TA 14.7 Top-down Econometric Analysis (Botex)

Technical annex

September 2018
Version 1.0

Southern Water

Navigation: TA 14.7 - *Top-down Econometric Analysis (Botex)*

Purpose:

This technical annex provides a summary of the process we undertook to develop our top-down view of efficient botex costs.

The table below summarises the Ofwat tests that are addressed by the evidence presented in this Annex.

Table 1 - Relevant Ofwat tests

Ref	Ofwat test		Comment
Primary Focus Areas			
Test area 6: Securing cost efficiency	How well evidenced, efficient and challenging are the company's forecasts of wholesale water expenditure, including water resources costs? How well evidenced, efficient and challenging are the company's forecasts of wholesale wastewater expenditure, including bioresources costs?	Features of a high–quality plan: The company will submit an efficient level of total expenditure in all areas. Features of an ambitious and innovative plan: The company will present strong evidence of sector-leading cost efficiency.	We have been through an extensive process and used a wide range of evidence to develop our top-down view of efficient botex costs. Based on this, Based on this, we are confident the outputs we have developed are credible and provide an appropriate basis for robustly challenging our detailed plan costs to ensure they are efficient.

Top-down econometric analysis (botex)

This annex provides an overview of the work we have undertaken to develop our top-down view of efficient botex costs for AMP7.

In developing our top-down view of efficient botex costs, we have used a wide range of sources. We developed and iterated our view as evidence became available, including through data updates and Ofwat's modelling consultation[1]. The figure below provides an overview of the evidence sources we have used.

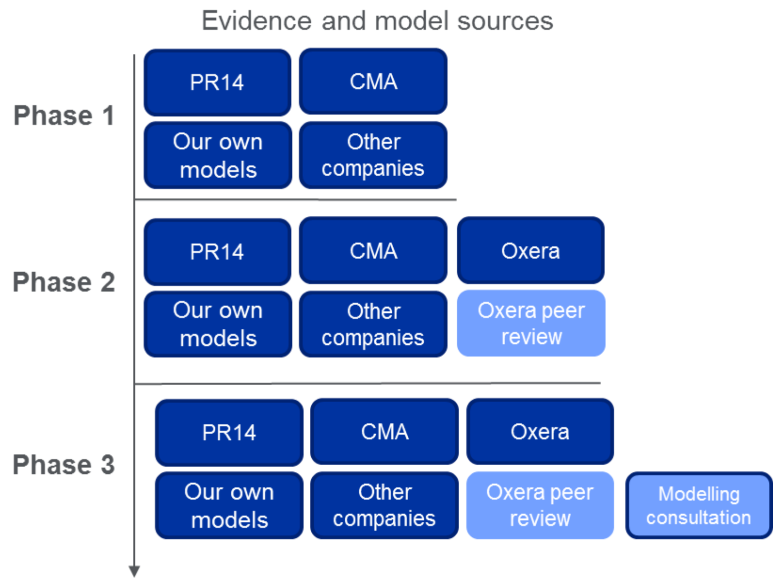

Figure 1. Evidence and model sources used to develop our top-down view of efficient botex costs

As a starting point, in addition to developing our own models, we used models from PR14, the Competition Markets Authority (CMA), as well as other companies in the industry (phase 1). This analysis was used to develop our initial top-down view of efficient botex costs. We describe the details of these models in appendix A and the table below sets out our initial view of the efficient costs based on these models.

Table 1. Initial top-down view of efficient AMP7 costs

Botex, 2017-18 prices	Waste	Water
Resources	£230m	£70m
Network plus	£1,200m	£560m
Total	**£1,430m**	**£630m**

To ensure our analysis was appropriately reviewed and challenged, we commissioned Oxera to peer review our work and assess our view of the efficient cost projections for AMP7 (phase 2). Their review concluded that, notwithstanding some technical and statistical issues with some of the models, our view of the projected efficient costs were broadly aligned. The review also noted that our projections were likely to over-estimate the efficient botex costs for Water by £30million over the AMP and were likely to underestimate these for Wastewater by £25-40million.

We further improved our projections by triangulating these with the outputs from Ofwat's modelling consultation. We particularly focussed on the models developed by Ofwat but also compared our projections with outputs from the models submitted by other companies (phase 3). This largely

[1]Ofwat modelling consultation (March, 2018): https://www.ofwat.gov.uk/consultation/cost-assessment-pr19-consultation-econometric-modelling/

confirmed the points made by Oxera, which gave us further confidence that our projections were credible and sufficiently challenging. Triangulation of our analysis with outputs from Ofwat's modelling consultation gave the following conclusions:

- **Wastewater:** our central top-down view of the efficient costs on Bio-resources was £40million lower over AMP7 than our view of the efficient costs estimated using Ofwat's consultation models. On Network plus, our central estimate was £90million higher than Ofwat's models. Overall, this meant we increased the efficiency challenge by reducing our top-down view of efficient costs by a further £50million on wastewater compared to our initial efficiency targets. The table below breaks down this change and provides the final target values, which include a 1% annual frontier shift.[2]

Table 2. Top-down view of efficient wastewater costs for AMP7

Wastewater			
Botex, 2017-18 prices, 1% frontier challenge	**Initial central top-down estimates of efficient AMP7 costs**	**Change in central top-down estimates of efficient AMP7 costs**	**Final value**
Bio resources	£230m	£40m	£270m
Wastewater network plus	£1,200m	-£90m	£1110m
Total	**£1,430m**	**-£50m**	**£1380m**

- **Water:** our Water models estimated efficient botex costs that were £160million lower over AMP7 than Ofwat's consultation models. Most of the difference was due to the differences in cost projections for Network Plus. However, reviewing the models in detail and noting some potential technical limitations with these, we have taken a conservative view and triangulated the results with other evidence including outputs from Oxera's industry study. Based on this, we have used efficient costs that are £90million lower and more stretching than the efficient costs estimated using Ofwat's consultation models to challenge our delivery plan. As our estimate was significantly more conservative than the outputs from Ofwat's and Oxera's modelling, we did not apply a further frontier shift to these values.

Table 3. Top-down view of efficient water costs for AMP7

Water			
Botex, 2017-18 prices	**Initial central top-down estimates of efficient AMP7 costs**	**Change in central top-down estimates of efficient AMP7 costs**	**Final value**
Water resources	£70m	£15m	£85m
Water network plus	£560m	£60m	£620m
Total	**£630m**	**£75m**	**£705m**

Based on this approach, we have developed the following upper quartile adjusted view of the efficient botex costs[3]:

[2] Note that the 1% efficiency gain assumption goes beyond the gains projected by Oxera's independent analysis, covered in annex: TA.14.6 Oxera report: Estimate of RPE and frontier shift

[3] Upper-quartile efficiency adjustments were made within the models, based on projecting forward historical efficiency performance for each company. This is the same approach that Ofwat adopted at PR14.

Table 4. Final central top-down estimates of efficient AMP7 costs

Botex, 2017-18 prices	Price control	Final central top-down estimates of efficient AMP7 costs
Wastewater	Bioresources	£270m
	Wastewater Network Plus	£1110m
Water	Water resources	£85m
	Water Network Plus	£620m

We have been through an extensive process and used a wide range of evidence. Based on this, we are confident the outputs we have developed are credible and provide an appropriate basis for robustly challenging our detailed plan costs to ensure they are efficient.

Appendix A: Overview of Southern Water's models

	Explanation
Econometric approach	The cost models were developed using the pooled Ordinary Least Squares (POLS) method.
Definition of Botex	Botex refers to: Base expenditure (BOTEX) = OPEX + Base CAPEX Base CAPEX includes capital expenditure for maintaining the long term capability of the assets (infrastructure and non-infrastructure). Base CAPEX does not include enhancement CAPEX (including infrastructure network reinforcement).
Definition of modelled costs	All base expenditure has been included in the modelled costs. In other words, no costs have been excluded from BOTEX in the modelling process.
Level of aggregation	BOTEX models were developed at the aggregate and price control levels. Six types of models were considered: Water resources; Network+ (water); Aggregate BOTEX (water); Bioresources; Network+ (wastewater); Aggregate BOTEX (wastewater).
Industry characteristics	Water resources – six models based on a combination of: Scale. The number of connected properties is controlled for in one model and distribution input in the other five models. Pumping requirements. Average pumping head in water resources is controlled for in five models. Source mix. The proportion of input from boreholes is controlled for in one model. Density. Population over area is controlled for in three models and properties over area is controlled for in one model. Input prices. Regional wages are controlled for in four models. Network+ (water) – three models based on a combination of: Scale. The number of connected properties is controlled for in one model and the length of the network in the remaining two models. Pumping requirements. Average pumping head in network+ is controlled for in all models. Treatment complexity. The proportion of input treated in complexity band 3, the proportion of input treated in complexity bands 3–4 and the proportion of input treated in complexity bands SW4–5 are controlled for in one model each. Density. Connected properties over the length of the network is used as a density driver in all models. Maintenance requirements. The proportion of mains laid before 1980 is controlled for in one model. Aggregate BOTEX (water) – four models based on a combination of: Scale. The length of the network is controlled for in all models. Size of treatment plants. The proportion of water treated in size bands 1–3 is controlled for in all models.

	Treatment complexity. The proportion of input treated in complexity bands 3–4 and the proportion of input treated in complexity bands 4–5 are controlled for in one and two models respectively. Density. Connected properties over the length of the network is used as a density driver in three models and population over area is used in the remaining model. Bioresources – four models based on a combination of: Scale. Total load is controlled for in two models, sludge produced in one model and the number of connected properties in the remaining model. Treatment complexity. The proportion of AD or AAD is used in all four models and the proportion of sludge treatment using raw sludge liming is controlled for in one model. Density. Population over area is used in one model. Network+ (waste) – 14 models based on a combination of: Scale. The number of connected properties is controlled for in two models, total load in one model and the remaining eleven models control for length of legacy public sewers. Pumping capacity. Pumping capacity is controlled for in four models Maintenance requirements. The proportion of mains laid at certain time periods are controlled for in eight models. Combined sewer overflows is controlled for in three models. Treatment complexity. The proportion of load with active secondary and tertiary treatment; the proportion of load with biological secondary and tertiary treatment; the proportion of load subject to ammonia <1mg/l and designated bathing waters are controlled for in one model each. Sewage treated in bands 1–3 is controlled for in ten models. Density. Population over area is controlled for in one model and the number of connected properties is controlled for in ten models. Other. The proportion of holiday population is controlled for in five models, the total intersiting work done in one model and the volume of network storage in two models. Aggregate BOTEX (wastewater) – six models based on a combination of: Scale. The length of legacy public sewers is controlled for in all models. Density. The number of connected properties over sewer length is controlled for in all models. Treatment complexity. Sewage treated in bands 1–3 is controlled for in all models. Designated bathing water is controlled for in one model. Other. Total intersiting work done, volume of network storage, average capacity of pumping stations and the proportion of holiday population are controlled for in one model each.
Statistical assessment	In the statistical assessment of Southern Water's models, the following diagnostic tests were considered: statistical significance of model coefficients; model fit (based on the adjusted R^2); model specification (based on the RESET test and Link test); heteroskedasticity of errors and the presence of statistical outliers. The assessment gave more weight to the economic and operational intuitiveness of the estimated coefficients, given the small sample properties and other assumptions behind these statistical diagnostic tests. On this basis, model outputs that were not aligned with operational expectations were excluded from consideration.