if one of the companies that "disappears" from the sample was a "benchmark" for other companies, then companies that were relatively inefficient might end up as 100 per cent efficient.

²⁰ However, it is worth noting here that Ofwat has in the past considered a number of these approaches and opted not to implement them. Therefore, to the extent that these approaches are appropriate alternatives in the face of a loss of a comparator, these alternative approaches are likely, at best, to partially offset any prejudice to Ofwat's ability to make comparisons.

²¹ Kumbhakar S. and Horncastle A. (2010), "Improving the econometric precision of regulatory models", *Journal of Regulatory Economics*, 38, 2

- The loss of a data point could mean that it is not possible to develop robust unit cost enhancement models. This could mean that Ofwat has to treat a greater number of cost items as “unmodelled”, which could increase the negative marginal impact of a merger.

With regard to other areas of comparisons, if there are fewer comparators available due to mergers in the sector, this could lead to Ofwat setting a less challenging benchmark for ODIs, SIM and retail costs. On the other hand, convergence in performance against outcomes to the upper quartile (as was assumed at PR14) might mean that the same degree of comparisons between firms to determine outcomes and ODIs is not required. The marginal impact of a merger may therefore be more limited. Similar considerations might apply in relation to SIM; however, as was the case with the OPA before it, Ofwat could change its approach whilst still using a similar framework, which would not reduce the need for comparisons.

More granular price controls

The introduction of network plus sub-limits would require Ofwat to generate cost models for the network plus elements and the non-network plus elements of the water and sewerage value chains.²² On the one hand, this could reduce the need for comparators, as the more granular treatment of costs could lead to more homogenous cost functions across the industry, therefore, reducing the impact of losing a comparator. On the other hand, consideration of the wholesale value chain as a whole could mask some of the between company heterogeneity, in which case the use of more granular models could result in a greater negative impact from losing a comparator. This effect would not necessarily be the same across all parts of the value chain.

In general, the use of very granular models in benchmarking can make the risk of identifying an “infeasible frontier” higher, as some companies may be more efficient in some parts of the value chain and less efficient in others, and so being efficient across all elements of the value chain might therefore be more difficult. Ofwat could offset this by adopting a less stringent benchmark. To address the potentially increased uncertainty, an SFA approach could be adopted.²³ However, as previously stated, SFA requires a lot of data, and the number of observations in the water sector is relatively low. A reasonable alternative might be to make use of sub-company data. However, the residuals of observations belonging to the same company are likely to be correlated: this makes the usual standard errors invalid and the usual correction (i.e. clustered standard errors) require a sufficiently large number of groups (i.e. companies) to be valid. Losing a comparator might therefore create a problem with the use of sub-company data too.²⁴

The use of more granular price controls may allow Ofwat to make comparisons to set more targeted outcomes (assuming outcomes commitments and ODIs are still in place in the future); however, the nature of these comparisons is unlikely to change. Therefore, the impacts of a merger on Ofwat’s ability to make comparisons to inform ODIs could be much the same as is described in section 2.1.1. The same would apply for SIM.

Increased competition

As discussed in section 1.2, if competition develops sufficiently well in contestable parts of the value chain, Ofwat may be able to scale back its use of comparators for the purposes of setting price controls, and the

²² Of course, if the network plus sub-limits are non-binding, Ofwat would still have to make use of wholesale cost assessment models, in which case the consideration outlined earlier in this section would still apply.

²³ As stated earlier in this section, SFA incorporates the possibility of measurement error or factors related to chance in the estimation. Therefore, any performances lower than the frontier can be traced back to random noise as well as inefficiency.

²⁴ The resource cost to Ofwat of adopting more granular data would also need to be borne in mind in any impact assessment, as more granular benchmarking models would obviously require greater data collection, collation and cleaning to allow the analysis to take place. Water and sewerage companies would also incur additional data collection and compliance costs.

use of comparators may become an *ex post* monitoring exercise (which could also make use of non-water comparators). In this case, the impact of a merger on Ofwat's ability to regulate could be more limited.

2.2 Benefits of a merger

The Water Act 2014 sets out the benefits that should be considered for a water merger. Specifically, the assessment should consider:

- lower prices, higher quality or greater choice of goods or services in any market in the United Kingdom; or
- greater innovation in relation to such goods or services.

If it is determined that Ofwat's ability to make comparisons is negatively impacted, then the benefits:

- which may be expected to accrue must be substantially more important than the prejudice concerned;²⁵
- must be expected to accrue within a reasonable period as a result of the merger concerned;²⁶ and
- must accrue to customers of any person carrying on an enterprise which, in the merger concerned, has ceased to be, or (as the case may be) will cease to be, a distinct enterprise.²⁷

The CMA's approach to assessing mergers, more generally, is driven by the aim of establishing whether, or not, the merger would lead to a substantial lessening of competition (SLC). This means that the assessment of mergers is primarily driven by an assessment of the costs to consumers through the potential to distort competition.²⁸ Nevertheless, the CMA also takes into account the potential benefits that may offset the detriment caused by a loss of effective competition. Since, these benefits are considered in the context of whether they offset the detriment caused by an SLC, they are sometimes referred to by the CMA as countervailing factors.²⁹ Three principal countervailing factors considered by the CMA are:

- the impact on economic efficiency;
- the impact on barriers to entry and expansion; and
- the impact on countervailing buyer power.³⁰

Such factors are also collectively referred to as "relevant customer benefits" that the CMA must take account of when prescribing potential remedies in light of a merger. The Water Act requires a similar assessment of relevant customer benefits that may be expected to occur from a merger. The following section sets out the key factors in considering the impact of a merger on each of the relevant customer benefits in terms of price; quality of service, choice and innovation.

2.2.1 Impact on prices

A key consideration in the assessment of a merger is the potential impact of the merger on economic efficiency or, rather, the extent to which the merger could generate cost synergies, which could result in lower prices. **Under the Water Act, to be considered a benefit of the merger the efficiencies must be expected to arise as a direct consequence of the merger and must not be expected to occur in the absence of the merger.**

²⁵ Water Industry Act 1991, Schedule 4ZA, s.4(1)(b).

²⁶ Water Industry Act 1991, Schedule 4ZA, s.7(2)(a).

²⁷ Water Industry Act 1991, Schedule 4ZA, s.7(4)(a).

²⁸ Competition Commission (2010) "Merger assessment guidelines"; adopted by the CMA.

²⁹ CMA (2014) "A Quick Guide to UK Merger Assessment"

³⁰ *Ibidem*.

In this section, we first discuss potential efficiency gains from operational synergies, followed by the scope for financial synergies.

Operational synergies

Operational synergies comprise production and/or administrative efficiencies that can arise as a result of a merger. These efficiencies are usually understood through the concepts of economies of scale and economies of scope. The former describes a situation in which the average cost of production decreases with the scale of production.

Such a relationship may be attributable to a variety of factors. First, economies of scale may result from a reduction in overhead costs per unit production. Overhead costs are those costs that are incurred in operating a business, but that are not directly attributable to the production of specific units. This encompasses the costs of running a range of support functions including: public relations; procurement; human resources; finance; and research and development. Areas in which there could be the greatest scope for overhead cost savings are the customer facing functions and the team involved in preparing regulatory and statutory accounts. An increase in firm scale may lead to a less than commensurate increase in the scale of these support functions and, as such, the overhead costs per unit of production could decrease.

By rationalising such support functions and avoiding a duplication of shared activities, a merger may be able to reduce the staff, IT and other infrastructure costs of the merged party. Some activities may be more conducive to rationalisation than others — for example, it might be easier to rationalise a human resources department than a research and development department, as the latter may face very specific challenges which relate to the geographic area in which it operates. The extent to which synergies can be realised across these different activities would be dependent on the characteristics of the merger parties, with synergies perhaps easier for contiguous firms.

Economies of scope describes a situation where the joint production of different goods or services is less than the sum of the production costs of the goods or services by separate specialised firms. In the context of the water industry, economies of scope would refer to the potential for cost-savings due to the joint supply of:

- water and sewerage services as a whole;
- household and non-household customers; and
- upstream and downstream services in either water or sewerage.

Economies of scope may come from the use of common inputs in the supply of water and sewerage services or reduced overhead costs through, for example, shared network management and common billing. The use of common inputs may also increase buyer power and thereby generate further cost savings, as discussed in more detail below.

The evidence on economies of scale and economies of scope from previous empirical studies is dependent on the size and type of the merging firms, i.e. WaSC-WaSC, WoC-WoC or WaSC-WoC.³¹ The majority of literature does not find evidence of economies of scope in the provision of water and sewerage services (e.g. Bottasso *et al.* (2011)³²) which suggests that WaSC-WoC mergers would be unlikely to generate efficiency savings. There is also little evidence in support of economies of scale emanating from WaSC-

³¹ It should also be noted that the definition of scale often varies in different studies, and the choice of how scale is defined matters both for whether there are economies of scale, and for whether they can be realised through a merger.

³² Bottasso, A., Conti, M., Piacenza, M. and Vannoni, D. (2010) 'The Appropriateness of the Poolability Assumption for Multiproduct Technologies: Evidence from the English Water and Sewerage Utilities', *International Journal of Production Economics*, vol. 130(1), pp112-117.

WaSC mergers — for example Stone & Webster (2009) find diseconomies of scale for the average sized WaSC.³³ However, evidence on the potential impact of WoC-WoC mergers is more mixed: Ashton (2003) found evidence of slight diseconomies of scale for WoCs, while Balance *et al.* (2004) concluded constant returns to scale.

Work done for Ofwat by CEPA for PR14 found that there are varying returns to scale in both water and sewerage services.³⁴ In water, elasticities with respect to length of mains suggest economies of scale for some companies and diseconomies for others. However, the range is narrow with the average company showing relatively constant returns to scale. In sewerage, all companies display economies of scale.

The benefits discussed so far relate specifically to those benefits that may accrue, either as a result of increased scale or as a result of increased scope of activities. However, irrespective of a change in scale or scope, the merging parties may be able to reap efficiency benefits by sharing best practices from their existing operations. It may, for example, be the case that one firm has a more efficient procurement process, while the other firm has a more efficient governance structure.

A merged party may be able to benefit from improved buyer power in procurement, as a supplier of inputs would have greater incentive to keep the custom of a large supplier, even if that was at the expense of a lower price per input charged, because the loss of such a large quantity of orders would be detrimental to revenue. Examples of inputs that are procured for the provision of water and sewerage services include engineering and construction support, piping, valves, water meters and billing software. A merged party may also benefit from improved buyer power in the procurement of more general, non-water specific inputs, such as the IT equipment and transport that are required by employers. The potential for improved buyer power could be considered of particular relevance to the water sector given the homogeneity of the end product and, hence, the similarity in some of the inputs required by firms. In assessing the extent to which a specific merger could generate favourable buyer power, important considerations are the size of the merged party relative to other industry players, as well as the extent of consolidation among the input suppliers themselves which would hamper such buyer power.

A sharing of best practices may not be limited to creating efficiency gains either. Sharing best practices could also improve the security of supply and product and infrastructure quality. A merger between two contiguous firms may, for example, streamline the sharing of water resources in supply-deficit areas (which could currently happen to some extent with water trading arrangements in place), thus helping to balance supply and demand.

There may also be one-off costs arising from the merger process, including the resource costs of any transitional arrangements that are set-up while the merger process is ongoing. Costs include the costs of migrating current IT systems, consolidating duplicate departments, staff retraining, the merging of accounting and regulatory practices, and the possible relocation, expansion or closure of company premises. The materiality of these costs would depend on the relative characteristics of the two merging parties, their relative sizes and whether they operate in contiguous regions or not. While these costs are transitional and, therefore, are only expected to be incurred in the early post-merger years, it is important to take such costs into account as they may offset any efficiency savings in the short-term.

Financial synergies

Financial synergies refers to the impact of a merger on the ability of the companies post-merger to raise finance more cheaply than they could pre-merger for example reducing the cost of debt.

³³ Stone & Webster Consultants (2004) 'Investigation into evidence for economies of scale in the water and sewerage industry in England and Wales'.

³⁴ CEPA (2014) "Cost assessment — advanced econometric models".

At PRI4, Ofwat considered whether it was appropriate to provide small WoCs with an uplift to the industry-wide allowed weight average cost of capital (WACC).³⁵ The WoCs considered that the cost of debt they pay is higher than the level that was set out in Ofwat's Risk and Reward Guidance because:³⁶

- The actual cost of embedded debt for WoCs is higher than Ofwat's guidance figure. However, Ofwat found little evidence to suggest that the large WoCs have a higher cost of embedded debt than the WaSCs.³⁷
- WoC bonds command a premium over WaSC bonds. Based on limited evidence (due to the relative rarity of bond issuances by small companies), Ofwat found that small WoC bonds had an average interest rate premium compared to WaSC bonds.
- WaSCs have access to a wider range of funding sources, whilst small WoCs may have to place greater reliance on bank debt.

Overall, Ofwat considered that small WoCs have a higher cost of debt finance of around 25 basis points, but an uplift was not appropriate for the cost of equity. Therefore, to the extent that a merger allows a small WoC to take advantage of financial synergies, there may be an efficiency gain with respect to the cost of debt the small WoC faces compared to its cost of debt in the absence of a merger.

2.2.2 Impact on quality of service, choice and innovation

Quality of service

The merger could provide benefits in terms of increase service quality. This could be driven by the sharing of best practices as well as some of the efficiency gains described above. Examples of improvements in quality of service that could result from a merger that may not be realised without the merger include:

- Improvements in security of supply for customers, due to better sharing of water resources in supply-deficit areas by merging parties in contiguous areas.
- Better customer service, e.g. as a result of the integration of better billing software and experience in operating alternative, better systems.
- Reduced leakage rates as a result of shared best practice, drawing on in-house engineering know-how.

In line with statutory requirements the improvement in customer service should be a direct result of the merger and should not be possible through alternative means such as the normal sharing of best practice across companies, or improvements in customer service over time.

Choice

The scope for a merger in the water sector to improve choice for customers is limited given the nature of the market at present. In particular, the non-household market will only be fully contestable from 2017, and the household market will remain the domain of regional monopoly suppliers, and therefore, these customers would not have a choice in choosing their supplier.

There is also not choice in the services offered, as all (incumbent) companies in the water and sewerage sectors currently offer the same "products". A merger would therefore not lead to greater product differentiation and variety for customers.

³⁵ Small WoCs are Bristol Water, Dee Valley Water, Portsmouth Water, Sembcorp Bournemouth Water, Sutton & East Surrey Water and South Staffordshire Water.

³⁶ PwC (2014) "Company specific adjustments to the WACC"; p.4.

³⁷ Large WoCs are Affinity Water and South East Water.

However, in the near term it is possible that the merger could improve choice in the non-household retail market, as the merger could lead to a spread in the range of tariffs offered by the merged company, compared to the unmerged entities.

Innovation

A merger could also have an impact on the level of innovation. This could occur in one of two ways:

- A merger could lead to a change in the effectiveness of research and development (R&D) spending on innovation.
- A merger could itself lead to more innovative structures, such as very large water only company or a sewerage only company, which could produce greater efficiency, than created by existing industry structures.

With regard to the first bullet point, a merger can impact on the effectiveness of R&D spending in three ways. First, the returns to R&D are higher the more widely the results of R&D are applied. Consequently a merger, by extending the production base across which the results of an R&D process can be applied, could increase the returns to the R&D process. This should therefore create stronger incentives for investment in R&D.

Second, a merger could provide benefits to the R&D process through information pooling/knowledge share. Employees of the merged firm may be encouraged to share information to improve the chances of finding innovative solutions. Due to the homogeneity of service in the water industry relative to other sectors, the production processes are likely to be more similar and so the effective R&D stock of a merged party could approximate to the unweighted sum of the individual company pre-merger R&D.

Third, in contrast to the two previous points, a merger could be detrimental to R&D if there are diminishing marginal returns to R&D investment, i.e. for every extra unit of R&D, the expected returns on that extra unit fall. In theory, a merging party that combines two existing R&D programmes (without tempering the scale of the R&D investment) might be expected to reach diminishing marginal returns quicker than two separate R&D departments. The extent to which diminishing marginal returns would materialise would depend on how far away each merging firm is from the minimum efficient scale of R&D, and where the merged firm will lie in relation to this threshold. Potentially of greater consequence are other factors such as differing cultures, internal rivalries, etc. which can often lead to R&D failures in mergers. Overall, however, conclusive evidence on the returns to the scale of R&D in the water sector is not available.

Changes to legislation could in the future create the potential for innovative mergers which could create benefits for customers of the merging parties. For example, if legislation allowed, more creative approaches to M&A, such as a merger between two companies of their wastewater businesses and, separately, their retail businesses, might offer the scope for greater synergies than a traditional, vertically integrated acquisition.³⁸

³⁸ Such changes to the structure of the market have not yet been formally consulted on. However, in a recent speech in London, Jonson Cox, Chairman of Ofwat, indicated that Ofwat would be looking for more than efficiency savings if asked to approve merger activity, and said that size was not necessarily an indicator of efficiency, and he called for more creative approaches to M&A. (See: http://www.ofwat.gov.uk/mediacentre/speeches/prs_spe201503jonsoncoxpolicyexchange.pdf)

3 Valuing the Prejudice to Ofwat's Ability to Make Comparisons

In this section, we discuss approaches to valuing the impacts of a merger on Ofwat's ability to make comparisons:

- First, we consider the appropriate framework for the assessment.
- Second, we look at techniques for assessing the impact on Ofwat's quantitative benchmarks:
 - the first step looks at techniques for assessing the impact of a merger on the benchmarks set for the current price control;
 - the next step looks at probabilistic approaches that have been used in the past by the Competition Commission to assess the impact on the benchmarks over time;
 - we then provide a recommended approach based on an assessment of the pros and cons of the different approaches described; and
 - we finally present suggested methodologies to apply the recommended approach.
- Third, we look at techniques for valuing the impact of a merger on the precision of Ofwat's econometric models:
 - the first approach is based on the theoretical impact of the reduction in sample size;
 - the second approach involves simulating the effect of the merger by re-running the econometric models;
 - the third approach is based on a statistical technique to increase sample sizes known as bootstrapping;
 - based on an assessment of the pros and cons of these approaches, we provide a recommended approach; and
 - we finally present suggested methodologies to apply the recommended approach.
- Fourth, we look at approaches for assessing the impact on some of Ofwat's other comparisons.

3.1 Framework for the assessment

The analysis of the impact of a merger needs to consider the incremental impact of the merger on Ofwat's ability to make comparisons, compared to a counterfactual scenario in which the merger does not take place. Ofwat will need to consider the impact of the merger, and the extent to which it creates prejudice in the context of its statutory duties. While Ofwat has a number of general and secondary duties, we consider that, given Ofwat's ongoing requirement to ensure that companies are able to finance their activities and undertake their functions, the focus of any assessment should be on the customer impact, or the net customer detriment, of any loss of a comparator.

The appropriate time period for assessing the impact on Ofwat's ability to make comparisons from a merger is the timeframe over which the customer impact (and therefore prejudice) might be expected to persist. While this timeframe is not certain, we note that once a merger had taken place, the company would be lost to Ofwat as a comparator and so any impacts may be enduring and long term. We therefore consider that the impact on Ofwat's ability to make comparisons should be assessed over a 30-year period.

This is the timeframe adopted in the last two merger inquiries made by the Competition Commission, and we consider it would be pragmatic to adopt a consistent approach.³⁹

To allow impacts over time to be compared, the assessment would need to bring all of the impacts together as net present values (NPV). The calculation of a net present value requires the use of a discount rate to apply to future values to convert them into present values. The impact of a merger on Ofwat's ability to make comparisons would feed through to the setting of prices, service quality, monitoring and enforcement. These effects would ultimately result in consumption impacts. We therefore consider that the assessment should use the social time preference rate as the discount rate, which is currently set at 3.5 per cent in HMT Green Book.⁴⁰ This is consistent with the approach used in the last two merger inquiries.

As discussed further below, some of the valuation techniques only estimate the impact in one price review period. This analysis would need to be extended to cover a period of 30 years, either through the introduction of "probabilistic approaches" which take account of the potential change in company performance over time, or more qualitative analysis of the likelihood of impacts continuing over time.

3.2 Valuing the impact on Ofwat's benchmarks

In this section we set out approaches to valuing the impact on Ofwat's quantitative use of comparators, focussing on the four key examples of wholesale cost assessment, ACTS, ODIs and SIM. We first consider in general the "static" impact of a merger on the benchmark set at the last price review, before explaining how this effect could be examined over time.

It should be stressed that none of the approaches discussed in this section is able to generate an "exact" answer of the incremental effect on Ofwat's use of quantitative benchmarks. Therefore, companies using these approaches would be expected to supplement quantitative analysis with supporting evidence around key assumptions. Further, any quantitative analysis would benefit from sensitivity analysis in the form of ranges derived from multiple techniques and/or ranges derived from the use of different scenarios within each technique (e.g. scenarios reflecting the degree of uncertainty in the expected performance of the merged entity, or expected performance over time).

3.2.1 Assessing the impact on the benchmark for the current price control period

One way to assess how a merger might impact on customers in the future, is to consider how a merger might have affected the current benchmark (i.e. the benchmark determined at the most recent price review). While the merger would not change this benchmark, as the price control has been set, this analysis would provide an indication of what the "static" impact of a merger might be on the set of tools used by Ofwat at price reviews.

This would involve determining revised rankings and new benchmarks for the industry in the following areas:

- A revised upper quartile wholesale water cost benchmark.
- A revised upper quartile wholesale wastewater cost benchmark.
- Revised ACTS benchmark.
- Revised upper quartile outcome performance benchmarks.
- Revised SIM rankings.

³⁹ See Competition Commission (2012) "South Staffordshire Plc/Cambridge Water PLC merger inquiry" (pages 33, 53 and 65) and Competition Commission (2007) "South East Water Limited and Mid Kent Water Limited" (pages 35 and 52).

⁴⁰ HM Treasury (2003) "The Green Book: Appraisal and Evaluation in Central Government".

There are a number of ways in which this analysis could be carried out, which we discuss in more detail below. Depending on the level of uncertainty in the results, it may be appropriate to consider several methods to provide ranges for the impact of a merger on the benchmark for the current price control.

Assume that the smaller merging party is lost as a comparator and the merged entity has the same performance as the larger merging party

- For wholesale costs, this could be done by removing the data points for the smaller merging party from Ofwat's cost assessment models and re-running the analysis to derive a new upper quartile threshold for water and, if necessary, for wastewater.⁴¹ An alternative would be to assume that the relative efficiency of the industry does not change, and simply recalculate the upper quartile threshold based on the efficiency scores derived at PR14, but removing the efficiency score for the smaller merging party.⁴²
- A new ACTS could be derived by recalculating the unweighted average once the smaller of the merging parties has been removed.⁴³
- A similar approach to that described above for ACTS could be adopted for the outcome performance benchmarks, but in this case it would be a revised upper quartile that is calculated, based on one fewer data point for internal sewer flooding, mean zonal compliance, pollutions incidents, supply interruptions and water quality contacts.⁴⁴
- The impact on the SIM is different, as SIM scores are calculated on an annual basis and rewards and penalties calculated accordingly. However, it would be possible to take historic performance from 2011-12 onwards, and calculate the effect on total penalties and rewards as a result of the change in the relative performance of the industry when the smaller of the merging parties is removed from the sample.⁴⁵

If the merging parties are of a similar size, an alternative to dropping the smaller firm from the sample would be to remove the merging party that has worse performance — this could be done in respect of each of the four areas listed above, or a decision made as to which firm has better performance (e.g. based on performance with respect to wholesale costs, given that this accounts for the majority of allowed revenues).

Assume that the merged entity's performance is the sum/average of the performance levels of the merging parties

- For wholesale costs, this would involve summing costs and cost drivers. For cost drivers such as "proportion of metered properties", a new proportion could be calculated by first deriving absolute numbers for each company, then summing them, then generating new proportions. For cost drivers such as "regional wage", it would be necessary to derive an average. An alternative, simpler approach that would not involve re-running Ofwat's models would be to assume that the relative efficiency of the industry does not change, and then simply recalculate the upper quartile threshold based on the efficiency scores derived at PR14, but removing the scores for the merging parties and introducing an efficiency score for the merged party based on an average of the pre-merger scores.

⁴¹ Ofwat's models and underlying data can be found here:

http://www.ofwat.gov.uk/pricereview/pr14/wholesale/prs_web140404pr14wholesalecostasses

⁴² The efficiency scores for the whole industry can be found here (p.27):

http://www.ofwat.gov.uk/pricereview/pr14/det_pr20141212riskrewardbenefits.pdf

⁴³ Ofwat's household retail ACTS final determination populated model can be found here:

http://www.ofwat.gov.uk/pricereview/pr14/pap_tec201412hhretailpopmodel.xlsx

⁴⁴ Ofwat's upper quartile calculations for these outcomes can be found here:

http://www.ofwat.gov.uk/pricereview/pr14/prs_web201412pr14uq

⁴⁵ Historic SIM scores can be found in Ofwat's work to estimate the benefits of an uplift to the cost of capital:

<http://www.ofwat.gov.uk/content?id=9d01e438-8542-11e4-8fe5-b9bb2e8303f4>

- A new ACTS could be derived by recalculating the unweighted average once the inputs for the merging parties have been summed.
- A similar approach to that described above for ACTS could be applied to calculate the impact of the merger on outcome performance benchmarks.
- As described above, the impact on the SIM is different. It would be possible to take historic performance from 2011-12 onwards, and calculate the effect on total penalties and rewards as a result of the change in the relative performance of the industry when the SIM scores for the merging parties are removed and an average SIM score for the merged entity is introduced.

Where averages are needed, these could be done on an unweighted or a weighted basis. Justification would need to be provided for the most appropriate approach (e.g. an unweighted average may be appropriate where the two merging firms are similar), and where a weighted average is used, it may be appropriate to carry out sensitivity analysis using different weights.

Assume some difference in the merged entity's performance relative to the sum/average of the performance levels of the merging parties, based on some qualified assumptions

This approach would involve the same steps for each of the four quantitative benchmarking exercises considered here. However, in this case the performance of the merged entity in each area may not simply be a combination of the merging parties, but would include some improvement in or worsening of performance levels. Any changes in cost efficiency or performance with respect to outcomes or service quality would need to be appropriately justified. (Further detail on how to value such benefits is provided in the next chapter on valuing benefits of the merger.)

3.2.2 Probabilistic approaches to assessing the impact on the benchmark over time

The Competition Commission used probabilistic approaches to identify the likelihood of a company remaining or moving above the benchmark in future price control periods in its assessment of the impact of the South Staffordshire Plc/Cambridge Water PLC merger and the South East Water Limited and Mid Kent Water Limited merger. Ofwat built on this approach in its assessment of the benefits of a company-specific uplift on the cost of capital.

The Competition Commission has used three different approaches to assess the probability that a company will remain at or move above the benchmark:

- **The changes approach.** This approach considers movements in rankings across every five year period in the sample, and then calculates the frequency of different magnitudes of changes in ranking. These frequencies are then used to estimate the probability associated with movements of different magnitudes.
- **The permutations approach.** This approach is similar but identifies the frequency of changes in ranking of different sizes over a five-year period by combining the change in rank over a two-year period and a three-year period. Specifically, this approach calculates the frequency of different permutations of changes in two- and three-year periods that result in a net change of rank of different sizes over a five-year period. The frequencies are then used to estimate the probability associated with changes in rank of different magnitudes.
- **The transitions approach.** The two approaches above do not take into account the ranking the company started at. The transitions approach takes into account a company's starting rank when assessing the frequency of change to calculate probabilities.

Changes approach

Under the changes approach, the Competition Commission considered movements in water companies' ranks across every five-year period from 2001 to 2009, i.e. they compared each water company's rank in

each year from 2001 to 2004 to its rank five years later and then calculate the frequency of different magnitudes of changes in ranking. These frequencies were then used to estimate the probability associated with movements in rankings of different magnitudes to identify whether companies would still contribute towards the benchmark.

Box 3.1: Competition Commission use of changes approach

Step 1: The Competition Commission calculated each company's rank in each year from 2001 to 2009.

Step 2: Next, for each company and each five-year period, the movement in that company's rank was calculated (i.e. by comparing each company's rank in each year from 2001 to 2004 to its rank five years later, and taking the difference). For example, a company ranked 11th in 2001 and 9th in 2006 would have a change in its rank in this five-year period equal to an improvement of two places.

Step 3: The third step was to calculate the frequency of changes in rank of different magnitudes, i.e. the number of times movements of different sizes (e.g. an improvement of two places, +2) were observed in the data.

Step 4: These frequencies were then used to evaluate the probabilities attached with movements of a given number of places in Ofwat's rankings — movements that were found to be historically more common were predicted to be more likely going forwards, and any movement in rank that had not been observed was assumed not to occur in the future.

Permutations approach

The Competition Commission also used the permutations approach when assessing whether a company was likely to contribute to a benchmark. The main benefit of the permutations approach is that it increases the number of observations available to estimate companies' changes in rank, by reducing the length of the periods across which changes in rank are assessed. Specifically, the Competition Commission considered the extent to which companies' ranks have historically changed across every two- and three-year period from 2001 to 2009.

Box 3.2: Competition Commission use of permutations approach

Step 1: The Competition Commission calculated each company's rank in each year from 2001 to 2009.

Step 2: Next, for each company, the movement in that company's rank was calculated for each two-year period and three-year period (i.e. rather than comparing 2001 to 2006, as in the changes approach, the ranking in 2001 was compared to the ranking in 2003, and the ranking in 2001 was separately compared to the ranking in 2004).

Step 3: The next stage was to calculate the frequency of different permutations of the identified two- and three-year changes that result in a net change of rank of different sizes over a five-year period. For example, to predict the probability of a company improving its rank by ten places over a five-year period, the Competition Commission would have summed its estimates of the likelihood of the company:

- increasing by 16 places in a two-year period, and then decreasing by 6 places in a three-year period (with a net impact of an increase of 10 places in Ofwat's ranks);

- increasing by 16 places in a three-year period, and then decreasing by 6 places in a two-year period;
- increasing by 15 places in a two-year period, and then decreasing by 5 places in a three-year period;
- decreasing by 5 places in a two-year period, and then increasing by 15 places in a three-year period;
- etc.

Step 4: These frequencies were then used to evaluate the probabilities attached with movements of a given number of places in Ofwat's rankings.

Transitions approach

The permutations approach assumed that the movements in rank over the two- and three-year periods are independent of each other, i.e. a change in a company's rank in the previous period has no impact on the extent to which its rank changes in the subsequent period. The Competition Commission analysed the proportion of water companies whose rank increased, stayed the same or decreased, depending on the change in their rank in the previous period, and found that the movement in a company's rank in one year may be related to the movement in that company's rank in the previous year.

The changes approach may also be affected by dependence in the data, as this methodology assumes that water companies' movements in rank are unaffected by their starting position. The Competition Commission found that the starting position may play a role in determining the probability of different movements of rank in subsequent years. To control for the impact of the starting position, the Competition Commission applied the transitions approach, which is described below.

Box 3.3: Competition Commission use of transitions approach

Step 1: The Competition Commission calculated each company's rank in each year from 2001 to 2009.

Step 2: Next, for each company and each five-year period, the movement in that company's rank was calculated (i.e. as was done for the changes approach).

Step 3: The third step was to identify changes in rank for a company with a given starting point by taking only those changes in rank for companies with that starting position or lower. For example, to predict the movements in rank for a company positioned sixth in Ofwat's models for opex efficiency (as were then used), the Competition Commission only took those changes in rank for companies whose starting position was sixth or lower.

Step 4: The next step was to calculate the proportion of the companies whose rank improved sufficiently to reach a given position in Ofwat's rankings (e.g. the top 3).⁴⁶ This was then repeated for each starting rank

⁴⁶ Ideally, this would be done for each ranking, but given the limited amount of data, this was not feasible. The Competition Commission therefore followed the approach taken in the South East Water/Mid Kent Water merger investigation, and partially accounted for companies' starting positions by grouping together all companies below a given position in Ofwat's rankings. This approach allowed the Competition Commission to estimate the probability of a company reaching the top of Ofwat's rankings given its starting position.

Step 5: These frequencies were then used to evaluate the probabilities associated with companies with different starting positions in Ofwat's rankings moving a given number of places.

Pros and cons of probabilistic approaches

In general, these approaches have the following disadvantages:

- The approaches 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 firm's performance.
- The approaches assume independence in the data across time and across companies.

Nonetheless, the approaches described above allow assessment of the likelihood of changes in rank over time, which can be used to infer an impact on performance with respect to different areas. However, there are issues with each approach that should be borne in mind. In particular:

- The changes approach can be based on limited data if there have been a small number of changes in rankings over time. Further, it could overestimate the probability of companies with a high starting position reaching the top of the rankings, as this approach does not account for the tendency for the rankings of companies with higher starting positions to worsen going forwards.⁴⁷
- The permutations approach is particularly susceptible to the independence of observations assumption as probabilities of different permutations of two- and three-year changes in rank are combined. As for the changes approach, the permutations approach could overestimate the probability of companies with a high starting position reaching the top of the rankings.
- The transitions approach will require a larger number of observations as this approach excludes those observations where a company's starting position was above a given rank.⁴⁸

Bearing these issues in mind, we consider the most appropriate approach is likely to be the changes approach, as it is less likely to suffer from issues related to dependence in the data as is the case for the permutations approach, and it is less likely to suffer from sample size issues as is the case for the transitions approach. However, if sufficient data are available, companies may wish to adopt the transitions approach (if deficiencies over the out-turn probabilities can be resolved); or companies may wish to follow all three approaches (which all use the same underlying data) to arrive at a range.

Further, extending the probabilistic change analysis to an analysis of the underlying drivers of changes in rankings (which are driven by the relative historic performance changes of the ranked firms) can provide insights into the causes of change in ranking, as probabilistic change analysis by itself does not identify or evaluate the impact of the drivers. Even where a statistical analysis to uncover such drivers may not be feasible for want of data, case study analyses can provide insights.

Amendments made by Ofwat in PRI4 work

Ofwat employed the changes approach in its assessment of whether wholesale costs, or SIM benefits from a comparator would continue in its work to assess whether to provide a company-specific uplift to the cost of capital.⁴⁹ Ofwat made two amendments to the general approach described above:

⁴⁷ For example, the Competition Commission's analysis of the effect of the South Staffordshire/Cambridge merger on Ofwat's benchmarking of opex efficiency found that the position of water companies towards the top of Ofwat's rankings were more likely to worsen in the next year.

⁴⁸ The Competition Commission's analysis using the transitions approach in the South Staffordshire/Cambridge merger was based on a very small sample, and as a result it appeared to give implausibly low probabilities of remaining at a certain rank.

- Ofwat only took into account those observations that were feasible for a given starting position and omitted those that were not, given that the changes approach is likely to over-estimate the probability of being at the top or bottom of the efficiency rankings, as an increase in the ranking from the top (or a reduction in the ranking from the bottom) cannot be achieved.
- The resultant matrix of probabilities (showing the probability of reaching different ranks given a starting rank) was multiplied by itself to produce probabilities for 10 years, 15 years, 20 years and 25 years to produce probabilities for the 30 year period considered in past merger cases.⁵⁰

We support these changes. In our judgement, the modification to the changes approach to only include observations that are feasible is appropriate to reduce the impact of overestimating the probability of certain scenarios. The assessment of probabilities in future price controls is appropriate as it avoids the need to assume that effects seen in this price control would persist in future price controls.

We therefore recommend that companies employ these methods when applying the changes approach (or other probabilistic approaches) — unless some better method can be identified — to understand the likelihood of a company remaining or moving above the benchmark in future price control periods.

Applicability of these approaches in the future

While the probabilistic approaches set above would not reflect the specific features of firms in the industry, it would provide an indication of the potential magnitude of losing one of the comparators in terms of the effect on benchmarks. However, this may not be the case in the future as regulatory changes and market reforms are implemented. We discuss the applicability of these approaches in the future below.

- Wholesale cost assessment:
 - These approaches may not be appropriate if more granular price controls are adopted. These probabilistic approaches rely on using past performance to inform the probability of a firm moving above or remaining above the benchmark. It would be necessary to make an assumption about how past performance across the value chain might relate to the different stages, given that there would not be data on cost performance at different stages of the wholesale value chain.
 - Here, a reasonable assumption might be to impose the historical distribution of rankings across the value chain on firms' performance at each relevant stage of the value chain.⁵¹ However, if there are substantial differences in opex and capex performance for different companies at different stages of the value chain, then such an assumption may not be appropriate. This is likely to be particularly problematic for capex efficiency performance which cannot be easily measured on annual basis, and would therefore need to be assessed on a five-yearly control period basis, during which performance could be affected by a myriad of factors.
 - As market reforms are implemented, the development of competition upstream might lead to a convergence in cost performance with regard to water resources or sludge. In the event that more granular sub-limits were introduced, this might mean that there is less need to assess the impact on the cost performance of these non-network plus stages of the value chain.

⁴⁹ Ofwat (2014) "Final price control determination notice: annex 3 – benefits assessment of an uplift on the cost of capital".

⁵⁰ The Competition Commission approach only provided a change of rankings over a five year period.

⁵¹ Ofwat arrived at its changes matrix in its work on the company-specific uplift to the cost of capital by weighing the source data taken from opex and capex rankings based on how much opex and capex there is in wholesale (a 60/40 split). If the proportions of capex and opex are known for a particular stage in the value chain, the same approach could be used.

- Retail cost to serve:
 - The introduction of more granular price controls would not affect the applicability of these probabilistic approaches for assessing the effect of a merger on the retail cost to serve, as the household retail stage of the value chain is already separate.
 - However, the development of competition in the non-household retail market could lead to spillover effects on cost efficiency in household retail which could lead to faster convergence in efficiency.
- ODIs
 - The introduction of more granular price controls should not affect the way in which comparisons are made, given that the development of ODIs inherently relates to outcomes rather than inputs.
 - These probabilistic approaches would therefore still be applicable in merger assessment (though the final incentives that are determined may relate to different sets of revenues, depending on which controls the outcomes are allocated to).
- SIM
 - As for retail cost to serve, the introduction of more granular price controls would not affect the applicability of these approaches to assessing the impact on the SIM benchmark as this would continue to be a function of retail performance.
 - The development of competition downstream could lead to spillover effects on performance in household retail which could lead to faster convergence in performance with regard to quality of service.

Overall, therefore, we do not consider that future regulatory changes or market reforms would invalidate these probabilistic approaches to assessing the impact of a merger on these benchmarks over time.

3.2.3 Recommended approach

In this section, we provide our recommendation on the most appropriate approach and provide suggested methodologies for applying this recommend approach.

The merging parties may wish to determine the effect on the current benchmarks (i.e. the benchmarks determined at the most recent price review) for wholesale cost assessment, ACTS, ODIs and SIM to illustrate the potential impact of a merger on the set of tools used by Ofwat at price reviews.

While these approaches may be helpful in providing an indication of the potential magnitude of any effect on Ofwat's analysis results, they do not provide concrete forward-looking impacts, as the price control for AMP6 has been set, and the merger would not affect the allowed expenditure for the period. Further, these approaches do not give any indication of the dynamic effect of a merger on Ofwat's benchmarks over time (e.g. in subsequent price controls).

To assess the impact over time, the effects on the PRI4 benchmarks could be assumed to persist over a 30 year assessment period, and the effect of the merger on the benchmark quantified on this basis. However, it would not be realistic to assume that the each company's performance across the industry would remain constant over this time period. An alternative approach would be to extrapolate information used to generate benchmarks at PRI4 over the 30 year period. However, again, this may result in unrealistic assumptions, as the merging companies would be assuming performance levels for all companies in the industry over time.

With this in mind, it would therefore be sensible to adopt a probabilistic approach to assessing the impact on Ofwat's benchmarks over time, as this would allow assessment of the likelihood of changes in rank over time, which can be used to infer an impact on performance with respect to different areas.

As described in section 3.2.2, the most appropriate probabilistic approach is likely to be the changes approach (modified in line with Ofwat's work on an uplift to the cost of capital at PR14), as it is less likely to suffer from issues related to dependence in the data than is the permutations approach, and it is less likely to suffer from sample size issues than is the transitions approach. However, companies may wish to follow all three approaches (which all use the same underlying data) to arrive at a range.

Box 3.4: Recommended overall approach to assessing the impact on Ofwat's benchmarks

We recommend that the analysis of the impact on Ofwat's benchmarks is based on the changes approach to assess changes in rankings at each price review over a 30 year period.

This analysis could be carried out for at least the following: Ofwat's wholesale cost assessment, the ACTS, ODIs and SIM. (See suggested approaches below.)

Companies should make the best use possible of historic data in each context to examine the changes in historic rankings to inform probability distributions for the rank of a company at future price reviews. These probability distributions should be applied to estimated changes in the benchmarks as a result of the merger to arrive at a monetised impact (which may be positive, i.e. beneficial). The results should be discounted and summed over a 30 year period to arrive at a present value impact.

3.2.4 Suggested methodologies based on recommendation

Suggested approach for wholesale cost assessment

We set out below a process to estimate the consumer impact (if any) from a merger on Ofwat's wholesale cost benchmarking. This approach draws on the Competition Commission's changes approach, as well as the approach taken by Ofwat in its work on the benefits of company-specific uplift to the cost of capital.

We suggest using a five year period for assessing changes in rankings, as this is consistent with the length of the price control and over this length of time changes in rankings with respect to cost performance should be robust to anomalous year-by-year changes. We note that this analysis does not need to be carried out on a five-yearly basis. The time period for the assessment should make the best use of historic data on cost performance, and be appropriately justified.

Box 3.5: Suggested approach for wholesale cost assessment

Step 1: Establish the rank for all companies in prior years. Given the change to totex at PR14, it is necessary to look at opex and capex separately in earlier years.

Step 2: The next step is to look at movements in each company's rank in each five-year period. Here, the approach taken by Ofwat in its PR14 work on the benefits of company-specific uplifts to the cost of capital provides a useful guide as to how this could be done. Specifically, the merging companies would need to assess the change in opex efficiency ranking for each company in all overlapping five-year periods for which data are available, and use capex efficiency rankings from PR99, PR04 and PR09.⁵² This would generate a separate distribution of the frequency of changes in rankings for opex and capex. A single totex distribution can then

⁵² Data on opex efficiency rankings for 2000-2009 were used in Ofwat's PR14 work; Ofwat (2014) "Final price control determination notice: annex 3 – benefits assessment of an uplift on the cost of capital".

be produced by taking a weighted average of the capex and opex distributions (weighted by the relative proportions of opex and capex in totex).

Step 3: Generate a probability distribution for the rank of a company at a future price control given its current rank. Here, Ofwat's modification at PR14 to the Competition Commission's changes approach could be used, i.e. including only those observations from the dataset (resulting from the previous steps) that are feasible.

Step 4: Multiply the probability distribution derived in step 3 (which provides the probability distribution of changes in rankings for the next price control) by itself to generate a distribution of starting at a given rank and ending at a given rank in 10 years' time (i.e. in two control periods' time), then again for 15 years, then again for 20 years, then again for 25 years (i.e. for 25-30 years' time).

Step 5: Establish the rank that a company would need to be at to be above the upper quartile threshold at the last price review. At PR14, the upper quartile threshold of 97 per cent was between the fifth and sixth ranked companies; therefore, a company would have to be ranked fifth or above to be above the upper quartile threshold.

Step 6: Calculate the probability of a firm reaching this rank in future price controls given its starting position by summing the probabilities in each distribution derived in Step 4. Taking the PR14 example, to calculate the probability of the firm ranked 18th at PR14 reaching fifth rank or higher in a future price control, one would sum the probabilities of reaching rank 1, 2, 3, 4 and 5 for a firm starting in 18th position. This should be done for each probability distribution, i.e. 5, 10, 15, 20 and 25 years.

Step 7: Establish what the upper quartile would be if the performance of the merged entity is above the upper quartile established at the last price review, and what it would be if the performance of the merged entity is below the upper quartile threshold established at the last price review.

Step 8: In each case derived in step 7, calculate the difference between the new upper quartile and the old upper quartile threshold, and multiply these differences by the total totex for the industry to derive a potential impact of the loss of a comparator in the event that the merged firm's performance is above the old threshold, and if it is below.

Step 9: Calculate the undiscounted customer impact of losing a comparator in future price control periods by multiplying the probability of reaching the upper quartile given a starting rank (established in Step 6) by the impact if the merged entity is above the old upper quartile threshold (established in Step 7) and add this to the multiple of the probability of not reaching the upper quartile given a starting rank and the impact if the merged entity is below the old upper quartile threshold. This should be done separately for each future price control period in the 30 year period.

Step 10: The £m figures arrived at in step 9 (which cover the impact over 30 years) should then be discounted to arrive at a present value impact. Given that the analysis will cover five-year periods, this exercise should be carried out taking the mid-point of each period as the number of periods to which the cost impact should be discounted.

Suggested approach for household retail cost assessment

This section sets out how the impact from losing a comparator on the household retail cost to serve could be calculated. The approach set out is similar that suggested above for wholesale costs. However, some modifications are required because the household retail cost assessment at PR14 was based on unweighted averages, rather than an upper quartile estimate. In particular, to enable implementation of a probabilistic approach, we suggest generating efficiency scores to rank firms.

To assess the likelihood of a company remaining above the ACTS without having to generate new historic ACTS estimates, we suggest using a five year period for assessing changes in rankings, based on the historic ACTS figures for 2013-14 and 2014-15 as well as the forecast data for 2015-16 to 2019-20.⁵³ However, the analysis does not need to be carried out on a five-yearly basis. Companies would be expected to make the best use of historic data on cost performance, and justify why a certain time period is appropriate.

Box 3.6: Suggested approach for ACTS

Step 1: For each company in the industry, generate efficiency scores for each cost to serve estimate (i.e. per unmetered customer, per metered water customer, per metered sewerage customer and per metered dual service customer) by dividing the company cost to serve by the industry cost to serve. Carry this out for all companies in the years 2013-2020 used in the ACTS assessment (using the 2013-14 industry ACTS) and establish the rank for each cost to serve estimate.

Step 2: The next step is to look at movements in each company's rank in each five-year period. This would generate a separate distribution of the frequency of changes in rankings for each cost to serve estimate (i.e. per unmetered customer, per metered water customer, per metered sewerage customer and per metered dual service customer). If data on changes in rankings are limited, it may be appropriate to consider changes across all of these cost to serve measures together, rather than separately.

Step 3: Generate a probability distribution for the rank of a company at a future price control (with respect to each cost to serve estimate) given its current rank. Here, Ofwat's modification at PR14 to the Competition Commission's changes approach should be carried out, i.e. only those observations from the dataset (resulting from the previous steps) that are feasible should be taken into account.

Step 4: Multiply the probability distribution derived in step 3 (which provides the probability distribution of changes in rankings for the next price control) by itself to generate a distribution of starting at a given rank and ending at a given rank in 10 years' time (i.e. in two control periods' time), then again for 15 years, then again for 20 years, then again for 25 years (i.e. for 25-30 years' time).

Step 5: For each cost to serve estimate (i.e. per unmetered customer, per metered water customer, per metered sewerage customer and per metered dual service customer), establish the rank that a company would need to be at to be above the median at the last price review.

Step 6: Calculate the probability of a firm reaching this rank (for each cost to serve estimate) in future price controls given its starting position by summing the probabilities in each distribution derived in Step 4. For example, to calculate the probability of a firm ranked 15th at PR14 with respect to the cost to serve metered water customers, one would sum the probabilities of

⁵³ See: http://www.ofwat.gov.uk/pricereview/pr14/pap_tec201412hhretailpopmodel.xlsx

reaching ranks 1 to 9. This should be done for each probability distribution, i.e. 5, 10, 15, 20 and 25 years.

Step 7: Establish what the median efficiency score would be if the performance of the merged entity is above the median based on the cost to serve estimates allowed at the last price review, and what it would be if the performance of the merged entity is below this median.

Step 8: In each case derived in step 7, calculate the difference between the new median and the old median, and multiply these differences by the industry ACTS (for each cost to serve estimate) and then by the total number of customers (as modelled by Ofwat at PR14). This calculation would derive a potential impact of the loss of a comparator in the event that the merged firm's performance is above the old median, and if it is below.

Step 9: Calculate the undiscounted customer impact of losing a comparator in future price control periods by multiplying the probability of reaching the median given a starting rank (established in Step 6) by the impact if the merged entity is above the old median (established in Step 7) and add this to the multiple of the probability of not reaching the median given a starting rank and the impact if the merged entity is below the old median. This should be done separately for each future price control period in the 30 year period.

Step 10: The £m figures arrived at in step 9 (which cover the impact over 30 years) should then be discounted to arrive at a present value impact. Given that the analysis will cover five-year periods, this exercise should be carried out taking the mid-point of each period as the number of periods to which the cost impact should be discounted.

It should be noted that this approach assumes that an average cost to serve would still be used in future price controls, and therefore estimates a median efficiency score to represent this. However, in the future this may not be the case. Ofwat has been clear that it sees the ACTS as part of an evolutionary approach that it hopes will enable it to move to an efficient cost to serve over future price controls.⁵⁴ Therefore, it may be sensible to conduct sensitivity analysis, by using an upper quartile rather than the median in the exercise above.

Suggested approach for ODIs

The following section sets out how the impact of a merger on Ofwat's horizontal ODIs could be assessed in a similar way to the wholesale cost modelling. (It should be noted that an impact on sewer flooding and pollution incidents will only be expected for mergers between two WaSCs.)

The box below sets out a suggested approach to assessing the impact of a loss of comparator for horizontal ODIs. To assess the likelihood of a company remaining as upper quartile we propose that changes in rankings should be considered on a year-by-year basis, as there would only be limited data on outcomes published during AMP6. As discussed below, it would be possible to use previous data as proxies for relative performance levels on certain outcomes, but given the absence of financial incentives pre-PR14, these data may not give an accurate representation of likely changes in rankings with respect to key outcomes. Nonetheless, as for other areas of Ofwat's benchmarking, the merging parties would be expected to make the best use of historic data on outcomes, and justify why a certain time period is appropriate for assessing changes in rankings.

⁵⁴ Ofwat (2014) "Final price control determination notice: policy chapter A5 – household retail costs and revenues"; p.3.

Box 3.7: Suggested approach for ODIs

Step 1: Establish each company's rank in prior years. Given the introduction of outcomes at PR14, it is necessary to use proxy measures to determine rankings in earlier years (though as PR14 data become available, these could be added to the analysis).

- Data on the number of interruptions lasting more than three hours are available in June Returns, which are publicly available.⁵⁵ This could be normalised using the total number of properties, and used as a proxy for average length of interruption per customer due to planned and unplanned interruptions >3hrs (minutes per property). Data beyond 2010-11 on the length of interruptions per property served are available in published key performance indicators (KPIs).⁵⁶

- Data on the number of pollution incidents at CSOs, foul sewers (categories 1, 2 and 3) and rising mains are available in June Returns, which are publicly available. This could be normalised using the total length of sewers, and used as a proxy for Category 3 pollution incidents (per km of sewer). Data beyond 2010-11 on the number of incidents per km of sewer are available in published key performance indicators (KPIs).

- Data on the number of sewer flooding incidents from overloading and other causes are available in June Returns, which are publicly available. This could be normalised using the total number of properties connected to the sewerage system, and provides a direct comparison to the outcome measure of number of properties flooded per 1000 connected properties. Data beyond 2010-11 on the total number of internal sewer flooding incidents are available in published key performance indicators (KPIs).

- Data on water quality contacts and mean zonal compliance (i.e. overall drinking water quality) are available for 2011-13.⁵⁷

Step 2: The next step is to look at movements in each company's rank from year-to-year with respect to the different outcome measures. (To note: this would only be possible for 2011-13 for water quality contacts and zonal compliance.) This would generate separate distributions of the frequency of changes in rankings for each measure.

Step 3: Generate a probability distribution for the rank of a company at a future price control given its current rank. Here, Ofwat's modification at PR14 to the Competition Commission's changes approach to remove unfeasible movements could be carried out, i.e. only those observations from the dataset (resulting from the previous steps) that are feasible in theory should be taken into account.

Step 4: Multiply the probability distribution derived in step 3 by itself to generate a distribution of starting at a given rank and ending at a given rank in each year of the assessment.

Step 5: Establish the rank that a company would need to be at to be above the upper quartile threshold at the last price review. This should use Ofwat's standard metrics rather than individual company metrics (e.g. in relation to sewer flooding, Ofwat's standard metric was number of properties flooded per 1000 properties).

⁵⁵ See: <http://www.ofwat.gov.uk/regulating/junereturn/>

⁵⁶ See: <http://www.ofwat.gov.uk/regulating/casework/reporting/earlierreports>

⁵⁷ Drinking Water Inspectorate (2013) "Drinking water 2013"; see: <http://dwi.defra.gov.uk/about/annual-report/2013/>

Step 6: Calculate the probability of a firm reaching this rank in future price controls given its starting position by summing the probabilities in each distribution derived in Step 4.

Step 7: For each metric, establish what the upper quartile would be if the performance of the merged entity is above the upper quartile established at the last price review, and what it would be if the performance of the merged entity is below the upper quartile threshold established at the last price review.

Step 8: In each case derived in step 7, calculate the difference between the new upper quartile and the old upper quartile threshold. Convert this difference in the standard metric to a difference in the company metric (where required, using Ofwat's conversions⁵⁸). Then multiply these changes in performance by the financial incentive for each outcome for each company to derive a potential impact of the loss of a comparator in the event that the merged firm's performance is above the old threshold, and if it is below.

Step 9: Calculate the undiscounted customer impact of losing a comparator in future price control periods by multiplying the probability of reaching the upper quartile given a starting rank (established in Step 6) by the impact if the merged entity is above the old upper quartile threshold (established in Step 7) and add this to the multiple of the probability of not reaching the upper quartile given a starting rank and the impact if the merged entity is below the old upper quartile threshold.

Step 10: The £m figures arrived at in step 9 should then be discounted to arrive at a present value impact.

The results of the analysis set out above should be treated with caution for two reasons. First, prior to PR14 these outcomes were not subject to financial incentives. Consequently forecasting rankings based on changes in rankings in the past may not be reliable. This issue should be reduced with the introduction of data from AMP6. When using this approach it will be important to justify why the future rankings are plausible.

Second, while this approach provides a means of estimating the impact of a merger on the estimation of the outcome performance upper quartile, it should be noted that because Ofwat assumes companies will meet or exceed the current upper quartile performance level, the basis on which Ofwat would set any horizontal ODIs for subsequent control periods is unclear, as is the relative performance of different companies at the start of the next period. Further, not all companies are subject to the horizontal ODIs outlined above and the basis for individual ODIs and their relative impacts on financial performance differs across companies, reflecting customer priorities for each company. This ultimately makes cross-sector comparisons difficult and reduces the potential benefits from additional comparator companies.

With regard to this second point, it may be sensible to carry out some sensitivity analysis to support the approach above based on an assumption that firms would converge in performance by the end of AMP6. The process would be similar to that set out above, but step 4 would only be repeated for the number of years remaining till 2020, with no impact assumed beyond 2020. In practice, Ofwat may tighten the benchmarks at the next price control, and further improvements may be garnered. However, it would not be possible to anticipate this in a merger assessment. Therefore, to illustrate the potential impact of convergence, it would be sensible to carry out sensitivity analysis along these lines.

⁵⁸ See: http://www.ofwat.gov.uk/pricereview/pr14/prs_web201412pr14uq

Suggested approach for SIM

The following section sets out how the impact of a merger on the SIM could be assessed in a similar way to the wholesale cost modelling

In what follows, we suggest assessing changes in rankings on a year-by-year basis, as there are limited historic data available for the SIM. However, more data will continue to become available during AMP6, and assessment of changes in rankings over longer time period will become possible. The time period for the assessment should make the best use of historic data on quality of service performance, and be appropriately justified.

Box 3.8: Suggested approach for SIM

Step 1: Establish the rank for all companies in prior years since the SIM was introduced, i.e. total annual SIM scores for each company. For each company, calculate the deviations in SIM score from the mean score, and the number of standard deviations from the mean in each year, and calculate a distribution of “standardised scores” (calculated as the difference between the company score and the mean score, divided by the standard deviation of all scores).

Step 2: The next step is to look at movements in each company's rank (for all companies) from year-to-year. This would generate distributions of the frequency of changes in rankings with respect to SIM scores.

Step 3: Generate a probability distribution for the rank of a company at a future price control given its current rank. Here, Ofwat's modification at PR14 to the Competition Commission's changes approach should be carried out, i.e. only those observations from the dataset (resulting from the previous steps) that are feasible should be taken into account.

Step 4: Multiply the probability distribution derived in step 4 by itself to generate a distribution of starting at a given rank and ending at a given rank in each year of the assessment. The timeframe considered could be chosen to reflect expected convergence in performance across the sector. For example, if convergence was expected over the next two control periods, probability distributions could be generated for 10 years.

Step 5: For each distribution, multiply the probabilities for a given rank by the distribution of standardised scores in any given year (calculated in step 2) to generate (for each company) forecast deviations from the mean score divided by standard deviation of scores.

Step 6: Calculate the forecast SIM scores, assuming the distribution of standardised scores is constant over time.

Step 7: Calculate the mean scores and standard deviation of scores for each year, when (separately) removing each of the merging parties to see what the effect in either case would be. Alternatively, the merging parties could generate a forecast set of scores for a merged party.

Step 8: Calculate the expected rewards and penalties for each company in the sector in each year with a company removed from the analysis, or with a forecast set of scores for the merged party. Discount and sum these forecast incentive payments and penalties to arrive at the total impact.

When carrying out this analysis, it is important to remember that this is likely to represent an upper bound of the likely detriment to Ofwat (as estimated by this approach), as Ofwat could make use of quality of service benchmarks from other sectors, which would limit the impact of a merger in the water sector.

3.3 Valuing the impact on precision of econometric models

Ofwat found that its wholesale cost models become less precise if a company is removed from the sample, but that the models continue to be fit for purpose to enable an upper quartile efficiency challenge — i.e. there would be no need to set a less stringent efficiency challenge to compensate for any lack of precision in the models.⁵⁹ Ofwat's assessment of the benefits of an uplift to the cost of capital therefore considered that there was no material impact on customers associated with a loss of precision.

However, as discussed earlier in the report, the loss of data points in Ofwat's wholesale costs models through the merger of two existing firms to form one merged party would reduce the number of data points for use in the econometric models, which *ceteris paribus* would increase the standard errors in the econometric results.

It is not possible to arrive at an “exact” answer of the effect of the merger on precision, because any re-running of the models would also result in changes in relative efficiency of the industry. It is therefore sensible to consider a number of approaches to valuing the impact (if any) of a merger on the precision of Ofwat's econometric models.

There are a number of approaches that could be taken to assess the impact on the precision of Ofwat's econometric models for wholesale cost assessment, which could be adapted from approaches used by the Competition Commission in the past to assess the impact on Ofwat's previous econometric models to assess opex efficiency, including:

- assessing the theoretical impact of a reduction in sample size (the Competition Commission's “general approach”);
- simulating the merger by re-estimating models (the Competition Commission's “specific approach”); and
- the use of bootstrapping to understand the potential effect of having more data.

While these techniques were used in the context of the opex efficiency models that Ofwat previously used, the same principles would apply when considering the impact on Ofwat's current totex models, though some modifications would be required.

In this section, we first highlight the approaches taken by the Competition Commission before going on to provide a recommended approach and setting out a suggested methodology based on this recommendation.

3.3.1 Assessing the theoretical impact of a reduction in sample size

The precision of an estimate derived using an econometric model can be measured by estimating the width of its confidence interval. These confidence intervals are derived using standard errors, a statistic which provides an estimate of the extent of uncertainty that should be attached to an estimate given the variation in the data used to derive that estimate.

The standard error of a coefficient estimate is given by the following formula:

⁵⁹ Ofwat (2014) “Final price control determination notice: Annex 3 – benefits assessment of an uplift on the cost of capital; p.8.

$$s.e. = \sqrt{\frac{1}{(n-k)} \times \frac{SSR}{SSX}}$$

Where:

- n = the sample size;
- k = the number of parameters being estimated;
- SSR = the sum of squared residuals = $\sum (y_i - \widehat{y}_i)^2$
- SSX = the sum of squared deviations in the independent variable from the mean = $\sum (x_i - \bar{x})^2$

Therefore, all else being equal, a decrease in the sample size as a result of a merger will lead to an increase in the standard errors of the coefficient estimates and a widening of the confidence intervals around them.

In its analysis of the South Staffordshire/Cambridge Water merger, the Competition Commission used the theoretical result that the standard error of an estimate is inversely proportional to the square root of the degrees of freedom to show the marginal rate of increase in the width of the confidence interval resulting from the loss of an observation, given the number of observations in an econometric model.⁶⁰

The analysis showed that, holding SSR and SSX constant, going from a sample size of 21 to a sample size of 20 would lead to a 2.7 per cent increase in confidence width in a model with a single independent variable (such as Ofwat's previous relative efficiency models for business activities, distribution and power opex), and a 2.9 per cent increase in confidence width in a model with two independent variables (such as Ofwat's Resources and Treatment model).

The text box below describes how the Competition Commission applied this "general approach" in its inquiry of the South Staffordshire Plc/Cambridge Water PLC merger (the approach was also applied in the South East Water/Mid Kent Water merger):

Box 3.9: Competition Commission use of the "general approach"

Step 1: First, the standard errors of the coefficient estimates for the cost drivers in each model were calculated with 21 and 20 observations, holding the data underlying the model constant.

Step 2: Then, using the standard errors for 21 observations:

- (i) The slope of the regression line in each of Ofwat's models was increased by one standard error. In each model, this amended slope was then used to generate a new regression line, and the inefficiency of each company relative to this new regression line was calculated. These inefficiencies were then summed together across Ofwat's four opex regression models (and the original post-modelling adjustments applied). Finally, the total inefficiency across all companies in the model was calculated (i.e. the sum of all companies' residuals relative to the amended frontier).

- (ii) The slope of the regression line in each of Ofwat's models was then decreased by one standard error, and total inefficiency across all companies relative to this frontier was calculated using the same methodology as set out in (i).

- (iii) Each of these estimates of total inefficiency was then compared with the equivalent total inefficiency associated with the original model, and the difference was calculated. The average of these differences (i.e. the mean deviation) was then calculated.

⁶⁰ Competition Commission (2012) "South Staffordshire Plc/Cambridge Water PLC merger inquiry", Appendix E; p.E2.

Step 3: Third, the above steps were then repeated using the larger standard error based on 20 observations.

Step 4: In the final step, the mean deviation derived in step 2 was compared with the mean deviation derived in step 3, and the relative difference between these two values was used to generate an estimate of the impact of the loss of a comparator on the precision of Ofwat's models.

Pros and cons of this theoretical approach

The major advantage of this approach are that it does not require re-running of regressions, and therefore, does not require new data. Further, it provides a simple way to isolate the effect on precision. However, this approach is theoretical, and does not account for specific features of the merging firms, and the impact of the new data point generated by merging on the precision of the model, though it should be pointed out that the use of specific features of the merging firm would then make it difficult to isolate impacts on precision from changes in relative efficiency across the industry. The latter point is also another drawback of this approach: this theoretical approach assumes that the characteristics of the sample does not change as a result of the merger, i.e. that all remaining firms maintain the same relative efficiency.

Nonetheless, bearing these caveats in mind, this approach provides a simple, effective way of providing an estimate of the effect of a merger on the precision of Ofwat's econometric models.

Applicability of this approach in the future

In principle, the approach outlined above should not change if more granular price controls are introduced, though, clearly, depending on the nature of the models developed in the future, the degree of changes in precision as a result of losing a comparator may be markedly different than they would be if these approaches are adopted for the current wholesale cost assessment models.

3.3.2 Simulating the merger by re-estimating models

This approach would involve simulating the merger by re-estimating the econometric models with the merging parties removed from the dataset but with the addition of a combined observation for the merged company.

The Competition Commission considered this approach in both of the last two merger cases between South Staffordshire and Cambridge Water, and between South East Water and Mid Kent Water. The text box below highlights the approach taken in the South Staffordshire/Cambridge Water merger:⁶¹

Box 3.10: Competition Commission use of re-estimation of models with merged entity

The Competition Commission reran Ofwat's models on opex efficiency with the merging parties removed and a new observation representing the merged entity added to the underlying data, and compared the estimates generated by the models when the different data sets were used.

Various assumptions were required to determine the characteristics of the observation representing the merged entity:

⁶¹ Competition Commission (2012) "South Staffordshire Plc/Cambridge Water PLC merger inquiry", Appendix E; pp. E7-E10.

- The Competition Commission assumed that in each category of opex the merged entity had costs equal to the sum of the costs of the merging parties.
- To generate a set of cost drivers for the merged entity, the Competition Commission took the sum of the properties served, length of mains, winter population, distribution input and total number of sources for the two merging parties.
- A weighted average was taken of the proportion for each company of distribution input that comes from boreholes, and of the average pumping head, in both cases weighting using each company's distribution input.
- The post-modelling adjustments for the merged entity were set according to Ofwat's assessment of what the adjustments for the company were likely to have been.

The Competition Commission then examined the effect on the coefficients, standard errors and confidence intervals, and R^2 of each model.⁶²

To assess the impact of using the revised data set on the final output of Ofwat's models, the Competition Commission compared the total inefficiency implied by Ofwat's models when the pre-merger data set is used with the total inefficiency implied by the models when a new observation is included in Ofwat's data set to represent the merged entity.

The precision of Ofwat's econometric models will be affected not only by the extent of error in the models and how this is distributed across the water companies, but also by the relative inefficiency of different water companies. Distinguishing between the impact of a change in the estimated inefficiencies and a change in error in the models is important as only the latter will relate to a change in precision. Using the "specific approach", it would not be possible to make this distinction, because all data (including data related to the merged entity) contain measures of both efficiency and error.

Therefore, it may also be sensible to investigate the specificities of the merging firms to assess qualitatively the extent to which the change suggested by the "specific approach" can be explained by idiosyncratic errors rather than changes in relative efficiency. Understanding the source of the residuals in Ofwat's econometric models is not a straightforward exercise. However, specific information on the relative efficiencies of the merging firms may provide insights as to the extent to which the estimated residual is being driven by pure inefficiency or error. The text box below sets out some of the points considered by the Competition Commission in the South Staffordshire/Cambridge Water merger in relation to Ofwat's PR09 distribution model.

Box 3.11: Analysis to understand the extent to which the observations for Cambridge Water and South Staffordshire are affected by error

The Competition Commission considered the extent to which Cambridge Water's position in Ofwat's Distribution model for PR09 was likely to be driven by error in Ofwat's model and by the relative inefficiency of Cambridge Water.

The Competition Commission noted that Cambridge Water was among the smallest water companies in Ofwat's models. In particular £4.9 million of Cambridge Water's operating costs

⁶² In the South East Water/ Mid Kent Water merger, the Competition Commission looked at F-tests, standard errors and adjusted R^2 .

were allocated to distribution in 2009. This compared to an industry total for this cost line of £518 million. Cambridge Water represented 0.9 per cent of the industry total operating costs.

The Competition Commission considered that a water company with lower opex may be more susceptible to error, but the evidence was inconclusive. On the one hand, a given error that affects Cambridge Water's observation will have a proportionately larger impact because of the relatively smaller scale of the water company's overall opex. On the other hand, the Competition Commission also noted that there may be reasons to expect larger water companies to be more susceptible to error, for example because of their greater complexity.

The Competition Commission noted that Cambridge Water did have a relatively high ratio of length of mains to number of connected properties which might explain some of the residual, but there were four water companies with higher values of this cost driver. Further, the ratio of length of mains to the number of connected properties for Cambridge Water's operating area was not very different to a number of other water companies including other small WoCs.

The Competition Commission also noted that in PR09 Cambridge Water was allowed a special factor adjustment for a distribution contract, and it received a regional salary adjustment. The cost drivers that these post-modelling adjustments were made to reflect were not included in Ofwat's models, suggesting that they are likely to have driven some part of Cambridge Water's residual in the Distribution model.

Given that the "specific approach" makes assumptions about the merged entity, and re-running the models with this merged entity in place will affect the relative inefficiency across the industry, it would also be sensible to consider sensitivity analysis. The text box below highlights the sensitivity analysis undertaken by South Staffordshire in its submissions to the Competition Commission:

Box 3.12: Sensitivity analysis for merger simulation submitted to the Competition Commission by South Staffordshire

South Staffordshire also considered the following scenarios in addition to the main scenario for the merged entity:

1. Moving Cambridge Water to the regression line in the Distribution model.
2. Forcing the overall efficiency of the merged entity implied by Ofwat's models to be the same as the sum of the efficiencies of South Staffordshire and Cambridge Water.
3. Forcing the overall efficiency of the merged entity implied by Ofwat's models to be the same as South Staffordshire, and dropping Cambridge Water from the models pre-merger.

South Staffordshire argued that although these sensitivity tests did not individually perfectly isolate the potential effects of efficiency, taken collectively, they demonstrated that the effect on precision from the merger cannot solely be related to efficiency issues. In particular, South Staffordshire argued that under all of the sensitivity tests, the "specific approach" still showed the merger to result in a reduction in total inefficiency in the industry, and that this result would not necessarily hold if similar simulations were conducted in respect of other potential mergers. The Competition Commission did not agree with these conclusions.

Pros and cons of simulating the merger

The key advantage of this approach is that it takes into account the specific features of the observations being removed.

However, using these approaches it is likely to be difficult to disentangle the effect on precision (to the extent that there is one) from changes in the distribution of efficiency, and may therefore over- or underestimate the effect of losing a comparator, depending on the way in which the benchmark also changes when the models are re-run.

Given the complexity of Ofwat's new models for wholesale cost assessment, this caveat is extremely important, as there may be important changes in the benchmark (depending on assumptions made about the merged firm) which make it difficult to estimate an effect on precision.

Applicability of this approach in the future

In principle, the approach outlined above should not change if more granular price controls are introduced, though, clearly, depending on the nature of the models developed in the future, the degree of changes in precision as a result of losing a comparator may be markedly different than they would be if these approaches are adopted for the current wholesale cost assessment models.

3.3.3 Bootstrapping

“Bootstrapping” is an approach to estimating a wide variety of statistics by drawing repeated samples (often called “replications”) from the data. The Competition Commission adopted this approach in its assessment of the effects of the South East Water/ Mid Kent Water merger on the precision of Ofwat's econometric models:⁶³

Box 3.13: Competition Commission use of bootstrapping

The Competition Commission compared the standard errors in Ofwat's four individual econometric models for operating expenditure to alternative standard errors that were estimated using bootstrapping. Specifically, this involved the following steps:

Step 1: Using Ofwat's four datasets of 22 observations for operating expenditure, the Competition Commission randomly drew with replacements 22 observations from each dataset.

Step 2: The second step was to re-estimate Ofwat's models and obtain the standard error of each coefficient.

Step 3: This was repeated 1,000 times, each time drawing a new random sample and re-estimating the model. This generated 1,000 estimates of the standard errors for each model.

Step 4: From this data, the standard error of the standard error was then estimated.

Step 5: The bias in Ofwat's estimates relative to the bootstrapped estimate (i.e. the difference between the bootstrapped standard errors and the standard errors from Ofwat's modelling) was then divided by the standard error derived in step 4 to generate the size of the bias as a proportion of the standard deviation of the standard errors.

Pros and cons of bootstrapping

⁶³ Competition Commission (2007) “South East Water Limited and Mid Kent Water Limited”, Appendix G; p.G2.

The principal disadvantage of this approach is that it would not allow an assessment of detriment to be made, as this technique would not provide a quantification of the impact of losing a comparator. Rather, this approach would provide an estimation of the standard errors associated with model runs using resampling, which would provide an indication of what the standard errors for each model might be, were Ofwat to have more data (i.e. more than n comparators).⁶⁴

Nonetheless, bootstrapping is able to provide a high degree of precision in generating a comparison point to estimates of the marginal impact of losing a comparator. It therefore provides a sensible cross-check to estimates of loss in precision derived from other methods (such as the “general approach” and “specific approach” described earlier), and therefore, estimates of detriment derived on the basis of those estimates of the loss in precision. Specifically, the result of the bootstrapping exercise would provide an indication of the degree of precision that could be expected if more data were available. If estimates of the loss of precision using other techniques suggest standard errors that are not hugely different to those derived from bootstrapping, it may be possible to determine that the effect of losing a comparator is small.

Applicability of this approach in the future

In principle, the approach outlined above should not change if more granular price controls are introduced, though, clearly, depending on the nature of the models developed in the future, the degree of changes in precision as a result of losing a comparator may be markedly different than they would be if these approaches are adopted for the current wholesale cost assessment models.

3.3.4 Recommended approach

As can be seen above, there are a number of approaches that the Competition Commission has used in the past to assess the impact on Ofwat's previous econometric models to assess opex efficiency. The same principles would apply when considering the impact on Ofwat's current totex models, though some modifications would be required.

The major advantage of the “general approach” is that it does not require re-running of regressions, and therefore, does not require new data. It provides a simple way to isolate the effect on precision. However, it should be stressed that this approach is theoretical, and does not account for specific features of the merging firms, and the impact of the new data point generated by merging, on the precision of the model (though the use of specific features of the merging firm would then make it difficult to isolate impacts on precision, to the extent that there is an impact on the degree of error, from changes in relative efficiency across the industry). Further, this theoretical approach assumes that the characteristics of the sample do not change as a result of the merger, i.e. that all remaining firms maintain the same relative efficiency. Nonetheless, bearing these caveats in mind, this approach provides a simple, transparent way of providing an estimate of the effect of a merger on the precision of Ofwat's econometric models.

The “specific approach” may allow qualitative inference to be drawn with regard to the extent to which the merger has an effect on the precision of Ofwat's models, taking into account the specific features of the observations being removed. However, as mentioned above, it may be difficult to disentangle any potential effect on precision from changes in the distribution of efficiency, and the approach may therefore over- or under-estimate the potential effect of losing a comparator, depending on the way in which the benchmark also changes when the models are re-run. Given the complexity of Ofwat's new models for wholesale cost assessment, this disadvantage should be borne in mind, as there may be important changes in the benchmark (depending on assumptions made about the merged firm) which may make it difficult to establish an effect on precision.

⁶⁴ See, for example, Competition Commission (2007) “South East Water Limited and Mid Kent Water Limited – Appendix G”; p.G2.

The use of bootstrapping would not allow an assessment of detriment to be made, as this technique would provide a quantification of what standard errors for each model would be based on resampling, thus providing an indication of the precision that might be expected if more data were available. Nonetheless, bootstrapping is able to provide a high degree of precision in generating a comparison to estimates of the marginal impact of losing a comparator. It therefore provides a sensible cross-check to estimates of loss in precision derived using these other methods.

Box 3.14: Recommended overall approach to assessing the impact on the precision of Ofwat's econometric models

In light of the analysis above, we recommend that the analysis of the impact on the precision of Ofwat's econometric models is based on all three of the approaches set out above.

Analysis could be carried out using both the Competition Commission's "general approach" and the "specific approach". Bootstrapping could be carried out to cross-check the magnitude of the changes in standard errors suggested by the "general approach" and the "specific approach".

The results could be combined in different ways, depending on the robustness of the results.

3.3.5 Suggested methodologies based on recommendation

Suggested approach for simulating the merger by re-estimating models

The text box below sets out how these approaches could be implemented to assess the impact on Ofwat's wholesale cost assessment models:

Box 3.15: Suggested approach for wholesale cost assessment

This approach would involve re-estimating the wholesale cost assessment regressions (including the two regressions for each unit cost enhancement model) with the merging parties removed from the dataset but with the addition of a combined observation for the merged company.

This would involve making assumptions on costs and cost drivers which the merging parties would of course need to justify. Where the merging party is assuming cost efficiencies owing to the merger, it would be sensible to cross-check the results by also testing the impact when simply summing cost estimates and averaging cost drivers, as was carried out by the Competition Commission (as described above).

The results of the modelling would then be aggregated using the triangulation process currently used. To assess the impact on the outputs of the models, the difference in the upper quartile (compared to that calculated at PR14) should be applied to total totex (as estimated at PR14) to generate the difference in efficiency. The impact in this price control would be assumed to last over 30 years, and future impacts should be discounted at the STPR identified in HMT Green Book (currently 3.5 per cent).

It may also be sensible to undertake some sensitivity analysis as follows:

- The models could be run, imposing a condition that the costs and cost drivers of the merged entity equal the average of the merging parties. In this case, it might be appropriate to weight the data based on some metric of relative size.

- The models could be run, imposing a condition that the costs and cost drivers of the merged entity equal that of one of the merging parties, i.e. by removing one of the merged parties from the analysis.

- As above, but with the other merging party.

The estimates derived from this analysis would represent an upper bound to the potential effect of the merger on precision *if* it was assumed that there was no change in relative efficiency (and all the difference was driven by error). On its own this would not therefore provide a reasonable estimate of the impact of the merger on precision. It would therefore be appropriate to investigate the specificities of the merging firms to assess qualitatively the extent to which the changes suggested by the “specific approach” can be explained by idiosyncratic errors rather than changes in relative efficiency.

Suggested approach for the theoretical “general approach”

The Competition Commission’s approach could simply be extended to Ofwat’s wholesale cost assessment models by following the steps outlined below; however, while the theoretical result above would apply to the OLS regressions, a slightly different formula would need to be used for the random effects model:

$$s.e. = \sqrt{\frac{1}{(nt - k)} \times \frac{SSR}{SSX}}$$

The formula for arriving at SSR and SSX would be different in the random effects model too; however, given that this theoretical approach holds SSR and SSX constant, we do not present this formula here in detail to expose the method in a simple way.⁶⁵ Taking Ofwat’s refined totex OLS model as an example:

Box 3.16: Worked example using Ofwat’s refined totex OLS model

The $(1 - \alpha)$ 100 per cent confidence width (CW) for β_j , $j = 1, \dots, K$ is:

$$CW_j(\alpha, n) = 2z_{\frac{\alpha}{2}} \sigma a_{jj}, \quad j = 1, \dots, K,$$

where a_{jj} is the square root of the (j, j) element of the XX^{-1} matrix, and j refers to the coefficient associated with j^{th} X in the regression; $z_{\alpha/2}$ is the value of the standard normal variable for which the area to the right tail of the distribution is 100 $(\alpha/2)$ per cent.

The theoretical approach assumes that SSR and SSX are held constant when n changes, and the impact on the confidence interval via the t-statistic is suppressed. Therefore, the change in the width of the confidence interval is driven by the change in the standard error, which is given by the formula above.

The refined totex OLS model has 90 data points ($n = 18$, $t = 5$), and 12 variables (including the constant). Given that SSR and SSX are held constant, the rate of increase in the width of the confidence interval for each coefficient boils down to the following calculation:

⁶⁵ In particular, the random effects model is estimated with feasible GLS, which is OLS applied to transformed data (both y and x) in order to remove the serial correlation associated to the individual error term. The transformation (which is a function of the variance of the two error terms) allow the estimation of the equation as if it were pooled OLS.

$$\% \text{ increase} = \frac{\sqrt{\frac{1}{(17 * 5) - 12}} - \sqrt{\frac{1}{(18 * 5) - 12}}}{\sqrt{\frac{1}{(18 * 5) - 12}}} = 3.4\%$$

The text box below sets out the approach for the wholesale cost models:

Box 3.17: Suggested approach for wholesale cost assessment

Step 1: Using the theoretical results above, estimate the standard errors in each econometric model with all pre-merger firms (n firms), and then again with n-1 firms (in the case of the RE models, this will be (n-1).t), holding the data underlying the models constant.

Step 2: Using the standard errors based on the model runs with n firms, calculate the impact of adjusting the central estimate by one standard deviation (upper and lower bound) in each model and on the triangulated efficiency score.

Step 3: Repeat Step 2 above using the larger standard error based on n-1 observations.

Step 4: Calculate the difference in the relevant mean deviations based on n and n-1 observations.

Step 5: Convert the difference in Step 4 to a loss in efficiency. The impact in this price control would be assumed to last over 30 years, and future impacts should be discounted at the STPR identified in HMT Green Book (currently 3.5 per cent).

Suggested approach for bootstrapping

The text box below sets out how this approach could be implemented to assess the impact on Ofwat's wholesale cost assessment models:

Box 3.18: Suggested approach for wholesale cost assessment

Step 1: For each econometric model, randomly draw (with replacement) n observations from the dataset (where n is the number of pre-merger firms).

Step 2: Re-estimate each model and obtain the standard error of each coefficient.

Step 3: Repeat this process a large number of times (1,000 times, say), each time drawing a new random sample and re-estimating the model.

Step 4: Using the data generated in Step 3, calculate the standard error of each coefficient based on the distribution of coefficient estimates (e.g. based on 1,000 outcomes of a coefficient).

Step 5: Using the data generated in Step 3, calculate the standard error of the standard errors for each coefficient from the bootstrapped sample.

Step 6: Estimate the difference in the PR14 standard errors relative to the standard error estimate derived in Step 4, and normalise it (for example, divide this by the standard error derived in Step 5 to generate the size of the "bias" as a proportion of the standard deviation of the standard errors).

3.4 Impact on Ofwat's other uses of comparators

Ofwat makes considerable use of comparisons in a number of other areas (as well as wholesale cost assessment, ACTS, SIM and ODIs). The Competition Commission has not in the past adopted any consistent framework or techniques for assessing the impact on such comparisons, particularly those that are qualitative in nature. However, the Competition Commission did look at certain qualitative indicators with quantitative aspects in a systematic way in its inquiry into the South East Water and Mid Kent Water merger. Specifically, it looked at the comparisons set out in the text box below:⁶⁶

Box 3.19: Competition Commission's analysis of qualitative indicators with quantitative elements

Movements in average scores and in the standard deviation of scores over time for seven DG indicators (such as "inadequate pressure" and "supply interruptions").

The distribution of companies' OPA scores.

For Ofwat's use of "non-performance" comparisons (i.e. other than wholesale cost assessment, ACTS, SIM and ODIs), there are two different scenarios to consider:

- Loss of a comparator with important similarities: it would be important to consider the extent to which the pre-merger firms are in similar circumstances to other firms in the industry (or a subset of firms), and the extent to which the merging companies provide valuable comparators for the regulatory regime (or perhaps for a subset of other firms in the industry, or in respect of one or more specific areas of operation), and therefore, the degree to which that would no longer be the case post-merger.
- Loss of a comparator with important differences: it would also be important to consider the extent to which a loss of differences between the merging companies and other firms in the industry is important for performing Ofwat's functions. If one or more of the merging companies takes an approach which is different from other firms in the industry, or useful to Ofwat when making comparisons between water enterprises, and there is a reasonable prospect that the different approach currently taken would be lost as a result of the merger, there may be a prejudice to Ofwat's ability to make these comparisons.

Therefore, one approach to assessing the potential impact on these types of comparisons, would be to establish whether either of the individual companies has previously been identified as having best practice in certain areas, and whether the merged entity would continue to follow this best practice and aim to drive improvements in other areas, thus continuing to provide a valuable comparator. (Also potentially of relevance may be the question of whether either of the individual companies has previously been identified as having poor practice in certain areas, and whether the merged entity would improve in these respects, thus becoming a useful comparator.)

This approach should be relatively straight forward if there are a set of criteria against which to judge whether the merger would result in the loss of comparator with important similarities or important differences.

Ofwat undertook a structured qualitative assessment of company business plans in its risk based review.⁶⁷ This involved grading each company business plan on a four-point (A to D) scale based on the extent to which the company had demonstrated that it had met certain criteria associated with the factor under investigation. Building on this approach, we have developed a set of indicators to allow the assessment of

⁶⁶ Competition Commission (2007) "South East Water Limited and Mid Kent Water Limited", Appendix I.

⁶⁷ Ofwat (2014) "Setting price controls for 2015-20 – pre-qualification decisions".

how the loss of a comparator might impact across a range of areas where Ofwat uses comparators, where the focus is not on some quantitative measure of performance. This approach provides a structured method of identifying whether the loss of a comparator would create a customer detriment in these areas.

The text boxes below set out potential indicators of whether the loss of a comparator is likely to have a detrimental impact. These are suggestions only, and further indicators could be developed, depending on how Ofwat uses comparators in the future. Further, the relevant context would need to be borne in mind. For example, it is possible that some issues in particular areas could have been raised with all companies across the industry, in which case, the merger may have limited impact on Ofwat's ability to make these types of comparisons.

The merging parties would have to demonstrate why the merged entity would be a valuable comparator in each area, and why the merged entity would not pose problems to Ofwat's ability to make these comparisons (as per the bullet points above). For example, where the merging companies have not scored well against these indicators in the past, they would have to demonstrate why the merged entity would perform better, how this could be secured, and how it might remedy any detriment to Ofwat's ability to make comparisons. The merging parties would also need to demonstrate how much weight Ofwat can place on the information provided. For example, if the proposed merger has been made public, the merging parties may wish to consult with their Customer Challenge Groups (CCGs) with regard to the expected impacts of the merger on Ofwat's ability to make the qualitative comparisons discussed below.

Box 3.20: Suggested indicators for demonstrating the impact of the loss of a comparator on customer engagement

Area of comparisons	Indicators
Customer engagement	<ul style="list-style-type: none"> • Was either merging party identified as having best practice with regard to customer engagement? • Did Ofwat request that companies should undertake further engagement on their business plan following the risk based review? • Was either merging party identified as having best practice with regard to its affordability measures?

The merging parties would have to demonstrate why the merger would continue to provide a good comparator and/or why it would not have a negative impact on Ofwat's ability to make comparisons of companies' approaches to customer engagement. If, for example, Ofwat or a company's CCG had raised issues about the extent of customer engagement carried out or the way in which it was carried out during PR14, the merging parties would need to demonstrate that the merger would not result in the other merging party adopting similar practices which would also raise concerns, or that the merger would improve performance with regard to customer engagement. Similarly, if either merging party has been identified as having best practice with regard to customer engagement, the merging parties would need to demonstrate that Ofwat would not be losing this comparator, and that the merged entity would adopt these best practices.

Box 3.21: Suggested indicators for demonstrating the absence of an impact on comparisons of specific cost adjustments

Area of comparisons	Indicators
Specific cost adjustments	<ul style="list-style-type: none"> Do either of the merging parties share similar operating characteristics with other companies (or a sub-set of companies)? For example, in relation to density, rural coverage, length of coastline, topography, water quality, etc. Has either merging party used comparisons with other companies to make the case for a special cost factor adjustments? Was either merging party identified as having low outlying costs for areas in which specific cost adjustments were considered in respect of bad debt, energy costs or any other special cost claims at PR14?

Here, the merging parties would need to demonstrate that the merger would not diminish Ofwat's ability to compare specific cost items across the industry and/or that the merged entity would be more in line with the industry average than would the two companies treated separately. If, for example, either (or both) of the merging parties had been identified by Ofwat at the last price review as having costs well in excess of, or well below, the average industry cost for specific cost items such as bad debt and energy costs, the merging parties would need to demonstrate that the merged entity would not be further removed from the average, i.e. it would not become more of an outlier.

Box 3.22: Suggested indicators for demonstrating the absence of an impact on comparisons of company behaviour

Area of comparisons	Indicators
Company behaviour	<ul style="list-style-type: none"> Were issues identified in Ofwat's risk based review with respect to the degree of Board assurance for either merging party? Have any issues been identified with Board assurance on information which either of the merging parties has provided to Ofwat (outside of PR14)? Were issues identified in Ofwat's risk based review with respect to the process undertaken by either merging party in preparing business plans? If issues were identified in Ofwat's risk based review with respect to the process undertaken by either merging party in preparing business plans, how will this be addressed by the merged firm? Was either merging party identified as having best practice with regard to business planning (e.g. did it achieve enhanced status)? Have any issues been identified with either merging party meeting Ofwat's board leadership, transparency and governance principles? Has action been taken against either of the merging parties following investigation of non-compliance with market rules? Has action been taken against either of the merging parties following investigation of non-compliance with their duties under the Water Industry Act 1991 or their licence conditions?

The merging parties would have to demonstrate why the merger would not have a negative impact on Ofwat's ability to make comparisons of companies' behaviour with respect to issues such as Board assurance and the preparation and submission of business plans. If, for example, Ofwat's risk based review raised issues about the degree of Board assurance at PR14, the merging parties would need to demonstrate that the merger would not result in the other merging party adopting similar practices which would also raise concerns, or that the

merger would improve the overall level of Board assurance offered for the merged entity. Similarly, if either merging party has been identified as having best practice with regard to business planning, the merging parties would need to demonstrate that Ofwat would not be losing this comparator, and that the merged entity would adopt these best practices. If the merger involved companies that had been investigated and found culpable of non-compliance with market rules or certain licence conditions, the merging parties could demonstrate why the merger would change the culture of compliance at the merged entity, reducing or negating the possibility of such non-compliance in the future.

Box 3.23: Suggested indicators for demonstrating the absence of an impact on comparisons of accounting practices and reporting of data

Area of comparisons	Indicators
Accounting and reporting of data	<ul style="list-style-type: none"> • Has either party previously been challenged to improve the degree of assurance of regulatory reporting, or any other information that has been reported to Ofwat? • Has the company previously been challenged with respect to transparency and/or reporting of data? • Has the company previously been challenged by Ofwat with regard to its tax assumptions in its business plans? • Has the company previously been challenged for not following cost allocation guidelines in regulatory reporting? • Has either merging party been identified as having best practice with regard to regulatory reporting? • Is either of the merging parties an outlier in any policies?

Ofwat uses comparisons in specific ways to identify concerns and to establish and spread best practice. The merging parties could therefore demonstrate that the merger would not diminish Ofwat's ability to make such comparisons. Specifically, if one (or both) of the merging parties has previously been challenged by Ofwat with regard to, for example, the degree of assurance of regulatory reporting or compliance with cost allocation guidelines, the merging parties would need to demonstrate how those issues were remedied, and why the merged entity would not be subject to such challenge in the future. If either merging party has been identified as having best practice with regard to regulatory reporting, the merging parties would need to demonstrate that Ofwat would not be losing this comparator, and that the merged entity would adopt these best practices.

Box 3.24: Suggested indicators for demonstrating the absence of an impact on comparisons of financeability and risk and reward

Area of comparisons	Indicators
Financeability and risk and reward	<ul style="list-style-type: none"> • Is the financing structure and governance arrangements of the Appointee and its parent companies transparent and easily accessible to stakeholders? • Is the financing structure that has been put in place by the merging companies prudent and/or have concerns been raised around the financing or governance structures of the merging companies? • Did Ofwat intervene in either company's choice of PAYG rate, RCV run-off rate or asset lives at PRI4 and were the merging companies' choices of PAYG rate, RCV run-off rate and asset lives consistent with customer views? • Did each company provide appropriate Board (or external) assurance that their plan was financeable on an actual and notional basis?

The merging parties could demonstrate that the merger would not have an adverse impact on Ofwat’s ability to make comparisons to ensure appropriate policy to ensure financeability and/or that the merged entity would provide a better point of comparison than the separate companies. For example, if one (or both) of the merging parties has previously been challenged by Ofwat with regard to the PAYG ratios or asset lives proposed at PR14, the merging parties would need to demonstrate how those issues were remedied, and why the merged entity would not be subject to such challenge in the future.

Box 3.25: Suggested indicators for demonstrating the absence of an impact on comparisons of performance commitments and outcome delivery incentives

Area of comparisons	Indicators
Performance commitments and outcome delivery incentives	<ul style="list-style-type: none"> • Has either merging party developed an innovative set of performance commitments that have not been used by other companies? • Has either merging party adopted an innovative approach to setting outcome delivery incentives that has not been used by other companies? • Does the company’s proposal for reporting and sharing out- and under-performance represent a leading approach?

The merging parties could demonstrate that the merger would not have an adverse impact on Ofwat’s ability to make comparisons to ensure innovative and comprehensive performance commitments and outcome delivery incentives. Specifically, if one of the merging parties has previously been cited as developing an innovative or comprehensive set of performance commitments and outcome delivery incentives, the merging parties would need to demonstrate how those benefits would be maintained in the future.

In seeking to demonstrate the effect of a merger on the areas described in the text boxes above, it would be important to bear in mind the relevant context, notably the performance of other companies in these areas. For example, if all firms have generally performed very well with respect to Board assurance, there may be limited impact of losing two comparators and replacing them with a firm achieving the same degree of Board assurance.

This relevant context could also consider the scope for making non-water comparisons. If it is possible to use comparisons from other sectors, then the impact of losing a comparator may be negligible, irrespective of the relative performance of other firms.

4 Valuing Benefits of a Merger

As set out in the Water Act 2014, relevant customer benefits are limited to benefits to “relevant customers” in the form of: lower prices, higher quality or greater choice of goods or services in any market in the United Kingdom; or greater innovation in relation to such goods or services.

In this section, we first consider the appropriate timeframe for assessment. We then set out possible approaches to valuing the possible benefits of a merger before going on to provide a recommended approach and setting out a suggested methodology based on this recommendation. This chapter is structured as follows:

- We first consider the appropriate timeframe for assessment.
- Second, we look at approaches to valuing the impact on prices:
 - the first approach is based on bottom-up estimates of cost efficiencies from the merging parties;
 - the second approach utilises econometric techniques to estimate cost efficiencies as a result of the merger;
 - a third approach draws on results in the academic literature on the effects of scale in the water and sewerage sectors to derive estimates of the impact of the merger on the costs of the merged party;
 - we then provide a recommended approach based on an assessment of the relative merits and drawbacks of these different approaches.
- Third, we consider approaches to assessing higher quality, greater choice of goods or services, and the impacts of a merger on innovation. In each case we provide:
 - suggested approaches, drawing on past assessment of these benefits by the Competition Commission; and
 - a recommended approach to assessing these benefits.

4.1 Timeframe for assessment

The CMA must believe that any benefit (fitting the description above, i.e. lower prices, higher quality or greater choice of goods or services in any market in the United Kingdom; or greater innovation in relation to such goods or services) is expected to accrue within a reasonable time period as a result of the merger (and that the benefit was, or is, unlikely to accrue otherwise).

Monitor, the healthcare regulator, recently published guidance on merger benefits.⁶⁸ This guidance set out the following:

Box 4.1: Monitor’s guidance on what constitutes a reasonable time period

“What is a reasonable period will vary case by case, depending for example on the nature of the proposed change and the circumstances of its implementation. We are likely to have greater confidence that improvements will be realised where their implementation is planned to take place soon after the merger. In previous merger cases, Monitor and CCP have typically found

⁶⁸ Monitor (2014) “Supporting NHS providers: guidance on merger benefits”; pp.10-12; see: https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/340823/Monitor_mergerbenefits_guidance.pdf

that a 1–2 year period to implement clinical changes or achieve cost savings following the merger is reasonable, although in some cases a longer period may be needed.”

Any evidence in support of benefits to offset any identified prejudice to Ofwat’s ability to make comparisons would need to provide well-evidenced assessment to support the timeframe in which the merging parties expect benefits to materialise.

4.2 Valuing the impact of lower prices

As highlighted earlier in the report, there are a range of ways in which a merger could result in a reduction in prices. We outline below some possible approaches that could be taken to valuing this benefit.

4.2.1 Estimates from merging parties

One relatively simple approach would be to require the merging parties to provide detailed bottom-up estimates of the expected efficiency gains from merging. These might relate to, for example, improvements in waste resource management, combined head office functions, leakage reduction, improved water efficiency or economies of scale. Unless commitments are made to reflect forecast reductions in costs in lower prices, merging parties may have an incentive to overstate the extent of this impact. In these circumstances it may be appropriate for the estimates to be provided or verified by an independent third party and/or to place less weight on the estimates.⁶⁹

The text box below highlights the savings that were identified in previous water mergers to provide an indication as to the potential range of benefits in this regard that could be expected:

Box 4.2: Identified (quantified) efficiency savings in past mergers

South East Water/Mid Kent Water — savings in operating expenditure of at least £3.1 million a year, resulting from cost savings; the alignment of efficient practices; and better management of water resources.⁷⁰

SAUR/Mid Kent/General Utilities — postponement of a major new regional resource facility would mean deferral of major investment which they estimated at £80 million. General Utilities and SAUR also estimated that a saving of £1.25 million a year in head office administration might be achievable through changes to the top management structure and through changes in the use of information technology.⁷¹

Wessex Water/South West Water — Wessex Water stated that £31 million a year could be saved, while South West Water claimed that it could make annual cost savings of £10 million a year (all from head office savings).⁷²

⁶⁹ For example, in its assessment of the South East Water / Mid Kent Water merger, the Competition Commission commissioned a water engineer to examine Hastings’ combined water resources report to satisfy itself that genuine benefits would result from the four proposed linkages between the distribution systems of Mid Kent Water and South East Water’s Southern region.

⁷⁰ Competition Commission (2007) “South East Water Limited and Mid Kent Water Limited”.

⁷¹ Competition Commission (1997) “Mid Kent Holding Plc and General Utilities Plc and SAUR Water Services Plc: A report on the proposed merger”.

⁷² Competition Commission (1996) “Wessex Water Plc and South West Water Plc: A report on the proposed merger”.

Severn Trent/South West Water — Severn Trent expected net savings of £30 million a year to be derived from manpower savings, non-manpower savings and revenue-enhancement measures. South West Water considered that annual cost savings of at most £10 million a year were possible, all from head office savings.⁷³

Lyonnaise des Eaux/Northumbrian — Lyonnaise des Eaux expected savings through the elimination of duplicated costs such as depot facilities, and increased purchasing power, and savings in materials and consumables, energy and other controllable costs, and group board and shareholder-related costs, amounting to £11 million a year. Northumbrian expected savings on management and organization costs: costs in relation to billing, accounts, personnel, computer services, transport, engineering, customer services and public relations; costs in running depots; costs of water treatment and distribution; cost of laboratories; and certain costs of debt finance and tax, amounting to £3.1 million a year.⁷⁴

4.2.2 Econometric techniques

It may also be possible to undertake econometric analysis to provide evidence of efficiency savings (that would lead to lower prices) to provide a cross check to the bottom-up estimates identified above. When considering the effects on the precision of Ofwat's models, one suggested approach which has been used by the Competition Commission in the past is to simulate the merger by re-estimating Ofwat's econometric models with data for a merged entity. This analysis could also be used to provide an estimate of the effect of the merger on costs, by comparing the costs of the merged entity predicted by Ofwat's models to the predicted costs for the unmerged parties.

Box 4.3: An example of the Competition Commission's consideration of econometric analysis of efficiency savings

For the Competition Commission's inquiry into the Wessex Water/South West Water merger, Wessex Water commissioned work to carry out a relative operating expenditure efficiency study of the water industry. The results from this study were used to estimate the operating cost savings that might be achieved following a merger between Wessex Water and South West Water on the assumption that the merged group was managed at the level of efficiency of Wessex Water (in 1994/95), and what further operating expenditure savings would have to be achieved by the merged group if it were to match the performance of the company with the best efficiency score in the industry (in 1994/95). The approach taken to measuring relative operating efficiency was similar to that used by OFWAT for the efficiency studies carried out for the 1994 Periodic Review.⁷⁵

However, a loss of precision might be expected in Ofwat's econometric models as a result of the loss of a comparator. Therefore, there may be less confidence in the estimated change in efficiency to the merger.

An alternative econometric approach, which has not been adopted by the Competition Commission in the past, would be to take one or two of the papers that exist in the literature on cost function estimation in the UK water and sewerage industry and simulate the impact of the merger by computing the sum of the

⁷³ Competition Commission (1996) "Severn Trent Plc and South West Water Plc: A report on the proposed merger".

⁷⁴ Competition Commission (1995) "Lyonnaise des Eaux Sa and Northumbrian Water Group Plc: A report on the merger situation".

⁷⁵ Competition Commission (1996) "Wessex Water Plc and South West Water Plc: A report on the proposed merger".

predicted (pre-merger) costs of the two merging companies and compare them with the predicted cost of the new merging firm (using data on density, network, environmental variables and so forth for the merged entity). If these predicted costs are lower, one could say that, either because economies of scope or scale (or both) the merged entity has lower costs. This exercise could be repeated using parameter estimates from different papers. Relevant papers include:

Box 4.4: Academic literature on economies of scale and scope

Zschille, M (2014), ‘Consolidating the water industry: an analysis of the potential gains from horizontal integration in a conditional efficiency framework’, *Journal of Productivity Analysis*, published online 10 Aug 2014

Saal et al (2013) ‘Scale and scope economies and the efficient vertical and horizontal configuration’, *Review of Network Economics*, 12 (1), 93-129.

Bottasso *et al* (2010) “The Appropriateness of the Poolability Assumption for Multiproduct Technologies: Evidence from the English Water and Sewerage Utilities”, *International Journal of Production Economics* 03/2011; 130(1):112-117.

Bottasso and Conti (2009) “Price Cap Regulation and the Ratchet Effect: A Generalized Index Approach”, *Journal of Productivity Analysis* 12/2009; 32(3):191-201.

Bottasso and Conti (2009) “Scale economies, Technology and Technical Change: Evidence from the English Water Only Sector”, *Regional Science and Urban Economics* 03/2009.

Saal, Parker and Weyman-Jones (2007) “Determining the Contribution of Technical, Efficiency, and Scale Change to Productivity Growth in the Privatized English and Welsh Water and Sewerage Industry: 1985-2000”, *Journal of productivity analysis*, 28 (1-2), pp. 127-139.

Hunt and Lynk (1995) “Privatisation and Efficiency in the UK Water Industry: An Empirical Analysis”, *Oxford Bulletin of Economics and Statistics*, 57: 371–388.

The limit of this approach is that is static in nature and captures only the costs and benefits of the merger given the current technology. However, in some translog studies there are interactions between output and the time trend. These interactions tell us whether technical change is faster or slower in the case of larger companies: this can give an indication of whether the rate of fall in costs will be higher for the larger merged entity. A key drawback of this approach is that, in general, interaction terms are not always precisely estimated. A further drawback is that as the structure of the industry changes, previous papers would no longer provide a useful guide (i.e. we should expect parameter estimates in the cost function to change).

4.2.3 Estimates of economies of scale and scope from academic literature

Another approach to cross check bottom-up estimates would be to review academic papers that have sought to quantify the (dis)economies of scale or scope.⁷⁶ This approach has not been used in past merger assessments; however, it could be used to provide a *prima facie* estimate of the impact of the merger. For instance: papers that have modelled WoCs could be used to analyse WoC-WoC mergers, while papers

⁷⁶ To note: this is considered here under the benefits section, but, clearly, any evidence for diseconomies would generate an incremental cost of the merger, rather than a benefit.

that have jointly considered WoCs and WaSCs could be used to consider what will happen between a WaSC-WoC merger.

The tables below highlight some key results on economies of scale and scope in the water and sewerage sectors. As can be seen in the tables below, the results can be quite varied and depend, to some degree, on the modelling approach taken and the variables used to represent scale. Merging companies adopting this approach to demonstrate the potential for a merger to lead to efficiency savings would therefore need to provide strong evidence to demonstrate that a particular estimate of economies of scale or scope is applicable.

Ofwat's cost assessment models

Modelling carried out by CEPA for Ofwat as part of work on cost assessment for PR14 found that there are varying returns to scale/density in both water and sewerage (as is allowed for by the translog specification used in the models). The tables below show the results with respect to the scale variables included in the models which were found to be statistically significant. In the tables that follow, a value above 1.0 is indicative of diseconomies of scale/density, while a value of less than 1.0 is indicative of economies of scale/density.

Table 4.1: Estimates of economies of scale in water (a value above 1.0 is indicative of diseconomies of scale/density; a value of less than 1.0 is indicative of economies of scale/density)

Variable	Estimate
Full totex OLS	
- Length of mains	0.90
Refined totex OLS	
- Length of mains	1.07
Refined totex RE	
- Length of mains	1.08
Refined base OLS	
- Length of mains	1.04
- Population density	2.01
Refined base RE	
- Length of mains	1.03
- Population density	1.05

Source: CEPA (2014) "Cost assessment — advanced econometric models".

Table 4.2: Estimates of economies of scale in wastewater (a value above 1.0 is indicative of diseconomies of scale/density; a value of less than 1.0 is indicative of economies of scale/density)

Variable	Estimate
Network	
- Length of sewers	0.82
Treatment OLS	
- Load	0.88
- Density	-0.61
Treatment RE	
- Load	0.83
- Density	-0.59
Base OLS	
- Load	0.98
Base RE	
- Load	0.88

Source: CEPA (2014) "Cost assessment — advanced econometric models".

In water, elasticities with respect to length of mains (size) range between 0.9 and 1.1, suggesting economies of scale for some companies and diseconomies for others. In sewerage, all companies have elasticities with respect to size less than one, suggesting economies of scale. It is also important to note the different

results with respect to different scale variables. In particular, in relation to density, CEPA found different shapes of the elasticity curve for water and sewerage: the extent of returns to density were found to be increasing in sewerage and decreasing in water.

Stone and Webber analysis

Ofwat commissioned a study in 2004 on economies of scale in the water and sewerage industry. While this analysis is not particularly recent, it provides an overview of the expected benefits (or otherwise) of scale and scope, and *inter alia* given the long-lived nature of many water and sewerage assets, the results can still be considered to be of relevance.

In the study, economies of scale for a WaSC are measured in terms of the changes in costs associated with the same proportionate change in water delivered volumes, water connected properties, sewerage connected properties, and equivalent population. For a WoC, the equivalent measure is defined in terms of the change in costs associated with the same proportionate change in water delivered volumes and water connections.

The table below presents key results with regard to scale. Here, in contrast to the CEPA work above, a value below 1.0 is indicative of diseconomies of scale, while a value of more than 1.0 is indicative of economies of scale. As can be seen, the table below suggests diseconomies of scale for WaSCs and slight economies of scale for WoCs.

Table 4.3: Estimates of economies of scale (value below 1.0 is indicative of diseconomies of scale; a value of more than 1.0 is indicative of economies of scale)

	WaSCs	WoCs
Short-run economies of scale	0.67	1.04
Long-run economies of scale	0.62-0.71	1.06-1.11

Source: Stone and Webber (2004) "Investigation into evidence for economies of scale in the water and sewerage industry in England and Wales"

The table below presents key results with respect to scope. Here a negative value represents diseconomies of scope, while a positive value represents economies of scope. As can be seen, there are strong diseconomies of scope in the joint production of water and sewerage services by WaSCs with respect to both outputs and fixed costs. However, there are economies of scope in the joint production of outputs and the joint serving of connections. According to Stone and Webber (2004), this can be interpreted as suggesting that scope benefits are to be found where the ability to share inputs across activities is greatest. There is no evidence that combining water and sewerage activities leads to savings of fixed costs.

Table 4.4: Estimates of economies of scope (negative value represents diseconomies of scope; a positive value represents economies of scope)

	Between water and sewerage production		Between water and sewerage outputs		Between water and sewerage connections	
	Outputs	Fixed costs	Outputs	Fixed costs	Outputs	Fixed costs
1993	-0.55	-0.19	0.91	-0.06	1.96	-0.06
1994	-0.55	-0.12	0.90	-0.04	1.91	-0.04
1995	-0.50	-0.14	0.82	-0.05	1.77	-0.05
1996	-0.48	-0.19	0.82	-0.06	1.77	-0.06
1997	-0.43	-0.16	0.76	-0.05	1.75	-0.05
1998	-0.39	-0.13	0.69	-0.04	1.67	-0.04
1999	-0.40	-0.13	0.72	-0.04	1.76	-0.04
2000	-0.40	-0.12	0.70	-0.04	1.69	-0.04
2001	-0.40	-0.15	0.70	-0.05	1.68	-0.05
2002	-0.43	-0.18	0.75	-0.06	1.79	-0.06
2003	-0.40	-0.19	0.72	-0.06	1.77	-0.06

Source: Stone and Webber (2004) "Investigation into evidence for economies of scale in the water and sewerage industry in England and Wales"

4.2.4 Recommended approach

As can be seen, there are a range of ways in which a merger could result in a reduction in prices. One straightforward approach to estimating the efficiency gains from merging (which would ultimately lead to lower prices at the next price review and through possible sharing of efficiency gains during AMP6) would be for the merging parties to provide detailed bottom-up estimates of expected cost savings. Unless there is a commitment for forecast costs to be reflected in reductions in future prices, merging parties may have an incentive to overstate the extent of this impact. Ofwat may be able to place greater weight on the estimates if they have been provided or verified by an independent third party and/or is supported by a detailed implementation plan and justification why the cost savings are only available through a merger.

Another approach would be for the merging companies to provide econometric evidence of efficiency savings. One approach would be to simulate the merger by re-estimating Ofwat's econometric models with data for a merged entity. However, as described above, a loss of precision might be expected in Ofwat's econometric models as a result of the loss of a comparator. Depending on the extent of the loss of precision, it may not be possible to place great weight on the estimate of efficiency savings. However, given that Ofwat's analysis at PR14 concluded that the loss of a comparator would not have a significant impact on the wholesale cost assessment models, this may not be an issue.

An alternative econometric approach would be to take one or two of the papers that exist in the literature on cost function estimation in the UK water and sewerage industry and simulate the impact of the merger by computing the sum of the predicted (pre-merger) costs of the two merging companies and compare them with the predicted cost of the new merging firm. The limit of this approach is that it is static in nature and just captures the costs and benefits of the merger given the current technology.

A third approach would be to review academic papers that have sought to quantify the (dis)economies of scale or scope to provide a prima facie estimate of the impact of the merger. For instance: papers that have modelled WoCs could be used to analyse WoC-WoC mergers, while papers that have jointly considered WoCs and WaSCs could be used to consider what will happen between a WaSC-WoC merger. The results of academic research have been quite varied and depend, to some degree, on the modelling approach taken and the variables used to represent scale. It would therefore be necessary to demonstrate that a particular estimate of economies of scale or scope is the most appropriate — something that is likely to prove difficult to do in practice. In addition, varying one cost driver to generate efficiency savings without altering associated cost drivers may lead to unrealistic results.

Box 4.5: Recommended approach to assessing the impact of a merger on costs

We recommend undertaking a bottom-up exercise to estimate the potential cost savings from merging. This could be independently verified to provide assurance to Ofwat that the estimates are robust.

The merging parties may wish to provide cross-checks of these estimates to further assure Ofwat that the magnitude of potential cost savings derived from the bottom-up exercise are plausible. Given the number of ways in which cost functions have been estimated in the academic literature and the differences in the resulting estimates of economies of scale, we recommend re-running Ofwat's econometric models with inputs for the merged entity based on the sum of the two pre-merger firms.

4.3 Valuing the impact on quality of service

One approach to valuing the impact of the merger on quality of service would be to carry out a bottom-up exercise to demonstrate the specific improvements that the merger would enable. For example, in the South Staffordshire/Cambridge Water merger, South Staffordshire argued that the merged entity would be in a position to offer increased resilience to emergency provision, increased resilience to call centre provision and improved billing services.

Box 4.6: South Staffordshire's submission to the Competition Commission on specific improvements

In relation to the ability of a merged company to respond to an emergency, South Staffordshire said that it would retain sufficient personnel at Cambridge Water to handle day-to-day needs. It also said that the journey time between South Staffordshire and Cambridge Water was approximately 2 hours, and that it could deploy staff from South Staffordshire to Cambridge Water if required. In the past South Staffordshire had provided personnel to assist Severn Trent to respond to an incident in Gloucester. South Staffordshire considered that it would have a greater incentive to support Cambridge Water under common ownership, than under independent ownership.

In relation to customer service, South Staffordshire said that it would retain a call centre in Cambridge as well as Walsall, and the merger would provide flexibility to route calls between centres if need be without the need to physically relocate the staff.

In relation to the integration of technology of the two companies, South Staffordshire considered that it was relevant to note the expertise within the South Staffordshire group that stemmed from ownership of RapidXtra, a customer contact, billing and operations system that was widely used within the UK water industry. South Staffordshire said that it had successfully implemented that product into South West Water, Bristol Water, Wessex Water, Northern Ireland Water and Hartlepool Water, and it was in the process of implementing it into Portsmouth Water. South Staffordshire considered that none of those had gone badly, which was not always the case with alternative solutions. The RapidXtra system was designed to handle the various billing arrangements (e.g. water and sewerage) relevant to the water industry.

This evidence could be combined with consumer research on customers' willingness to pay for these improvements to derive an estimate of the value of these improvements, though it would have to be noted that these might be upper bound estimates in the absence of evidence to indicate the cost of implementing

the improvements, which would feed through to the cost base at the next price review, (at least in part, depending on the cost benchmarking exercise undertaken at the next price review). Alternatively, the merging companies could provide supporting evidence to explain why the improvements would not entail a cost.

4.3.1 Recommended approach

We recommend the approach set out above. Any quantification of the monetary impact of these improvements through willingness to pay research would need to be supported through well-evidenced qualitative assessment.

Box 4.7: Recommended approach to assessing the impact of a merger on quality of service

We recommend that a bottom-up exercise is undertaken to establish specific service quality improvements that would result from the merger. The value of these improvements could be estimated by using the results of market research on the willingness to pay for these improvements. This research could be independently verified and/or supported by a detailed implementation plan to provide assurance to Ofwat that the estimates are robust and are only available through a merger.

4.4 Valuing the impact on choice

The merging companies may wish to identify the range of non-household tariffs the companies currently offer and how this would change following the merger, and the corresponding effect on choice for existing non-household customers to switch to alternative tariffs provided by the merged entity. It would not be possible to quantify this impact without making assumptions about the value placed by different business customers on the availability of more tariffs. However, the merging party may wish to provide qualitative evidence based on customer research.

4.5 Valuing the impact on innovation

There are no simple methods for assessing the (net) benefit resulting from R&D and innovation (or from innovative mergers), or applying general results which would be too broad brush to apply to the specific characteristics of the water sector.

The text box below identifies some examples of innovative activities that have been considered in past merger cases (though it should be noted that these examples relate to speculation about the impacts of the mergers in question on innovation):

Box 4.8: Competition Commission's consideration of innovation impacts

South Staffordshire/Cambridge Water

In this merger case, the companies did not provide examples of innovative activities that would take place because of the merger. However, to illustrate the types of innovative activities which might be possible, we highlight below past innovations by the companies that were considered by the Competition Commission.

It was noted that due to South Staffordshire's relatively high level of average pumping head, it was developing a level of sophisticated network optimization to reduce average pumping head,

carbon and operational costs. Similarly, South Staffordshire was considered a leader in its approach to energy management and procurement.

Cambridge Water was an early mover on metering among the WoCs, due to the growing population and water scarcity of its area of operation, and it was investigating ways in which nitrates may be prevented from leaching into its supply network.

The non-executive directors of Cambridge Water informed the Competition Commission that the ethos of Cambridge Water had been to strive for innovation, for example the early promotion of chlorination to sterilise the water supplied and the use of wireless telemetry to control pumps and valves on the pipe network. Other projects included: the use of chlorine in different form so as to avoid the danger and cost of chlorine gas; a scheme for use of 'grey water' in housing developments in collaboration with Cambridge City Council; and a collaboration between Cambridge Water, the University of Cambridge's Department of Plant Science and the University of East Anglia to develop innovative cost-effective means of reusing the effluent from the nitrate-removal plants that are being installed across the area.

Cambridge Water had in fact expressed concerns that innovations such as those described above would no longer occur if the traditional close connections of Cambridge Water with the University of Cambridge and the local community were severed.

South East Water/Mid Kent Water

Hastings (the owners of Mid Kent Water) had said that, by virtue of its size, the merged company would be more likely to innovate than a small WoC like Mid Kent Water. In particular, the area served by Mid Kent Water would be more likely to see management innovation after the integration with South East Water given the ability to identify best practice across a larger company. In addition, Hastings said that the enhanced ability of the integrated group to invest in management resources would drive innovation.

Vivendi Water/Southern

Vivendi Water argued that Southern would have access to all of the water, wastewater and environmental experience within the VE group, and that this would enable Southern to be more confident in the selection of innovative ideas. Furthermore, within the VE group, Southern would have access to: the findings of a worldwide group research programme and to opportunities for collaboration on specific research projects; highly-specialised design and construction capabilities, such as on coagulation/flocculation equipment, on membrane technologies and on various innovative biological treatments; and advanced process design experience, such as the design, construction and operation of compact wastewater treatment plants (particularly in highly dense or sensitive coastal areas), the use of the combination of activated carbon and ozonation, and in sludge treatment and disposal.

SAUR/Mid Kent Water/General Utilities

It was noted in the Competition Commission's final report that (in contrast to the positive points above) companies which are part of large corporate groups do not have the full capacity for independent and innovative action (which is the basis of at least part of the value of a comparator). Mid Kent Water also said that its independent and innovative research and development function would probably be lost in the event of a merger.

As can be seen, the Competition Commission has not in the past taken a quantitative approach to assessing innovation impacts, and has tended to provide qualitative assessment.

To arrive at a quantitative estimate of the impact of innovation (or an innovative merger) on a merged firm's operations and costs and revenues (relative to the operations at the two independent firms), one approach would be to look at innovative initiatives expected to be taken — *that would not be undertaken absent the merger* — and the effects on cost savings.⁷⁷ This would ideally be done at a granular level, using data from the merging firms.

If it is not possible to quantify the types of innovative impacts discussed in the text box above, a simpler approach would be to look at results on R&D and innovation in the academic literature and apply them to the merger. However, it should be noted that the results in the academic literature may not translate well to the water sector, given the specificities of the sector, and therefore, the types of innovation that might occur. Therefore, any application of this approach would need to strongly justify why the results were appropriate for the merging firms *and* why these benefits would not materialise without a merger. The text box below highlights some potentially useful results:⁷⁸

Box 4.9: Academic literature on innovation

An important paper which provides an overview of the literature on competition and innovation (and that is written for antitrust bodies that need to evaluate the impact of a merger on innovation is) Gilbert (2006) "Competition and innovation".⁷⁹ The paper sets out key innovation concerns in merger policy, a review of literature on the incentives for innovation under different market structures (including consideration of managerial incentives for R&D), and a review of key empirical results in relation to: market structure and R&D intensity; pre-emptive R&D investment; and, perhaps most importantly in this context, the relationship between firm size and R&D intensity.

The article by Gilbert notes the difficulty in generalising the effects of mergers on innovation. This is because competition (which is in general reduced in the case of a merger) does not have necessarily a clear cut effect on innovation incentives: if a merger reduces competition, it is possible that innovation might increase, if this increases the size of the market and therefore the profits from the innovation (Schumpeterian effect), but it could well reduce innovation if the merger reduces the competitive pressure to escape competition. Gilbert notes that to analyse the effects of a merger on innovation incentives it is important to consider the industry and the firm involved in the merger: it is important to analyse the intensity of *ex ante* and *ex post* competition, the type of innovation (e.g. whether there is patent protection or not). Moreover, Gilbert discusses the important of diversity in R&D paths: a merger, by eliminating a rival, might consolidate research efforts in one single direction, which may or may not be good for innovation.

⁷⁷ This could overlap with efficiency savings expected to lower prices. However, for the purpose of identifying the impacts of a merger on innovation, it would be sensible to separate efficiency savings owing to innovation and consider them separately to ensure that these benefits are not double counted.

⁷⁸ Other potentially useful sources of literature include: Kleer, R. (2006): The effect of mergers on the incentive to invest in cost reducing innovations, Wuerzburg Economic Papers, 2006-73; Jost, P. J. and C. van der Velden (2006): Mergers in patent contest models with synergies and spillovers, Schmalenbach Business Review, 58, pp. 157-179; and Kleer and Wagner (2013): Acquisitions through innovation tournaments in high tech industries: a comparative perspective, Economics of Innovation and New Technologies, 22, 1.

⁷⁹ Richard J. Gilbert. "Competition and Innovation" Issues in Competition Law and Policy. Ed. Wayne Dale Collins. American Bar Association Antitrust Section. (see: http://eml.berkeley.edu/~gilbert/wp/competition_and_innovation.pdf)

A recent paper by Cefis and Marsili (2015) finds that being involved in a merger increases both the probability of persisting in innovative activities and the probability of becoming an innovator. In particular, in the case of small firms, a merger increases the likelihood that firms change their status from “not-innovator” to “innovator”; while large firms are those that benefit more from innovation.⁸⁰

Phillips and Zhdanov (2013) provide estimates on the impact of M&A activity in an industry on the firms’ incentive to undertake R&D, and they find that the smaller of the merging firms is likely to benefit more. These results may suggest that a lower impact would be seen if M&A activity in the water sector is low, and that the gains may be higher for a WoC in a WoC-WaSC merger.⁸¹

The inverted U shape theory of Aghion *et al* (2005) suggests that the effect of less competition (e.g. a merger) might also depend on how efficient the firms involved in the merger are: an inefficient firm might not have innovated in the first place (because the chances to innovate and catch up with the frontier are small) and a merger with a more efficient firm might therefore be less harmful than a merger between two efficient firms.⁸²

4.5.1 Recommended approach

In light of the discussion above, we recommend the following:

Box 4.10: Recommended approach to assessing the impact of a merger on innovation

We recommend the merging firms should provide quantitative estimates of the effects of innovation on a merged firm’s operations and costs and revenues using a bottom-up approach, as recommended for assessing the impact of the merger on price. (This benefit could be considered as a sub-set of the impact on prices. Merging firms must make sure not to double-count this benefit.)

If it is not possible to provide such estimates (for example if the underlying data is not robust or the outcome of the R&D process is uncertain), the merging firms could provide qualitative analysis. In this analysis, the merging firms may wish to allude to key academic results, but caution should be taken in extrapolating academic findings obtained outside the water sector to the water sector.

⁸⁰ Cefis E and Marsili O (2015), Crossing the innovation threshold through mergers and acquisitions, *Research Policy*, 44.3.

⁸¹ Phillips and Zhdanov (2013) “R&D and the Incentives from Merger and Acquisition Activity”, *Review of Financial Studies*, 26, 1, 34-78

⁸² Aghion, Phillipe, Nick Bloom, Richard Blundell, Rachel Griffith, and Peter Howitt (2005), “Competition and Innovation: An Inverted-U Relationship,” *Quarterly Journal of Economics*, Vol. 120, No. 2, pp.701-728.

5 Identifying and Valuing the Impact of Undertakings in Lieu

If the analysis of impacts of the merger concludes that the relevant customer benefits do not outweigh the prejudice to Ofwat's ability to make comparisons, the merging companies may wish to propose undertakings in lieu (of a mandatory reference to the CMA) to offset any identified prejudice.

These undertakings in lieu would need to be designed as a response to the harm that may arise as a consequence of a merger. This response could take many forms, including: preventing the harm arising altogether; resolving, in part or wholly, a harm that has already materialised; or generating further benefits to offset the potential harm.

This chapter is structured as follows:

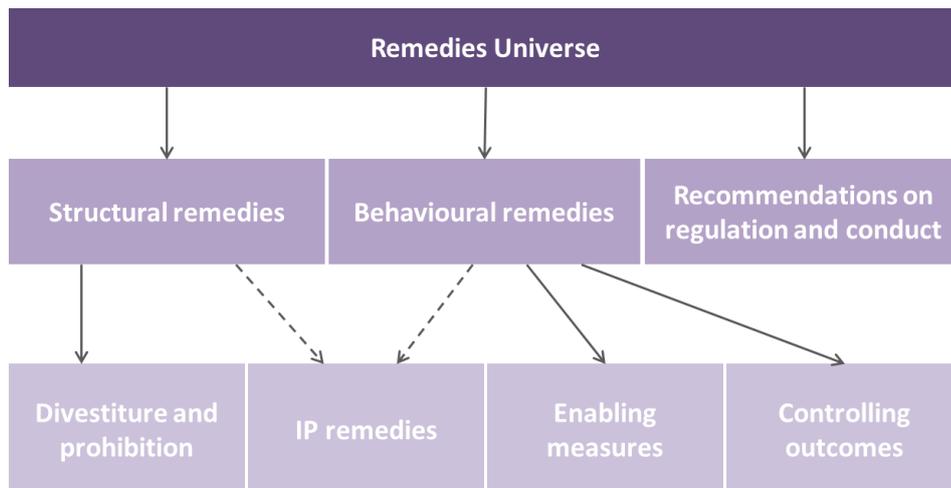
- We first set out the range of undertakings in lieu that merging parties may wish to offer (in the event that a prejudice to Ofwat's ability to make comparisons is identified, but any relevant customer benefits do not offset this prejudice). The potential undertakings in lieu discussed here draw on remedies that have been imposed by the Competition Commission in past merger cases in the water and sewerage sectors.
- Second, we go through each type of undertaking in lieu and set out a suggested approach to assessing the impact of this undertaking in lieu, i.e. to assess whether the undertaking is of sufficient magnitude to offset any identified prejudice.

5.1 Types of undertakings in lieu that merging companies could offer

In this section, we set out the types of undertakings in lieu that merging parties may wish to offer in the event that a prejudice to Ofwat's ability to make comparisons has been identified, but any relevant customer benefits are not sufficient to offset this prejudice.

The diagram below provides the typology of merger remedies set out in the Competition Commission guidelines on merger remedies which has now been adopted by the CMA.⁸³ This provides a sensible starting point for considering what types of undertakings in lieu Ofwat might consider.

⁸³ Competition Commission (2008) "Competition Commission Guidelines: Merger Remedies"; p.12.

Figure 5.1: Typology of merger remedies identified by the CMA

Merger remedies are generally classified as either structural or behavioural (conduct-based) remedies, each of which have potential drawbacks which must be considered in determining an appropriate remedy.

As set out in the CMA's (adopted) guidance on water merger references, the following types of remedies would be considered:⁸⁴

- Structural remedies that are intended to restore all or part of the *status quo ante* (i.e. the way things were before), for example:
 - prohibition of a proposed merger;
 - divestiture of a completed acquisition; and
 - partial prohibition or divestiture (i.e. covering part of one or more of the merging companies' business).
- Behavioural remedies that are intended to decrease the prejudice to Ofwat's ability to make comparisons and any other adverse effect resulting from the prejudice, for example:
 - amendments to the company's licence, for instance regarding provision of information; and
 - a requirement to maintain separate management or separate accounting arrangements.

In past merger inquiries in the water and sewerage sector, the Competition Commission has also considered controlling measures in the form of enforced price cuts (see, for example, the Mid Kent South East merger).⁸⁵

In some situations, the CMA may recommend modifications to licence conditions to help address or control the adverse effects of the merger. In these cases, it would be for the Government to decide whether to act on the recommendation (and the CMA would consult with the Government before making any recommendation). However, in general the CMA would only use such recommendations in merger inquiries where it lacks the jurisdiction to impose an effective remedy in its own right, and as is demonstrated in the sections that follow, the CMA has not used such recommendations in the context of water mergers in the past.⁸⁶

⁸⁴ Competition Commission (2004) "Water Merger References: Competition Commission Guidelines"; pp.16-17.

⁸⁵ Competition Commission (2007) "South East Water Limited and Mid Kent Water Limited"; pp80-85.⁸⁶ Competition Commission (2008) "Competition Commission Guidelines: Merger Remedies"; p.14.

⁸⁶ Competition Commission (2008) "Competition Commission Guidelines: Merger Remedies"; p.14.

Therefore, in the event that the merger assessment identifies a prejudice to Ofwat's ability to make comparisons, the merging parties may wish to offer undertakings in lieu akin to the types of remedy that the Competition Commission has generally considered in the past in the water and sewerage sectors. In the sections that follow, we set out the following undertakings in lieu:

- divestiture;
- maintaining separate sources of information;
- price reductions; and
- licence modifications.

In addition to the undertakings in lieu listed above, the merging parties may wish to make the case for changes to Ofwat's approach to making comparisons which would partially offset any identified prejudice under the current approach as a result of the merger.

5.2 Structural undertakings in lieu

5.2.1 Divestiture

In most product markets, the objective of divestiture is to inject a new source of product market competition or strengthen an existing source of product market competition by transferring some part of the merged entity to a new or existing market participant respectively. In the water context, the purpose of divestiture would be to prevent the loss of a comparator. Divestiture could be full or partial (the former being akin to a prohibition).

The text box below outlines the Competition Commission's consideration of divestiture options as a remedy in past cases:

Box 5.1: The Competition Commission's consideration of divestiture as a remedy

South East/Mid Kent

The Competition Commission presented qualitative assessment of the likely impact of two divestiture options in this case: full divestiture of either South East Water or Mid Kent Water; and partial divestiture of part of either South East Water or Mid Kent Water.

The Competition Commission considered that a full divestiture remedy would directly address the prejudice identified by removing the concentration of ownership that had created the prejudice: Mid Kent Water and South East Water would be able to operate independently under separate ownership.

In the Competition Commission's view, if successfully implemented, partial divestiture would preserve the number of independent comparators and would therefore remedy the prejudice, at least to a large extent. It would remedy the precision and qualitative adverse impacts, since the number of independent companies submitting data to Ofwat would be maintained. Partial divestiture would also be likely to address the adverse impact on Ofwat's comparisons of cost base, although this would depend on the precise list of standard costs for which the new company would be able to submit data to Ofwat compared with the lists of standard costs previously submitted by Mid Kent Water and South East Water.

The Competition Commission considered that divestiture of the Northern region of South East Water, with the Southern region and Mid Kent Water permitted to operate under a single licence, was likely to be preferable to the divestiture of the Southern region of South East

Water, which would prevent many of the claimed merger benefits from being obtained. The Competition Commission considered that a water company the size of South East Water's Northern region would be able to operate effectively and efficiently. Nevertheless, splitting the Northern region out of South East Water to form a separate business for sale would be time consuming and there would be a significant risk that the implementation would not be successful. Although the two regions have separate tariffs, production and distribution systems, they are operated as parts of the same business, sharing the same management team and services.

In addition, to address fully the prejudice to Ofwat's ability to make comparisons in PR09, the separation and sale process would need to have been completed in time for separate data to be provided for the new company by 2008/09. Any long period of uncertainty would increase the risk that key Northern region staff would leave. Therefore, due to the practicability and the timeliness of this remedy, the Competition Commission concluded that partial divestiture was unlikely to be an effective remedy option.

Vivendi/Southern

The Competition Commission considered the possibility of the divestment of Three Valleys, the largest of Vivendi's three WoCs. As a water company, Three Valleys was larger than Southern, and since it was only in water not sewerage that the detriment would arise, the Competition Commission considered that, on grounds of relative size alone, this remedy would be disproportionate to the detriment.

The Competition Commission also considered the divestment of Vivendi's other two WoCs, F&D and Tendring Hundred. Both were very small, and the Competition Commission did not consider that their divestment would be relevant in the context of the loss of Southern's independence. The divestment of F&D to a third party would, moreover, involve discarding the benefits that could be realised from bringing F&D and Southern under common ownership.

The Competition Commission considered the argument that the divestment of Vivendi's 31.4 per cent stake in the owner of South Staffs Water, which serves a population of some 1.2 million, would not in itself balance the acquisition of 100 per cent of Southern, which provides water services to some 2.2 million people, and the minor detriment to F&D's value as a comparator. However, the Competition Commission considered that the detriment caused by the merger to the comparative regime, while material, was not great enough to justify the more severe divestment remedies described above. Moreover, the Competition Commission took into account Vivendi's sale of its stake in Bristol Water, as well the merger's potential benefits for water resource management. On balance, the Competition Commission concluded that the securing of the independence of South Staffs Water as a comparator would be the most appropriate and proportionate remedy for the adverse effect.

If the merging parties wished to propose some form of divestiture as an undertaking in lieu to offset the identified detriment to Ofwat's ability to make comparisons, they could provide an assessment of the likely impact of the divestiture by following similar techniques to those they would use to quantify the extent of prejudice in the first instance.

Assessing the impact on Ofwat's benchmarks

In the event that the proposed merger resulted in a detrimental effect on Ofwat's benchmarks for wholesale cost assessment, household retail cost assessment, ODIs and SIM, the merging parties would

need to demonstrate that the divestment would yield an independent comparator which had sufficiently good performance to offset the decrease in the benchmarks that the proposed merger would create.

This could be done using the same probabilistic approaches set out in section 3.2.4. Specifically, the approaches set out for estimating the impact of the proposed merger on these benchmarks could be repeated, but with the merged entity and the divested entity included in the sample. The result of this exercise could then be compared with the detriment identified before the divestiture is taken into account.

Assessing the impact on the precision of Ofwat's econometric models

In principle, a divestiture would be able to maintain the number of comparators available to Ofwat, and would therefore offset any loss in precision in its econometric models. However, given the use of panel data at PR14, this might not be the case, as historic cost data for the divested entity would be required to ensure that Ofwat did not lose any data points. If a merging party is proposing a divestiture as an undertaking in lieu, it would therefore have to explain how historic cost estimates would be derived, such that Ofwat would not lose any data points. In the absence of such data, the merging parties could calculate the loss in precision from a reduced number of data points in the same way as was carried out to assess the impact of the merger on precision without any remedying measures. The two estimates could then be compared to arrive at an estimate of the extent to which the prejudice is offset.

Assessing the impact on Ofwat's qualitative comparisons

If a divestiture is put forward as an undertaking in lieu, the merging parties would need to justify why and how a divestiture would reduce the risk (or negate all together) any negative impact on Ofwat's other uses of comparisons, such as those made to identify and spread best practice. The merging companies would need to provide evidence to suggest why Ofwat would be able to place weight on the divested entities performance in areas such as board assurance, business planning and customer engagement.

5.3 Behavioural undertakings in lieu

Behavioural undertakings in lieu would be remedying measures which operate on an ongoing basis with the aim of altering, in specific ways, the behaviour of the merged party. Altering behaviour could be in the form of forcing a merged party to engage in certain types of conduct, i.e. enabling measures, or in the form of preventing behaviour which would lead to undesirable consequences, i.e. controlling outcomes. The Competition Commission has tended to consider approaches to maintaining separate sources of information and enforcing price reductions. With regard to the latter, it is important to note that an undertaking of this type would not address the prejudice, but would remedy or mitigate the adverse effects expected to result from the prejudice. We consider each undertaking in lieu in turn below.

5.3.1 Maintaining separate sources of information

The text box below sets out the Competition Commission's consideration of options for maintaining separate sources of information between the merging parties to mitigate any detriment caused by the merger.

Box 5.2: The Competition Commission's consideration of remedies which maintain separate sources of information

South East/Mid Kent

The Competition Commission considered two possible options for maintaining separate sources of information: operating two enterprises under separate licences; or providing two (or more) separate sets of data to Ofwat from a merged entity operating under a single licence.

The Competition Commission found that separate licences would preserve the number of comparators and would therefore go some way to addressing the precision adverse impact by maintaining the number of the comparators in Ofwat's econometric modelling. The two data sets submitted to Ofwat would not, however, be completely independent. As two of the comparators would no longer be independently owned they would be likely to share some common policies. These factors would cause some reduction in the quality of data received by Ofwat, which would be likely to regard the two data sets as lacking the necessary degree of independence. Ofwat stated that it would not use any such data as separate data points in its econometric models. Qualitative information submitted by the two companies may also not be fully independent.

The Competition Commission considered whether it would be possible to put in place restrictions on the management of the business units that would ensure the usefulness of their sub-company data within Ofwat's econometric models. In particular, the Competition Commission considered whether it would be possible to establish separate, appropriately incentivised, management teams for the two business units and to impose accounting separation. However, as described above, the Competition Commission found that any such measures would be unlikely to result in Ofwat's using the data separately in its econometric models and would be unlikely to improve the effectiveness of this remedy.

Overall, the Competition Commission concluded that there would be very limited value in the separate provision of data sets, even by two companies operating under separate licences.

Vivendi/Southern

Vivendi was willing to deliver a new independent comparator in the form of Hampshire Water. However, the Competition Commission considered that there were several issues with this proposal. In particular, it would result in an increase in costs. First Aqua estimated that the additional running costs, aggregated across Hampshire Water and the rest of Southern, would be around £4.5 million a year, while the initial cost of establishing Hampshire Water would be around £7 million. In addition, it would be some years before the operational data on Hampshire Water, as a brand new comparator, became of much value to the comparative regime. Meanwhile, there would be disruption to the data on Southern as a result of a significant part of its water operations being hived off.

Mid Kent/General Utilities/SAUR Water Services

The Competition Commission considered that there was little merit in listing majority-owned subsidiaries separately, as this would be artificial and it would not provide information that could be relied upon.

Lyonnais des Eaux/Northumbrian Water

Consideration was given to whether the adverse effect could be remedied by maintaining the two companies as separate management units within a merged operation under separate appointments which might enable them to continue to serve as separate comparators. It was noted that the merger is intended to lead to the integration and rationalisation of the two organisations so as to achieve efficiency benefits and cost savings, and that such benefits and savings would be substantially diminished by a requirement to retain a degree of separation. A conclusion was therefore reached that such an approach was not appropriate.

This approach could, in theory, offset any prejudice arising from a loss of precision in Ofwat's models. It also has the potential to offset any effects of the merger on Ofwat's benchmark (whether this effect is beneficial or detrimental). However, this would only be possible if the two separate datasets are independent.

It would not be feasible to quantify these effects. However, as can be seen in the Competition Commission's past assessment of such remedies, the merging parties would need to provide sufficient evidence to Ofwat with regard to the independence of the two datasets so that they could continue to be used in econometric models and other comparisons.

Past merger cases have not reported how the extent of independence in the datasets was assessed. The text box below sets out some suggestions for how the companies might provide assurance of the limited dependence between separate datasets. The merging parties may be able to point to other indicators based on the nature of the merger to provide assurance as to the independence of the datasets. However, it should be noted that even if these issues are addressed, Ofwat may still regard the datasets as not being independent.

Box 5.3: Suggested indicators to demonstrate the extent of independence of the two separate entities

The companies could, for example, provide evidence of the limited extent of dependence between the separate datasets by demonstrating that:

- Management teams will remain completely separate.
- Appropriate transfer pricing policies would be in place between the two entities.
- Maintenance of separate customer engagement activities.

5.3.2 Price reductions

Price reductions may not address the prejudice directly, but could remedy or mitigate the adverse effects expected to result from the prejudice. In considering this undertaking in lieu it is important to note that the adverse effects of the merger would be felt by all water customers in England and Wales. This has been a common remedy considered by the Competition Commission, as set out in the text box below:

Box 5.4: The Competition Commission's consideration of price reductions to offset detriment

South East/Mid Kent

The Competition Commission noted that the adverse effects on customers of companies other than Mid Kent and South East Water would be mitigated if the merged company became sufficiently efficient in 2008/09 to become a benchmark company in PR09. Ofwat estimated the savings required for this to occur with reference to expenditure reported in 2005/06 (though the final numbers were excised from the Competition Commission's final publication). The Competition Commission thought it was unlikely that the merged company would be able to achieve savings of this magnitude to become a benchmark by 2008/09.

The Competition Commission considered that there were advantages to the price reduction being effected by means of a one-off lump sum transfer to South East Water and Mid Kent Water customers, made in advance of PR09 (described as an "upfront" transfer). This would have the advantage of decoupling the effectiveness of this remedy from the periodic review process: customers would be guaranteed a price reduction irrespective of the achievement of

future efficiency savings by the companies. In addition, such a mechanism would have the advantage of avoiding any ongoing compliance costs both for the parties and Ofwat.

However, the Competition Commission also noted that the price control process provides a means of securing price reductions for South East Water and Mid Kent Water customers. To the extent that price reductions might be funded by efficiency savings, the price control process should mean that such efficiencies are passed through to customers in any event from PR09.

The Competition Commission noted that £4m was broadly in the middle of its indicative range of customer detriment. The Competition Commission therefore took the view that a one-off price reduction of this amount would effectively mitigate the adverse effects that were expected to result from the prejudice. In addition, the Competition Commission thought that this remedy should be accompanied by a requirement on the merging parties to accept a price control determination in 2009 based on savings in operating expenditure of £3.1 million a year as compared with current operating expenditure costs and projections.

Vivendi/Southern

The Competition Commission considered the possible imposition of price reductions on Southern, with a view to advancing the efficiency frontier as well as benefiting Southern's customers. But while the merger offered benefits for the management of water resources which should reduce costs in the long term, the cost savings which Vivendi identified as arising in the short and medium term were small. Accordingly, the Competition Commission determined that there was no basis for significant price reductions which would be sustainable.

Mid Kent/General Utilities/SAUR Water Services

The Competition Commission considered that it was clear that the efficiency gains achievable through the proposed merger were small. In view of this, large price reductions from the merged companies would not be sustainable in terms of long-term cost reductions, and as such, this would be of no benefit to the comparator regime. The price cuts would need to be funded from the existing resources of the parent companies and the benefits would last only until the next Periodic Review. Therefore, the damage to the comparator regime arising from the loss of an independent WoC would be permanent.

Wessex Water/South West Water and Severn Trent/South West Water

In both cases, the Competition Commission asked the regulator whether any actions were feasible to remedy the adverse effects of prejudice to his ability to make comparisons. Ofwat's view was that, wherever possible, the most effective remedy for the reduction in the number of comparators was likely to be through the improvement in the quality of comparators overall by the creation of an exemplary new comparator. In these two cases, the remedy of a new comparator of higher quality might be achieved by a package of measures designed to maintain or increase the quality of outputs and service to customers while reducing costs, together with measures to improve the visibility and independence of the regulated business within the group. As part of this package, very substantial immediate price reductions of between 15 and 20 per cent of the revenue of the merged entity would be necessary.

In both cases, South West Water submitted that the detriment arising from the merger would be substantially greater than that arising from any previous merger in the water industry and was incapable of remedy. In its view, any remedy, such as a price cut, could be expected to have effect only until the next Periodic Review and would only provide the incentive for the merged

enterprise to become an exemplary comparator until that time. It was not a remedy for the permanent reduction in the effectiveness of comparative competition caused by the loss of an independent WaSC. The remedy of creating an exemplary comparator was accordingly only a short-term palliative and could not be a permanent solution; over time, the new frontier created by the exemplary comparator would be attained and exceeded through the leap-frogging impact of comparative competition, which would itself, however, have been weakened by the reduction in the overall number of comparators.

The Competition Commission's own approximate calculations confirmed that the effect of the proposed price reductions in both cases were substantially less than the effect of Ofwat's suggested price reduction in terms of revenue loss.

- Wessex Water estimated the operating cost saving of its proposed price reduction as £34 million (in 2002/03) whilst Ofwat's estimate of the equivalent annual revenue loss of the proposed price reduction is in the range of £69m to £91m.

- Severn Trent estimated the operating cost savings arising from the merger as £30 million by 2000/01 whilst Ofwat's estimate of the equivalent annual revenue loss of the proposed price reduction is in the range of £161m to £215m.

Having identified the extent of detriment to Ofwat's ability to make comparisons (in the case that there is detriment, and therefore, some undertaking in lieu is appropriate), the merging parties may wish to offer a price reduction as an undertaking in lieu of a CMA referral. In determining the appropriate size of the price reduction, it would be appropriate to consider the interaction with efficiency sharing factors. Any efficiency gains from the merger would be passed on to customers in part through efficiency sharing. The price reduction offered as an undertaking in lieu would therefore need to reflect the identified prejudice to Ofwat's ability to make comparisons and may provide greater surety that efficiency savings are passed back to customers.

The merging parties may choose whether to enforce this price reduction as a combination of an immediate one-off reduction for its own customers and efficiency improvements at the next price review, or just as efficiency improvements at the next price review (bearing in mind that relevant customer benefits must accrue within a reasonable time period).⁸⁷ The merging parties could also choose where the cost reductions (which would lead to the price reductions) are imposed, though it might be expected that reductions in wholesale costs are most appropriate as this accounts for the majority of a company's total costs across the value chain, and this is where any effects of the merger on precision would be experienced. In any case, the merging companies would need to justify why a particular approach had been taken, and why it represented the best option relative to alternatives.

5.4 Recommendations on regulation and conduct

5.4.1 Licence modifications

The Competition Commission has in the past not considered this option in its assessment of mergers in the water sector. However, the merging parties may wish to offer some form of licence modification as an undertaking in lieu of a CMA referral.

⁸⁷ The merging parties may also wish to demonstrate how cost reductions would feed through to tariffs for different customers.

For example, this might involve changes to licences that are consistent with wider regulatory objectives, such as the adoption of a modular licences for different stages of the value chain, on the basis that this would enable separate reporting at each stage of the value chain, and setting of price controls at a disaggregated level using this information, which could in turn foster a drive for greater efficiency by allowing the use of more specific cost functions in carrying out cost assessment, for example.⁸⁸

Ofwat's impact assessment of changes to the methodology for setting price limits may provide an indication of the potential benefits that could arise from enabling the benefits of upstream market reforms. The impact assessment states the following with regard to the implementation of network plus sub-limits:⁸⁹

Box 5.5: Ofwat's assessment of the potential benefits of introducing network plus

“Accurate data on the revenues associated with different parts of the value chain will be necessary if Ofwat is to set appropriate sub-limits and more generally adapt its regulatory framework to promote the development of market reforms. Efficiency gains could also arise from the increased range of regulatory options available to Ofwat once it has access to the network plus data although these impacts (if any) depend on future policy decisions.

“Defra estimated the potential benefits of upstream market reform to be £1.75bn. To enable competition to operate, the costs and revenues across the value chain would need to be clear and sub-limits would need to be set for the segments of the value chain that would remain non-contestable. This would prevent cross-subsidisation by integrated companies and it would enable potential entrants to assess more robustly the business case for entry. This argument is analogous to the rationale for a separate control in the non-household retail segment. We believe that the measure will help to deliver upstream market reform, although the estimated £1.75bn benefit of the reform cannot be attributed to the network plus reforms (since this would double count the estimated benefits of the WB).

“Moreover, by collecting data earlier in the control period and testing non-binding sub-limits, Ofwat may be able to accelerate the benefits of upstream market reform when undertaking its next Periodic Review (PR19).

“Upstream market reform is a significant reform which will require major changes in the regulatory approach. This means that if Ofwat is able to put some of the required mechanisms in place now it will make it easier to implement the subsequent reforms earlier. We estimate that every year of delay of the implementation of upstream market reform would cost £135m (the benefits accrue later which reduces their NPV). Since these potential benefits depend on the introduction of upstream market reform following the reforms enabled by the WB, they would not be realised if the WB does not progress.”

Merging parties that wish to propose a modular licence as an undertaking in lieu of a CMA reference may wish to draw on Ofwat's assessment of the benefits of network plus to estimate the potential impact of introducing modular licences. This assessment may need to take into account the following:

⁸⁸ See Ofwat (2015) “Ofwat's forward programme 2015-16” for information on Ofwat's intention to develop modular licences (p.31); see: http://www.ofwat.gov.uk/aboutofwat/plans/rpt_fwd2015-16complete.pdf

⁸⁹ Ofwat (2013) “Updated Price Limits Impact Assessment”; p.59; see: http://www.ofwat.gov.uk/pricereview/pr14/rpt_com201307pwcimapct.pdf.

- **The nature of the licences being proposed.** If the merging parties are proposing a modular licence, such as for network plus sub-limits, the extent to which benefits would have materialised anyway would need to be considered.
- **Timing.** The merging parties may wish to consider in their assessment the extent to which the implementation of a modular licence would aid the advancement the implementation of upstream market reforms.
- **Application of the proposal.** If a modular licence is to be proposed, the merging parties may wish to liaise with Ofwat (and possibly other stakeholders) to understand the likelihood of the same modular licence being applied across the industry, or whether it would only be applied to the merging parties, in which case the extent of potential benefits may be more limited.

Merging parties offering such a remedy may be expected to provide a qualitative assessment of the benefits of carrying out benchmarking at each stage of the value chain, for example to demonstrate that it would be possible to undertake cost benchmarking exercises at each stage of the value chain. If the licence change is intended to be applied more broadly across the industry, any cost to the industry of effecting licence changes would need to be reflected in the merging parties' assessment.