Staff paper 17 - Econometric models

Developing the modified models

We used the same method that Ofwat uses in developing our models. The information that the companies in England and Wales provide to Ofwat is published on the Ofwat website. We also took account of the adjustments to costs that Ofwat has made. This included adjustments to the allocation of leakage expenditure, which were published in Ofwat's 'Water and sewerage service unit costs and relative efficiency 2007-08 report'. We checked the consistency of the information that we used from the companies south of the border by ensuring that we would replicate Ofwat's calculations in every aspect.

We then added information from Scottish Water to the information provided by the companies. We used regression analysis and unit cost calculations to develop the modified models. The results of our analysis are outlined below.

The modified models

We did not change the form of the Ofwat models, and developed a suite of nine operating expenditure models:

- Water resources and treatment,
- Water distribution,
- Water power,
- Water business activities,
- Sewer network,
- Large sewage treatment works,
- Small sewage treatment works,
- Sludge treatment and disposal; and
- Sewerage business activities.

Water resources and treatment

We developed the water resources and treatment model shown in table 17.1.

Table 17.1: Modified model (Scottish Water information included) for water resources and treatment operating expenditure

Modelled cost	Resources and treatment functional expenditure (£m), less power expenditure (£m), less Environment Agency or Scottish Environment Protection Agency charges (£m), divided by resident population (millions)	
Explanatory factors	**Coefficient**	**Standard error**
Constant	5.927	1.003
Number of sources divided by distribution input (Ml/d)	22.273	7.833
Proportion of supplies derived from boreholes	-5.981	2.394
Statistical indicators	Number of observations: 23	R^2: 0.293

The information from Scottish Water had no significant impact on the coefficients of the model.

Water distribution

We developed the water distribution model shown in table 17.2.

Table 17.2: Modified model (Scottish Water information included) for water distribution operating expenditure

Modelled cost	Log to base e of (distribution functional expenditure (£m), less power expenditure (£m), divided by number of connected properties at year end (£000))	
Explanatory factors	**Coefficient**	**Standard error**
Constant	-2.075	0.673
Log to base e of (Length of mains/number of connected properties)	-0.710	0.251
Statistical indicators	Number of observations: 23	R^2: 0.275

The information from Scottish Water had no significant impact on the coefficients of the model.

Water power

We developed the water power model shown in table 17.3.

Table 17.3: Modified model (Scottish Water information included) for water power operating expenditure

Modelled cost	Log to base e of power expenditure (£m)	
Explanatory factors	**Coefficient**	**Standard error**
Constant	-8.147	0.255
Log to base e of (Distribution input (Ml/d) x average pumping head)	0.912	0.023
Statistical indicators	Number of observations: 23	R^2: 0.986

The information from Scottish Water had no significant impact on the coefficients of the model.

Water business activities

We developed the water business activities model shown in table 17.4.

Table 17.4: Modified model (Scottish Water information included) for water business activities operating expenditure

Modelled cost	Log to base e of (business activities expenditure (£m) plus doubtful debts (£m))	
Explanatory factors:	**Coefficient**	**Standard error**
Constant	-3.504	0.240
Log to base e of number of billed properties (thousands)	0.918	0.037
Statistical indicators	Number of observations: 23	R^2: 0.968

The information from Scottish Water had no significant impact on the coefficients of the model.

Sewer network

We developed the sewer network model shown in table 17.5

Table 17.5: Modified model (Scottish Water information included) for sewer network operating expenditure

Modelled cost	Log to base e of (sewer network functional expenditure (£m), plus terminal pumping costs, less Environment Agency or Scottish Environment Protection Agency charges (£m), per kilometre of sewer for each area)	
Explanatory factors:	**Coefficient**	**Standard error**
Constant	-5.283	0.331
Log to base e of area of sewer district per km of sewer	0.210	0.030
Log to base e of residential population per km of sewer	0.870	0.169
Holiday population divided by resident population	1.221	0.984
Statistical indicators	Number of observations: 71	R^2: 0.478

The information from Scottish Water had no significant impact on the coefficients of the model.

Large sewage treatment works

We developed the large sewage treatment works model shown in table 17.6.

Table 17.6: Modified model (Scottish Water information included) for large sewage treatment works operating expenditure

Modelled cost	Log to base e of (functional expenditure on sewage treatment at large works (£000), less Environment Agency or Scottish Environment Protection Agency charges (£000) less terminal pumping costs (£000))	
Explanatory factors:	**Coefficient**	**Standard error**
Constant	-1.190	0.244
Log to base e of total load	0.768	0.027
Activated sludge used	0.296	0.052
Tight effluent consent for both suspended solids and BOD5	0.126	0.046
Statistical indicators	Number of observations: 403	R^2: 0.712

The information from Scottish Water had no significant impact on the coefficients of the model.

Small sewage treatment works

We developed the small sewage treatment works model shown in table 17.7.

Table 17.7: Modified model (Scottish Water information included) for small sewage treatment works operating expenditure

This is a unit cost model. Each company's annual functional expenditure on sewage treatment at small works (excluding Environment Agency or Scottish Environment Protection Agency costs), divided by the total load treated at each works is compared with the weighted average industry cost.										
	Weighted average industry unit cost £000s/(kg BOD5/day)									
	Primary	Secondary activated sludge	Secondary biological	Tertiary A1	Tertiary A2	Tertiary B1	Tertiary B2	Sea outfall preliminary	Sea outfall screened	Sea outfall unscreened
Size band 1	1.29	1.26	1.08	1.80	1.84	1.36	1.02	0.63	-	0.24
Size band 2	0.44	0.94	0.62	0.99	0.69	0.73	0.92	0.56	-	0.09
Size band 3	0.26	0.53	0.37	0.58	0.59	0.41	0.47	0.14	0.17	-
Size band 4	0.31	0.25	0.19	0.25	0.37	0.19	0.22	0.10	0.12	0.04
Size band 5	0.06	0.18	0.13	0.17	0.21	0.14	0.14	0.03	0.01	-
Number of observations: 550										

Adding in the information from Scottish Water does appear to have an impact on the unit costs in the model. In particular many of the unit costs for the smaller size bands have decreased. This perhaps appears to be a surprising effect – we would generally expect small sewage treatment works to be affected by diseconomies of scale and to incur higher unit costs. Indeed Scottish Water has argued that it incurs higher costs than the companies in England and Wales because it has a large number of small sewage treatment works. We would expect these higher costs to have been reflected in Scottish Water's reported costs, but this does not appear to be the case.

Sludge treatment and disposal

We developed the sludge treatment and disposal model shown in table 17.8 when we included information from Scottish Water.

Table 17.8: Modified model (Scottish Water information included) for sludge treatment and disposal operating expenditure

This is a unit cost model. Each company's annual expenditure on sludge treatment and disposal (less Environment Agency or Scottish Environment Protection Agency costs) is divided by the amount of sludge disposed to each disposal route, and this is compared with the weighted average industry cost.								
	Weighted average industry unit cost £000s/(thousand tones dry solids)							
	Farmland – untreated	Farmland – conventional	Farmland – advanced	Incineration	Landfill	Composted	Land reclamation	Other
£000/ttds	-	166.7	235.2	181.6	210.7	214.0	128.9	181.2
Number of observations: 88								

Three of the unit costs in table 17.8 are significantly higher than those in the Ofwat model. These are the unit costs for farmland-advanced, landfill and land reclamation. This is likely to be an indication that Scottish Water incurs relatively high costs in its treatment and disposal of sludge.

Sewerage business activities

We developed the sewerage business activities model shown in table 17.9 when we included information from Scottish Water.

Table 17.9: Modified model (Scottish Water information included) for sewerage business activities operating expenditure

This is a unit cost model. Each company's annual business activities expenditure (plus doubtful debts) is divided by the number of billed properties. This is then compared with the weighted average industry cost.	
£/billed property	Weighted average industry unit cost: 14.37
Number of observations: 11	

Including the information from Scottish Water has resulted in a slight decrease in the unit cost.

Results of our analysis for each model

Tables 17.10 to 17.18 set out the results for each econometric model.

Table 17.10 Water Resources & Treatment Model

	£m Predicted OPEX	£m Modelled OPEX	£m Residual	Residual %	Efficiency Score	Recalibrated Score
Anglian	29.85	22.47	-7.38	-24.7%	75.3%	74.9%
Dŵr Cymru	23.87	25.06	1.20	5.0%	105.0%	104.5%
Northumbrian	31.22	30.51	-0.71	-2.3%	97.7%	97.2%
Severn Trent	45.37	52.10	6.73	14.8%	114.8%	114.3%
South West	13.48	14.52	1.05	7.8%	107.8%	107.2%
Southern	15.00	9.33	-5.68	-37.8%	62.2%	61.9%
Thames	49.25	42.10	-7.15	-14.5%	85.5%	85.0%
United Utilities	50.76	43.95	-6.80	-13.4%	86.6%	86.2%
Wessex	9.51	7.50	-2.01	-21.2%	78.8%	78.4%
Yorkshire	36.58	29.98	-6.60	-18.0%	82.0%	81.5%
Bournemouth & W Hampshire	2.73	2.92	0.19	6.9%	106.9%	106.4%
Bristol	7.10	11.89	4.79	67.5%	167.5%	166.6%
Cambridge	2.31	0.98	-1.33	-57.5%	42.5%	42.3%
Dee Valley	2.46	2.97	0.51	20.7%	120.7%	120.1%
Folkestone	1.51	2.48	0.98	64.9%	164.9%	164.0%
Mid Kent	5.16	3.56	-1.60	-31.0%	69.0%	68.6%
Portsmouth	2.30	2.95	0.65	28.1%	128.1%	127.5%
South East Water	11.46	11.43	-0.03	-0.3%	99.7%	99.2%
South Staffordshire	6.66	5.90	-0.76	-11.4%	88.6%	88.1%
Sutton & East Surrey	3.91	4.93	1.02	25.9%	125.9%	125.3%
Tendring Hundred	1.08	1.47	0.38	35.3%	135.3%	134.6%
Three Valleys	15.42	14.61	-0.81	-5.3%	94.7%	94.3%
Scottish Water	46.71	33.66	-13.05	-27.9%	72.1%	71.7%
					100.5%	100.0%

*Numbers may not add up due to rounding

Table 17.11 Water Distribution Model

	£m Predicted OPEX	£m Modelled OPEX	£m Residual	Residual%	Efficiency Score	Recalibrated Score
Anglian	32.43	22.81	-9.62	-29.7%	70.3%	67.9%
Dŵr Cymru	20.46	23.77	3.32	16.2%	116.2%	112.2%
Northumbrian	39.31	32.55	-6.76	-17.2%	82.8%	79.9%
Severn Trent	66.71	60.90	-5.81	-8.7%	91.3%	88.1%
South West	11.64	17.30	5.66	48.6%	148.6%	143.4%
Southern	21.29	20.35	-0.94	-4.4%	95.6%	92.3%
Thames	95.42	138.50	43.08	45.1%	145.1%	140.1%
United Utilities	63.60	47.49	-16.11	-25.3%	74.7%	72.1%
Wessex	8.53	6.50	-2.03	-23.8%	76.2%	73.5%
Yorkshire	42.27	36.08	-6.19	-14.6%	85.4%	82.4%
Bournemouth & W Hampshire	3.81	3.17	-0.64	-16.8%	83.2%	80.3%
Bristol	9.95	9.67	-0.28	-2.8%	97.2%	93.8%
Cambridge	2.06	4.58	2.52	122.0%	222.0%	214.3%
Dee Valley	2.10	1.87	-0.24	-11.3%	88.7%	85.6%
Folkestone	1.39	1.34	-0.04	-3.2%	96.8%	93.5%
Mid Kent	4.28	4.39	0.11	2.5%	102.5%	98.9%
Portsmouth	6.88	6.90	0.02	0.3%	100.3%	96.8%
South East Water	10.92	9.57	-1.35	-12.4%	87.6%	84.6%
South Staffordshire	13.01	12.60	-0.41	-3.1%	96.9%	93.5%
Sutton & East Surrey	5.81	5.87	0.06	1.0%	101.0%	97.5%
Tendring Hundred	1.51	1.41	-0.10	-6.7%	93.3%	90.0%
Three Valleys	28.08	35.37	7.29	26.0%	126.0%	121.6%
Scottish Water	39.15	39.66	0.51	1.3%	101.3%	97.8%
					103.6%	100.0%

*Numbers may not add up due to rounding

Table 17.12 Water Power Model

	£m Predicted OPEX	£m Modelled OPEX	£m Residual	Residual%	Efficiency Score	Recalibrated Score
Anglian	18.93	21.25	2.32	12.3%	112.3%	111.2%
Dŵr Cymru	12.84	12.00	-0.84	-6.6%	93.4%	92.6%
Northumbrian	11.61	10.99	-0.62	-5.4%	94.6%	93.8%
Severn Trent	26.58	22.10	-4.48	-16.9%	83.1%	82.4%
South West	7.23	6.81	-0.42	-5.8%	94.2%	93.3%
Southern	8.32	8.69	0.37	4.5%	104.5%	103.5%
Thames	26.28	28.70	2.42	9.2%	109.2%	108.2%
United Utilities	15.46	16.15	0.68	4.4%	104.4%	103.4%
Wessex	5.21	6.00	0.79	15.1%	115.1%	114.1%
Yorkshire	16.94	16.85	-0.09	-0.5%	99.5%	98.5%
Bournemouth & W Hampshire	2.37	1.71	-0.67	-28.1%	71.9%	71.2%
Bristol	4.94	5.41	0.46	9.3%	109.3%	108.3%
Cambridge	0.69	0.73	0.04	5.8%	105.8%	104.8%
Dee Valley	1.16	1.03	-0.12	-10.8%	89.2%	88.4%
Folkestone	0.67	0.83	0.16	24.2%	124.2%	123.0%
Mid Kent	2.71	2.70	-0.01	-0.3%	99.7%	98.7%
Portsmouth	1.65	1.66	0.00	0.1%	100.1%	99.2%
South East Water	6.69	6.86	0.17	2.5%	102.5%	101.6%
South Staffordshire	6.94	4.99	-1.95	-28.1%	71.9%	71.2%
Sutton & East Surrey	3.48	3.31	-0.17	-4.9%	95.1%	94.2%
Tendring Hundred	0.42	0.42	0.01	1.4%	101.4%	100.5%
Three Valleys	11.10	13.44	2.34	21.1%	121.1%	119.9%
Scottish Water	13.04	15.54	2.50	19.1%	119.1%	118.0%
					100.9%	100.0%

*Numbers may not add up due to rounding

Table 17.13 Water Business Activities Model

	£m Predicted OPEX	£m Modelled OPEX	£m Residual	Residual%	Efficiency Score	Recalibrated Score
Anglian	30.95	28.60	-2.35	-7.6%	92.4%	90.5%
Dŵr Cymru	21.74	25.83	4.10	18.8%	118.8%	116.4%
Northumbrian	30.02	32.15	2.13	7.1%	107.1%	104.9%
Severn Trent	50.52	41.50	-9.02	-17.8%	82.2%	80.5%
South West	13.02	15.04	2.02	15.5%	115.5%	113.1%
Southern	17.12	16.84	-0.29	-1.7%	98.3%	96.3%
Thames	53.01	46.10	-6.91	-13.0%	87.0%	85.2%
United Utilities	46.01	71.68	25.67	55.8%	155.8%	152.6%
Wessex	9.86	8.85	-1.01	-10.3%	89.7%	87.9%
Yorkshire	32.91	24.19	-8.72	-26.5%	73.5%	72.0%
Bournemouth & W Hampshire	3.77	3.77	0.01	0.2%	100.2%	98.1%
Bristol	8.73	8.12	-0.61	-7.0%	93.0%	91.1%
Cambridge	2.50	2.83	0.32	12.8%	112.8%	110.5%
Dee Valley	2.36	2.44	0.08	3.3%	103.3%	101.2%
Folkestone	1.53	1.96	0.44	28.6%	128.6%	125.9%
Mid Kent	4.70	3.55	-1.15	-24.4%	75.6%	74.0%
Portsmouth	5.54	3.59	-1.94	-35.1%	64.9%	63.6%
South East Water	10.56	13.25	2.69	25.5%	125.5%	122.9%
South Staffordshire	9.56	8.41	-1.15	-12.1%	87.9%	86.1%
Sutton & East Surrey	5.05	5.19	0.14	2.7%	102.7%	100.6%
Tendring Hundred	1.50	1.44	-0.06	-3.9%	96.1%	94.1%
Three Valleys	20.78	28.70	7.92	38.1%	138.1%	135.3%
Scottish Water	38.65	38.30	-0.35	-0.9%	99.1%	97.1%
					102.1%	100.0%

*Numbers may not add up due to rounding

Table 17.14 Sewerage Network Model

	£m Modelled OPEX	£m Predicted OPEX	£m Residual	Residual%	Efficiency Score	Recalibrated Score
Anglian	30.36	34.75	-4.40	-12.7%	87.3%	89.8%
Dŵr Cymru	23.48	19.39	4.09	21.1%	121.1%	124.6%
Northumbrian	14.07	13.74	0.32	2.3%	102.3%	105.3%
Severn Trent	48.58	42.97	5.61	13.1%	113.1%	116.3%
South West	8.95	10.78	-1.83	-17.0%	83.0%	85.4%
Southern	22.51	23.12	-0.61	-2.7%	97.3%	100.1%
Thames	58.60	54.23	4.37	8.1%	108.1%	111.1%
United Utilities	29.23	32.58	-3.34	-10.3%	89.7%	92.3%
Wessex	12.12	15.21	-3.10	-20.4%	79.6%	81.9%
Yorkshire	20.51	25.94	-5.42	-20.9%	79.1%	81.3%
Scottish Water	36.80	33.84	2.96	8.7%	108.7%	111.8%
					97.2%	100.0%

Table 17.15 Large Sewage Treatment Works Model

	£m Modelled OPEX	£m Predicted OPEX	£m Residual	Residual%	Efficiency Score	Recalibrated Score
Anglian	26.62	23.08	3.54	15.3%	115.3%	104.0%
Dŵr Cymru	10.67	13.21	-2.54	-19.3%	80.7%	72.8%
Northumbrian	13.79	12.56	1.23	9.8%	109.8%	99.0%
Severn Trent	44.29	38.47	5.82	15.1%	115.1%	103.8%
South West	10.64	5.98	4.66	77.9%	177.9%	160.4%
Southern	23.42	18.84	4.58	24.3%	124.3%	112.1%
Thames	51.30	52.99	-1.70	-3.2%	96.8%	87.3%
United Utilities	40.38	39.55	0.84	2.1%	102.1%	92.1%
Wessex	11.74	10.53	1.21	11.4%	111.4%	100.5%
Yorkshire	26.87	22.82	4.05	17.7%	117.7%	106.2%
Scottish Water	8.14	11.88	-3.73	-31.4%	68.6%	61.8%
					110.9%	100.0%

*Numbers may not add up due to rounding

Table 17.16 Small Sewage Treatment Works Model

	£m Modelled OPEX	£m Predicted OPEX	£m Residual	Residual%	Efficiency Score	Recalibrated Score
Anglian	35.32	34.98	0.34	1.0%	101.0%	99.5%
Dŵr Cymru	18.3	18.21	0.09	0.5%	100.5%	99.1%
Northumbrian	6.07	6.56	-0.49	-7.5%	92.5%	91.2%
Severn Trent	22.99	27.88	-4.89	-17.5%	82.5%	81.3%
South West	16.52	12.7	3.82	30.1%	130.1%	128.2%
Southern	11.74	13.35	-1.61	-12.1%	87.9%	86.7%
Thames	13.98	11.56	2.42	20.9%	120.9%	119.2%
United Utilities	14.63	13.27	1.36	10.2%	110.2%	108.7%
Wessex	10.7	12.73	-2.03	-15.9%	84.1%	82.9%
Yorkshire	17.65	16.55	1.1	6.6%	106.6%	105.1%
Scottish Water	20.62	20.74	-0.12	-0.6%	99.4%	98.0%
					101.4%	100.0%

Table 17.17 Sludge Treatment and Disposal Model

	£m Modelled OPEX	£m Predicted OPEX	£m Residual	Residual%	Efficiency Score	Recalibrated Score
Anglian	39.53	31.62	7.91	25.0%	125.0%	111.2%
Dŵr Cymru	18.65	19.04	-0.39	-2.0%	98.0%	87.2%
Northumbrian	19.99	17.24	2.75	16.0%	116.0%	103.2%
Severn Trent	41.02	43.33	-2.30	-5.3%	94.7%	84.3%
South West	12.72	14.16	-1.44	-10.2%	89.8%	79.9%
Southern	27.00	19.20	7.79	40.6%	140.6%	125.1%
Thames	54.79	67.56	-12.77	-18.9%	81.1%	72.2%
United Utilities	42.40	40.03	2.37	5.9%	105.9%	94.2%
Wessex	12.60	14.33	-1.73	-12.1%	87.9%	78.2%
Yorkshire	25.12	33.07	-7.95	-24.1%	75.9%	67.6%
Scottish Water	10.53	4.76	5.77	121.3%	221.3%	196.9%
					112.4%	100.0%

*Numbers may not add up due to rounding

Table 17.18 Sewer Business Activities Model

	£m	£m	£m			
	Predicted OPEX	Modelled OPEX	Residual	Residual%	Efficiency Score	Recalibrated Score
Anglian	35.36	36.05	0.69	1.9%	101.9%	96.0%
Dŵr Cymru	19.04	24.46	5.43	28.5%	128.5%	121.1%
Northumbrian	16.56	17.47	0.91	5.5%	105.5%	99.4%
Severn Trent	53.41	48.60	-4.81	-9.0%	91.0%	85.7%
South West	9.57	13.78	4.22	44.1%	144.1%	135.7%
Southern	25.74	33.42	7.68	29.8%	129.8%	122.3%
Thames	76.55	49.50	-27.05	-35.3%	64.7%	60.9%
United Utilities	42.35	74.21	31.86	75.2%	175.2%	165.1%
Wessex	16.01	12.27	-3.74	-23.4%	76.6%	72.2%
Yorkshire	29.39	18.67	-10.72	-36.5%	63.5%	59.9%
Scottish Water	33.55	29.10	-4.46	-13.3%	86.7%	81.7%
					106.1%	100.0%

*Numbers may not add up due to rounding

Calculation of Scottish Water's relative efficiency: The modified models

We have used the modified set of econometric and unit cost models to assess Scottish Water's relative efficiency. We used 2007-08 information for both Scottish Water and for the companies south of the border in our analysis.

Results of our analysis

The results of our analysis are set out in Tables 17.20 and 17.21 for the water and sewerage service respectively. In Table 17.19 we summarise these results.

The results of our analysis have been adjusted such that the average score is 100. The adjustments to residuals (10% on the water service and 20% on the sewerage service to take account of potential errors in the information and in statistical processes) are applied to all companies and the modelled results are adjusted to set the average company at 100. Scottish Water's relative efficiency has improved since the last periodic review (2006-10) but there is still a significant gap from reaching an upper quartile performance. We define as upper quartile performance the average efficiency score between the second and third companies based on companies' rankings.

Table 17.19: Scottish Water's efficiency gaps after residual adjustments

	Efficiency gap – modified models
Upper quartile performance – water	10%
Upper quartile performance – sewerage	10%
Upper quartile performance – combined	10%

Table 17.19. shows that after the adjustments to residuals, the efficiency gap between Scottish Water and the upper quartile performance benchmark is around 10% for the water service, 10% for the sewerage service and 10% for water and sewerage combined.

Table 17.20 Water Aggregate

	£m	£m	£m	£m	£m	£m	£m	£m	£m	£m					
	Modelled OPEX	Predicted OPEX	Regional Salaries Adjustment	Atypicals	Special Factors	Pension Adjustment	Unmodelled costs	Adjusted Total Modelled OPEX	Residual	Adjusted Residual 10%	Adjusted Residual %	Ranking	Efficiency Score	Recalibrated Score	Efficiency Gap to upper quartile
Anglian	95.13	112.16	0.00	1.60	2.19	0.00	0.00	91.34	-20.82	-18.73	-16.7%	2	83.3%	85.3%	-1.2%
Dŵr Cymru	86.66	78.90	0.00	0.40	0.99	0.00	0.00	85.27	6.38	5.74	7.3%	17	107.3%	109.8%	21.4%
Northumbrian	106.20	112.16	0.00	0.00	0.00	0.00	0.00	106.20	-5.96	-5.36	-4.8%	11	95.2%	97.5%	11.4%
Severn Trent	176.60	189.18	0.00	0.40	0.00	0.00	0.00	176.20	-12.98	-11.68	-6.2%	8	93.8%	96.1%	10.1%
South West	53.67	45.37	0.00	2.27	1.46	0.00	-0.03	49.91	4.54	4.09	9.0%	19	109.0%	111.6%	22.6%
Southern	55.21	61.73	0.00	0.83	0.00	0.00	0.00	54.37	-7.36	-6.62	-10.7%	7	89.3%	91.4%	5.5%
Thames	255.40	223.96	5.88	0.00	12.54	0.00	0.00	236.99	13.02	11.72	5.2%	16	105.2%	107.8%	19.9%
United Utilities	179.26	175.82	0.00	4.55	3.39	0.00	0.00	171.32	-4.50	-4.05	-2.3%	13	97.7%	100.0%	13.7%
Wessex	28.85	33.12	0.00	0.00	1.08	0.00	-0.15	27.62	-5.50	-4.95	-14.9%	4	85.1%	87.1%	0.9%
Yorkshire	107.11	128.70	0.00	0.09	0.00	-1.79	0.00	105.23	-23.47	-21.12	-16.4%	3	83.6%	85.6%	-0.9%
Bournemouth & W Hampshire	11.57	12.68	0.00	0.00	0.41	0.00	0.00	11.16	-1.52	-1.37	-10.8%	6	89.2%	91.3%	5.5%
Bristol	35.07	30.72	0.00	0.00	4.49	0.00	0.00	30.58	-0.14	-0.12	-0.4%	14	99.6%	102.0%	15.3%
Cambridge	9.12	7.57	0.15	0.00	0.13	0.00	0.00	8.84	1.27	1.15	15.1%	21	115.1%	117.9%	26.8%
Dee Valley	8.30	8.08	0.00	0.00	0.21	0.00	0.00	8.09	0.01	0.01	0.1%	15	100.1%	102.5%	15.8%
Folkestone	6.63	5.09	0.00	0.07	0.17	0.00	0.00	6.39	1.29	1.16	22.8%	22	122.8%	125.8%	31.4%
Portsmouth	15.10	16.37	0.00	0.06	0.26	-2.30	0.00	12.48	-3.90	-3.51	-21.4%	1	78.6%	80.5%	-7.3%
South East Water*	55.30	56.48	0.14	-0.32	1.34	0.02	0.00	54.15	-2.33	-2.09	-3.7%	12	96.3%	98.6%	12.4%
South Staffordshire	31.90	36.17	0.00	-0.15	0.73	-0.52	0.00	30.79	-5.38	-4.84	-13.4%	5	86.6%	88.7%	2.7%
Sutton & East Surrey	19.30	18.26	0.47	0.80	1.00	0.00	0.00	17.04	-1.23	-1.10	-6.0%	9	94.0%	96.2%	10.2%
Tendring Hundred	4.74	4.51	0.00	-0.25	0.10	0.00	0.00	4.89	0.38	0.34	7.5%	18	107.5%	110.1%	21.6%
Three Valleys	92.12	75.38	1.36	0.70	2.12	0.00	0.00	87.94	12.56	11.30	15.0%	20	115.0%	117.7%	26.7%
Scottish Water	127.16	137.55	0.00	-3.86	2.40	0.00	-0.01	128.62	-8.93	-8.04	-5.8%	10	94.2%	96.4%	10.4%
													97.7%	100.0%	

*South East Water is the merged South East Water and Mid Kent Water.

Table 17.21 Sewerage Aggregate

	£m	£m	£m	£m	£m	£m	£m	£m	£m	£m				
	Total Modelled Opex	Total Predicted Opex	Regional Salaries Adjustment	Atypicals	Special Factors	Pension Adjustments	Unmodelled Costs	Adjusted Total Modelled Opex	Residual	Adjusted Residual 20%	Adjusted Residual %	Ranking	Efficiency Score	Recalibrated Score	Efficiency Gap to upper quartile
Anglian	167.88	159.80	0.00	3.50	7.59	0.00	0.00	156.79	-3.01	-2.41	-1.5%	5	98.5%	99.3%	11.1%
Dŵr Cymru	95.56	88.89	0.00	0.00	1.02	0.00	0.02	94.56	5.67	4.54	5.1%	9	105.1%	106.0%	16.7%
Northumbrian	71.39	66.66	0.00	0.00	1.10	0.00	-0.81	69.48	2.82	2.26	3.4%	8	103.4%	104.3%	15.3%
Severn Trent	205.48	206.06	0.00	0.70	0.00	0.00	0.02	204.80	-1.26	-1.01	-0.5%	6	99.5%	100.4%	12.0%
South West	62.61	53.83	0.00	2.57	4.71	0.00	0.01	55.34	1.51	1.21	2.2%	7	102.2%	103.1%	14.4%
Southern	118.08	99.60	0.00	1.67	3.72	0.00	0.01	112.70	13.10	10.48	10.5%	10	110.5%	111.5%	20.8%
Thames	228.16	262.89	5.72	1.70	3.70	0.00	1.64	218.68	-44.22	-35.37	-13.5%	2	86.5%	87.3%	-1.2%
United Utilities	200.86	167.77	0.00	2.55	4.28	0.00	0.00	194.03	26.25	21.00	12.5%	11	112.5%	113.5%	22.2%
Wessex	59.43	68.82	0.00	0.00	0.00	0.00	-0.43	59.00	-9.82	-7.86	-11.4%	3	88.6%	89.3%	1.2%
Yorkshire	108.82	127.77	0.00	2.14	0.00	-1.49	0.12	105.32	-22.45	-17.96	-14.1%	1	85.9%	86.7%	-1.9%
Scottish Water	105.19	104.77	0.00	-4.89	9.52	0.00	1.27	101.84	-2.93	-2.34	-2.2%	4	97.8%	98.6%	10.4%
													99.1%	100.0%	

Formulae used in the assessment

The formulae listed below were used for various adjustments in the course of our econometric modelling.

Adjusted Total Modelled OPEX = Modelled OPEX – Regional Salaries Adjustments – Atypicals – Special Factors + Pension Adjustment + Unmodelled Costs

Residual = Adjusted Total Modelled OPEX – Predicted OPEX

Adjusted Residual (for Water) = Residual – (10% * Residual)

Adjusted Residual (for Sewerage) = Residual – (20% * Residual)

Adjusted Residual % = (Adjusted Residual / Predicted OPEX) * 100%

Efficiency Score = 100% + Adjusted Residual

Recalibrated Score = Company's Efficiency Score / Average Efficiency Score of all Companies

Efficiency gap from Benchmark = (Company's Recalibrated Score – Benchmark Company's Recalibrated Score) / Company's Recalibrated Score