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RIIO-T1/GD1: Initial Proposals – Real price effects and ongoing efficiency appendix

Consultation – appendix

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Overview:

This appendix to the main RIIO-T1 and GD1 consultation documents sets out our proposals in relation to real price effects (RPEs) and ongoing efficiency. This document is aimed at those seeking a detailed understanding of our proposals in this area.

Associated documents

Main consultation papers

RIIO-GD1: Initial Proposals - Overview

RIIO-T1: Initial Proposals for NGGT and NGET - Overview

Relevant supporting documents

RIIO-T1: Initial Proposals for NGET and NGGT – Cost assessment and uncertainty

RIIO-GD1: Initial Proposals – Supporting document – Cost efficiency

Other associated documents

Decision on strategy for the next gas distribution price control – RIIO-GD1

Decision on strategy for the next transmission price control – RIIO-T1

Handbook for implementing the RIIO model - Ofgem, October 2010

Glossary for all the RIIO-T1 and RIIO-GD1 documents

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1. Introduction

Chapter Summary
This chapter sets out how this methodology paper contributes to the RIIO-T1 and GD1 Initial Proposals. It also summarises our proposed real price effects and ongoing efficiency assumptions for the gas distribution networks (GDNs), National Grid Electricity Transmission (NGET) and National Grid Gas Transmission (NGGT).

Summary

1.1. In March 2011 we published our strategy (Strategy Document) where we set out our proposed approach to assessing the network companies' proposals for real price effects (RPEs) and ongoing efficiency. We included a list of potential data sources and the type of analysis that we intended to use in deriving such assumptions.

1.2. In their business plans, the network companies proposed RPE allowances and provided evidence behind their assumptions for ongoing efficiency. We have based our assumptions, included here as part of Initial Proposals, on both the evidence we have been presented with by the network companies and our own analysis.

1.3. RPEs and the ongoing efficiency assumption form part of the ex ante allowances of each network company. The allowance for RPEs represents the expected change in input prices (eg wages) relative to the Retail Prices Index (RPI). The ongoing efficiency assumption is the expected productivity improvements that an efficient company should be able to make over the price control. This is on top of any efficiency challenges set for those companies deemed less efficient as part of our cost assessment.

1.4. In deriving the allowances for RPEs and ongoing efficiency we have considered a range of techniques and a range of evidence including that put forward by the network companies. This paper sets out in detail how we have reached our assumptions.

Structure of this document

1.5. The remainder of this document is structured as follows:

- Chapter 2 sets out the methodology and data used in deriving our RPE assumptions.
- Chapter 3 sets out the methodology and data used in deriving our ongoing efficiency assumptions.
- Chapter 4 compares the results obtained from separate assumptions of RPEs and ongoing efficiency with other data available on the potential net impact.

2. Real price effects

Chapter Summary
This chapter sets out the RPE assumptions for the GDNs, NGET and NGGT. It explains the methodology used to derive these assumptions, and the data used.

Summary

2.1. Table 2.1 sets out our average annual proposed RPE assumptions for the GDNs, NGET and NGGT.[1] These assumptions represent the expected change in input prices relative to the RPI.

Table 2.1: Proposed average annual RPE assumption (2011/12 to 2020/21)[2]

	GDNs	NGET TO	NGGT TO	NGET SO	NGGT SO
Opex	0.4%	0.5%	0.6%	0.4%	0.4%
Capex	0.6%	0.9%	0.7%	0%	0%
Repex	0.6%	-	-	-	-
Totex	0.5%	0.8%	0.7%	0.2%	0.2%

General methodology

2.2. To calculate the RPE assumptions in table 2.1 requires two steps:

- First we construct an input price trend relative to the RPI for labour, materials and a range of other costs relevant to the inputs purchased by the network companies.
- These input price trends are then weighted together based on the assumed proportion of labour, materials, etc. in the cost areas of opex, capex, repex and totex.

2.3. A third step coverts these assumptions into monetary allowances. This is done by taking the RPE assumptions and multiplying by the network companies expenditure allowances, which are set in 2009/10 prices.

2.4. In our Strategy Document we listed techniques we would consider in deriving RPE assumptions, including (but not limited to) the analysis of historical trends in price indices, analysis of the historical correlation of price indices with RPI and the use of independent forecasts.

[1] For NGET and NGGT there are different assumptions for the transmission operator (TO) and system operator (SO).
[2] For annual data see Appendix 1.

2.5. In deriving RPE assumptions for Initial Proposals our general approach for establishing a forecast of input prices is to draw on the long-term real trend of relevant indices. We have calculated the long-term trend based on data for c. 20 years. We have calculated the long-term trend based on data up to and including 2009/10. We excluded the last two years of data from the long-term average because the impact of the global recession over these years could result in an historical trend which understates the expected growth over the longer-term.

2.6. Our approach to estimating RPEs is predicated on the assumption that there is a long-term relationship between input prices and RPI, and input price will revert to the historical long run real average.

2.7. RPEs for 2011/12 are calculated using actual data.[3] For example, the labour RPE uses actual data for average weekly earning (AWE) in the private sector. For the labour RPE we have also drawn upon shorter-term independent forecasts for the path of wages over the next two years. Where we have not applied independent forecasts we have assumed a reversion to long-term trend in 2012/13.

2.8. To derive opex, capex and repex RPE indices for the GDNs we have assumed a notional structure, ie the same weightings of labour, materials and other inputs for each GDN. For NGET and NGGT we have assumed the structure these network companies have stated in their business plans due to the lack of comparators in which to base a notional structure.

2.9. The notional structure for the GDNs has been constructed by calculating an unweighted average of the GDNs' structures which they included as part of their business plans. Table 2.2 below represents the notional structure of a GDN used in deriving our RPE assumptions.

Table 2.2: Notional structure of a GDN

	Opex	Capex	Repex
Direct labour	34%	11%	10%
Contractor labour	18%	45%	67%
Materials	6%	19%	13%
Equipment/plant	1%	4%	0%
Transport	2%	0%	0%
Other	39%	21%	11%

2.10. We set out below further details on how we have derived our assumptions for RPEs for labour, materials, equipment/plant, transport and other.

[3] The outturn data referenced in this document is data available as of May 2012.

Labour

2.11. There are a number of labour indices available which reflect historical growth in wages for both the general economy and more specialist industries. We have considered a number of these indices in constructing a labour RPE. Table 2.3 summarises our labour RPE. We have assumed the same labour RPE across the GDNs, NGET and NGGT as we do not consider that the growth in wages for these industries will be materially different.

Table 2.3: Labour RPE

	2011/12	2012/13	2013/14	2014/15 to 2020/21	Average over period
Labour RPE	-2.9%[1]	-0.9%[2]	-0.2%[2]	1.4%[3]	**0.5%**

(1) Based on actual real earnings growth for the private sector (from the ONS). (2) Based on HMT consensus forecast of average real earnings growth for the whole economy.[4] (3) Based on the long run average associated with following series: Average Weekly Earnings (AWE) private sector; AWE construction industry; AWE transport and storage industry; and civil engineering labour index (Price Adjustment Formula Index (PAFI) published by BCIS).

Short-term forecast (2011/12 to 2013/14)

2.12. Our RPE for 2011/12 is based on outturn data from the Office of National Statistics (ONS) for RPI and average weekly earnings (AWE) of the private sector economy including bonuses.

2.13. Our forecast for 2012/13 and 2013/14 draws on the HM Treasury consensus forecast for average earnings growth for the whole economy. As the figures show, the series suggests negative RPEs over this period consistent with current subdued real wage settlements.

2.14. We have used the HM Treasury consensus forecast rather than other published forecasts, eg the Office of Budget Responsibility (OBR) forecast for private sector earnings. One GDN proposed that the OBR forecast was more appropriate because it represents a forecast of private sector earnings rather than whole economy earnings. We consider that the HM Treasury consensus forecast is appropriate and more robust forecast for setting RPEs as it represents the consensus view rather than the view of a single organisation. We also note that the difference in the impact on totex by applying the two forecasts is not material. Historically there has been no systematic difference between private sector and whole economy wage growth, and therefore in the longer-term we would expect this relationship to hold.

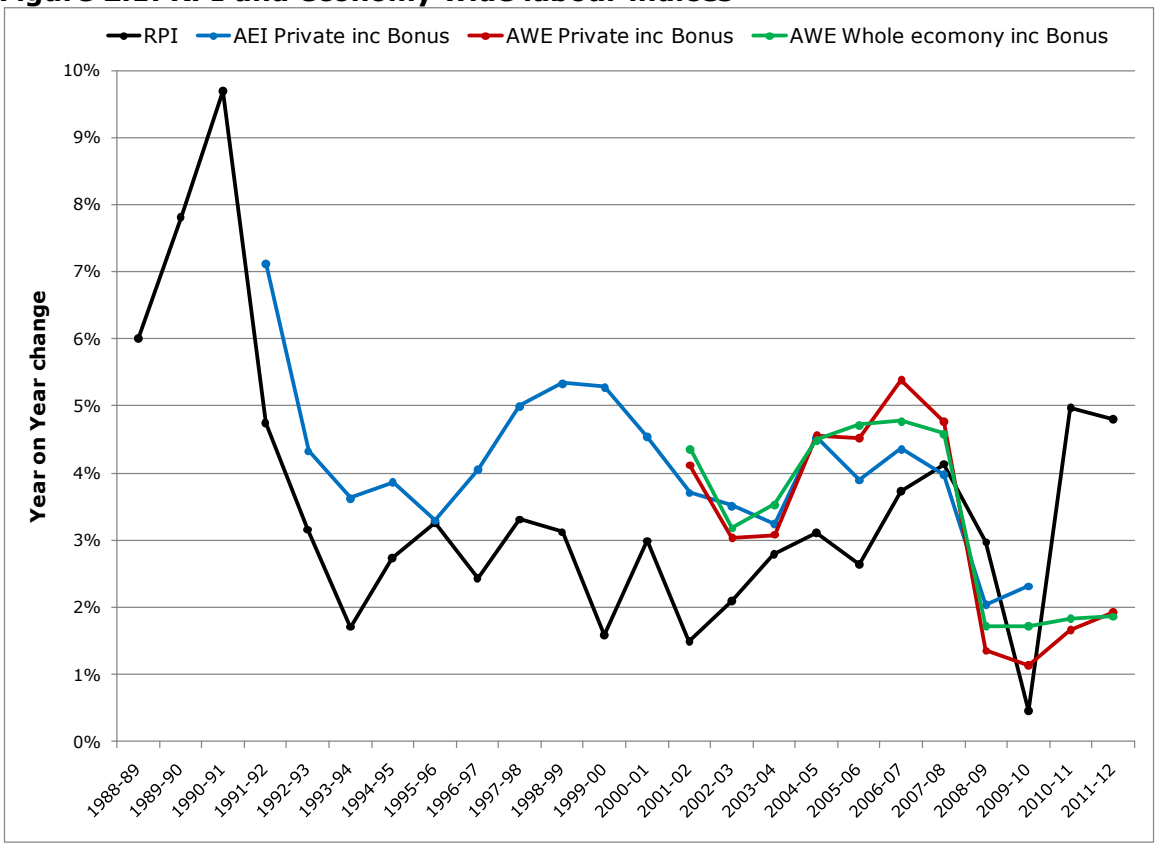
[4] Source: Forecasts for the UK economy http://www.hm-treasury.gov.uk/data_forecasts_index.htm

Longer-term forecast (2014/15 to 2020/21)

2.15. Beyond the period where the HM Treasury consensus forecast is available, we draw on the historical real wage growth for a range of wider economy and specialist labour indices equal to 1.4 per cent per annum.

2.16. Figure 2.1 shows the labour indices for the private sector economy. Figure 2.2 shows a number of labour indices for more specialist industries including construction and engineering.

Figure 2.1: RPI and economy wide labour indices

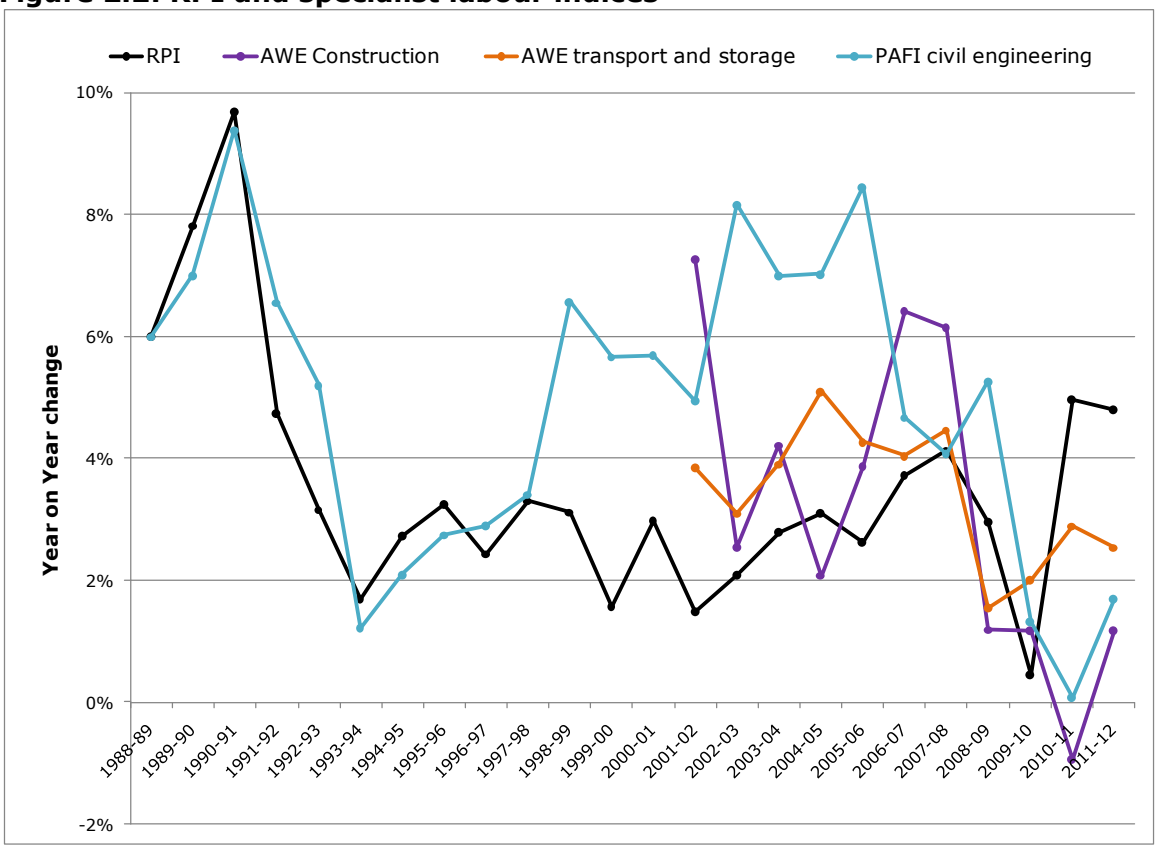


2.17. Figure 2.1 shows that both private sector and whole economy earnings growth significantly fell in 2008/09, remaining reasonably stable since. In 2011/12 there was no difference between growth in the private sector compared to the whole economy.

2.18. In common with private sector wage growth, indices representing more specialist sectors akin to those of the network companies also experienced a decline in growth in recent years, as seen in Figure 2.2. Engineering and construction industries have experienced more significant declines in growth than the wider economy and are still experiencing negative real wage growth. However, over the

last two decades the wage growth in civil engineering industry in particular has outstripped the general economy.

Figure 2.2: RPI and specialist labour indices



2.19. In constructing the forecast of labour RPE from 2014/15, we draw on evidence of both general real wage growth in the private sector as well as wage growth for the construction, transportation and engineering sectors. In determining our overall forecast for labour real wage growth of 1.4 per cent per annum, we take an unweighted average of these forecasts. Table 2.4 shows the growth forecast for each index.

Table 2.4: Forecast real labour indices

	2011/12 (Outturn)	2014/15 to 2020/21 (Based on long-term trend)
AWE private inc. bonus	-2.9%	1.4%
AWE construction	-3.6%	1.3%
AWE transport and storage	-2.3%	1.0%
PAFI civil engineering	-3.1%	1.8%

2.20. Network companies have expressed different views on whether contractor real wage growth is likely to differ from directly employed real wage growth. We have not differentiated between contractor and directly employed wage growth in our assumptions. The reason for not identifying separate forecasts for direct and contract labour is that: (i) we do not consider there is evidence to support a long-term differential; (ii) we do not want to set differential real wage assumptions based on network companies preferred operational/contract decisions. Our composite labour RPE reflects the trend for both general and more specialist labour.

Materials

2.21. There are a number of indices available that could proxy the changes in cost of the materials that network companies purchase. The network companies themselves referenced a range of indices, independent forecasts, and commodity price forecasts.

2.22. As per our approach for establishing a forecast of real labour growth, we have drawn on indices that we consider best reflect the materials purchased by the network companies. Some examples of these relevant indices are:

- Price index adjustment formulae (PAFI) which represent the changes in contractors costs for specified materials, eg steel works.
- Resource cost indices (RCI) which reflect a notional trend in costs of labour, materials and plant.
- British Electrotechnical and Allied Manufacturers Association (BEAMA) index of electrical equipment costs.
- Producer Price indices (PPI) from the ONS which represent changes in prices of materials purchased by the manufacturing industry for processing (input PPI) and changes in prices charged for materials (output PPI).

2.23. Table [2.5] summarises our materials RPEs. We have assumed different RPEs for opex and capex/repex. We have also assumed different RPEs across the three sectors for capex/repex to reflect the different materials used in each sector.

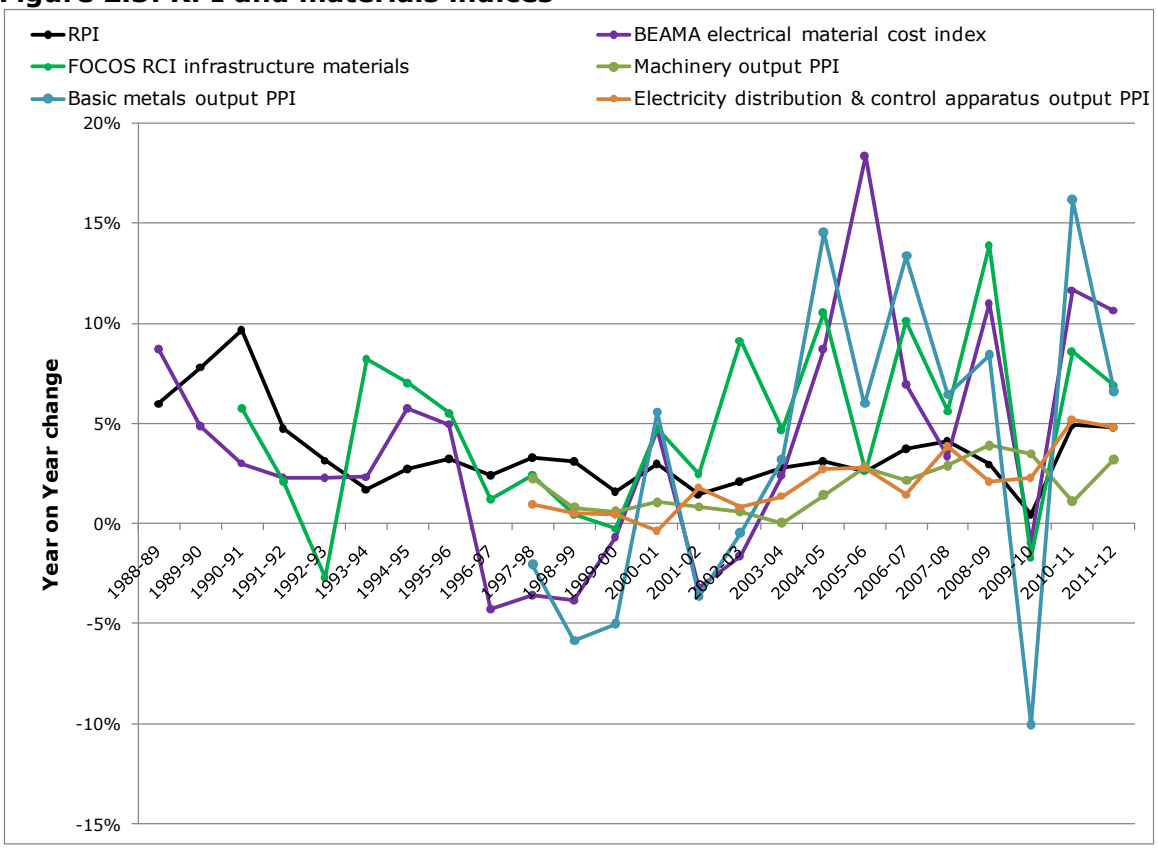
Table 2.5: Materials RPEs

	2011/12	2012/13 to 2020/21	Average over period
Materials opex[1]	2.1%	1.5%	**1.6%**
GDN materials capex/repex[2]	1.7%	1.7%	**1.7%**
NGET materials capex[3]	4.3%	2.2%	**2.4%**
NGGT materials capex[4]	2.1%	1.7%	**1.7%**

(1)Based on FOCOS resource cost index for the infrastructure industry. (2) Based unweighted average of PAFI indices for steel works, plastic pipes and copper piping. (3) Based on PAFI index for copper piping. (4) Based on PAFI index for steel works.

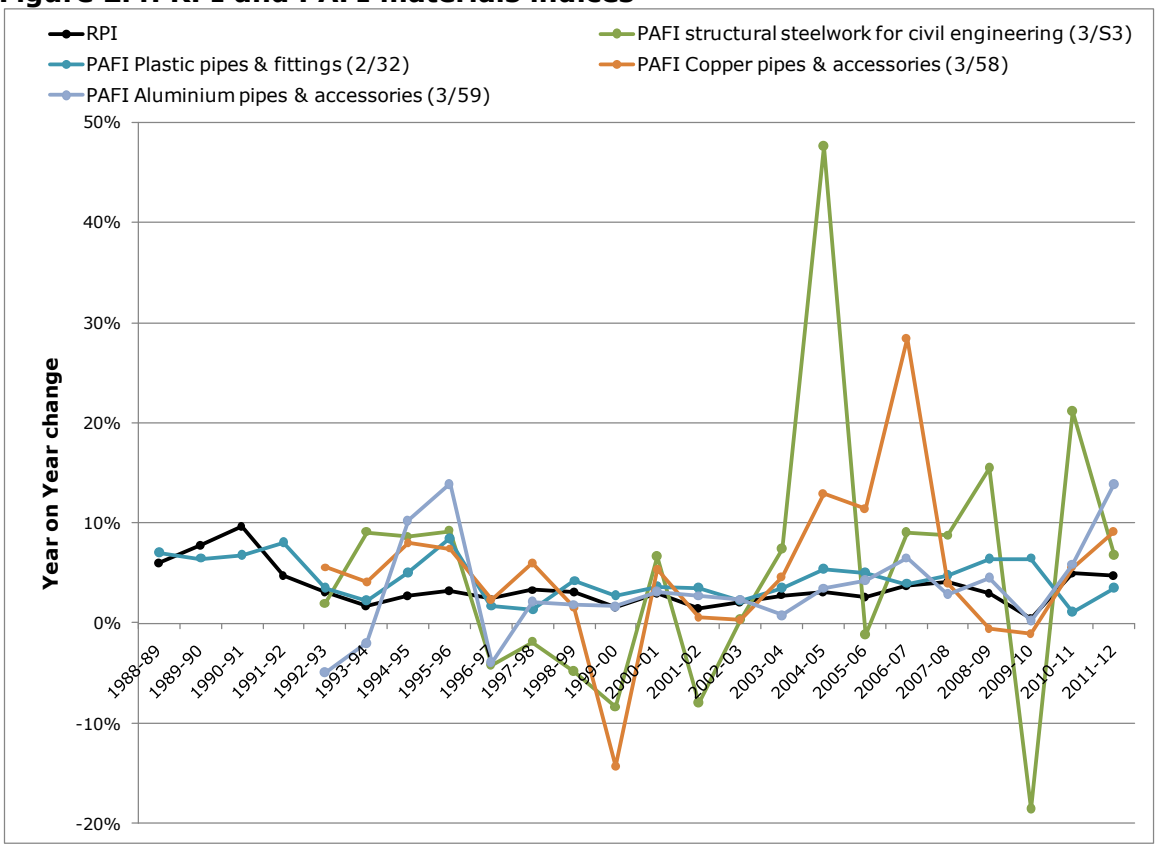
2.24. Our RPEs for 2011/12 are based on outturn data. From 2012/13 the data draws on the long-term real trend in the relevant indices. Figures [2.3] and [2.4] show the historical growth in RPI and a number of indices we considered in forecasting RPEs for the gas and electricity sectors.

Figure 2.3: RPI and materials indices



2.25. As can be seen in figures 2.3 and 2.4 these indices are more volatile than labour wage indices. Generally these indices have shown positive real growth, ie growth has been greater than the growth in RPI.

Figure 2.4: RPI and PAFI materials indices



2.26. In constructing the forecast of materials RPEs, we draw on some of the indices in the figures above. We have chosen indices which we consider most relevant to the network companies. Our forecasts for these indices are based on outturn data in 2011/12 and the long-term real trend from 2012/13 onwards. Table 2.6 shows the growth forecast for each index we have used in constructing the RPEs.

Table 2.6: Forecast real materials indices

	2011/12 (outturn)	**2012/13 to 2020/21 (based on long-term trend)**
FOCUS RCI infrastructure materials	2.1%	1.5%
PAFI steel works	2.1%	1.7%
PAFI plastic pipes	-1.3%	1.2%
PAFI copper piping	4.3%	2.2%

2.27. For our opex RPE forecast for all sectors, we have assumed the FOCUS resource cost index for infrastructure materials. For the GDNs capex/repex materials we have assumed an unweighted average of the PAFI indices for steel works, plastic pipes and copper piping. For NGET we have assumed the forecast of PAFI copper

piping and for NGGT we have assumed the forecast of PAFI steel works. The different assumptions for each sector reflect the different materials that each sector requires.

2.28. Some of the network companies proposed RPEs based on commodity price forecasts weighted together based on an assumed proportion of each commodity in the goods purchased, eg the RPE for plastic pipe required for the gas sector was made up of crude oil, gas, copper and other materials forecasts.

2.29. We have considered this approach in developing our RPE assumptions. We have concerns that this approach does not reflect other factors affecting the price of the goods that the network companies purchase. For example, the price of plastic piping will not only be influenced by the price of commodities but also labour input prices. Given that the network companies do not purchase raw materials but the final manufactured good we do not consider that this commodity forecast based approach best represents the potential cost pressures that they will face.

2.30. Some network companies have also requested an RPE for electricity purchases. We do not consider that an RPE for electricity is required because it constitutes a very low share of network companies' costs (ie less than 2 per cent). In setting RPEs, we propose to focus on the important input prices; all other inputs will be consolidated within the "other" category. Electricity makes up around 2 per cent of the RPI, which is higher than the proportion of electricity in the network companies' expenditure. Therefore, we consider that the impact on the network companies' costs as a result of changes in electricity prices will be allowed through indexation of revenues by the RPI.

Equipment and plant

2.31. There are a number of indices available that could proxy the change in costs of the equipment and plant that network companies use. Table 2.7 summarises our equipment/plant RPE. We have assumed the same RPE across the GDNs, NGET and NGGT.

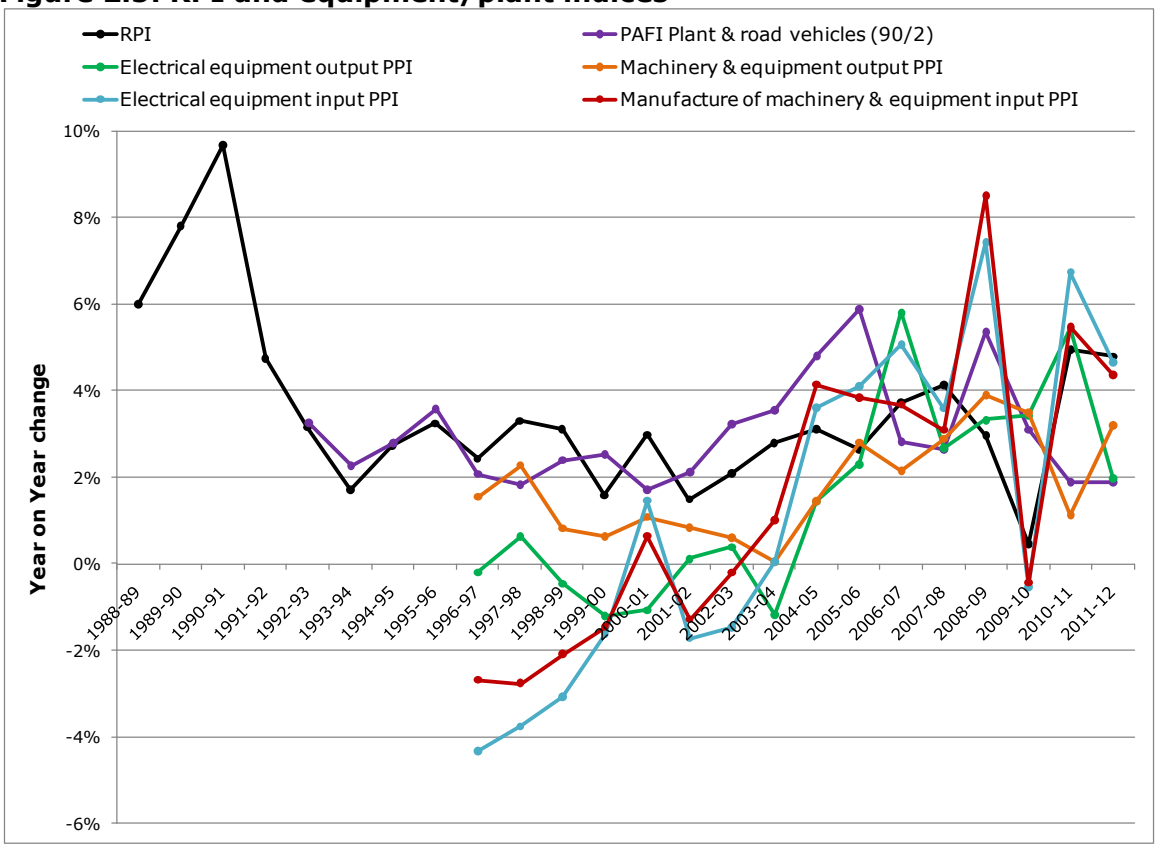
Table 2.7:Equipment/plant RPE

	2011/12	2012/13 to 2020/21	Average over period
Equipment/plant	-1.6%	-0.7%	**-0.8%**

(1) Based on historical unweighted average of following indices: PAFI plant & road vehicles, machinery & equipment output PPI and machinery & equipment input PPI.

2.32. Figure 2.5 shows the historical growth in RPI and a number of indices representing equipment and plant.

Figure 2.5: RPI and equipment/plant indices



2.33. In constructing the forecast of equipment/plant RPE, we draw on some of the indices in the figure above. We have chosen indices which we consider most relevant to the network companies. The forecasts for these indices are based on outturn data in 2011/12 and the long-term real trend from 2012/13 onwards. Table 2.8 shows the growth forecast for each index we have used in constructing the RPE.

Table 2.8: Forecast real equipment/plant indices

	2011/12 (outturn)	2012/13 to 2020/21 (based on long-term trend)
PAFI plant & road vehicles	-2.9%	0.5%
Machinery & equipment output PPI	-1.6%	-0.9%
Machinery & equipment input PPI	-0.4%	-1.6%

Transport

2.34. The network companies' business plans assumed a range of RPE assumptions for transport, ranging from no RPE to an assumed 41 per cent increase in costs by the end of RIIO-T1 and GD1.

2.35. As per our decision to not allow an RPE for electricity we are assuming a zero RPE for transport costs as it constitutes a relatively minimal element of network companies' costs. Based on historic trends in relevant indices, we also consider that there is no evidence that transport cost inputs prices will be materially different from RPI.

Other

2.36. Our assumption for the other category is that costs will grow in line with RPI and thus there will be a zero RPE.

2.37. Some network companies have submitted assumptions for RPEs in relation to other costs. We consider that the RPEs discussed in the rest of this chapter reflect the material categories where there is a valid expectation of materially different growth than that of the RPI.

3. Ongoing efficiency

Chapter Summary
This chapter sets out the ongoing efficiency assumptions for the GDNs, NGET and NGGT. It also sets out the methodology used to derive these assumptions, including references to the data used.

Summary

3.1. The ongoing efficiency assumption is a measure of the productivity improvements that are expected to be made by the network companies over the price control period. Table 3.1 sets out our average annual proposed RPE assumptions for the GDNs, NGET and NGGT.

Table 3.1: Proposed annual ongoing efficiency assumption (2011/12 to 2020/21)

	GDNs	NGET TO	NGGT TO	NGET SO	NGGT SO
Opex	-1%	-1%	-1%	-1%	-1%
Capex	-0.7%	-0.7%	-0.7%	-0.7%	-0.7%
Repex	-0.7%	-	-	-	-
Totex	-0.8%	-0.7%	-0.7%	-0.9%	-0.9%

Measures of productivity

3.2. To estimate long term efficiency, we have drawn on total factor productivity (TFP) measures and partial factor productivity (PFP) measures calculated using data from the EU KLEMS dataset.[5] This was the approach we used at the last gas distribution price control (GDPCR1) and the previous electricity distribution price control (DPCR5). At GDPCR1, we commissioned Reckon LLP, an economic consultancy, to estimate ongoing efficiency drawing on the above measures. In determining ongoing efficiency for RIIO-T1 and GD1, we have also reviewed recent regulatory reports, including a report by Reckon commissioned by the Office of Rail Regulation (ORR) in May 2011.[6]

3.3. Estimates of productivity represent the difference between output volume growth and input volume growth. For example, productivity growth of one per cent a year implies that the volume of output can be kept constant whilst reducing the volume of inputs by one per cent per year.

[5] EU KLEMS: http://www.euklems.net/
[6] Reckon, Productivity and unit cost change: http://www.rail-reg.gov.uk/upload/pdf/reckon_200511.pdf

3.4. There are two measures of TFP that can be calculated from the EU KLEMS database: a value added (VA) measure and a gross output (GO) measure. TFP has been calculated using the following formulae:

TFP (VA) = growth in volume of VA
– (share of capital in VA*growth in volume of capital)
– (share of labour in VA*growth in volume of labour)

TFP (GO) = growth in volume of GO
– (share of capital in GO*growth in volume of capital)
– (share of labour and intermediate goods in GO*growth in volume of labour and intermediate goods)

3.5. The VA and GO measures of industry output provide different information:

- VA is a measure of the value of gross output minus the value of intermediate inputs (energy, materials and services) required to produce the final output. The inputs for VA are therefore labour and capital.
- GO is a measure of the value of the output of an industry, ie the combined turnover of the companies within that industry. The inputs for gross output are therefore capital, labour, energy, materials and services.

3.6. Both measures of TFP have pros and cons. Using the GO measure of productivity allows as to estimate the productivity improvements as a result of changes in the use of labour, capital and intermediate inputs, where as the VA measure only represents productivity improvements due to use of labour and capital. The GO measure may also capture changes in the vertical structure of organisations within the industry. TFP (GO) is systematically smaller in magnitude than TFP (VA).

3.7. Reckon, in its May 2011 paper for the ORR, argues that a gross output measure is more applicable to the study of specific company productivity improvements. Where as First Economics (FE) in their report for NGN and SGN argue that a value added measure is more appropriate as it will not be impacted by changes in the vertical structure of industries.[7] FE also state that the gross output measure is more susceptible to measurement error.

3.8. We have calculated partial factor productivity for labour based on a value added measure, and partial factor productivity for labour and intermediate inputs based on a gross output measure. These have been calculated assuming constant capital, using the formulae below:

Labour productivity (VA) at constant capital = TFP (VA)/share of labour in VA

[7] First Economics report on productivity for NGN: http://www.northerngasnetworks.co.uk/documents/a7.pdf

Labour and intermediate inputs productivity (GO) at constant capital
= TFP (GO)/share of labour and intermediate inputs in GO

3.9. By assuming constant capital we eliminate the impact of capital substitution. Capital substitution is the reduction in labour or intermediate inputs that have only been achievable through increasing the use of capital. We have also calculated labour and intermediate input productivity with no adjustment for capital substitution. If this figure is higher it can be deduced that there is scope for capital substitution, ie some of the productivity if the industry has been achieved by increasing the use of capital. We calculated labour and intermediate inputs productivity (GO) using the following formula:

Labour and intermediate inputs productivity (GO)
= growth in volume of GO
– (share of labour in labour and intermediate inputs*growth in volume of labour
– (share of intermediate inputs in labour and intermediate inputs*growth in volume of intermediate inputs)

3.10. In annex 2, table A2.1, we provide the results for these calculations for each industry sector in the EU KLEMS database for the UK, where data was available. We have highlighted those sectors that were used as comparators at either GDPCR1 or DPCR5.

3.11. To derive an ongoing efficiency assumption at GDPCR1 and DPCR5 we looked at historical productivity measures for comparator sectors in the EU KLEMS dataset. Comparator sectors were chosen based on the similarity of their business processes to the gas and electricity distribution networks, ie their comparable use of labour, materials and other inputs in the production process. We have excluded the electricity, gas & water supply sector as we expect the historical productivity will have captured the impact of privatisation, the introduction of incentive based regulation and structural changes, as well as incorporating the upstream supply and production sectors, which are not comparable to the distribution and transmission sectors.

3.12. Table 3.2 provides the average annual productivity of selected industry sectors and averages across all industries. The averages at the all industry level have been constructed from the lowest level of sub section available in the dataset. We have excluded real estate (K), public admin (L), education (M), health (N) and social services (O) from this average. Academic literature cautions against the use of TFP measures for these industries due to the difficulty of estimating productivity growth in sectors where there is not an end output that has a market price and is sold to customers.

3.13. For the weighted average we have calculated the weights on the basis of the proportion of gross value added at current basic prices or the proportion of gross output at current basic prices, dependent on the measure we are averaging. We

have also calculated an average that excludes manufacturing industries due to the concerns raised at previous price reviews that manufacturing was not a relevant comparator to the distribution sector.

Table 3.2: Average annual growth rates for productivity measures from EU KLEMS (1970 to 2007): selected industry sectors

Sector (EU KLEMS sector code)	TFP (VA)	Labour & Productivity (VA) at constant capital	TFP (GO)	Labour & Intermediate Input Productivity (GO) at constant capital	Labour & Intermediate Input Productivity (GO)
Manufacture Of Chemicals & Chemical Products (24)	3.9%	5.8%	1.3%	1.4%	1.4%
Manufacture Of Electrical & Optical Equipment (30-33)	4.1%	5.8%	1.6%	1.8%	1.9%
Manufacture Of Transport Equipment (34-35)	3.3%	3.3%	1.1%	1.1%	0.9%
Construction (F)	0.7%	0.7%	0.3%	0.3%	0.4%
Sale, Maintenance & Repair Of Motor Vehicles/Motorcycles; Retail Sale of Fuel (50)	2.0%	2.4%	1.0%	1.1%	1.4%
Transport & Storage (60-63)	2.4%	2.6%	1.2%	1.3%	1.2%
Financial Intermediation (J)	-0.6%	-0.9%	-0.3%	-0.4%	0.3%
Unweighted average selected industries	**2.3%**	**2.8%**	**0.9%**	**0.9%**	**1.1%**
Unweighted average selected industries (exc. manufacturing)	**1.1%**	**1.2%**	**0.5%**	**0.6%**	**0.8%**
Unweighted average all industries[1]	**1.3%**	**1.5%**	**0.5%**	**0.5%**	**0.8%**
Weighted average all industries[1]	**1.1%**	**1.1%**	**0.5%**	**0.5%**	**0.8%**

(1) We have excluded the following industries from this average: real estate (K), public admin (L), education (M), health (N) and social services (O).

Choice of productivity measure

3.14. We note that there are arguments in support of using VA and GO measures as the basis for the ongoing efficiency assumption. In Reckon's latest report for the ORR, it argues that GO measures are generally used as the basis for economic studies of productivity improvements, and Reckon consider that GO based labour and intermediate inputs productivity, at constant capital, represents the best proxy for opex costs.

3.15. The VA measure of productivity only allows us to evaluate the impact of the use of labour and capital on outputs, thus limiting the costs that this can be applied to. Therefore to fully evaluate the productivity improvements that a network company can make would require making additional assumptions about the use of intermediate inputs.

3.16. FE in its report for two of the GDNs, NGN and SGN, argues that a VA measure is more appropriate. It considers that GO measures are more susceptible to

measurement error than VA measures. It also argued that it is affected by changes in the vertical structure of industries whereas VA measures are not. FE considered that only applying a labour productivity measure was not a concern as productivity improvements for intermediate inputs would be picked up in the assumptions for input price inflation (RPEs).

3.17. NGGD cited the Competition Commission's (CC) assessment of Bristol Waters price control decision referral.[8] It has taken the CC's consensus view of 1 per cent per annum opex ongoing efficiency and made a number of adjustments, referencing similar adjustments made by the CC, to derive an opex ongoing efficiency assumption of 0.8 per cent. The adjustments made were a positive adjustment (ie, that makes the ongoing efficiency assumption more challenging) to account for the scale of the investment challenge, a negative adjustment to account for the double counting of efficiencies in historical data and a final negative adjustment to account for the potential for uncertainty in the calculation.

3.18. We have considered the adjustment made by NGGD for dealing with double counting in historical data. The assumption that NGGD has made is that historical data includes productivity improvements of those companies that were catching up with the most efficient company.

3.19. We do not consider that we need to make such an adjustment proposed by NGGD given our approach. As set out above, we have excluded industries (namely, utilities) from our comparator set where we would expect there to be systematic catch-up, ie where the historic productivity improvements for these industries will reflect a material element of movement to the efficiency frontier (which our comparative efficiency assessment addresses), as well as movement of the efficiency frontier (which is the element we need to identify).

3.20. By contrast, for our comparator industries, we consider that the historical change in productivity is a good proxy for the movement in the efficiency frontier. Consider if this were not the case. For example, if our historical productivity measures (ie based on KLEMS) were materially greater than the *actual* movement in the efficiency frontier over the same time period, this would imply systematic convergence of all companies in all industries to the efficiency frontier. However, it is not clear to us that the distribution of companies' relative efficiency across all industries at the end of our data period should be materially different from the distribution of technical efficiency at the beginning. Thus, we consider long term historical TFP and partial productivity measures for our comparator industries approximate to the expected improvement in the efficiency frontier.

3.21. In estimating productivity improvements, we do not rely on single estimates of productivity in an industry but draw on wide a range of evidence. We also consider that a longer period represents the best estimate for future ongoing efficiencies

[8] Appendix K: http://webarchive.nationalarchives.gov.uk/+/http://www.competition-commission.org.uk/rep_pub/reports/2010/fulltext/558_appendices.pdf

because it reduces the potential measurement error and the impact of business cycle will be minimised. In table 3.2 we consider the sensitivity of one measure of productivity, TFP (GO), to the data period chosen. As can be seen, the choice of data period can have a significant impact on the value derived, but there is no systematic bias for all sectors.

Table 3.3: Average annual growth rates in TFP (GO) at constant capital from EU KLEMS

Sector (EU KLEMS sector code)	1970-2007	1990-2007	1997-2007
Manufacture Of Chemicals & Chemical Products (24)	1.3%	1.3%	1.1%
Manufacture Of Electrical & Optical Equipment (30-33)	1.6%	1.7%	2.2%
Manufacture Of Transport Equipment (34-35)	1.1%	0.7%	0.7%
Construction (F)	0.3%	0.2%	-0.2%
Sale, Maintenance & Repair Of Motor Vehicles/Motorcycles; Retail Sale of Fuel (50)	1.0%	1.4%	2.0%
Transport & Storage (60-63)	1.2%	0.8%	0.6%
Financial Intermediation (J)	-0.3%	0.7%	0.6%
Unweighted average selected industries	0.9%	1.0%	1.0%
Unweighted average selected industries (exc. manufacturing)	0.5%	0.8%	0.7%
Unweighted average all industries[1]	0.5%	0.7%	0.7%
Weighted average all industries[1]	0.5%	0.7%	0.6%

(1) We have excluded the following industries from this average: real estate (K), public admin (L), education (M), health (N) and social services (O).

Conclusions

3.22. In determining our ongoing efficiency assumptions, we draw on evidence for both GO and VA measures of productivity. We have considered the range of productivity measures from the EU KLEMS dataset along with the evidence provided by the network companies and previous regulatory decisions.

3.23. We consider that the historical data supports an assumption in productivity associated with opex of around 1 per cent per annum. To arrive at this assumption we have drawn upon the average industry estimates of PFP measures (ie labour, and labour and intermediate inputs) in table 3.2, which range from 0.5 per cent to 2.8 per cent per annum. A 1 per cent opex efficiency assumption also sits within the range of assumptions made by the network companies and of those made at previous regulatory decisions.

3.24. For capex and repex, we consider TFP measures of productivity to derive our assumption. We consider that historical measures of productivity support an assumption that network companies can make efficiencies on their allowed capex and repex expenditure of 0.7 per cent per annum.

3.25. To arrive at this assumption we have drawn on TFP measures for construction, manufacturing sectors and the wider economy. We consider evidence from the construction sector which we consider is comparable to the network companies' capex/repex activities, as well as evidence from the composite selected industries TFP measures and TFP for the economy as a whole to ensure that we do not rely on any one set of data. We draw on TFP as we consider such measures better reflect the proportion of inputs in network companies' capex/repex programmes as it will account for productivity improvements where there is a similar mix of capital, labour and intermediate inputs required. We also propose to draw on both VA and GO measures.

3.26. As set out Table 3.2, the construction TFP is in the range of 0.3 to 0.7 per cent per annum. The selected industries averages fall in the range of 1.1 to 2.3 per cent per annum (VA) and 0.5 to 0.9 (GO). We consider that a figure at the top end of the estimate for TFP for the construction sector (but below the averages for other industries) of 0.7 per cent per annum represents a reasonable assumption for the GDNs, NGET and NGGT.

4. Net impact of RPEs and ongoing efficiency

Chapter Summary
This chapter summarises our assumptions for RPEs and ongoing efficiency and compares it with other measures of the net effect of these two assumptions.

Summary

4.1. Combining the assumptions for RPEs and ongoing efficiency provides the expected growth in expenditure, relative to the RPI, over the price control period (assuming all else held equal). Table 4.1 sets out the combined impact of our assumptions for the GDNs, NGET and NGGT.

Table 4.1: Average annual net impact (2011/12 to 2020/21)

	GDNs	NGET TO	NGGT TO	NGET SO	NGGT SO
Opex	-0.6%	-0.5%	-0.4%	-0.6%	-0.6%
Capex	-0.1%	0.2%	0%	-0.7%	-0.7%
Repex	-0.1%	-	-	-	-
Totex	-0.3%	0.1%	0%	-0.7%	-0.7%

4.2. As set out, our overall conclusions at the totex level for the GDNs is -0.3 per cent per annum. Our estimate is marginally below the lowest GDN assumption, from WWU, of -0.2 per cent per annum. For NGET TO and NGGT TO the conclusions at the totex level are for marginally positive growth and zero growth respectively. For NGET SO and NGGT SO we assume negative growth. This is lower than that assumed for the TOs due to the zero RPE assumption for SO capex.

Measures of unit cost and output prices

4.3. We compare our estimates for the net impact of RPEs and ongoing efficiency with unit cost and output price measures (which incorporate the combined effect of RPEs and productivity) as a consistency check. In doing so we have drawn on available information from the EU KLEMs dataset as well as the BCIS published construction output price indices.

4.4. In table 4.2 we present both unit cost measures and output price growth, relative to the RPI, calculated from data in the EU KLEMS dataset. We have calculated unit cost measures using the following formulae:

Unit labour cost (VA) at constant capital (relative to RPI)
= growth in wages
- growth in labour productivity (VA) at constant capital

- growth in RPI

Unit labour and intermediate input costs (GO) at constant capital (relative to RPI)
= growth in wages and price of intermediate goods
- growth in labour and intermediate input productivity (GO) at constant capital
- growth in RPI

4.5. In Annex [2] table A2.2 we provide the results for these calculations for each industry sector in the EU KLEMS database for the UK, where data was available. We have highlighted those sectors that were used as comparators at either GDPCR1 or DPCR5.

4.6. Output price growth for the construction industry is 1.1 per cent per annum which seems relatively high compared with other estimates.

Table 4.2: average annual growth rates for unit cost measures from EU KLEMS (1970 to 2007)

Sector (EU KLEMS sector code)	Unit Labour Cost (VA) at constant capital (relative to RPI)	Unit Labour and Intermediate Input Cost (GO) at constant capital (relative to RPI)	Output price growth (GO)
Manufacture Of Chemicals & Chemical Products (24)	-2.7%	-1.0%	-0.9%
Manufacture Of Electrical & Optical Equipment (30-33)	-3.3%	-2.3%	-2.4%
Manufacture Of Transport Equipment (34-35)	-2.1%	-0.7%	-0.4%
Construction (F)	1.8%	1.3%	1.1%
Sale, Maintenance & Repair Of Motor Vehicles/Motorcycles; Retail Sale of Fuel (50)	0.4%	0.1%	-0.1%
Transport & Storage (60-63)	-0.7%	-0.5%	-0.7%
Financial Intermediation (J)	2.3%	1.1%	0.6%
Unweighted average selected industries	-0.6%	-0.3%	-0.4%
Unweighted average selected industries (exc. manufacturing)	1.0%	0.5%	0.2%
Unweighted average all industries[1]	0.7%	0.1%	-0.3%
Weighted average all industries[1]	1.1%	0.2%	-0.2%

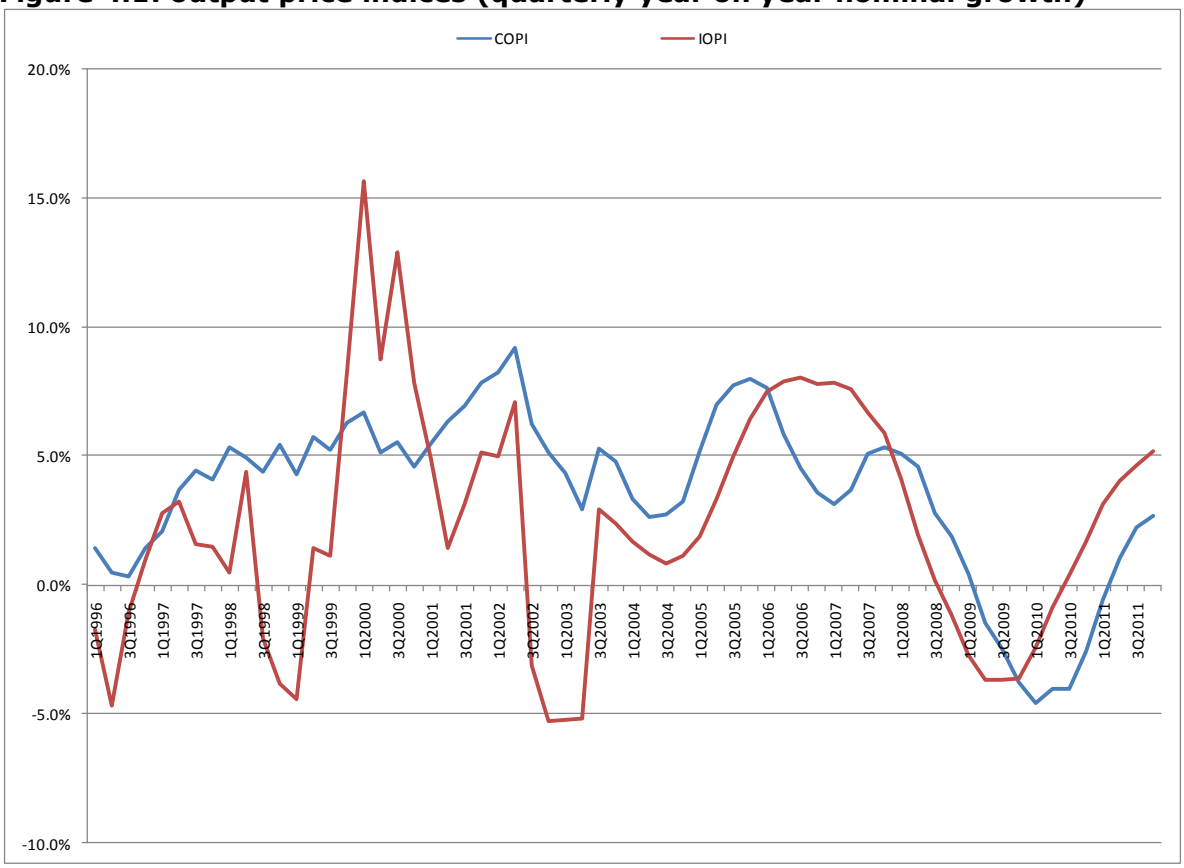
(1) We have excluded some industries from this average: real estate (K), public admin (L), education (M), health (N) and social services (O).

4.7. A negative figure in the table above would suggest that productivity improvements have more than offset RPEs. The figures in table [4.2] tend to suggest marginal increases in unit costs. By contrast, our RPE net of ongoing efficiency

assumption assumes a marginal decline in unit costs over time for the GDNs, a marginally positive unit cost for NGET TO and a zero unit cost change for NGGT TO. However, we consider that the apparent differences between our RPE net of ongoing productivity an unit cost trends is explained by the low/ negative RPE assumptions for the early part of the price review (notably the first year, 2011/12), reflecting the continuation of downward pressure on real wage growth. By contrast, the unit cost data does reflect the short-term negative RPEs for this period.

4.8. In figure 4.1 below we present the construction output price index (COPI) and the infrastructure output price index (IOPI). It shows that the growth rate in the COPI and the IOPI fell significantly in 2008 but are showing signs of returning to positive year on year growth.

Figure 4.1: output price indices (quarterly year on year nominal growth)



4.9. We have calculated historical real trends in output price indices including and excluding the recent period of decline. This suggests that construction output price growth, relative to RPI, has been between -1 per cent and 1 per cent per annum. Our estimates for the net impact of RPEs and ongoing efficiency for capex/repex fall within this range. Thus, we consider our estimates of the net impact are consistent with the unit cost data.

Table 4.3: average annual growth in real output price indices

Index	Real average growth (exc RPI) 1987-2007	Real average growth (exc RPI) 1987-2011
COPI	0.9%	0.1%
IOPI	-0.4%	-0.8%

Appendices

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Appendix 1 – Annual RPEs for the GDNs, NGET and NGGT

1.1. This appendix sets out the annual growth rate in RPEs for the GDNs, NGET and NGGT.

Table A1.1: GDNs' annual RPE assumption (year on year growth (%))

	2011/12	2012/13	2013/14	2014/15	2015/16	2016/17	2017/18	2018/19	2019/20	2020/21
Opex	-1.41	-0.41	-0.01	0.80	0.80	0.80	0.80	0.80	0.80	0.80
Capex	-1.32	-0.21	0.21	1.05	1.05	1.05	1.05	1.05	1.05	1.05
Repex	-1.99	-0.49	0.08	1.25	1.25	1.25	1.25	1.25	1.25	1.25
Totex	-1.63	-0.41	0.06	1.02	1.02	1.02	1.02	1.02	1.02	1.02

Table A1.2: NGET's annual RPE assumption (year on year growth (%))

	2011/12	2012/13	2013/14	2014/15	2015/16	2016/17	2017/18	2018/19	2019/20	2020/21
TO Opex	-1.52	-0.41	0.03	0.94	0.94	0.94	0.94	0.94	0.94	0.94
TO Capex	0.20	0.31	0.58	1.13	1.13	1.13	1.13	1.13	1.13	1.13
TO Totex	-0.03	0.21	0.51	1.11	1.11	1.11	1.11	1.11	1.11	1.11
SO Opex	-1.73	-0.55	-0.09	0.85	0.85	0.85	0.85	0.85	0.85	0.85
SO Capex	0	0	0	0	0	0	0	0	0	0
SO Totex	-1.18	-0.37	-0.06	0.58	0.58	0.58	0.58	0.58	0.58	0.58

Table A1.3: NGGT's annual RPE assumption (year on year growth (%))

	2011/12	2012/13	2013/14	2014/15	2015/16	2016/17	2017/18	2018/19	2019/20	2020/21
TO Opex	-1.28	-0.28	0.15	1.01	1.01	1.01	1.01	1.01	1.01	1.01
TO Capex	0.08	0.40	0.56	0.90	0.90	0.90	0.90	0.90	0.90	0.90
TO Totex	-0.10	0.31	0.51	0.91	0.91	0.91	0.91	0.91	0.91	0.91
SO Opex	-1.71	-0.54	-0.08	0.85	0.85	0.85	0.85	0.85	0.85	0.85
SO Capex	0	0	0	0	0	0	0	0	0	0
SO Totex	-0.94	-0.30	-0.05	0.47	0.47	0.47	0.47	0.47	0.47	0.47

Appendix 2 – Productivity and unit cost measures by industry, EU KLEMS

1.2. This appendix sets out the average annual growth rate for productivity and unit cost measures for UK industries in the EU KLEMS database.

Table A2.1: Annual growth rates for productivity measures from EU KLEMS (1970 to 2007)

Sector (EU KLEMS sector code)	Used as a comparator previously	TFP (VA)	Labour & Productivity (VA) at constant capital	TFP (GO)	Labour & Intermediate Input Productivity (GO) at constant capital	Labour & Intermediate Input Productivity (GO)
Agriculture (A–B)		2.3%	3.4%	0.9%	1.0%	0.9%
Mining (C)		-1.1%	-6.7%	-0.9%	-2.3%	1.5%
Total Manufacturing (D)		1.9%	2.4%	0.6%	0.7%	0.8%
Manufacture of Food, Beverages & Tobacco (15-16)		0.6%	0.8%	0.2%	0.2%	0.3%
Manufacture of Textiles, Leather & Footwear (17-19)		2.3%	2.5%	0.9%	0.9%	1.0%
Manufacture of Wood & Cork (20)		0.6%	1.0%	0.2%	0.2%	0.3%
Manufacture Of Pulp, Paper, Printing & Publishing (21-22)		0.9%	1.2%	0.4%	0.4%	0.5%
Manufacture Of Chemical, Rubber, Plastics & Fuel (23-25)		2.8%	4.2%	0.8%	0.9%	1.0%
Manufacture Of Coke, Refined Petroleum & Nuclear Fuel (23)		-0.3%	-0.9%	0.0%	-0.1%	0.3%
Manufacture Of Chemicals & Chemical Products (24)	**GDPCR1/ DPCR5**	3.9%	5.8%	1.3%	1.4%	1.4%
Manufacture Of Rubber & Plastics (26)		2.2%	3.0%	0.9%	1.0%	1.0%

Sector (EU KLEMS sector code)	Used as a comparator previously	TFP (VA)	Labour & Productivity (VA) at constant capital	TFP (GO)	Labour & Intermediate Input Productivity (GO) at constant capital	Labour & Intermediate Input Productivity (GO)
Manufacture Of Other Non-Metallic Minerals (26)		1.8%	2.4%	0.8%	0.9%	1.2%
Manufacture Of Basic Metals & Fabricated Metals (27-28)		2.0%	2.4%	0.7%	0.7%	0.8%
Manufacture Of Machinery Not Elsewhere Classified (29)		1.2%	1.5%	0.5%	0.5%	0.7%
Manufacture Of Electrical & Optical Equipment (30-33)	**DPCR5**	4.1%	5.8%	1.6%	1.8%	1.9%
Manufacture Of Transport Equipment (34-35)	**DPCR5**	3.3%	3.3%	1.1%	1.1%	0.9%
Manufacture Not Elsewhere Classified; Recycling (36-37)		-1.4%	-1.8%	-0.5%	-0.5%	-0.3%
Electricity, Gas & Water Supply (E)		2.2%	5.7%	0.9%	1.2%	0.6%
Construction (F)	**GDPCR1/ DPCR5**	0.7%	0.7%	0.3%	0.3%	0.4%
Wholesale And Retail Trade (G)		0.3%	0.4%	0.1%	0.1%	0.7%
Sale, Maintenance & Repair Of Motor Vehicles/Motorcycles; Retail Sale of Fuel (50)	**GDPCR1/ DPCR5**	2.0%	2.4%	1.0%	1.1%	1.4%
Wholesale Trade & Commission Trade, Except of Motor Vehicles & Motorcycles (51)		-0.6%	-0.9%	-0.4%	-0.5%	0.2%
Retail Trade, Except of Motor Vehicles & Motorcycles; Repair of Household Goods (52)		0.5%	0.6%	0.3%	0.3%	0.8%
Hotels & Restaurants (H)		-0.9%	-2.2%	-0.4%	-0.5%	0.1%
Transport, Storage & Communication (I)		2.5%	3.1%	1.3%	1.5%	1.8%

Sector (EU KLEMS sector code)	Used as a comparator previously	TFP (VA)	Labour & Productivity (VA) at constant capital	TFP (GO)	Labour & Intermediate Input Productivity (GO) at constant capital	Labour & Intermediate Input Productivity (GO)
Transport & Storage (60-63)	**GDPCR1/ DPCR5**	2.4%	2.6%	1.2%	1.3%	1.2%
Post & Telecoms (64)		2.7%	4.3%	1.7%	2.2%	3.0%
Finance, Insurance, Real Estate & Business Services (J-K)		-0.9%	-1.5%	-0.5%	-0.7%	-0.1%
Financial Intermediation (J)	**GDPCR1/ DPCR5**	-0.6%	-0.9%	-0.3%	-0.4%	0.3%
Real Estate, Renting & Business Activities (K)		-0.9%	-1.7%	-0.6%	-0.8%	-0.3%
Real Estate Activities (70)		-2.1%	-9.3%	-1.4%	-2.7%	-1.8%
Renting of Machinery & Equipment, & Other Business Activities (71-74)		-0.1%	-0.3%	-0.1%	-0.1%	0.8%
Community, Social & Personal Services (L-Q)		-0.8%	-0.9%	-0.4%	-0.5%	-0.3%
Public Admin & Defence; Compulsory Social Security (L)		-0.8%	-0.9%	-0.4%	-0.5%	-0.1%
Education (M)		-1.5%	-1.7%	-1.0%	-1.1%	-1.2%
Health & Social Work (N)		0.2%	0.2%	0.1%	0.1%	0.2%
Other Community, Social & Personal Services (O)		-1.1%	-1.5%	-0.6%	-0.6%	-0.1%

Table A2.2: Annual growth rates for unit cost measures from EU KLEMS (1970 to 2007)

Sector (EU KLEMS sector code)	Used as a comparator previously	Unit Labour Cost (VA) at constant capital (relative to RPI)	Unit Labour and Intermediate Input Cost (GO) at constant capital (relative to RPI)	Output price growth (GO)
Agriculture (A–B)		-1.3%	-1.7%	-2.2%
Mining (C)		12.3%	5.8%	4.0%
Total Manufacturing (D)		-0.5%	-0.4%	-0.6%
Manufacture of Food, Beverages & Tobacco (15-16)		0.3%	-0.8%	-1.0%
Manufacture of Textiles, Leather & Footwear (17-19)		-0.4%	-1.1%	-1.4%
Manufacture of Wood & Cork (20)		0.8%	-0.3%	-0.5%
Manufacture Of Pulp, Paper, Printing & Publishing (21-22)		0.7%	0.1%	-0.2%
Manufacture Of Chemical, Rubber, Plastics & Fuel (23-25)		-1.3%	0.1%	0.0%
Manufacture Of Coke, Refined Petroleum & Nuclear Fuel (23)		2.9%	1.2%	0.8%
Manufacture Of Chemicals & Chemical Products (24)	**GDPCR1/ DPCR5**	-2.7%	-1.0%	-0.9%
Manufacture Of Rubber & Plastics (26)		-0.4%	-0.9%	-1.2%
Manufacture Of Other Non-Metallic Minerals (26)		0.5%	0.4%	0.1%
Manufacture Of Basic Metals & Fabricated Metals (27-28)		0.0%	-0.3%	-0.6%
Manufacture Of Machinery Not Elsewhere Classified (29)		-0.3%	-0.2%	-0.4%
Manufacture Of Electrical & Optical	**DPCR5**	-3.3%	-2.3%	-2.4%

Sector (EU KLEMS sector code)	Used as a comparator previously	Unit Labour Cost (VA) at constant capital (relative to RPI)	Unit Labour and Intermediate Input Cost (GO) at constant capital (relative to RPI)	Output price growth (GO)
Equipment (30-33)				
Manufacture Of Transport Equipment (34-35)	**DPCR5**	-2.1%	-0.7%	-0.4%
Manufacture Not Elsewhere Classified; Recycling (36-37)		3.8%	0.6%	0.2%
Electricity, Gas & Water Supply (E)		-3.8%	-1.2%	-1.0%
Construction (F)	**GDPCR1/ DPCR5**	1.8%	1.3%	1.1%
Wholesale And Retail Trade (G)		1.1%	0.5%	-0.1%
Sale, Maintenance & Repair Of Motor Vehicles/Motorcycles; Retail Sale of Fuel (50)	**GDPCR1/ DPCR5**	0.4%	0.1%	-0.1%
Wholesale Trade & Commission Trade, Except of Motor Vehicles & Motorcycles (51)		2.2%	0.7%	-0.2%
Retail Trade, Except of Motor Vehicles & Motorcycles; Repair of Household Goods (52)		0.6%	0.5%	0.1%
Hotels & Restaurants (H)		6.1%	2.5%	1.3%
Transport, Storage & Communication (I)		-1.0%	-0.7%	-1.2%
Transport & Storage (60-63)	**GDPCR1/ DPCR5**	-0.7%	-0.5%	-0.7%
Post & Telecoms (64)		-2.1%	-1.5%	-2.3%
Finance, Insurance, Real Estate & Business Services (J-K)		2.6%	1.3%	0.7%

Sector (EU KLEMS sector code)	Used as a comparator previously	Unit Labour Cost (VA) at constant capital (relative to RPI)	Unit Labour and Intermediate Input Cost (GO) at constant capital (relative to RPI)	Output price growth (GO)
Financial Intermediation (J)	**GDPCR1/ DPCR5**	2.3%	1.1%	0.6%
Real Estate, Renting & Business Activities (K)		2.6%	1.4%	0.7%
Real Estate Activities (70)		9.4%	2.5%	2.2%
Renting of Machinery & Equipment, & Other Business Activities (71-74)		1.4%	0.9%	-0.2%
Community, Social & Personal Services (L-Q)		2.0%	1.4%	1.0%
Public Admin & Defence; Compulsory Social Security (L)		2.1%	1.4%	1.0%
Education (M)		2.1%	1.4%	1.0%
Health & Social Work (N)		1.0%	1.1%	1.2%
Other Community, Social & Personal Services (O)		2.9%	1.5%	0.7%