Water and Sewerage Service
Price Control 2013-2015

PC13 Annex D
The Rate of Frontier Shift Affecting Water Industry Costs

A report prepared for the Utility Regulator

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First Economics Limited

Registered office: 72a Belgrave Court, Westferry Circus, London, E14 8RL
Registered in England and Wales, no: 5075274

Executive Summary

- This report by First Economics estimates the annual rate of change in base opex at the England and Wales efficiency frontier.

- Our approach to this task has been to obtain forecasts of input price inflation, ongoing productivity growth and RPI-measured inflation, both individually and in combination as follows:

  Frontier shift in real terms ≈ input price inflation *minus* productivity improvement *minus* forecast RPI-measured inflation

- This is consistent with the approach taken by the Competition Commission in its 2010 Bristol Water inquiry.

- Our forecasts of future input price inflation are set out in table A.

Table A

		PC13	
	2012/13	**2013/14**	**2014/15**
Labour	2.4	3.5	4.4
Equipment	1.5	1.5	1.5
Chemicals	5.0	5.0	5.0
Power	4.0	4.0	4.0
Rates	5.6	3.0	2.3
Bad debt	2.9	2.6	2.6
EA charges	2.9	2.6	2.6
Other	2.9	2.6	2.6
Input price inflation	3.03	3.25	3.60

- The profile of future price increases shown here reflects the current macroeconomic outlook of a gradual recovery from recession during 2012 and 2013 followed by trend economic growth thereafter. The forecast of wage inflation comes directly from the Office of Budgetary Responsibility's (OBR) March 2012 forecasts; the other estimates are our own extrapolations from historical data.

- We estimate the rate of ongoing productivity growth in opex activities to be 0.86% per annum. This estimate is based on evidence of historical productivity growth in a selection of comparator industries and sits broadly in line with the figures that have been used in a number of other price control decisions.

- Our forecasts of RPI-measured inflation come from the Utility Regulator's PC13 model, which in turn references the OBR's March 2012 RPI inflation forecast.

Table B

		PC13	
	2012/13	**2013/14**	**2014/15**
RPI inflation	2.9	2.6	2.6

- These are slightly higher inflation rates than have been used in previous reports of this type, in part reflecting a number of atypical, short-term factors that are expected to move RPI upwards in the next few years and in part reflecting analysis from the OBR which suggests that the long-term wedge between RPI inflation and the government's 2% CPI inflation target has widened recently.

- Our estimates of real input price inflation and productivity growth can either be applied separately to costs or in combination as per table C.

Table C

		PC13	
	2012/13	**2013/14**	**2014/15**
Input price inflation	3.03	3.25	3.60
Productivity growth	(0.86)	(0.86)	(0.86)
RPI-measured inflation	(2.9)	(2.6)	(2.6)
Frontier shift	RPI – 0.73	RPI – 0.21	RPI + 0.14

- We recommend to the Utility Regulator that it should add (or subtract) the figures in the final row of this table to any catch-up efficiency targets that it is proposing to set NI Water. Because the figures vary significantly from year-to-year, we also recommend that the Utility Regulator should apply the specific set of numbers in each 12-month period rather than calculate an average for each price control.

Contents

1. Introduction

The Utility Regulator has commissioned First Economics to undertake a study into the rate of frontier shift affecting water and sewerage companies' operating expenditure (opex).

The question our report asks is: should the Utility Regulator be making an addition to or subtraction from its catch-up target for NI Water to account for the natural long-term trend in water and sewerage companies' costs relative to RPI-measured inflation? Elsewhere in the UK economy there are some industries whose costs move naturally on an above-RPI trend, while other sorts of firms tend to see costs increase less quickly than RPI. Our objective is to understand which of these categories water and sewerage companies fit into.

The report is structured into five main parts:

- section 2 outlines the methodology which we think can best address the above issues;
- section 3 and 4 contains estimates of the rates of input price inflation and productivity growth that are likely to impact upon costs between 2012/13 and 2014/15;
- section 5 gives forecasts of RPI-measured inflation; and
- section 6 brings our analysis together into our overall estimates of opex frontier shift. We also provide a number of cross-checks to confirm the reasonableness of these estimates.

Note that the economic analysis set out in this paper was produced in July/August 2012 and has not been updated for new economic data that has been published since this time.

2. Methodology

The PC13 review will make projections of NI Water's costs to 31 March 2015. When making these projections both company and regulator will be considering three main influences on expenditure:

- productivity improvement: what opportunities are there to make reductions in manpower or other inputs so as to improve the overall efficiency with which activities are carried out;
- input price inflation: how much more will NI Water have to pay in future for the labour, materials and equipment that it requires in order to run its businesses; and
- variations in outputs: will the service offered to customers change, necessitating changes in the amount of activity that a company undertakes?

These three factors can be combined as follows:

Annual change in costs ≈ input price inflation *minus*
productivity improvement *plus*
cost associated with variations in outputs (1)

The third of these terms is very specific to NI Water. The first and second terms will be heavily dependent on NI Water's comparative efficiency and the potential for catch-up to the standards of cost of control exhibited by the best performing companies in Great Britain. After accounting for this catch-up, there is then a residual amount of change in costs which regulators label 'frontier shift' in their periodic review consultation papers, i.e.:

Frontier shift ≈ industry input price inflation *minus*
natural long-term rate of productivity improvement (2)

Restated in real terms – the convention for all of the Utility Regulator's price control analysis – the definition of frontier shift is:

Frontier shift in real terms ≈ input price inflation *minus*
productivity improvement *minus*
forecast RPI-measured inflation (3)

The analysis that follows is directed at obtaining estimates of the rates of input price inflation, productivity growth and RPI-measured inflation that are likely to affect a frontier company operating in Northern Ireland.

The focus is deliberately on a hypothetically efficient company. The Utility Regulator will be challenging NI Water in PC13 to close the efficiency gap to the frontier in England & Wales, adjusted for any NI-specific special factors, and this requires us in this study to reveal how this frontier will itself shift in the period to 2014/15.

If, for example, the hypothetically efficient company can be expected to produce real terms reductions in its costs, the Utility Regulator ought to add to the catch-up targets emerging from its comparative efficiency analysis. Conversely, if costs at the frontier are expected to rise in real terms, the Utility Regulator should be thinking of making a deduction from its catch-up target.

Our analysis proceeds by:

- identifying the input mix that can be found within the frontier company's opex;
- investigating the price trends affecting each individual input before forecasting input price growth for each input through to 2015;

- aggregating the line-by-line estimates obtained into an overall measure of input price inflation; then
- separating the individual activities that water and sewerage companies undertake in their day-to-day opex;
- benchmarking the scope for productivity growth in each of these different activities with reference to a database on productivity growth trends in different types of UK firm;
- aggregating the productivity benchmarks into an overall estimate of the rate of frontier productivity growth; and finally
- identifying and deducting published forecasts of RPI-measured inflation.

The results of this bottom-up work ought to give a clear picture of the likely trend in a frontier company's costs. Section 6 of the paper brings the component parts together and then cross checks our results with out-turn cost data from recent June Returns and other regulators' periodic review determinations in order to confirm that the results are a sensible and plausible input into the Utility Regulator's price control calculations.

3. Input Price Inflation

3.1 The input mix

The expenditures incurred by water and sewerage companies comprise a mix of labour, materials, chemicals and power costs. Companies also pay rates and Environment Agency charges, and must carry bad debts. The precise basket of inputs varies from company to company, so that in practice input price inflation is likely to vary slightly across the industry according to companies' size, customer characteristics, and so on. Despite this, we found in our work for Water UK in PR09 that the companies are sufficiently similar that it is possible to generalise and construct a representative input mix that broadly applies to all firms in the industry.

This representative input mix is set out in table 3.1.[1]

Table 3.1: Input mix for a representative water company

Input	% of expenditure
Labour	50
Materials and equipment	10
Chemicals	2.5
Power	12.5
Rates	10
EA charges	5
Bad debt	5
Other	5
Total	100

NI Water in its response to the Utility Regulator's draft determination questioned this input mix. Its concern was as follows:

> The assessment of input price inflation is based on an industry standard input mix. We believe NI Water's mix is materially different for several cost categories … It is worth highlighting that the proportion of power costs to total opex for an average WaSC is assumed as 12.5% compared to an actual figure of 23%. NI Water would recommend the actual input mix is used in the Final Determination.

We are not persuaded that we should refocus our work to consider an NI Water specific basket of input types or, by implication, NI Water specific cost pressures. To go down this path would create a methodological inconsistency and a real risk of overlap and double counting in the separate comparative efficiency and frontier shift work.

This said, we note that the Utility Regulator made allowance in its draft determination for a special factor for power costs. The regulator's view is that there are structural factors which lie outside of NI Water's control which make power costs higher in Northern Ireland than in England & Wales. As a consequence, there is validity in NI Water's arguments that power costs necessarily constitute a higher percentage of opex and that real terms increases in power costs will affect NI Water more than a typical England & Wales company.

[1] We note that the Competition Commission used broadly comparable percentages in its 2010 Bristol Water inquiry report. See table 10 in appendix K of the Commission's report.

We think that the best way of dealing with this issue is for us to adjust the table 3.1 weights to take account of the calculated scale of NI-specific special factors. This approach, in effect, modifies the analysis from an estimation of frontier shift in England & Wales to an estimation of the shift in the efficiency frontier in Northern Ireland.

The weight for power in the analysis that follows has therefore been increased by an amount that is proportional to the size of the Utility Regulator's special factor for power. For consistency, we also adjust down the weight for labour costs by an amount that is proportional to the Utility Regulator's regional wages special factor.

Table 3.2: Input mix for a hypothetically efficient NI company

Input	% of expenditure
Labour	47
Materials and equipment	10
Chemicals	2
Power	17
Rates	10
EA charges	5
Bad debt	5
Other	5
Total	100

Note: weights do not sum to 100 due to rounding.

In order to estimate the rate of input price inflation affecting the industry it is necessary to put forecasts against each of the individual lines in table 3.2.

3.2 Macroeconomic outlook

These forecasts need to be anchored to the overall macroeconomic outlook for the UK in the years covered by this study.

In previous First Economics reports we have relied on HM Treasury and Bank of England projections of GDP growth. The HM Treasury's forecasts are now produced by the independent Office of Budget Responsibility (OBR), which in our view strengthens the case for using public-sector numbers as the anchor for our calculations.[2]

Table 3.3 and figure 3.4 reproduce figures that may be found in HM Treasury's March 2012 Budget and the Bank of England's May 2012 Inflation Report.

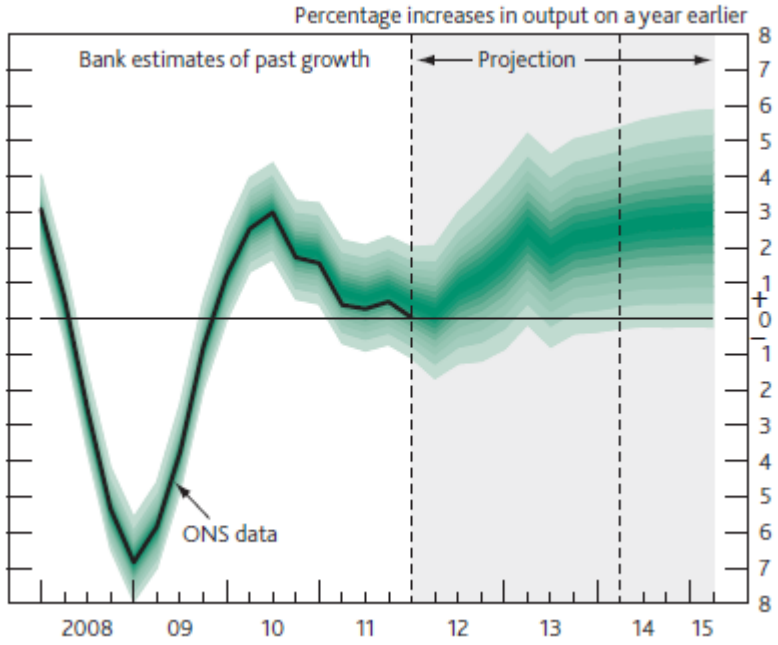
[2] The alternative of using a single private-sector provider of economic forecasts presents a number of dangers. For one, it could be that the selected forecaster takes a view of future economic prospects that sits outside of mainstream consensus. This might give an inappropriately extreme picture of the price inflation that is likely to impact on companies. It could also be that stakeholders come in future to shop around for forecasts that further their interests – i.e. very high price inflation for companies, very low price inflation for customers. We do not think that this would be a positive development.

Table 3.3: HM Treasury's March 2012 forecasts of GDP growth

	Percentage change on a year earlier, unless otherwise stated						
	Outturn	Forecast					
	2010	2011	2012	2013	2014	2015	2016
World economy							
World GDP at purchasing power parity	5.1	3.8	3.3	4.1	4.7	4.8	4.9
Euro Area GDP	1.8	1.5	-0.3	1.1	1.6	1.7	1.7
World trade in goods and services	12.4	6.3	4.1	6.4	6.9	6.9	7.0
UK export markets[1]	12.1	6.2	3.6	6.1	6.3	6.2	6.3
UK economy							
Gross domestic product (GDP)	2.1	0.8	0.8	2.0	2.7	3.0	3.0

Source: HM Treasury.

Figure 3.4: The Bank of England's May 2012 forecasts of GDP growth



Source: Bank of England.

The two sets of forecasts tell a fairly consistent story about the path which the UK economy is set to follow. In both cases, there is a year of disappointing growth during 2012 as households continue to grapple with shrinking real incomes, exporters struggle with a eurozone recession and the government reins back its spending. Thereafter the recovery gathers pace through the first half of 2013 and starts to exhibit growth of around 3% per annum – i.e. just above trend – from late 2013 through to 2015 or 2016.

The Bank of England also helpfully identifies the key uncertainties around the central case. The main downside risk is around the challenges within the eurozone, but there are also concerns about further erosion of household incomes. Balanced against this on the upside, the Bank notes that a slowdown in inflation would help support household consumption and that productivity growth would help to boost wages. It is also possible that fears about the eurozone economies have been exaggerated. Figure 3.4 shows a balanced set of risks around the central case, with the downside probabilities no greater than the upside probabilities in the Bank's estimation.

As far as the global economy is concerned, the figures in table 3.3 show a small slowdown in world GDP growth in 2012 and 2013 as the effects of the eurozone slowdown and weak growth in the US affect export-oriented economies around the world. However, the scale of this slowdown is not to be overstated and there is a return to very strong global growth from late 2013 onwards.

Looked at side-by-side, the implication of these forecasts is that domestic inflationary pressures will be weak generally for the next 12-18 months before strong global growth and the much-delayed recovery of the UK economy put new pressures on prices. We now consider to what extent this is apparent in recent data and what the prognosis is for the 2012/13 to 2014/15 period.

3.3 Detailed input-by-input forecasts

3.3.1 Wages

Our analysis of wage increases for the majority of people that regulated networks employ has previously been focused around the ONS's average earnings index. This index was discontinued by the ONS in 2010 and observers have been directed instead to the newer average weekly earnings index for information on wage increases across the UK economy. Figure 3.5 plots the series for private sector wages including and excluding bonuses.

Figure 3.5: Private sector wage inflation

Source: ONS.

The chart shows a marked shift in wage pressures due to recession. After growing at an average annual rate of just over 4% on both measures between 2000 and 2008, wages declined in absolute terms in 2009, after accounting for the effects of withdrawn bonuses, and then grew by only 2.0% to 2.5% in 2010 and 2011. The latest monthly data from May 2012 shows a further weakening in wage pressures, with annual private-sector wage growth at 1.5% including bonuses and 1.8% excluding bonuses.

Going forward the expectation is one of subdued wage growth stretching over a period of up to 3 years. This is based to a large extent on historical experience which shows that pay increases typically lag behind the growth in GDP by several quarters, mainly because recession creates a pool of unemployed workers who compete vigorously for jobs once economic activity picks up and firms resume hiring. Although this recession resulted in fewer redundancies than previous recessions, there are still around 1m more individuals than normal in unemployment and many more who have been forced onto part-time hours or into jobs that they might not otherwise have taken. This should mean that employers, including the water and sewerage companies, will for a period find that they do not need to offer significant pay increases in order to attract and retain good staff.

HM Treasury's March 2012 Budget report gives a sense of what sort of increases firms should expect to have to pay during the next five years.

Table 3.6: Labour market forecasts

	Percentage change on a year earlier, unless otherwise stated						
	Outturn	Forecast					
	2010	2011	2012	2013	2014	2015	2016
Labour market							
Employment (millions)	29.0	29.2	29.1	29.2	29.4	29.7	30.0
Wages and salaries	2.2	1.5	2.0	3.5	5.1	5.5	5.6
Average earnings[6]	2.4	1.2	2.6	3.1	4.3	4.5	4.5
ILO unemployment (% rate)	7.9	8.1	8.7	8.6	8.0	7.2	6.3
Claimant count (millions)	1.50	1.53	1.65	1.64	1.52	1.35	1.19

Source: HM Treasury.

The projections have average earnings growth accelerating from 2.6% in 2012 to 4.5% by the end of the forecast period. We use the financial year equivalents as the best available estimates of the wage inflation for workers employed by a water and sewerage company, as set out in table 3.7 below.

Table 3.7: General wage inflation

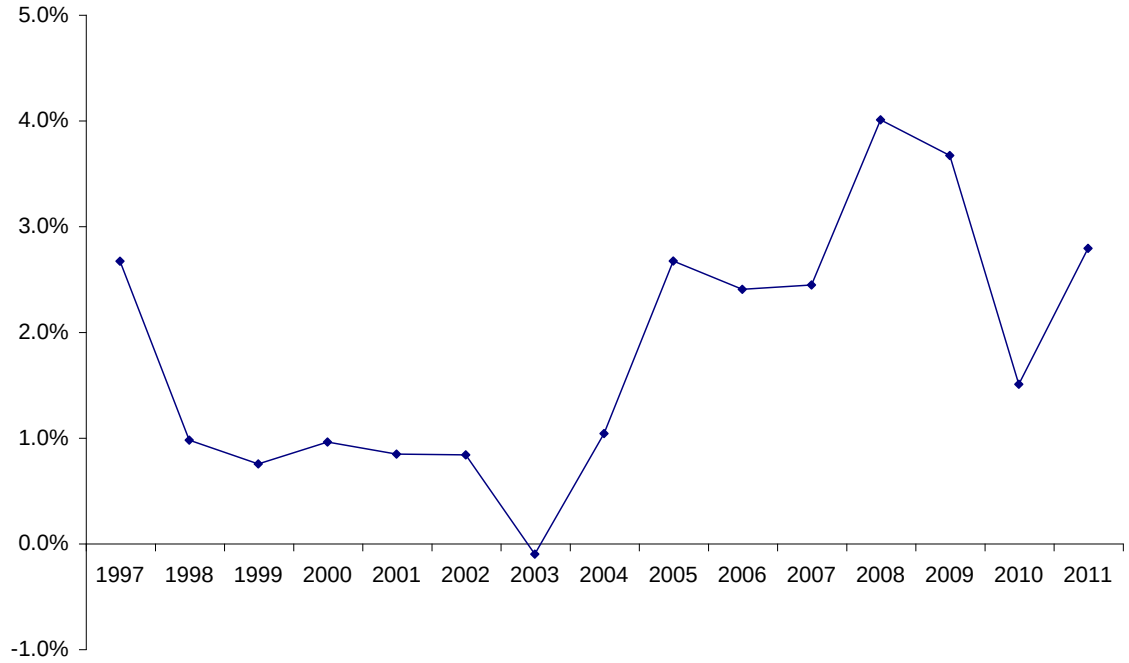
	Average earnings growth
2012/13	2.4%
2013/14	3.5%
2014/15	4.4%

3.3.2 Materials and equipment

Equipment and materials purchases by companies typically take the form of small pieces of machinery which are installed during the maintenance of the network. An indication of cost trends in this area can be obtained by looking at the prices that UK firms in general are paying for plant and machinery.

Figure 3.8 plots the annual change in the machinery and equipment component of the ONS's producer input prices index.

Figure 3.8: Annual change in the price paid by firms for machinery and equipment



Source: ONS.

The picture here is very different from the analysis of labour costs. The chart shows that prices have increased more rapidly in recent years even as the UK economy has been in recession. This is to a large extent a reflection of the depreciation of sterling and the consequent 'imported inflation' which buyers of goods have been suffering across the economy.

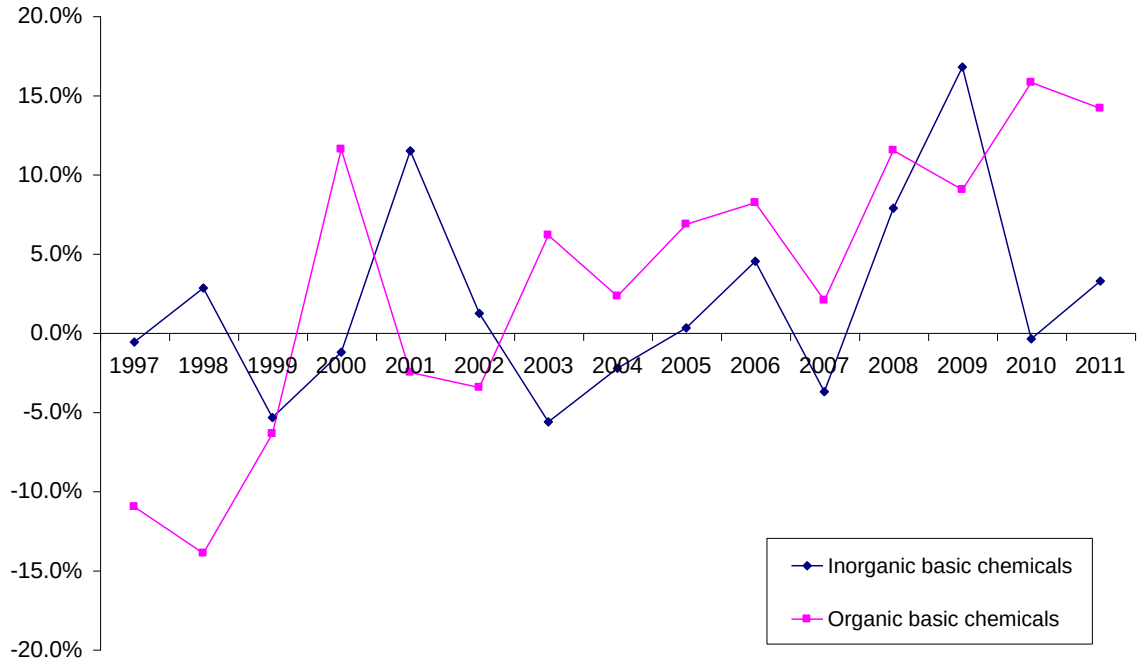
In making projections of prices during through to 2014/15 it is prudent to allow for some drop off from recent levels of inflation. The value of sterling has been much more stable in the last 1-2 years and it will not be long before the effects of previous adjustments in exchange rates work fully through the system, or perhaps even start to reverse. This is borne out in the data for the first six months of 2012, which shows much more stability in prices.

We therefore allow for annual prices increases of 1.5% per annum.

3.3.3 Chemicals

The picture for chemicals is not unlike the picture for machinery and equipment. Figure 3.9 plots the annual change in the inorganic chemicals and organic chemicals components of the ONS producer input prices index.

Figure 3.9: Annual change in the price paid by firms for chemicals, chemical products and man-made fibres



Source: ONS.

The charts tell a story of gradually increasing price pressures, especially for organic chemicals. The ONS indices for 2011 are 36% higher than in 2000 for inorganic chemicals and 94% higher than in 2000 for organic chemicals.

While the value of sterling is important here, a bigger driver of cost increases is growing global demand for raw commodities driven in turn by rapid economic growth in less developed parts of the world. This growth in demand has affected not just chemical prices, but also oil prices (which is itself a further driver of price increases in the energy intensive chemical sector), metal prices and food prices.

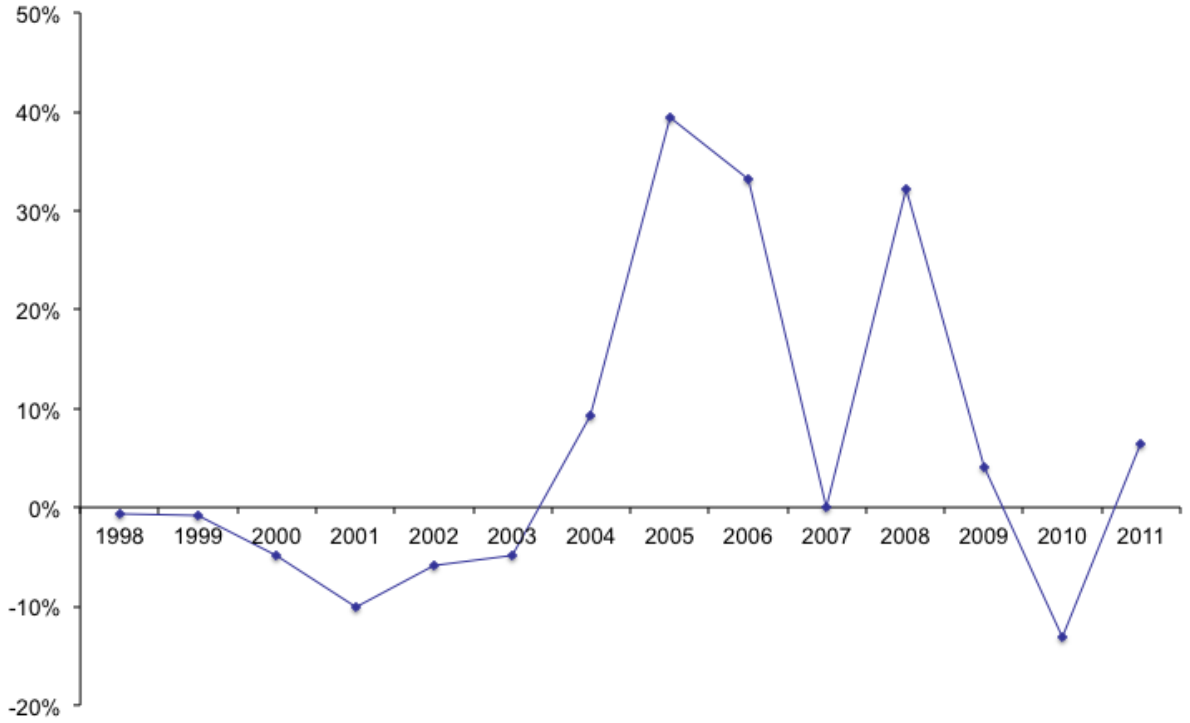
In forecasting what will happen to these indices in the coming months and years, one has to take account first and foremost of likely commodity price movements. Here the story for the foreseeable future remains one of continued strong demand from China and other developing countries putting pressure on supply and driving prices up. Insofar as the outlook for global economic growth is one of reasonably good growth in 2012 and 2013 followed by strong and stable expansion (as shown in the OBR forecasts in table 3.1 above), the likeliest or central scenario has to be one in which prices move in line with the average rates of growth that have been observed in our selected indices since around 2003.

This points to an average increase in prices of around 5% per annum.

3.3.4 Power

Power prices have been more volatile than any other input cost in recent years. Figure 3.10 plots DECC's moderately large user electricity purchase cost series.

Figure 3.10: Annual change in electricity purchase costs (p/kWh) for a user with annual demand of between 8.8m kWh and 150m kWh



Source: DECC.

Smoothing out the volatility, electricity prices are currently around double the level they were in 1998. Most of the upward pressure on prices has come from higher fuel costs, but there have also been significant increases in the charges that suppliers must pay to the transmission and distribution networks.

Going forward, the future direction in NI energy prices depends mainly on global oil prices. There is a wide range of available forecasts, reflecting, understandably, considerable uncertainty about the underlying geopolitics. We think that it is prudent to allow for a steady annual increase in electricity purchase costs going forwards. Future volatility will almost certainly mean that such a forecast proves to be too high or too low in individual years, but by allowing for a long term trend increase in costs, we can capture the fundamentals of continued strong global demand and scarcity of supply, the combination of which very clearly points towards price increases.

We have consulted with the Utility Regulator on the appropriate assumption to make, drawing on its understanding of local market conditions, and have agreed on an increase of 4% per annum. This is consistent with the projections that Bergen Energi made during PR09 and with projections produced during Ofgem's ongoing RIIO price control reviews.

3.3.5 Rates

The total amount that local councils collect in rates is indexed in accordance with RPI-measured inflation in the preceding September. Although it is possible that five-year revaluations will rebase the contributions paid by water and sewerage companies upwards or downwards, it is reasonable for us to provide for RPI-linked increases in this study.

The figures below come from the HM Treasury March 2012 Budget forecasts.

Table 3.11: Business rates increases

	Annual change
2012/13	5.6%
2013/14	3.0%
2014/15	2.3%

3.3.6 Bad debt

The industry has seen bad debts increase substantially during recent years as a result of recession and the government's ban on disconnection. The trend going forward will be influenced by:

- future increases in bills;
- the manner in which customers respond to price increases;
- the wider macroeconomic environment; and
- the success of new initiatives to deter non-payment.

For the purposes of this high-level study we make the simple assumption that bad debts remain a constant percentage of companies' annual billing. We therefore allow for increases in bad debts in line with RPI.

3.3.8 Other

The analysis of labour, equipment, chemicals, power, rates and bad debt covers approximately 90% of our representative company's opex. The remaining 10% comprises Environment Agency charges, insurance, laboratory materials, licence fees and other miscellaneous items, none of which are large enough individually to have a major impact on the overall calculation.

To simplify the analysis, we assume that all of these costs move in line with RPI.

This allowance is combined with the other forecasts set out above to give an overall estimate of input price inflation in section 6.

4. Productivity Growth

4.1 Total factor productivity growth

The extent to which productivity growth can be expected to offset the input price pressures identified in section 3 depends on a number of factors, including:

- the pace of technical progress affecting the sector;
- the availability of opportunities to reduce overheads; and
- companies' ability to bring better working practices to bear on their operational activities.

Evidence of historical rates of productivity growth in the water industry (and elsewhere in the utility sector) gives some sense of the industry's potential in these areas, but is distorted by a step change in productivity after privatisation and by the impact of a large ongoing quality programme. A better source of information is the historical total factor productivity (TFP) improvements achieved by competitive sectors of the UK economy which are in some way similar to the water and sewerage industry. The most up-to-date source for this type of data is the EU KLEMS project which looked at economic growth, productivity and technological change for all European Union member states during the period 1970 to 2007. A database released to the public in 2008 and updated in 2010 allows researchers to analyse TFP growth on an industry-by-industry basis and to compare/benchmark the historical performance of UK companies against firms from elsewhere.

For the purposes of analysing trends in opex, data for three generic types of sector are especially interesting:

- sectors in which a product is being processed or produced;
- sectors where firms are repairing/maintaining existing assets or operating some sort of established asset/network; and
- sectors where the core activity is the provision of a business service.

In each case, the competitive industries in this list can be said to be carrying out activities which bear certain similarities to the activities contained within a water and sewerage company's opex. Knowing what productivity trends in these industries have been may therefore help to reveal the underlying potential for the water industry to deliver productivity improvements of its own.

Table 4.1 shows average annual TFP growth rates in each of these industries for the 1970 to 2007 period as a whole and for the more recent 1990 to 2007 period. The definition of TFP growth that we have used is value-added TFP growth, consistent with the measure used in most other periodic reviews.

Table 4.1: Annual total factor productivity growth (%) by sector

UK Sector	1970 to 2007	Average	1990 to 2007	Average
Manufacturing	1.8	1.8	1.9	1.9
Electricity, gas and water supply	2.2	2.2	0.9	1.7
Sale, maintenance and repair of motor vehicles; retail sale of fuel	2.0		2.6	
Transport and storage	2.4		1.7	
Finance, insurance, real estate and business services	(0.9)	(0.9)	0.3	0.3

It is apparent from table 4.1 that perceptions of the water industry's productivity improvement potential depends in part on which of the periods is seen as providing the best guide to future performance and in part on which of the industries are considered to be the best comparators. On the first of these points, we have a strong preference for using up-to-date information. It is not at all clear to us how data on productivity growth from the 1970s and, to some extent, the 1980s can act as a reliable indicator of what might be expected of companies in the period 2012/13 to 2014/15. Although there are difficulties with any approach that seeks to extrapolate from the past to predict the future, we are much more confident in using data from the most recent business cycle (i.e. 1990 to 2007) in such an exercise.[3]

On the second point, previous studies in this field have sought to weight the different components of table 4.1 in line with the 'nature of work' involved in running a water and sewerage network. Although by no means completely precise, an overall comparator constructed in this way ought to show how the different rates of productivity growth affecting different parts of a company's business come together at the overall company level.

Our nature of work comparator is shown in table 4.2.

[3] NI Water questioned this choice in its response to the Utility Regulator's draft determination and suggested that it might be better to focus on data from the period 1997 to 2007. In this instance, the choice of period does not have a material impact on the calculation: the 1997 to 2007 data implies productivity growth of 0.90% per annum as compared to a figure of 0.86% using the 1990 to 2007 data. This does not give us sufficient cause to revise our calculations.

Table 4.2: Nature of work comparator

Activity	% of opex	Annual productivity growth
Water resources and treatment Sewage treatment Sludge treatment and disposal	20%	1.9%
Water distribution Sewerage	20%	1.7%
General and support Customer services Scientific services Other business activities	45%	0.3%
EA charges Bad debts Other	15%	-
	Weighted average	0.86%

The percentages in the first column of the table are taken from our analysis of companies' June returns. For the industry as a whole, we identify 20% of costs in 'production', 20% of costs in running and maintaining networks, 45% of costs in business support services and a further 15% of costs in charges, bad debts and other.

The productivity trends shown in the final column are the simple averages from the relevant rows of table 4.1.

When the two columns of table 4.2 are combined, the average annual rate of productivity improvement affecting opex-related activities is just short of 1% per annum. What this means in practice is that relatively high rates of productivity improvement in production and network maintenance/operation balance out relatively slow productivity growth in companies' business service functions. This is consistent with the idea that productivity grows more quickly in the goods/manufacturing side of the economy than in the service sector.

To put our findings in some sort of perspective, the 0.86% per annum implies that water companies will out-perform the historical rate of productivity improvement for the UK economy as a whole of 0.7% per annum. As such, it is by no means a soft target to expect companies to meet over the next five-year period.

4.2 Adjustments

Capital substitution

In previous studies of this type it has been recognised that labour productivity typically increases more quickly than TFP as companies over time replace people with capital. In applying our analysis of TFP trends to base opex we ought to make an adjustment for this capital substitution otherwise we will be understating the reductions in opex that water and sewerage companies will make in matching the achievements of our nature of work comparator.

The scale that this adjustment should take is not something that can be easily measured. The EU KLEMS data shows that labour productivity growth has outstripped TFP growth by a significant margin, but a large part of this differential will be as a result of the sorts of quality-

improving and volume-growing investment that we are deliberately excluding from our analysis of base opex. In the absence of any reliable information from comparators, estimation of the capital substitution effect really ought to become a matter for expert judgment – i.e. something for companies and regulator to take a view on together having observed what sorts of people costs companies save when they carry out only like-for-like investment.

A very rough ballpark estimate of the magnitude of this effect would be around 0.5% per annum. This is the figure that the ORR used in its 2008 periodic review decision for Network Rail and which Ofwat subsequently incorporated into its PR09 analysis. The 0.5% is derived from the assumption that the marginal rate of capital substitution in our comparator population from section 4.1 matches the marginal rate of capital substitution in the UK economy as a whole – an assumption which seems equally appropriate in our analysis.

Catch-up efficiencies

The Competition Commission in its 2010 Bristol Water inquiry made a further adjustment to the comparator data to allow for the possibility that some of an industry's reported productivity growth has been the result of firms in the selected industry catching up to the frontier rather than frontier shift per se. Its adjustment was worth slightly less than 0.5% per annum.

We think this might overstate the extent to which productivity growth over long horizons (i.e. 37 years and 17 years in table 4.1 above) can be the result of less efficient companies embracing the practices adopted by leading companies. However, recognising the importance of not departing too far from established regulatory precedent in this study, we propose to follow the Commission's lead and bring the same adjustment in to our calculations.

Overall

This means that the two adjustments that we need to make to the table 4.2 calculation broadly cancel each other out.

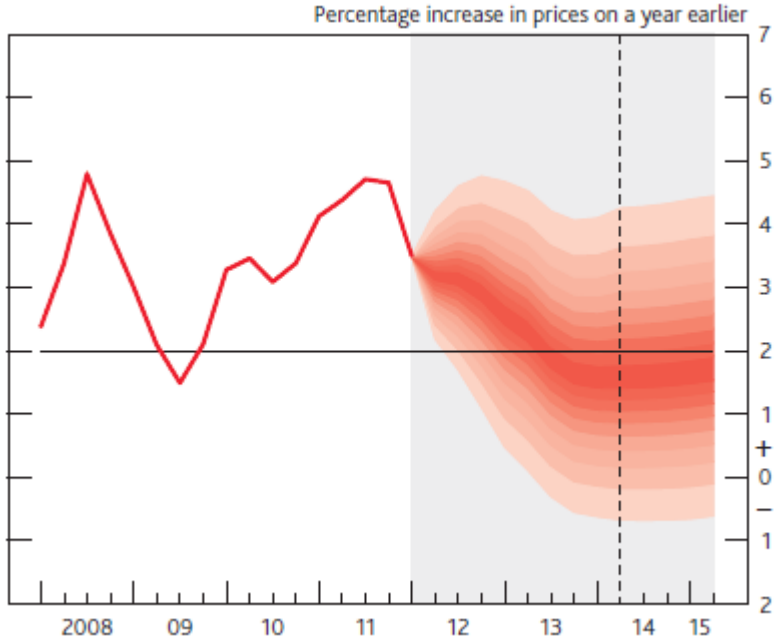
We therefore take the 0.86% directly through to our overall frontier shift calculation in section 6 of this report.

5. RPI-measured Inflation

The final component of equation 3 from section 2 is a forecast of RPI-measured inflation.

Having opted to anchor our analysis to the GDP forecasts prepared by HM Treasury and the Bank of England, it is only logical that our forecasts of RPI are derived from the same sources. Figure 5.1 and table 5.2 reproduce the projections found in the Bank's May 2012 Inflation Report and HM Treasury's March 2012 Budget report.

Figure 5.1: The Bank of England's May 2012 CPI Forecasts



Source: Bank of England.

Table 5.2: OBR/HM Treasury March 2012 inflation forecasts

	Percentage change on a year earlier, unless otherwise stated						
	Outturn	Forecast					
	2010	2011	2012	2013	2014	2015	2016
Inflation							
CPI	3.3	4.5	2.8	1.9	1.9	2.0	2.0
RPI	4.6	5.2	3.2	2.3	2.5	3.6	4.0
Terms of trade[5]	-0.6	-1.5	-0.2	0.2	0.2	0.0	-0.1
GDP deflator at market prices	2.9	2.3	2.5	2.5	2.5	2.5	2.5

Source: HM Treasury.

As always with these forecasts, CPI-measured inflation is assumed to come more or less into line with the government's 2% target two years from now and stay at 2% thereafter. In the intervening 24 months, the forecast has CPI-measured inflation noticeably above target as the aftermath of the significant import price shock that hit the UK between 2009 and 2011 continues to impact upon consumer prices.

The most interesting part of the numbers is the forecast of RPI-measured inflation that sits alongside the CPI numbers. Between 2012 and 2014 RPI-measured inflation moves in broadly the same way as CPI-measured inflation. Thereafter, a noticeable wedge opens up between the RPI and CPI inflation rates.

This surprisingly large gap is explained by the OBR to be a function of two main factors:

- a temporary divergence between the two measures of inflation caused by the upward movement in mortgage interest rates (which are included in the RPI basket but not the CPI basket) back to 'normal' levels; and
- a more permanent widening of the gap that naturally exists between CPI- and RPI-measured inflation from around 0.5 to 0.8 percentage points historically to around 1.4 percentage points going forward.

Box 1: The long-run gap between CPI- and RPI-measured inflation

In a working paper published alongside its November 2011 macroeconomic forecasts, the OBR explains that the government's 2% annual CPI inflation target is now best thought of as converting to annual RPI-measured inflation over the long term of 3.3% to 3.5% per annum. This is a noticeably higher number than anyone has ever talked of before. (In previous price reviews, regulators have typically converted the government's 2% CPI inflation target to RPI-measured inflation of 2.5% to 2.8% per annum.)

The 1.3 to 1.5 percentage point gap between the two measures of annual inflation is attributable to three factors. Two are linked to housing costs:

- the RPI measure of inflation includes the effects of rising house prices, but CPI does not. If one assumes that house prices in the long term rise with average earnings growth, and if average earnings go up by around 4% to 4.5% in normal economic conditions, this serves to pull RPI inflation up by around 0.35 percentage points per annum; and

- the RPI measure also includes the effects of changes in mortgage interest payments. CPI does not. If mortgage interest rates can be assumed to be stable over long horizons, mortgage interest payments will move up in line with house prices. This is thought to add another 0.15 percentage points per annum to RPI inflation.

The third driver of the difference between CPI- and RPI-measured inflation is something known as the 'formula effect'. This is a reference to the way in which the CPI measure of inflation collates the tens of thousands of different prices collected by the ONS statisticians using geometric averages, whereas the RPI measure of inflation makes use of arithmetic averages. As a mathematical fact, geometric averages of non-identical numbers will always be lower than arithmetic averages, meaning that CPI will always show lower increases than RPI even if the two measures are using exactly the same source data.

Historically, the so-called formula effect has been a very stable 0.5 percentage points per annum. However, in recent months the effect has been measured at around 1.0 percentage points per annum. The ONS attributes this increase to changes in the way that it is measuring certain prices, most notably the prices of clothing and footwear. Specifically, because the ONS is now using a much larger number of data points to track the price of clothes and shoes, the dispersion in the data set has grown and the gap between geometric and arithmetic averages has widened.

In the absence of any change in the ONS' methodologies for measuring inflation, it is now not tenable to assume that the formula effect will be the historical 0.5 percentage points per annum. The OBR in its forecasts allows for a formula effect in the future of 0.8 to 1.0 percentage points per annum.

Added to the two other factors identified above, the net result is that RPI-measured inflation will sit naturally 1.3 to 1.5 percentage points above CPI-measured inflation.

Our RPI forecasts follow the March 2012 OBR financial year projections, except that we have been asked by the Utility Regulator to assume an identical inflation rate in 2013/14 and 2014/15 to be consistent with RPI assumptions are used elsewhere in the PC13 financial model. The assumptions are as set out below.

Table 5.3: RPI-measured inflation forecasts

	RPI-measured inflation
2012/13	2.9%
2013/14	2.6%
2014/15	2.6%

6. Overall Frontier Shift Calculation and Cross Checks

6.1 Frontier shift calculation

Table 6.1 combines our estimates of input price inflation, productivity growth and RPI-measured inflation into an overall estimate of frontier shift.

Table 6.1: Frontier shift calculation (%)

		PC13	
	2012/13	**2013/14**	**2014/15**
Labour	2.4	3.5	4.4
Equipment	1.5	1.5	1.5
Chemicals	5.0	5.0	5.0
Power	4.0	4.0	4.0
Rates	5.6	3.0	2.3
Bad debt	2.9	2.6	2.6
EA charges	2.9	2.6	2.6
Other	2.9	2.6	2.6
Input price inflation	3.03	3.25	3.60
Productivity growth	(0.86)	(0.86)	(0.86)
RPI-measured inflation	(2.9)	(2.6)	(2.6)
Frontier shift	RPI – 0.73	RPI – 0.21	RPI + 0.14

Note that an alternative way of applying these numbers in the Utility Regulator's price control decisions would be to identify separately the real input price inflation and productivity growth impacting on frontier companies' base opex. These figures are provided in table 6.2.

Table 6.2: Real input price inflation and productivity growth assumptions (%)

		PC13	
	2012/13	**2013/14**	**2014/15**
Real input price inflation	0.13	0.65	1.00
Productivity growth	(0.86)	(0.86)	(0.86)

The main observation to make about these numbers is that the rate of frontier shift is not a constant. It varies from year-to-year in line with the input price pressures that water and sewerage companies can be expected to face and the benchmark level of RPI-measured inflation.

6.2 Cross-check 1: recent industry cost data

One obvious sense check to apply to the estimates in table 6.1 is a comparison to the actual rate of frontier shift in England & Wales in recent years.

Table 6.3 and figure 6.4 attempt to calculate this rate of frontier shift using base opex data for the two companies that the Utility Regulator has deemed to be the frontier England & Wales companies in 2010/11 – Yorkshire Water for the water service and Wessex Water for the sewerage service. The experiences of these businesses are relevant benchmarks

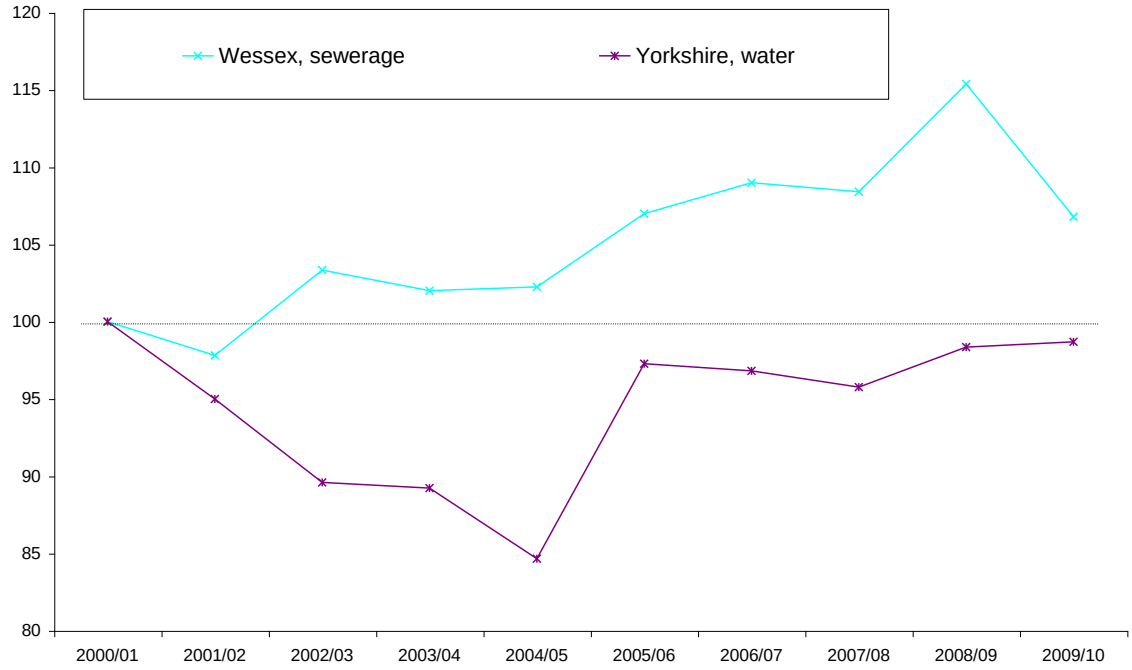
because the companies concerned have been at the top of Ofwat's efficiency rankings for a number of years. As a consequence, the recent trend in these businesses' base opex provides the best available insights into what has been going on at the industry's efficiency frontier, excluding any catch-up effects.

Table 6.3: Base opex (excluding exceptionals), 2009/10 £m

	00/01	01/02	02/03	03/04	04/05	05/06	06/07	07/08	08/09	09/10
Yorkshire, water	146.9	139.6	131.6	131.2	124.4	135.5	134.8	140.7	144.5	145.0
Wessex, sewerage	51.9	50.7	53.6	52.9	53.0	55.5	56.5	56.2	59.8	55.4

Note: to construct consistent data series we have re-based AMP4 opex in line with the methodology outlined in Ofwat's 7 March 2006 instructions to companies. We have also corrected for changes in pension and customer supply pipe repair accounting policies.

Figure 6.4: Base opex (excluding exceptionals) in real terms, 2000/01 = 100



The data shows a marked upward drift in costs relative to RPI at the industry opex frontier in recent years, which seems at first sight to contradict the projections that we have in table 6.1.

However, one of the explanatory factors that lies behind this is a doubling of energy prices between 2003/04 and 2009/10. Although it is not generally good practice to arbitrarily exclude the component in costs which just happens to have risen the most, [4] we need to

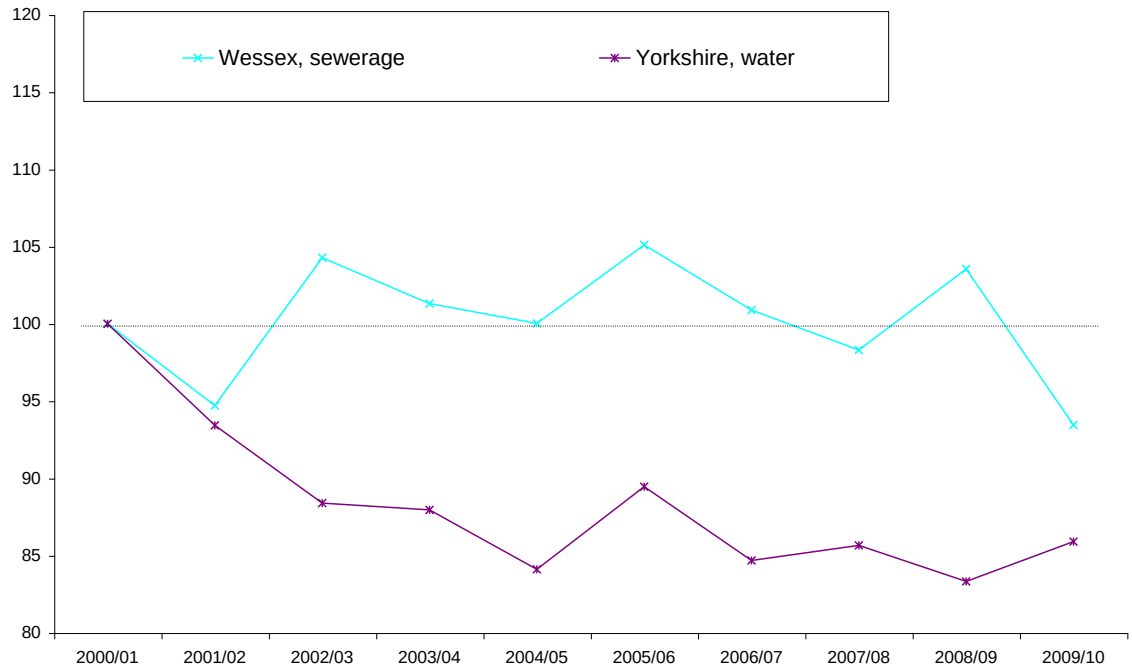
[4] In any control period it is inevitable that some types of cost will increase more quickly than others. If at every periodic review companies and regulators exclude from their analysis costs which have risen most quickly, the rate of frontier shift observed will be systematically biased downwards.

recognise that we are allowing in our forward-looking projections for much more modest increases in power costs of just 4% per annum. It is therefore instructive to see what has been happening to base opex excluding power costs. In table 6.5 and figure 6.6 we strip out these costs.

Table 6.5: Base opex (excluding exceptionals and power costs), 2009/10 £m

	00/01	01/02	02/03	03/04	04/05	05/06	06/07	07/08	08/09	09/10
Yorkshire, water	135.2	126.4	119.6	119.0	113.8	121.0	114.5	115.9	112.7	116.2
Wessex, sewerage	45.5	43.1	47.5	46.1	45.6	47.9	46.0	44.8	47.2	42.6

Figure 6.6: Base opex (excluding exceptionals and power costs) in real terms, 2000/01 = 100



After stripping out power costs, the figures in table 6.4 and the lines in figure 6.5 look fairly flat. In the case of Yorkshire Water, water service base opex was 2% lower in 2009/10 compared to 2003/04. In the case of Wessex Water, sewerage costs were 8% lower, albeit due in large part to the very large cost reductions that the business was able to achieve in 2009/10.

We take this to mean that the estimates that we have in table 6.1 are in the right ballpark. If we roll forward these companies' base opex using our frontier shift calculations, we are leaving base opex in 2014/15 0.8% lower than base opex in 2011/12. This does not seem to be an unrealistic expectation given historical experience.

6.3 Cross-check 2: regulatory precedent

The Utility Regulator is not the only regulator that has been having to think about the long-term underlying trend in companies' costs. Table 6.7 summarises estimates of frontier shift in other recent periodic reviews.

Table 6.7: Summary of recent opex frontier shift estimates (annual)

	Decisions issued between 2008 and 2010	Decisions issued in 2012
Ofgem – electricity/gas transmission	–	RPI – 0.5%
Ofgem – gas distribution	–	RPI – 0.6%
Ofgem – electricity distribution	RPI + 0.4%	–
Ofwat – water Ofwat – sewerage	RPI – 0.25%	–
Competition Commission – water	RPI – 0.25%	–
ORR – Network Rail, opex	RPI + 0.75%	–
ORR – Network Rail, maintenance	RPI + 0%	–
PPP Arbiter – underground infracos, central costs	RPI + 0.8%	–
PPP Arbiter – underground infracos, opex	RPI + 0.3%	–

The table shows that regulatory determinations made between 2008 and 2010 typically estimated the rate of frontier shift to be at or just above RPI-measured inflation. The exception to this rule was Ofwat's PR09 frontier shift calculation, which the Competition Commission confirmed in its 2010 Bristol Water decision.

A cross-check between table 6.1 and table 6.7 suggests that our estimates are reasonable. A more detailed reading of these decisions also shows that this is the case.

First, we note that our estimate of frontier productivity growth sits squarely in line with regulatory precedent. Table 6.8 isolates the assumptions appearing in the above determinations. Our 0.86% figure slots quite naturally into this table.

Table 6.8: Regulators' calculations of productivity growth at the industry frontier

	% reduction in opex per annum
NIAUR – gas distribution	1.0%
Ofgem – distribution and transmission	1.0%
Competition Commission – water	0.9%
ORR – Network Rail, opex	0.7%
ORR – Network Rail, maintenance	1.4%
PPP Arbiter – underground infracos, central costs	0.7%
PPP Arbiter – underground infracos, opex	0.9%

Second, it is important when making comparisons between regulatory decisions made at different points in time to allow for differences in the macroeconomic conditions that the regulators were dealing with. In particular, table 6.1 shows very clearly that input price

inflation and RPI-measured inflation are not constants and there is no reason a priori to think that an estimate of frontier shift made in 2009 will be the same as an estimate of frontier shift made in 2012.

This is evident from the Ofgem entries in table 6.7. Its 2012 RIIO-GD1 estimate of frontier shift for the period 2012/13 to 2022/23 is almost 1 percentage points per annum lower than its 2009 electricity distribution price control review estimate of frontier shift between 2009/10 and 2014/15. Ofgem has made no major change in its methodology between these two reviews, but it has recognised the effects of recession and a shift up in expected RPI-measured inflation that we identified in section 5. This means that it has arrived quite logically at a below-RPI estimate of frontier shift in its 2012 proposals as opposed to an above-RPI estimate of frontier shift in 2009.

Our analysis in this period relates to three specific years with very specific economic conditions. As such, there should be no a priori expectation that our frontier shift estimates will exactly match PR09 calculations or any other regulatory precedent. Rather they are calibrated to the circumstances that NI Water and the Utility Regulator find in front of them in PC13.

6.4 Recommendations

Having performed the cross-checks set out in sections 6.2 and 6.3 we are content that our estimates of input price inflation, productivity growth and RPI-measured inflation combine to give a reasonable and robust estimate of the frontier shift that is likely to affect leading England & Wales companies' opex in future. We therefore recommend to the Utility Regulator that it should add (or subtract) the following numbers to its catch-up efficiency targets.

Table 6.9 Proposed additions/(deductions) to NI Water's catch-up efficiency targets

	Frontier shift allowance
2012/13	0.73%
2013/14	0.21%
2014/15	(0.14%)

Because the figures in table 6.9 vary from year to year, we further recommend to the Utility Regulator that it should apply a specific frontier shift assumption for each 12-month period rather than allow for an average rate of frontier shift over a full control period.

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