

Cost of capital study for the RIIO-T1 and GD1 price controls

Report by FTI Consulting

24 July 2012



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Glossary

Term	Definition
2013/21 Price Controls	The RIIO-T1 and the RIIO-GD1 price controls.
CAPM	Capital Asset Pricing Model.
DGM	Dividend Growth Model.
DMS	Dimson, Marsh and Staunton.
DPCR5	The price control review for the electricity distribution network operators, covering the years 2010 to 2015.
DPS	Dividends per share.
ENA	Energy Networks Association.
EPS	Earnings per share.
ERP	Equity risk premium.
EUR	Euro.
FTI Consulting	FTI Consulting LLP.
GBP	British pounds.
GDP	Gross domestic product.
GDPCR	The review of the price control applying to gas distribution networks, covering the years 2008 to 2013.
iBoxx	A range of fixed income benchmark indices published by Markit Group Limited.
ILGs	Index-linked Gilts.
IPP	<i>“Financeability study for RIIO: Invitation to provide a proposal for provision of a service contract under the terms of a framework agreement”</i> , Ofgem, March 2012

National Grid	NGET, NGGD and NGGT collectively.
Network Rail	Network Rail Limited.
NGET	National Grid Electricity Transmission.
NGGD	National Grid Gas Distribution.
NGN	Northern Gas Networks.
Ofcom	The communications regulator in the UK.
Ofgem	Office of Gas and Electricity Markets
ORR	Office of Rail Regulation.
Revenue Drivers	A means of linking revenue allowances under a price control to specific measurable events which are considered to influence costs.
RIIO Framework	Ofgem's new regulatory framework, RIIO (Revenue = Innovation + Incentives + Outputs).
RIIO Strategy Consultation	<i>"Consultation on strategy for the next gas distribution price control - RIIO-GD1 Overview paper"</i> and <i>"Consultation on strategy for the next transmission and gas distribution price controls - RIIO-T1 and GD1 Financial issues"</i> , December 2010.
RIIO Strategy Decision	<i>"Decision on strategy for the next transmission and gas distribution price controls - RIIO-T1 and GD1"</i> , Ofgem, March 2011.
RIIO Strategy Decision – Financial Issues Annex	<i>"Decision on strategy for the next transmission and gas distribution price controls - RIIO-T1 and GD1 Financial issues"</i> , Ofgem, 31 March 2011.
RIM	Residual Income Model.
SGN	Southern Gas Networks.
SHETL	Scottish Hydro Electric Transmission Limited.
SONI	System Operator for Northern Ireland (SONI) Limited.
SPTL	Scottish Power Transmission Limited.
SSE	Scottish and Southern Electricity Plc.

TPCR4	TPCR4 established the price controls for the transmission licensees covering the years 2007 to 2012.
Trailing average	Moving average.
Uregni	The Utility Regulator in Northern Ireland.
WBA	Wholesale Broadband Access.
WWU	Wales & West Utilities.

1. Issues addressed in this report

- 1.1 We summarise the issues addressed in this report and our conclusions in the tables below. Table 1-1 relates to the cost of equity, and Table 1-2 relates to the cost of debt
- 1.2 The tables presented below provide a brief summary of our conclusions; these should be read and understood in conjunction with the corresponding sections of this report.
- 1.3 In this report we refer to the RIIO-T1 and the RIIO-GD1 price controls collectively as the “2013/21 Price Controls”.

Table 1-1 – Conclusions regarding cost of equity

Issue	Do issues analysed warrant a change in Ofgem's position?	Comments
Section 4 - Estimates of CAPM parameters		
There have been new UK regulatory cost of equity determinations since March 2011.	No	Ofgem's range is consistent with regulatory determinations since March 2011.
There have been changes in risk-free rate and short-term estimates of the equity risk premium.	Possibly	Since the RIIO Strategy Decision, yields on index-linked gilts have fallen and estimates of the implied equity risk premium have risen. Ofgem should monitor developments up to its final proposals for the 2013/21 Price Controls.
Section 5 - Alternative approaches to estimating the cost of equity		
Economic analysis submitted by the network companies includes analysis of the cost of equity using DGM and RIM approaches.	No	The range of estimates using a Dividend Growth Model is consistent with the Ofgem range. The Residual Income Model is unlikely to provide a reliable estimate of the cost of equity for the network companies.
Section 6 - Risk during the 2013/21 Price Controls relative to previous price control periods		
The length of the price control period has increased from five to eight years under the RIIO Framework. Network companies have argued that this will increase the cost of equity relative to previous price controls.	Possibly	There will be higher variability of returns due to forecasting risk of expenditures that are further away. This will be partially offset by uncertainty mechanisms and efficiency incentives. The overall impact on cost of equity will depend on whether any increase in risk is diversifiable.
The network companies will bear the the risk of funding any unforecasted incremental defined benefit pension liabilities during the 2013/21 Price Controls.	No	We expect the effect is likely to be small initially because the forecasted <i>incremental</i> liabilities will be small relative to the total asset value of the network companies.

Issue	Do issues analysed warrant a change in Ofgem's position?	Comments
The volatility of returns of capital investment projects relative to non-regulated companies may increase during the 2013/21 Price Controls in comparison to previous price control periods.	Possibly	The risk of undertaking capital investment projects is lower for network companies relative to non-regulated companies for individual projects. However, the scale of investment of some network companies means that it is possible that, in aggregate, risks for those network companies will move closer to those of non-regulated companies during the 2013/21 Price Controls.
Section 7 – Risk Modelling		
Some network companies employ risk modelling to argue that risk, and therefore cost of equity, will be higher during the 2013/21 Price Controls.	Possibly	Given the sensitivity of the risk modelling conducted to the input assumptions, we consider that the results provide a useful indication of the extent of changes in risk carried by the network companies during the 2013/21 Price Control, but should not be used in a deterministic way with respect to Ofgem's decision regarding an appropriate cost of equity.

Table 1-2 – Findings on issues regarding the cost of debt allowance

Issue	Do issues analysed warrant a change in Ofgem's position?	Comments
Section 8 – Cost of debt indexation		
The cost of debt allowance should include a margin above the cost of debt index to take into account the risk of rising interest rates over the 2013/21 Price Controls.	No	We agree with Oxera that indexation does not remove all risk of movements in the cost of debt, but it does materially reduce the risk faced by the network companies. Depending on the profile of the network companies' debt, and future movements in interest rates, companies may be better or worse off under indexation than a fixed allowance over the course of the 2013/21 Price Controls. Ofgem's conclusions in the RIIO Strategy Decision did not depend on the cost of debt allowance removing all risk faced by the network companies. An allowance for "headroom" in the 2013/21 Price Controls would be duplicative of the protection an indexed allowance provides against rising interest rates.
Cost of debt indexation increases the cyclicity of charges, which increases the risk to equity investors.	No	Cost of debt indexation could increase cyclicity of revenues. However, this is not likely to have a significant effect on beta, because the effect will be muted by use of 10-year trailing average, returns may not be cyclical, and because the procyclical effect may be subject to time lags and the effect of other shocks.
The costs of embedded debt will not be funded by the indexed cost of debt allowance.	No	The indexed cost of debt allowance will not guarantee that the costs of embedded debt will be funded. However, the risks relating to the funding of embedded debt are not new in the 2013/21 Price Controls.
Recent bond yields have been low relative to previous years, and this will reduce the indexed cost of debt allowance.	Possibly	In general, an indexation mechanism based on 10 years of data will reflect average rates over the course of an economic cycle, and no adjustment would be required for low (or high) rates in any one period. However, we recognise that recent interest rates have been at historically low levels that may be unrepresentative of a normal economic cycle. Depending on the future pattern of interest rates, the inclusion of these rates in the index may, therefore, not reflect the efficient costs of debt for a network company over the 2013/21 Price Controls.

Issue	Do issues analysed warrant a change in Ofgem's position?	Comments
The cost of debt of network companies with low or infrequent borrowing requirements may fall below the cost of debt allowance.	No	Depending on future interest rate movements, companies with low borrowing requirements may face a cost of debt that is higher than the cost of debt allowance. Ofgem has stated that in exceptional circumstances companies may propose alternative weightings of the trailing average index; we consider that this addresses the issue.
Possible future changes in the make-up of the iBoxx indices might affect the comparability of the indices to the network companies' cost of debt.	No	We agree that structural changes in the index could have a negative effect if they make the index a less appropriate benchmark and if they create uncertainty for network companies. However, we do not expect that the effect of such changes to be material. We recommend that Ofgem retains a provision to change the indexation mechanism if there are any extreme changes to the index.
The trailing average index value will follow the index value with a lag.	No	With a fixed allowance, no adjustment would be made to the cost of debt allowance during the price control period. In contrast, under cost of debt indexation the network companies receive higher revenues as a result of an increase in the cost of debt, while consumers benefit from decreases in the trailing average index.
By indexing the cost of debt allowance to longer term bonds might incentivise network companies to issue bonds of shorter maturities because these typically face lower yields.	No	Given that the incentive to reduce the maturity of borrowing is unaffected by the introduction of cost of debt indexation (network companies will always face an incentive to reduce their cost of debt, unless these costs are fully passed through to consumers), and that there are material risks of reducing the maturity of their borrowing, we do not consider this a material concern.

Issue	Do issues analysed warrant a change in Ofgem's position?	Comments
Section 9 – Basel III and Solvency II		
The Basel III regulations may affect the extent to which the indexed allowance is a representative benchmark for the network companies' cost of debt by, for example, increasing the cost of the general purpose credit facilities required as back-up by issuers of commercial paper.	No	Overall we do not consider that Basel III will affect the extent to which the allowance is a representative benchmark. With respect to the cost of general purpose credit facilities, there are likely to be cheaper alternatives such as dedicated credit facilities which will have less costly capital requirements for banks.
The Solvency II regulations may affect the extent to which the indexed allowance is a representative benchmark for the network companies' cost of debt.	Possibly	Solvency II may reduce demand for longer duration bonds, such as those issued by the network companies, possibly requiring companies to shift towards issuing shorter dated bonds. The final form of the Solvency II regulations and the insurers' response is uncertain. Therefore, it is impossible, in our view, to adjust the RIIO cost of debt mechanism to effectively address this issue. In the light of this uncertainty, we suggest the consideration of a mid-price control review for this issue.
Section 10 - Other costs of debt financing (such as debt issuance costs)		
Estimates of these costs presented by the network companies mostly lie in the range of 20 to 30 basis points.	N/A	Ofgem decided that no explicit allowance should be set for these costs, as Ofgem expects that they will be funded by the network companies' ability to outperform the cost of debt index. We have not analysed these cost estimates.
The level of outperformance of the cost of debt index may be lower than in the past due to new issue premia.	Possibly	New issue premia can exist and may have emerged as a consequence of the recent financial crisis, albeit they are typically a short term phenomena that will likely disappear once stability returns to the bond markets. Ofgem may wish to continue to monitor evidence on new issue premia up to the time of final proposals.

Issue	Do issues analysed warrant a change in Ofgem's position?	Comments
Recent outperformance of the cost of debt index suggest that it may have been diminished / removed.	Possibly	More recent evidence suggests that the outperformance has returned. However, we consider that Ofgem may wish to assess the level of outperformance as part of a mid-period review.
The level of outperformance of the cost of debt index may fall in the future.	Possibly	There is significant uncertainty over the way in which market conditions will continue to develop over the price control period. Ofgem may wish to assess the level of outperformance as part of a mid-period review.
Section 11 – Inflation risk premium		
The real cost of debt allowance is calculated by deflating the nominal yield on an index using breakeven inflation data. The argument has been raised that the existence of an inflation risk premium is an indication that the breakeven inflation rate is not an unbiased estimate of inflation expectations.	Possibly	Ofgem consider that there are other factors that offset the inflation risk premium, such as the liquidity risk premium. We find that there is enough evidence to presume the existence of an inflation risk premium and some evidence of the possible existence of a liquidity risk premium. To the extent that these exist, the premia will both impact Ofgem's calculated inflation estimate but with one offsetting (to a greater or lesser extent) the other's effect. The net effect of the two premia is unclear.

2. Executive summary

Introduction

- 2.1 We have been asked to provide advice to the Office of Gas and Electricity Markets (“Ofgem”) on the cost of equity and the cost of debt for electricity and gas transmission companies and gas distribution companies under the upcoming RIIO-T1 and RIIO-GD1 price controls¹. These price controls will be the first to be implemented under the new RIIO (Revenue = Innovation + Incentives + Outputs) regulatory framework (the “RIIO Framework”) and will come into effect for eight years from April 2013².
- 2.2 Ofgem published its assessment of the cost of capital for the T1 and GD1 price control reviews in two strategy decision papers (and a financial issues annex) in March 2011 (the “RIIO Strategy Decision”)³. Its assessment of the cost of capital was broadly based on the Capital Asset Pricing Model (“CAPM”), sense-checked against market evidence and regulatory precedents, and was decided after the publication of independent research commissioned by Ofgem and consultation with the network companies⁴.

¹ *“Financeability study for RIIO: Invitation to provide a proposal for provision of a service contract under the terms of a framework agreement”*, Ofgem, March 2012 (“IPP”).

² *“RIIO: A new way to regulate energy networks”*, Ofgem, October 2010.

³ *“Decision on strategy for the next transmission price control - RIIO-T1”*, Ofgem, 31 March 2011; *“Decision on strategy for the next gas distribution price control - RIIO-GD1”*, Ofgem, 31 March 2011; and *“Decision on strategy for the next transmission and gas distribution price controls - RIIO-T1 and GD1 Financial issues”*, Ofgem, 31 March 2011 (“RIIO Strategy Decision – Financial Issues Annex”).

⁴ *“The weighted average cost of capital for Ofgem’s future price control”* Phase II and III reports, Europe Economics, December 2010 and March 2011; Ofgem set out their consultation proposals in *“Consultation on strategy for the next gas distribution price control - RIIO-GD1 Overview paper”* and *“Consultation on strategy for the next transmission and gas distribution price controls - RIIO-T1 and GD1 Financial issues”*, December 2010 (the “RIIO Strategy Consultation”).

Scope of work undertaken

- 2.3 We have been asked to consider the implications of recent market developments and recent regulatory precedent in the UK on the CAPM inputs to Ofgem's assessment of the cost of equity, since the publication of the RIIO Strategy Decision in March 2011.
- 2.4 We have also been asked to consider certain issues raised by the network companies in the business plans they submitted to Ofgem^{5,6}. These issues relate to both the cost of equity and the cost of debt. The issues we have considered are listed in the first column of Table 1-1 and Table 1-2.
- 2.5 In particular, we have been asked to assess whether, and if so to what extent, Ofgem's analysis and conclusions in the RIIO Strategy Decision need to be updated to reflect new issues or developments. We have not been asked to comment on the approach taken by Ofgem in the RIIO Strategy Decision.
- 2.6 Our work is therefore limited to a consideration of certain issues that we have been asked to address, and the implications of those issues for the cost of capital of the network companies. As such, this report should not be construed as expressing any opinion on Ofgem's approach or its previous conclusions in the RIIO Strategy Decision or elsewhere.
- 2.7 We have not been asked to consider notional gearing and financeability in this report.

Cost of equity

- 2.8 Ofgem uses a CAPM framework to assess the cost of equity and determined that a range of 6.0% to 7.2% was appropriate for the network companies. We have reviewed recent regulatory determinations, considered market developments since the RIIO Strategy Decision, and performed cross checks on the cost of equity using alternative models.

⁵ IPP, paragraph 2.

⁶ We have been provided with all or part of the business plans submissions for National Grid Electricity Transmission ("NGET") and National Grid Gas Distribution ("NGGD"), collectively ("National Grid"); Northern Gas Networks ("NGN"); Southern Gas Networks ("SGN"); and Wales and West Utilities ("WWU"). We list the documents we have been provided with and abbreviations used for these documents in Appendix 1 to this report.

Regulatory determinations since March 2011

- 2.9 Our review of recent regulatory precedent shows that Ofgem's estimates of CAPM parameters in the RIIO Strategy Decision are consistent with recent regulatory determinations on the cost of equity in the UK.

Market developments since March 2011

- 2.10 Our review of the effect of recent market conditions on the input parameters used by Ofgem to determine the cost of equity showed that there have been material movements in the real risk free rate (based on the yield of Index Linked Gilts ("ILGs")) and the market implied ERP (based on analysis by the Bank of England). Yields on ILGs have decreased significantly since the RIIO Strategy Decision and are currently negative in real terms. At the same time, market implied estimates of the ERP have increased significantly from around 5% in March 2011 to around 7% based on the latest data available from the Bank of England.
- 2.11 There is also significant uncertainty over the way in which market conditions will develop through to the final proposals. Accordingly, it may be premature to make any revisions to Ofgem's assessment of the cost of equity, based on data that could turn out to be unduly influenced by short term fluctuations. Instead, we consider that Ofgem should regularly monitor changes in these parameters in the period up to final proposals for the 2013/21 Price Controls.

Cross checks to the CAPM framework using other models

- 2.12 We have reviewed the network companies' estimates of the cost of equity using different variations of the Dividend Growth Model ("DGM") and the Residual Income Model ("RIM"). We have also performed our own analysis using the DGM.
- 2.13 Although we have identified various shortcomings in DGM, we consider it to provide a useful cross check to estimates of the cost of equity using CAPM. It is an established and widely used model that is frequently applied in commercial contexts. It is also relied upon by regulators in the United States.
- 2.14 As a cross-check using the DGM, we estimated a reasonable range for the cost of equity for National Grid PLC to be **6.8% to 8.6%**, and a reasonable range for SSE to be **6.3% to 8.1%**. These estimates are for the listed companies. We have not attempted to use these to develop specific estimates of the network companies' cost of equity. We conclude that the range of estimates using a DGM is consistent with Ofgem's range of estimates of the cost of equity using the CAPM.

- 2.15 As a cross-check for the cost of equity of stand-alone network companies, Ofgem has requested that we also estimate the cost of equity using a DGM for three listed water companies. We consider a reasonable range of estimates for Severn Trent lies in the range **5.5% to 7.3%**, for Pennon Group lies in the range **4.6% to 6.4%**, and for United Utilities lies in the range **6.0% to 7.8%**.
- 2.16 We conclude from our sensitivity analysis that the RIM provides estimates that are broadly consistent with the Ofgem's range of estimates using the CAPM. However, the range of estimates is too wide to provide a reliable basis for estimating cost of equity for the 2013/21 Price Controls.
- 2.17 We place significantly less weight on analysis using the RIM. It is not as widely used in practice and relies heavily on the quality of accounting information, which can lead to misestimation of the implied cost of equity. This is particularly true for companies which have significant intangible assets or assets recorded at cost on the balance sheet which do not reflect market values.

Other issues on the cost of equity and the cost of debt

- 2.18 We have been asked to consider a number of specific issues in relation to the cost of equity and the cost of debt. The specific issues we have been asked to consider are:
- (1) the effect of certain factors on the level of risk during the 2013/21 Price Controls compared to previous price controls, including the introduction of the RIIO Framework and other changes;
 - (2) quantification of changes in risk performed by the network companies using risk modelling;
 - (3) risks associated with using a variable cost of debt allowance;
 - (4) potential implications of the Basel III and Solvency II regulations on cost of debt;
 - (5) the funding of other costs of debt financing;
 - (6) inflation risk premia; and
 - (7) adjustments proposed to the cost of debt indexation mechanism.

Relative risk during the 2013/21 Price Control

2.19 Some network companies have raised a number of issues with regard to the level of risk during the 2013/21 Price Controls relative to previous price control periods. In summary, our views in relation to the issues we have been asked to consider are as follows (the issue raised in shown in bold text):

- (1) **The increased length of price control period will increase variability of returns and may increase the cost of equity:** There is greater risk due to the forecasting risk of expenditures that are further away and the potential for forecasting errors to persist over a longer period. This will be partially offset by the introduction of annual updating of revenue allowances for uncertainty mechanisms and efficiency incentives. There will be a net increase in risk because the efficiency incentives do not fully protect network companies from the effect of any misestimates of costs. The extent of any increases in risks will be mitigated, in part, by a reduction in the level of regulatory risk. The overall impact on cost of equity will depend on whether any increase in risk is diversifiable.
- (2) **The network companies will bear the risk of funding any unforecasted incremental defined benefit pension liabilities:** we expect the effect is likely to be small initially because the incremental liabilities will be low relative to the overall asset value of the network companies⁷. Ofgem should monitor the impact of this risk, and consider whether any adjustments to the cost of equity are required in future price controls.
- (3) **The volatility of returns of capital investment projects relative to non-regulated companies will increase during the 2013/21 Price Control in comparison to previous price control periods:** The volatility of returns of capital investment projects is lower for network companies relative to non-regulated companies, for individual projects. However, the scale of investment for some network companies means that it is possible that, in aggregate, risks for those network companies will move closer to non-regulated companies during the 2013/21 Price Controls. We note that not all network companies are expected to undertake significant investment during the 2013/21 Price Controls.

⁷ The extent to which risk will increase depends on the circumstances of individual pension schemes. For example, it depends on the level of participation in defined benefit schemes, and whether these are open to new participants.

Risk Modelling

- 2.20 Using risk modelling, a number of companies have sought to quantify the additional risk in the 2013/21 Price Controls and the impact on their cost of equity. The risks modelled include some of those referred to above and other risks not discussed in this report. Our comments below relate to the approach to risk modelling rather than changes to individual categories of risk.
- 2.21 The risk modelling uses Monte Carlo simulation based on complex operational models to estimate the dispersion of equity returns, an indicator of risk. The dispersion estimate is used in a Sharpe ratio analysis to assess the increase in the cost of equity associated with the increased risk of the RIIO Framework compare to the existing regulatory regime. In addition, National Grid applied a scaling factor to the relative risk calculation to scale down the impact of the additional risk in the 2013/21 Price Controls under the assumption that a part of this risk is diversifiable. Frontier Economics derived the scaling factor using a comparative analysis.
- 2.22 Based on our review of the network companies presentation of their modelling we find that:
- (1) the companies' description of their models appears to be consistent with a well specified model using reasonable inputs but, without a detailed review of the models themselves, we are unable to comment further on the actual models. The Monte Carlo simulations are sensitive to multiple input assumptions for which there are likely to be equally reasonable alternative sets of assumptions which would affect the results. In addition, we note that to a certain extent the results of the modelling (directionally) are inevitable given the compounding effect of, for example, annual price shock assumptions on the dispersion of returns faced over a longer price control period;
 - (2) the Sharpe ratio calculation is by its nature sensitive to small changes in the standard deviation inputs. To the extent that Monte Carlo simulations produce a range of standard deviation estimates, then the most appropriate output of the Sharpe ratio calculation should also be a range;
 - (3) Frontier Economics comparative analysis of National Grid's increased risk in the 2013/21 Price Control ("triangulation") relies on a comparator set which, in our view, cannot produce an accurate scaling factor to remove the diversifiable component of NGET's⁸ additional risk in the 2013/21 Price Controls; and

⁸ We understand that a similar approach is applied in the NGGT business plan submissions.

- (4) Given the sensitivity of the risk modelling conducted to the input assumptions, we consider that the results provide a useful indication of the extent of changes in risk carried by the network companies in the 2013/21 Price Controls, but should not be used in a deterministic way with respect to Ofgem's decision regarding an appropriate cost of equity.

Risks associated with using a variable cost of debt

2.23 The network companies have raised a number of issues with regards to the level of risk under the cost of debt indexation mechanism proposed by Ofgem. In summary, our views in relation to the issues we have been asked to consider are as follows:

- (1) **Application of a margin above the indexed cost of debt allowance to take into account risks of changes in the market cost of debt:** Cost of debt indexation does not remove all risk of movements in the cost of debt, but it does materially reduce the risk faced by the network companies. Ofgem's conclusions in the RIIO Strategy Decision did not depend on the cost of debt allowance removing all risk faced by the network companies. An allowance for "headroom" in the 2013/21 Price Controls may be duplicative of the protection an indexed allowance provides against rising interest rates.
- (2) **Cost of debt indexation may increase correlation of network companies' returns with the market:** Cost of debt indexation could increase cyclicalities of revenues. However, this may not have a significant effect on beta because changes in the index will be muted by the use of a 10-year average, which will reflect average rates over the course of the business cycle. Further, the effect on returns will depend on the borrowing profile of companies, since the average cost of debt of the network companies will also change in response to movements in the market cost of debt. The relationship identified will also be subject to time lags and the effect of other shocks, which will mitigate any increase in correlation with the market.

- (3) **For some network companies, the cost of existing or ‘embedded’ debt may not be funded by the cost of debt allowance:** The indexed cost of debt allowance will not guarantee that the costs of embedded debt will be funded; however, the risks relating to the funding of embedded debt are not new in the 2013/21 Price Controls. This risk does not, in principle, justify an adjustment to the cost of debt allowance, because the trailing average index should generally include rates across the business cycle. However, where efficiently-acquired debt was acquired during the recent financial crisis, at rates that are unlikely to recur during the price control period, this may mean that certain costs of embedded debt may not be financed through the indexed allowance.
- (4) **Recent low yields will reduce the trailing average index, and so the cost of debt allowance may not fund the cost of debt of network companies:** In general, an average based on 10 years of data will reflect rates over the course of an economic cycle, and no adjustment would be required for low (or high) rates in any one period. However, we recognise that recent interest rates have been at historically low levels that may be unrepresentative of a normal economic cycle. Depending on the future pattern of interest rates, the inclusion of these rates in the index may, therefore, not reflect the efficient costs of debt for a network company over the 2013/21 Price Controls.
- (5) **The cost of debt of network companies that have low or infrequent borrowing requirements will be less likely to track the index:** Since these companies will borrow infrequently, the cost of embedded debt is likely to represent a more significant proportion of their cost of debt. If market rates continue to be lower than historical rates, we agree that companies with low borrowing requirements may face a cost of debt that is higher than the cost of debt allowance. We note that Ofgem has stated that in exceptional circumstances companies may propose alternative weighting of the trailing average index; we consider that this addresses this issue.
- (6) **Changes in the composition of the relevant iBoxx⁹ indices may reduce the comparability of the indices to the network companies’ cost of debt:** Structural changes in the index could make the index a less appropriate benchmark, and the potential for such changes could create uncertainty for network companies. However, we do not expect the effect of such changes to be material. We recommend that Ofgem retains a provision to change the indexation mechanism if there are any extreme changes to the index.

⁹ “iBoxx” is a range of fixed income benchmark indices published by Markit Group Limited.

- (7) **The trailing average index value will follow the index value with a lag:** Compared to a fixed allowance, no adjustment would be made to the cost of debt allowance during the price control period. In contrast, under cost of debt indexation the network companies receive higher revenues as a result of an increase in the cost of debt. Further, the cost of debt for network companies is also subject to a lagging effect, which may offset the lagging effect identified. In our view, this will not have a significant impact on the equity risk of the network companies.
- (8) **Cost of debt indexation might incentivise network companies to issue bonds of shorter maturities:** Given that the incentive to reduce the maturity of borrowing is unaffected by the introduction of cost of debt indexation (network companies will always face an incentive to reduce their cost of debt, unless these costs are fully passed through to consumers), and that there are material risks of reducing the maturity of their borrowing, we do not consider this a material concern.

Implications of Basel III and Solvency II

- 2.24 Basel III and Solvency II are packages of new regulations for the global banking and EU insurance industry, respectively, which will increase banks' and insurers' capital requirements. In principal, capital requirements will take more account of the riskiness of assets with capital requirements increasing as the risk increases.
- 2.25 The network companies contend that a principal impact for them of Basel III will be to increase the cost of their backup liquidity facilities for commercial paper. Banks will need to consider these facilities are fully drawn even if they are unused, increasing their capital requirements, a cost they are likely to pass on to their customers, among them, the network companies. We find that there are likely to be cheaper alternatives such as dedicated credit facilities which will have less costly capital requirements for banks. Accordingly, we do not consider that Basel III will affect the extent to which the allowance is a representative benchmark for the cost of debt of the network companies.

2.26 Solvency II places additional capital requirements on insurers holding assets which are longer dated or have a lower credit rating. As insurers have traditionally been major investors in network companies' longer dated bonds, some companies believe they could be exposed to an increased cost of debt and lower demand for their bonds which could even affect their optimal capital structure. We consider that:

- (1) To the extent that the iBoxx index used in the 2013/21 Price Controls captures the increase in bond rates for longer rated bonds then the network companies will not be exposed to an unfunded increase in their cost of debt. We do not expect companies to be left exposed as Ofgem has shown that the average maturity of the debt constituting the index is similar to that of the network companies¹⁰.
- (2) The most material risk of the new regulatory regimes is to the debt structure of the network companies. Solvency II's capital charges for longer duration bonds, such as those issued by the network companies, may significantly reduce insurer demand for such bonds, possibly requiring companies to shift towards issuing shorter dated bonds. The current uncertainty about the final form that the Solvency II regulations will take, and about the insurers' response, make it impossible, in our view, to adjust the RIIO cost of debt mechanism to effectively address this issue. In the light of this uncertainty, we suggest the consideration of a mid-price control review of the extent to which companies' financeability will have been affected by Solvency II.

Other costs of debt financing

2.27 Ofgem has recognised that the network companies have typically been able to issue debt at rates that are below the index values, and has considered that such costs are funded through this difference¹¹.

2.28 We have reviewed estimates of the additional costs of debt financing. The estimates presented by the network companies mostly lie in the range of 20 to 30 basis points.

¹⁰ RIIO Strategy Decision – Financial Issues Annex, paragraph 3.34.

¹¹ RIIO Strategy Consultation – Financial Issue Annex, paragraph 3.14.

- 2.29 In summary, our views in relation to the points that we have been asked to consider are as follows:
- (1) **The level of outperformance of the cost of debt index may be lower than in the past due to new issue premia:** New issue premia can exist and may have emerged as a consequence of the recent financial crisis, albeit they are typically a short term phenomena that disappear once stability returns to the bond markets. However, pending resolution of the Eurozone crisis, Ofgem may wish to continue to monitor evidence on new issue premia up to the time of final proposals.
 - (2) **Recent outperformance of the cost of debt index suggest that historical levels of outperformance may have been diminished / removed:** During 2010 and 2011, the ability of the network companies to issue debt below the index was lower than in previous periods. However, the most recent evidence indicates that the level of outperformance of the index available to fund the costs associated with debt financing has returned.
 - (3) **The level of outperformance of the cost of debt index may fall in the future:** There is significant uncertainty over the way in which market conditions will develop through to the final proposals and over the price control period. We consider that Ofgem may wish to continue to monitor the level of outperformance of the index by network companies during the forthcoming price control period. For example, by incorporating a review of the headroom into a mid-period review process.

Inflation risk premium

2.30 Under the RIIO Framework, Ofgem converts the nominal iBoxx index yields to a real cost of debt using an inflation assumption. The network companies have raised concerns that this inflation assumption includes an inflation risk premium, which causes the real cost of debt to be understated. For example, National Grid presented an inflation risk premium estimate of around 30 basis points based on a Bank of England working paper.^{12,13} In summary, we consider that:

- (1) The UK inflation breakeven rates used to discount the nominal cost of debt values appear likely to include an inflation risk premium. To date, however, the research has failed to coalesce around either an estimation methodology or a consensus value for the inflation risk premium.

¹² NGET: paragraph 389.

¹³ NGGD: paragraph 2.19.

- (2) We find that there is enough evidence to presume the existence of an inflation risk premium and the possible existence of a liquidity risk premium. These premia will both impact Ofgem's calculated inflation estimate but with one offsetting (to a greater or lesser extent) the other's effect. The net effect of the two premia is unclear.

3. Introduction and scope of work

- 3.1 We have been asked to provide advice to Ofgem on the cost of equity and the cost of debt for electricity and gas transmission companies and gas distribution under the upcoming T1 and GD1 price controls¹⁴. These price controls will be the first to be implemented under the new RIIO Framework developed by Ofgem and will come into effect for eight years from April 2013¹⁵.
- 3.2 In this section, we provide a brief overview of the RIIO Framework and Ofgem's approach to assessing the cost of capital. We then explain the scope and limitations of our work.

Preparation and use of this report

- 3.3 This report has been prepared by Daniel Ryan, assisted by staff from FTI Consulting working under his direction, supervision and review. Unless stated otherwise, all references to "we" and "us" refer to the author and the team working under his direction. We have discussed issues relevant to this report with Ofgem. The opinions expressed in this report are, however, the author's own.
- 3.4 The information presented in this report has not been subject to independent audit or verification by FTI Consulting or by us. This report contains information obtained or derived from a variety of sources. We have not sought to establish the reliability of those sources, or verified the information provided. No representation or warranty of any kind (whether express or implied) is given by FTI Consulting or us to any person as to the accuracy or completeness of any information relied upon in this report.
- 3.5 We reserve the right to reconsider any opinions given in this report in light of additional information that may be made available to us in the future.

¹⁴ IPP.

¹⁵ "RIIO: A new way to regulate energy networks", Ofgem, October 2010.

Background to the 2013/21 Price Controls

- 3.6 In the UK, there are three electricity transmission companies, one gas transmission company, eight gas distribution companies and 14 electricity distribution companies¹⁶. These companies are regulated by Ofgem and have, for the last 20 years, been subject to price control reviews every five years using the RPI-X framework¹⁷.
- 3.7 In March 2008, Ofgem started a comprehensive review of the RPI-X framework for energy network regulation called RPI-X@20¹⁸. The review was designed to identify how the regulatory process should be updated to take into account the significant challenges facing the UK energy market over the coming years and the need to meet the UK's renewable energy targets.
- 3.8 In October 2010, Ofgem concluded that review with 12 recommendations on how the regulatory framework needed to be updated¹⁹. The new regulatory framework based on these recommendations is called the RIIO model, and reflects Ofgem's view that revenue should be driven by "Innovation, Incentives and Output". The new framework is being implemented for the current price control reviews for electricity and gas transmission companies (RIIO-T1) and gas distribution companies (RIIO-GD1), both of which come into effect for eight years from April 2013^{20,21}. RIIO will also be implemented for electricity distribution companies in the upcoming price control, which will come into effect for eight years from April 2015²².

¹⁶ <http://www.ofgem.gov.uk/Networks/Trans/Pages/trans.aspx>; <http://www.ofgem.gov.uk/Networks/GasDistr/Pages/Gasdistr.aspx>; and <http://www.ofgem.gov.uk/Networks/ElecDist/Pages/ElecDist.aspx>.

¹⁷ "RIIO: A new way to regulate energy networks", Ofgem, October 2010.

¹⁸ "RIIO: A new way to regulate energy networks", Ofgem, October 2010.

¹⁹ "RIIO: A new way to regulate energy networks", Ofgem, October 2010.

²⁰ "RIIO: A new way to regulate energy networks", Ofgem, October 2010.

²¹ We refer to these companies in this report as 'network companies'.

²² "RIIO: A new way to regulate energy networks", Ofgem, October 2010.

- 3.9 Ofgem consulted on the implementation of the RIIO Framework for the T1 and GD1 price controls in December 2010 and, in March 2011, it published its strategy decision papers for the price controls²³. These decision papers and the associated financial issues annex set out a number of important updates to Ofgem's position on the cost of capital and the financeability of network companies²⁴. We refer to them as the "RIIO Strategy Decision".
- 3.10 As explained in the RIIO Strategy Decision, the price control periods under the RIIO Framework have been extended from five to eight years.

Cost of capital in the 2013/21 Price Controls

- 3.11 Ofgem has made several updates to its approach to calculating the real, vanilla²⁵ weighted average cost of capital ("WACC") for network companies in the 2013/21 Price Controls compared to its approach in previous price controls. These updates were based on Ofgem's research and analysis, consultation with the network companies and research from independent consultants, including Europe Economics (on behalf of Ofgem), Oxera and NERA (for the network companies), and CEPA (for Centrica).
- 3.12 Ofgem set out its assessment of the cost of equity, the cost of debt and notional gearing for the network companies in the March 2011 decision paper²⁶. Its assessment of the WACC is a product of its determinations for each of these components.

²³ "Decision on strategy for the next transmission price control - RIIO-T1", Ofgem, 31 March 2011; "Decision on strategy for the next gas distribution price control - RIIO-GD1", Ofgem, 31 March 2011.

²⁴ RIIO Strategy Decision – Financial Issues Annex.

²⁵ 'Vanilla' refers to an estimate of WACC using a pre-tax cost of debt and a post-tax cost of equity. Since the cost of equity assessed using CAPM is the post-tax cost of equity, accordingly, the vanilla WACC is estimated by making no adjustments for taxation.

²⁶ RIIO Strategy Decision – Financial Issues Annex

Cost of equity

- 3.13 Ofgem reaffirmed its commitment to a CAPM based approach to estimating the cost of equity, sense-checked against other approaches.²⁷ Under this model, the cost of equity comprises a risk free rate of return and an additional premium to reflect the non-diversifiable risk of the company or industry being considered. This additional premium is calculated by multiplying the market risk premium by a company or industry specific beta, which reflects its sensitivity to changes in the market.
- 3.14 In its simplest form, the CAPM can be presented as follows:

$$R_e = R_f + \beta_e \times ERP$$

where:

R_e Cost of equity (or required return)

R_f Risk free rate²⁸

β_e A measure of the relationship between the returns on the stock of a particular company and the returns on the market in general

ERP Equity risk premium (calculated as $R_m - R_f$, where R_m is the required return for the market in general)

- 3.15 Ofgem has estimated each input parameter to the CAPM separately. In the decision paper, Ofgem concluded on a range for each parameter, which in turn was used to determine a range for the cost of equity.
- 3.16 On this basis, Ofgem determined the real, post tax cost of equity for network companies to be in the range of 6.0% to 7.2%.

²⁷ RIIO Strategy Decision – Financial Issues Annex, paragraph 3.4

²⁸ Ofgem use a real risk free rate to calculate the cost of equity on a real basis as opposed to a nominal basis.

Cost of debt

- 3.17 Ofgem has determined that it will apply an assumed cost of debt for network companies based on the average of the iBoxx broad A and broad BBB benchmark indices for bonds with a maturity of 10 years or more²⁹. The cost of debt allowance will be³⁰:
- (1) calculated as a trailing average of the indices over 10 years;
 - (2) updated annually; and
 - (3) deflated using 10-year breakeven inflation data from the Bank of England.
- 3.18 This replaces Ofgem's previous approach of determining a fixed cost of debt during the price control review which is applied over the entire price control period.
- 3.19 The cost of debt implied by the iBoxx index and Bank of England inflation data as at 31 December 2011 was 3.03%³¹.

Gearing

- 3.20 Ofgem decided that notional gearing of network companies would be assessed taking into account the level of risk in the network companies' business plans³².

Basel III and Solvency II

- 3.21 The Basel Committee agreed new measures on banking regulation in September 2010 under a new agreement referred to as Basel III. Solvency II covers similar regulation for the insurance industry.
- 3.22 Although this regulation is independent of the RIIO Framework, it will come into effect during the 2013/21 Price Controls and may affect the cost of capital for network companies; it is therefore potentially relevant to the implementation of the RIIO Framework.

²⁹ RIIO Strategy Decision – Financial Issues Annex, paragraph 3.1.

³⁰ RIIO Strategy Decision – Financial Issues Annex, paragraph 3.1.

³¹ “*RIIO-T1: Initial Proposals for SP Transmission Ltd and Scottish Hydro Electric Transmission Ltd – Supporting document*”, Ofgem, 7 February 2012, paragraph 5.43.

³² RIIO Strategy Decision – Financial Issues Annex, paragraph 3.11.

Scope of our work

- 3.23 We have been engaged by Ofgem to provide a report addressing certain issues relating to the cost of equity and cost of debt in the upcoming price T1 and GD1 price determinations, under the RIIO Framework. We have not been asked to consider notional gearing and financeability.
- 3.24 In relation to the cost of equity, we have been asked to consider:
- (1) market developments since March 2011;
 - (2) regulatory determinations on the cost of capital in the UK, since March 2011;
 - (3) certain issues raised by the network companies' in the business plans they submitted to Ofgem, including the length of price control periods, pension risk, the requirement for large capital investment programmes, and the results of risk modelling analysis commissioned and submitted by certain network companies.
- 3.25 In relation to the cost of debt, we have been asked to consider certain issues raised by the network companies, including index-matching and risk, the potential impacts of Basel III and Solvency II, costs not explicitly covered by the iBoxx indices, the inflation risk premium and proposals to apply re-opener conditions to the indices.
- 3.26 Our work is limited to consideration of issues identified by Ofgem as within the scope of this report, and the implications of those issues for Ofgem's conclusions in the RIIO Strategy Decision. Most of the issues we have been asked to consider are new points which have been raised since the RIIO Strategy Decision was published in March 2011. We do not comment on the appropriateness of the approach adopted by Ofgem in that paper. As such, our report should not be construed as expressing any views on the validity or otherwise of the approach taken by Ofgem in the RIIO Strategy Decision.

Business plan documents

- 3.27 We have been provided with all, or part, of the business plans submissions for NGET; NGGD; NGN; SGN; and WWU³³. Throughout this report, we refer to NGET, NGGD and NGGT collectively as "National Grid", except where specific comments relate to specific network companies.

³³ We have not been provided with any submissions by National Grid Gas Trading ("NGGT").

- 3.28 In some cases, we have been provided with all or part of an original business plan, and also a revised business plan. Additionally, we have been provided with reports prepared by consultants on behalf of various network companies.
- 3.29 We list the documents we have been provided with and the abbreviations we use when referring to these in Appendix 1.

Structure of this report

- 3.30 The remainder of this report is structured is as follows:
- 3.31 In Sections 4 to 7, we consider the cost of equity:
- in Section 4 we review recent market developments and regulatory precedent in relation to the CAPM parameters and the cost of equity;
 - in Section 5, we consider alternatives to CAPM for assessing the cost of equity; and
 - in Sections 6 and 7, we consider issues raised by the network companies with respect to the relative risks in the 2013/21 Price Controls compared to previous price controls, and the risk modelling performed to quantify the impact on the cost of equity.
- 3.32 In Sections 8 to 11, we consider the cost of debt:
- in Section 8, we consider points raised by the network companies relating to index matching and risk under the RIIO Framework;
 - in Section 9, we consider the potential effects of Basel III and Solvency II on the cost of debt;
 - in Section 10, we consider points raised regarding the funding of transaction costs associated with the cost of debt; and
 - in Section 11, we consider issues relating to the “inflation risk premium”.

4. Estimates of CAPM parameters

- 4.1 In the RIIO Strategy Decision, Ofgem reaffirmed its commitment to a CAPM based approach to estimating the WACC, with cross checks to be performed using other models.
- 4.2 As explained in Section 3, the CAPM relies on estimates of the risk free rate, the equity risk premium and beta, which are used to calculate the cost of equity. In the RIIO Strategy Decision, Ofgem estimated high and low figures for each of these parameters.
- 4.3 We summarise these estimates and Ofgem's conclusions on the real cost of equity in Table 4-1 below.

Table 4-1 - Ofgem's determination of the real cost of equity in the RIIO Strategy Decision

	Low	High
Real risk-free rate	1.7%	2.0%
ERP	4.75%	5.5%
Equity beta	0.9	0.95
Real cost of equity	6.0%	7.2%

Source: RIIO Strategy Decision – Financial Issues Annex, Figure 3.13.

- 4.4 In this section, we review the effect of recent developments in capital markets, and regulatory precedent on the input parameters to CAPM since Ofgem's determination in the RIIO Strategy Decision in March 2011³⁴. As explained in Section 3, the scope of our work is limited to an update of previous calculations for recent developments rather than a full assessment of the cost of equity.

³⁴ We performed this review in the course of May 2012. We specify the data cut-off dates for individual parameters in the paragraphs that follow. We consider that minor differences in cut-off dates will not materially affect the results of our review.

Real risk-free rate

- 4.5 The real risk free rate is typically assessed by reference to the yields on inflation-linked UK government bonds, or nominal bonds adjusted for the effects of inflation. In the RIIO Strategy Decision, Ofgem considered evidence on index-linked UK government bonds (ILGs) and we restrict our analysis in this section to those bonds only.
- 4.6 Based on its analysis of the yields on index-linked gilts and regulatory precedent on the risk free rate, Ofgem estimated the real risk-free rate to be 1.7% to 2.0%³⁵. The lower bound of 1.7% was the 10-year trailing average yield on 10-year ILGs in March 2011³⁶. The upper bound was based on recent regulatory precedent in the UK.

Review of recent relevant developments in the capital markets

- 4.7 We have reviewed development in the yields on index linked gilts since March 2011.
- 4.8 In Table 4-2 below, we compare the 5- and 10-year trailing average yields of ILGs with different maturities shown in the RIIO Strategy Decision in March 2011 with the values as at 3 May 2012. The rate that Ofgem used to determine the lower bound for its assessment of the real risk free rate is shown with an asterisk.

Table 4-2: Average historical yield on ILGs

Maturity	Trailing average yield %	
	March 2011	May 2012
ILGs 5-year trailing average		
5 years	1.3	0.6
10 years	1.3	0.9
20 years	1.1	0.9
ILGs 10-year trailing average		
5 years	1.6	1.2
10 years	1.7*	1.4
20 years	1.5	1.3

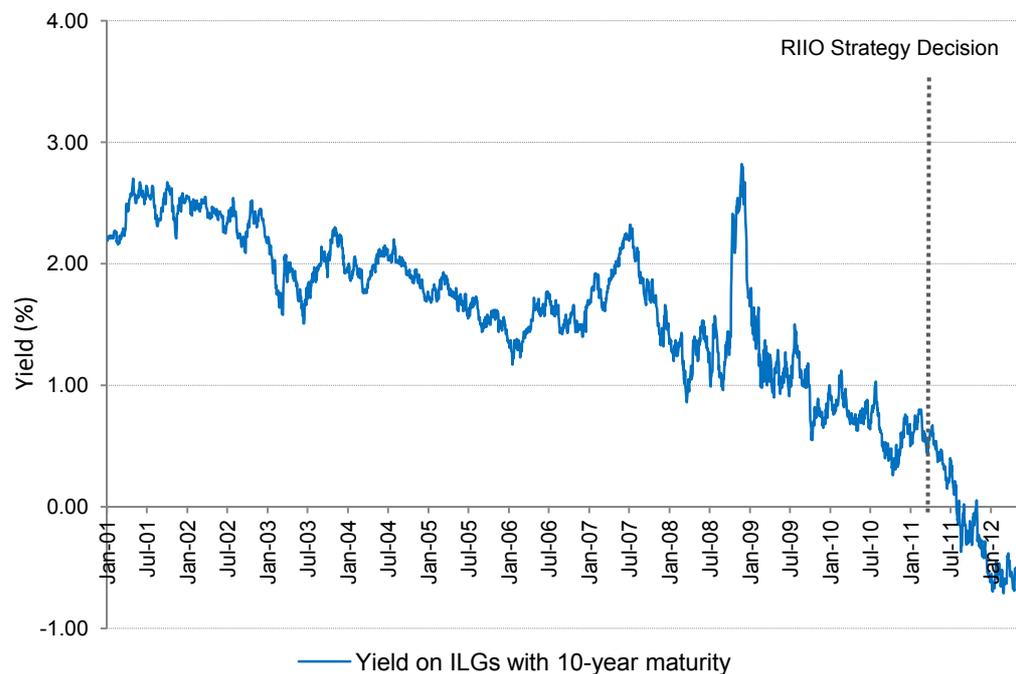
Source: Bank of England. Notes: * indicates rate used in RIIO Strategy Decision.

³⁵ RIIO Strategy Decision – Financial Issues Annex, paragraph 3.70.

³⁶ RIIO Strategy Decision – Financial Issues Annex, paragraph 3.70.

- 4.9 Table 4-2 shows that trailing averages for yields on ILGs have decreased across each of the maturities considered and for both 5- and 10-year averages. The average yield relied upon by Ofgem in the Strategy Decision has decreased by 0.3% from 1.7% to 1.4%.
- 4.10 Figure 4-1 below shows how the yield on 10-year maturity ILGs has changed between January 2001 and May 2012. This shows the decline in yields since the RIIO Strategy Decision, in the context of historical movements in yields.

Figure 4-1: Yields on 10-year ILGs between January 2001 to May 2012



Source: Bank of England.

- 4.11 Figure 4-1 shows that the yield on 10-year ILGs decreased from just over 2% in January 2001 to less than 1% in March 2011. Since March 2011 yields have decreased further and are now negative in real terms.

- 4.12 There are a number of factors that are likely to have affected the yields on ILGs since March 2011, including the UK's monetary policy (which has recently seen several rounds of quantitative easing³⁷), and the ongoing sovereign debt crisis in the Eurozone. The current uncertainty in the capital markets makes it very difficult to assess how yields will change over the upcoming price control period, which will last for eight years from April 2013.

Review of recent regulatory precedent

- 4.13 We have also reviewed recent regulatory determinations on the cost of capital in the UK since the date of the RIIO Strategy Decision. Ofgem relied on regulatory precedent as the basis for the upper end of its assessment of the range for the real risk free rate used in the CAPM.³⁸

³⁷ The Bank of England announced further rounds of quantitative easing in October 2011 and February 2012.

³⁸ RIIO Strategy Decision – Financial Issues Annex, paragraph 3.70.

4.14 The latest determinations on the real risk free rate are set out in Table 4-3 below.

Table 4-3: Regulatory determinations on the real risk-free rate in the UK since March 2011

Year	Regulator	Sector / entity	Estimate
April 2012	Ofcom	Wholesale ISDN 30 access	1.4%
December 2011	ORR*	Network Rail Limited	2.0%
July 2011	Ofcom	Wholesale Broadband Access ("WBA") ³⁹	1.4%
May 2011	Ofgem	Independent Gas transporters	2.0%
April 2011	Uregni	System Operator for Northern Ireland ("SONI")	2.0%

Notes: (1) Figure for Office of Rail Regulation ("ORR") is the value proposed by First Economics. ORR has not yet made a determination. (2) Ofcom is the communications regulator in the UK. (3) ISDN30 price control used the same WACC estimate as the WBA charge control. (4) Ofgem's May 2011 determination stated that this estimate may be generous. (5) "Uregni" is the Utility Regulator in Northern Ireland.

Sources: Regulatory determinations⁴⁰.

³⁹ The WBA Charge Control estimated the risk free rate in both nominal and real terms. The risk free rate was estimated to be 4.4% in nominal terms. "WBA Charge Control, Charge control framework for WBA Market 1 services", Ofcom, July 2011, Table 6.3.

⁴⁰ "Network Rail's allowed return", First Economics for ORR, December 2011; "Wholesale ISDN30 Price Control", Ofcom April 2012; "Decision on the cost of capital value to be used in the 'reasonable profits test' where applicable to Independent Gas Transporters (IGTs) and updated guidance on the test", Ofgem, 24 May 2011 ("IGT Decision Letter"). "WBA Charge Control, Charge control framework for WBA Market 1 services", Ofcom, July 2011 ("WBA Charge Control Statement"). "SONI Price Control – Decision Paper", Uregni, April 2011.

- 4.15 The most recent determinations used rates of 1.4% and 2.0%⁴¹, which is broadly consistent with the range of 1% to 2% applied in the Bristol Water Appeal judgment⁴², and the upper bound of 2% relied upon by Ofgem in its RIIO Strategy Decision⁴³.
- 4.16 The most recent determination that we reviewed was the Wholesale ISDN 30 price control by Ofcom in April 2012. In this determination Ofcom concluded that the real risk free rate should be set at 1.4% based on its review of the yields on 5- and 10-year maturity ILGs⁴⁴. Ofcom's conclusion was based on the analysis it performed for the July 2011 WBA Charge Control, which also concluded on a risk free rate of 1.4%.
- 4.17 This conclusion is consistent with our analysis of the 10-year trailing average of yields on ILGs with a maturity of 10 years, although it appears that Ofcom put more weight on shorter trailing averages and the yields on 5-year ILGs than Ofgem, which explains why it reached different conclusions in July 2011, only four months after the RIIO Strategy Decision was published. Ofcom did not update its analysis between July 2011 and April 2012 on the basis that any further declines in the real risk free rate would have a small net impact on its determination of the WACC. Ofcom concluded that the benefits of maintaining consistency between its regulatory determinations meant that a real risk free rate of 1.4% remained appropriate⁴⁵.

⁴¹ "Network Rail's allowed return", First Economics for ORR December 2011; "Wholesale ISDN30 Price Control", Ofcom, April 2012. We note that Ofcom determined a risk-free rate of 1.4% based on five-year and ten-year average of ILGs with maturities of 5 and 10 years.

⁴² "Bristol Water plc, A reference under section 12(3)(a) of the Water Industry Act 1991", Competition Commission, August 2010, Appendix N, paragraph 150(d).

⁴³ RIIO Strategy Decision – Financial Issues Annex, paragraph 3.70.

⁴⁴ "WBA Charge Control, Charge control framework for WBA Market 1 services", Ofcom, July 2011, paragraphs 6.49 to 6.52.

⁴⁵ "Wholesale ISDN30 price control Annexes", Ofcom April 2012, paragraphs A4.7– A4.17.

- 4.18 The other recent determinations set out above each concluded on a real risk free rate of 2.0%. In its report to ORR in December 2011, First Economics concluded that the real risk free rate has little impact on WACC for companies with beta close to 1, and so maintaining a level of 2.0% despite a fall in yields was an appropriate measure. Although First Economics notes that betas for regulated utility companies have fallen since the previous ORR price control⁴⁶, it concludes that gilt yields prior to the onset of the financial crisis give the best indication of returns to be expected on risk-free assets for the period of the price control⁴⁷. In its determination for Independent Gas Transporters in May 2011, Ofgem noted that yields had fallen below 2.0%, but it applied that rate on the basis that it had never previously used a real risk free rate below 2.0% in a price control; we note that Ofgem considered that this may be generous⁴⁸.

Conclusions on the risk free rate

- 4.19 Recent regulatory precedent provides a range of 1.4% to 2.0% for the risk free rate. The upper end of this range, 2.0%, is the same as the upper end of the range for the risk-free rate adopted by Ofgem in March 2011.
- 4.20 If Ofgem replicated the same approach as it adopted in March 2011, recent market data on real risk free rates suggests that, the lower bound for the risk-free rate range should be reduced from 1.7% to 1.4%.
- 4.21 However, given the current uncertainty over how yields will change during the course of the price control period and the effect of low (and even negative) real interest rates on trailing average yields, it is not clear whether an updated range of 1.4% to 2.0% would be appropriate. It is unclear how yields will change in the future, which means that there is a material risk that a parameter estimate based on current market data (which may place undue weight on low/negative real returns that may not persist in the future) could turn out to inappropriately restrict the allowed returns to the network companies over the price control period.
- 4.22 To the extent that Ofgem continues to rely on its analysis of the yields on ILGs, we recommend that it also reviews the latest available data in the period up to final proposals to ensure that its final determination does not differ materially from rates in the capital markets.

⁴⁶ "Network Rail's Allowed Return", First Economics December 2011. paragraph 2.2.

⁴⁷ "Network Rail's Allowed Return", First Economics December 2011. paragraph 2.1.

⁴⁸ IGT Decision Letter.

Equity risk premium

- 4.23 In the RIIO Strategy Decision, Ofgem estimated an ERP in the range of 4.75% to 5.50%, based on:
- (1) estimates of ERP by Dimson, Marsh and Staunton (“DMS”) in 2011, using historical data on stock market returns in the UK from 3.9% to 5.2%. DMS estimate the ERP to be between 4.0% and 5.5%⁴⁹ (rounded to the nearest 0.5%), depending on whether the ERP is estimated using an arithmetic or geometric average of returns; and
 - (2) the Bank of England’s estimates of ERP implied by using a multi stage dividend growth model. The Bank of England estimated the inter-quartile range of the implied ERP for the UK since 1998 to be 3.75% to 4.75%. The latest estimate of the ERP published by the Bank before March 2011 was its December 2010 report, which estimated the implied ERP at that time to be around 5%⁵⁰.
- 4.24 We have reviewed the latest data available from DMS and the Bank of England, since the RIIO Strategy Decision was published in March 2011.

Updates to estimates of the ERP by DMS

- 4.25 DMS regularly publish updated estimates of the ERP based on historical stock market returns. The latest data available at the time of writing is the 2012 yearbook and the 2012 source book.
- 4.26 They calculate the historical equity risk premium by calculating the average returns (in excess of the risk free rate) from investing in the stock market over a given period of time. This approach implicitly assumes that past returns are a good indicator of the return that investors will demand in the future. The nature of the calculation (being an average over a long period of time) means that when stock markets decline, the average will fall. However, it may well be that in the current circumstances of exceptional market turmoil, investors demand a higher risk premium.

⁴⁹ RIIO Strategy Consultation – Financial Issues Annex, paragraphs 3.68 to 3.70.

⁵⁰ RIIO Strategy Decision – Financial Issues Annex, paragraphs 3.71 to 3.72.

- 4.27 Table 4-4 below shows that the arithmetic and geometric average of excess returns on the stock market are lower when the time period is extended from 1900-2010 to 1900-2011. The reason for this decrease is that returns on the stock market were negative in 2011, while returns on bonds were particularly high⁵¹.

Table 4-4 – DMS estimates of the historical ERP for the UK

Period of estimation	Geometric average (%)	Arithmetic average (%)
	(Low)	(High)
DMS estimates considered by Ofgem:		
1900 to 2005	4.1	5.3
1900 to 2009	3.9	5.2
1900 to 2010	3.9	5.2
DMS estimates since the RIIO Strategy Decision:		
1900 to 2011	3.6	5.0

Sources: (1) "The Worldwide Equity Premium: A Smaller Puzzle", DMS (2006). (2) "The Weighted Average Cost of Capital for Ofgem's Future Price Control, Final Phase I Report by Europe Economics", 1 December 2010. (3) "Equity Premia around the World", DMS, 9 October 2011 update. (4) Credit Suisse Global Investment Returns Sourcebook 2012.

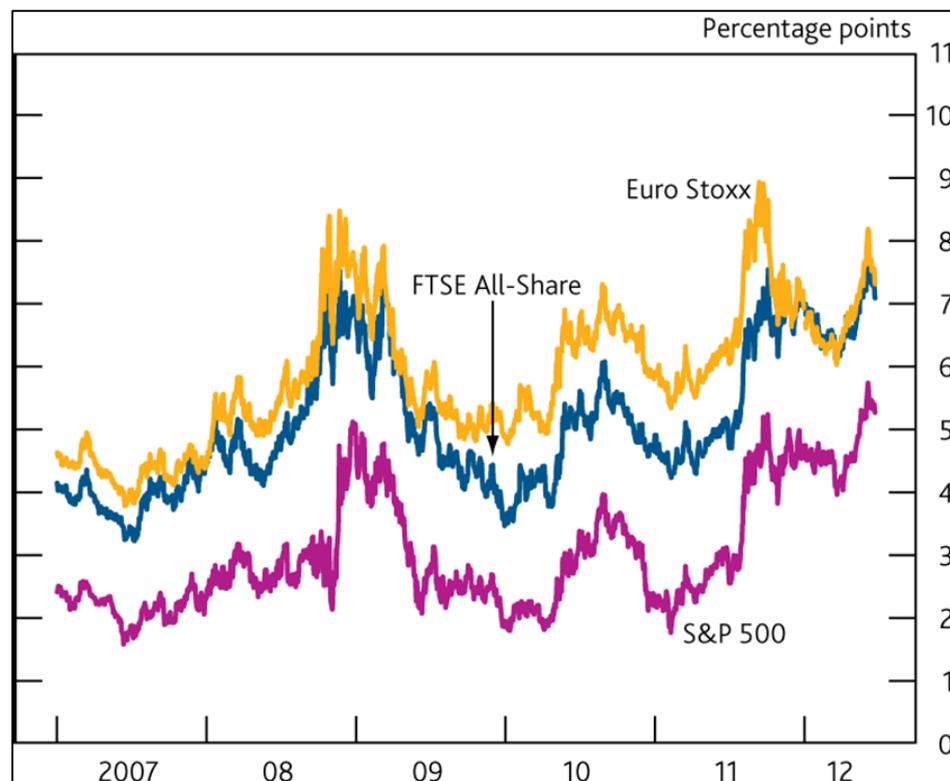
- 4.28 Given the way in which DMS calculate the ERP using historical data, it is not surprising that their estimate of the ERP has decreased after including data for 2011. Their latest figures show that the historical ERP has fallen from 3.9% to 5.2% to 3.6% to 5.0%.
- 4.29 The historical outperformance of equities over bonds, as has been calculated by DMS, is a commonly used basis for estimating ERP. However, we consider that the decline in the historical ERP estimated by DMS represents unusual market conditions in 2011, and so would not represent a meaningful update to Ofgem's analysis. Further, as we explain below, the fall in the estimated historical ERP is inconsistent with changes in the market implied ERP.

⁵¹ Credit Suisse Global Investment Returns Sourcebook 2012, Table 66.

Bank of England estimates of implied ERP

- 4.30 The Bank of England publishes regular estimates of the market implied ERP based on its own analysis using a multi-stage DGM. Ofgem relied on the latest estimates available at the time the RIIO Strategy Decision was published, which were set out in the Bank's December 2010 Financial Stability Report. The bank estimated the implied ERP at that time was around 5%, which was slightly higher than the top of the inter-quartile range of the implied ERP of 3.75% to 4.75% for the period from 1998 to 2010⁵².
- 4.31 The latest Financial Stability Report available from the Bank of England at the time of writing this report is the June 2012 report. We reproduce figure 1.12 from that report in Figure 4-2 below.

Figure 4-2 – Reproduction of Bank of England estimate of the implied ERP



Source: *Financial Stability Report, June 2012, Bank of England.*

⁵² RIIO Strategy Decision – Financial Issues Annex, paragraph 3.71.

- 4.32 Figure 4-2 shows that since December 2010, the market implied ERP estimated by the Bank of England has increased significantly and is now at around 7% for the FTSE All-Share index in the UK. This compares to around 5% in December 2010 (the latest data available when Ofgem published the RIIO Strategy Decision. The current rate is well above the inter-quartile range of 3.75% to 4.75% previously relied upon by Ofgem.
- 4.33 Figure 4-2 also shows that the market implied ERP for the S&P 500 and the Euro Stoxx indices also increased during the same period.
- 4.34 There is evidence that the equity risk premium rises during times of economic crisis⁵³. The recent increases in the market implied ERP shown in Figure 4-2 above may reflect the current uncertainty over the Eurozone crisis. It is unclear how market implied rates will change in the future in light of further developments in the Eurozone and other factors that could affect investors' attitude towards risk.

Recent regulatory precedent

- 4.35 We have also reviewed precedent from UK regulatory determinations since the RIIO Strategy Decision. The table below sets out the rates determined in recent determinations.

⁵³ "Why do risk premia vary over time? A theoretical investigation under habit formation", De Paoli B. And Zabczyk, Bank of England Working Paper No. 361, February 2009. We note that many financial analysts, also consider that estimates of ERP change over the economic cycle; see for example, "Duff & Phelps Decreases U.S. Equity Risk Premium Recommendation to 5.5%, Effective January 15, 2012", Duff & Phelps, January 2012.

Table 4-5 – Recent regulatory precedent on equity risk premium

Year	Regulator	Sector / entity	Estimate (%)
April 2012	Ofcom	Wholesale ISDN 30 price control	5.0
December 2011	ORR*	Network Rail Limited ("Network Rail")	4.4 to 5.0
July 2011	Ofcom	WBA Charge Control	5.0
May 2011	Ofgem	Independent Gas transporters	5.0
April 2011	Uregni	SONI (Electricity systems operator)	4.75

Notes: (1) The figure for ORR is the value proposed by First Economics. ORR has not yet made a determination. (2) ISDN30 price control used the same WACC estimate as the WBA charge control. (3) Ofgem's May 2011 determination stated that this estimate may be generous, in order to compensate for not granting a small company premium. (4) ERP for SONI is calculated as market return less risk-free rate. Sources: Regulatory determinations⁵⁴.

- 4.36 The ERP used in the most recent determinations lie in the range 4.4% to 5.0%. These estimates are consistent with the range proposed by Ofgem. Two precedents – the Ofcom ISDN30 determination and the ORR Network Rail estimate – post date the significant increase in the market implied ERP shown in Figure 4-2.

Conclusion on ERP

- 4.37 The latest historical estimates of the ERP published by DMS suggest that the ERP has decreased from 3.9% - 5.2%, to 3.6% - 5.0%. However, as explained above this reduction arises due to unusual market conditions in 2011. We therefore conclude that it is not appropriate to update Ofgem's analysis based on this result.
- 4.38 The latest data available (December 2011) on the Bank of England's estimate of the market implied ERP shows that the market implied ERP has increased from around 5% when the RIIO Strategy Decision was published to 7% at December 2011. This is materially higher than the inter-quartile range published for the Bank of England's market implied ERP from 1998 to 2010 (we note that the Bank of England does not publish an inter-quartile range for its estimates of the market implied ERP over this period).
- 4.39 Recent regulatory determinations since the RIIO Strategy Decision have used a range of estimates for the ERP from 4.4% to 5.0%. This range is consistent with Ofgem's previous conclusion that the ERP should be between 4.75% to 5.5%.

⁵⁴ "Network Rail's allowed return", First Economics for ORR, December 2011; "Wholesale ISDN30 Price Control", Ofcom April 2012; IGT Decision Letter; WBA Charge Control Statement; and "SONI Price Control – Decision Paper", Uregni, April 2011.

- 4.40 Based on the information we have considered, Ofgem should either maintain its current range for the ERP or update it to reflect the recent increases in the market implied ERP. The most appropriate approach depends on how market conditions change up to and during the price control period. Given the uncertainty in the market at the moment, we are unable to take a view on how the market implied ERP will change over this period. We therefore recommend that Ofgem continues to review the Bank of England's latest estimates of the ERP and gives necessary weight to any changes in the period up to final proposals for the 2013/21 Price Controls.
- 4.41 Given the evidence that, over the long-run, the market return on equity appears to be relatively stable given the variability in the ERP and risk-free rate, any updates to the ERP should be considered alongside movements in the risk-free rate.

Equity beta

- 4.42 In the RIIO Strategy Decision, Ofgem estimated an equity beta in the range 0.90 to 0.95, after taking into account⁵⁵:
- (1) estimates of the equity beta of National Grid PLC and SSE, calculated by Europe Economics, of 0.55 to 0.65⁵⁶;
 - (2) the estimate of equity beta used in Ofgem's determination in the most recent price control for electricity distribution network operators in 2010 ("DPCR5") of 0.9; and
 - (3) the risks faced by GDNs and TOs during the 2013/21 Price Controls. In particular, Ofgem considered the significant investment programme required by some of the network companies during the upcoming price control period, and risks about future network usage.

⁵⁵ RIIO Strategy Decision – Financial Issues Annex, paragraph 3.76.

⁵⁶ "The Weighted Average Cost of Capital for Ofgem's Future Price Control Report III", Europe Economics, March 2011, paragraph 2.40.

- 4.43 The range adopted by Ofgem of 0.90 to 0.95 is based primarily on (2) and (3) above. In the RIIO Strategy Decision, Ofgem noted that Europe Economics had identified a sharp fall in beta for SSE and National Grid PLC. However, they did not reflect this fall in the decision⁵⁷:

“With this being a sharp and drastic change, we do not think it would be appropriate for us to rely on the latest data [on equity betas for National Grid and SSE] in determining the equity beta for RIIO-T1 and GD1. However, we will monitor the situation in the lead-up to final proposals”.

- 4.44 We have reviewed recent regulatory precedent on beta since the RIIO Strategy Decision and updated the beta estimates performed by Europe Economics, although we place limited weight on those updates given the scope of this report and the emphasis placed by Ofgem on other factors in the Strategy Decision Paper.

Recent regulatory precedent

- 4.45 We summarise recent regulatory determinations in the UK on the equity beta in Table 3-6 below. The relevance of these determinations is limited, however, by the fact that betas applied by the regulators (other than Ofgem) are specific to the industries or companies they are considering and are not directly comparable to the betas relevant to the companies regulated by Ofgem in the 2013/21 Price Controls.

Table 4-6 – Recent regulatory precedent on equity beta

Year	Regulator	Sector / entity	Estimate
April 2012	Ofcom	Wholesale ISDN 30 price control	0.87 to 1.14
December 2011	ORR*	Network Rail	0.35 [asset beta]
July 2011	Ofcom	WBA Charge Control	0.87 to 1.14
May 2011	Ofgem	Independent Gas transporters	1.0
April 2011	Uregni	SONI (Electricity systems operator)	0.88

Notes: (1) The figure for ORR is the value proposed by First Economics. ORR has not yet made a determination. (2) ISDN30 price control used the same WACC estimate as the WBA charge control. (3) Ofgem’s May 2011 determination stated that this estimate may be generous. Sources: Regulatory determinations⁵⁸.

⁵⁷ RIIO Strategy Decision, Financial Issues Annex, paragraph 3.74.

⁵⁸ “Network Rail’s allowed return”, First Economics for ORR, December 2011; “Wholesale ISDN30 Price Control”, Ofcom April 2012; IGT Decision Letter; WBA Charge Control Statement; and “SONI Price Control – Decision Paper”, Uregni, April 2011.

- 4.46 Recent regulatory precedent suggests a range of 0.9 to 1.1 (excluding ORR⁵⁹) for the equity beta of regulated companies. This is consistent with the range adopted by Ofgem in the RIIO Strategy Decision of 0.90 to 0.95. However, we note that two of these examples may be higher than might be expected for the network companies:
- Ofgem noted that independent gas transporters may have higher betas than more established utility sectors⁶⁰; and
 - Uregni noted that SONI has exceptionally high operational gearing which leads to higher equity betas⁶¹. Further, SONI is a system operator, which does not own an electricity transmission network. In this sense, it is less comparable, as it is not an infrastructure company.
- 4.47 Both of Ofcom's determinations were based on a range for the part of BT excluding Openreach, as Ofcom considers Openreach and the rest of BT to have differing risk profiles⁶². Openreach may be more comparable to the network companies than the rest of BT. We recognise that this reduces the comparability of these estimates to the network companies.
- 4.48 We note that many of the recent regulatory determinations have stated while market estimates of beta have fallen due to the impact of the credit crisis, they have decided not to consider this in their determinations⁶³. This suggests that they consider that the observed reduction in covariance with the market during the credit crisis is unlikely to be representative of future periods.
- 4.49 We consider that, similarly, Ofgem should not take into consideration recent market evidence indicating that the equity beta has fallen, as this may reflect the effects of unusual market conditions during the credit crisis, which may not be representative of the future.

⁵⁹ ORR's 2013 review decision has not yet been published. The figure stated in Table in 3-8 is an estimate by of beta by First Economics, who are advising ORR. We note, however, that First Economics have proposed that Network Rail have similar cost of capital assumptions to those of regulated gas and utility companies, which suggests that the regulator may adopt a higher estimate of beta as part of its decision. See "Network Rail's Allowed Return", First Economics, December 2011 paragraph 2.2.

⁶⁰ IGT Decision Letter, page 3.

⁶¹ "SONI Price Control 2012-15", Uregni April 2011 paragraphs 8.2 and 8.3.3.

⁶² WBA Charge Control Statement, paragraph 6.97 to 6.102.

⁶³ For example, WBA Charge Control Statement, paragraph 6.99.

Estimates of beta for National Grid PLC and SSE

- 4.50 As explained above, Ofgem placed little weight on the estimates of beta calculated by Europe Economics for National Grid PLC and SSE. Nevertheless, we have updated their analysis to take into account the latest data available.
- 4.51 The range of estimates prepared by Europe Economics was based on:
- estimates of the equity beta of listed UK energy network companies. In particular, they estimated beta using 12-months of daily data. Their estimate of beta was based on the interquartile range of rolling beta estimates over the preceding five years;
 - asset betas for other utility companies (including UK water companies and European energy utilities); and
 - regulatory precedent.
- 4.52 Our analysis is limited to a review of the equity betas of UK energy network companies. We have been able to replicate Europe Economics beta calculations and have updated those calculations using recent market data. These estimates are set out in Table 4-7 below.

Table 4-7 – Updated estimates of equity beta for the UK energy sector⁶⁴

Estimates	Europe Economics, March 2011	FTI update, May 2012
Using one year of daily data (95% confidence interval)	0.52 (0.42 to 0.62)	0.45 (0.36 to 0.53)
Using two years of daily data (95% confidence interval)	0.45 (0.38 to 0.52)	0.48 (0.42 to 0.54)

Notes: (1) figures presented for Europe Economics are the point estimates and 95% confidence interval estimate. (2) The FTI estimates use data from 10/05/2011 to 09/05/2012 and 10/05/2010 to 09/05/2012 respectively. (3) The confidence intervals are estimated using OLS standard errors. Sources: Bloomberg. FTI Analysis. "The Weighted Average Cost of Capital for Ofgem's Future Price Control, Phase III Report by Europe Economics", 22 March 2011, tables 2.2 and 2.3.

⁶⁴ We have performed a regression of daily returns for the sector against daily returns on the FTSE All share. We have calculated the average daily returns for the sector as the market-capitalisation weighted average of the returns for National Grid, SSE and Scottish Power (for the period that it was listed). This is consistent with the method described in Appendix 1 of "The Weighted Average Cost of Capital for Ofgem's Future Price Control, Final Phase I Report by Europe Economics", 1 December 2010.

- 4.53 Our estimates of beta using the latest market data for a one year daily beta are lower than the equivalent figures at March 2011. However, the May 2012 beta lies within the confidence interval at March 2011.
- 4.54 The current two year daily beta is slightly higher than the equivalent figures at March 2011. Overall the range between the one year and two year beta estimates has narrowed – from 0.45-0.52 to 0.45-0.48.
- 4.55 In summary, our updated calculation of Europe Economics beta estimates suggests that betas have not changed materially since March 2011.
- 4.56 Given the limited weight Ofgem placed on these estimates in the RIIO Strategy Decision, there does not seem to be any reason for Ofgem to change its assumptions as to the appropriate beta given the latest data available.

Conclusion on equity beta

- 4.57 We have not identified any evidence to suggest that Ofgem should update its range for beta in light of either recent regulatory precedent or recent market conditions.

Overall conclusion on CAPM parameters

- 4.58 Our review of recent regulatory precedent shows that Ofgem's determinations in the RIIO Strategy Decision are consistent with recent regulatory determinations on the cost of equity in the UK.
- 4.59 Our review of the effect of recent market conditions on the input parameters estimated by Ofgem showed that there have been material movements in the real risk free rate (based on the yield of ILGs) and the market implied ERP (based on analysis by the Bank of England). There is significant uncertainty over the way in which market conditions will change in the periods up to and during the 2013/21 Price Controls.
- 4.60 We conclude that the most significant changes to the CAPM analysis relied upon by Ofgem in its Strategy Decision are the movements in the yields on ILGs and the market implied ERP. Yields on ILGs have decreased significantly since the RIIO Strategy Decision and are currently negative in real terms. At the same time, market implied estimates of the ERP have increased significantly from around 5% in March 2011 to around 7% based on the latest data available from the Bank of England.

- 4.61 However, given the current uncertainty over how these parameters will change in the future, it may be premature to make any revisions to Ofgem's assessment of the cost of equity, based on data that could turn out to be unduly influenced by short term fluctuations. Instead, we consider that Ofgem should monitor changes in these parameters in the period up to final proposals for the 2013/21 Price Control.
- 4.62 We recommend that, in considering any updates, Ofgem should continue to consider whether the estimates of ERP and risk-free rate applied are reflective of the likely cost of equity for network companies during the 2013/21 Price Controls.

5. Alternative approaches to estimating the cost of equity⁶⁵

Introduction

- 5.1 The most commonly applied method for estimating the cost of equity is the CAPM. It is the model most often used by regulators in the UK⁶⁶. However, it is widely recognised that the CAPM has certain flaws – in particular, there are often large uncertainties in parameter estimation, and the empirical evidence for its success in predicting returns is weak⁶⁷.
- 5.2 Given the uncertainties in the estimation of CAPM parameters it can be useful to cross-check results derived from the CAPM with other methods for estimating the cost of equity. This is consistent with the approach taken by Ofgem in the RIIO Strategy Decision, where Ofgem noted that although its analysis was based on the CAPM, it should be “*sense-checked by other approaches*”⁶⁸.
- 5.3 In this section, we consider two models as potential cross checks to our analysis of the cost of equity:
- (1) the DGM; and
 - (2) the RIM.
- 5.4 We consider the relative merits of using each model as a cross check, comment on estimates of the cost of equity prepared by National Grid in its submissions to Ofgem, and present our own calculations.

⁶⁵ In this section, references to ‘National Grid’, refer to submissions by NGET, NGGD and NGGT collectively; or the listed entity National Grid Plc.

⁶⁶ Sudarsanam, S (2011), ‘*Cost of Equity for Regulated Companies: An international Comparison of Regulatory Practices*’, page 37. We refer to this paper as “Sudarsanam (2011).”

⁶⁷ “*Toward an Implied Cost of Capital*”, Gebhardt W., Lee C, and Swaminathan B, Journal of Accounting Research, Vol. 39 No. 1 (Jun., 2001), page 136

⁶⁸ RIIO Strategy Decision - Financial Issues Annex, paragraph 3.4.

Dividend Growth Model

5.5 The DGM is a model for estimating the value of the equity of a company based on its expected dividends and growth. The DGM assumes that the share price of a company is equal to the present value of future expected dividend payments, discounted at the cost of equity.

5.6 Since the equity value of a listed company can be observed by reference to the price at which its shares are traded, the DGM can also be used to calculate an implied cost of equity from the current market share price and future dividend growth expectations as follows:

$$k_e = \frac{D_0 \times (1 + g)}{P_0} + g$$

5.7 where:

5.8 k_e is the post-tax cost of equity;

5.9 D_0 is the current dividend;

5.10 g is the dividend growth rate (assumed to be constant in this example); and

5.11 P_0 is the current share price.

5.12 To estimate the cost of equity using a single stage version of the DGM, information is required on the value of the share and estimates of future dividends into perpetuity. Alternative specifications of the DGM can be prepared that include explicit forecasts of dividends for a number of years followed by constant dividend growth in the future (potentially with a gradual transition between these assumptions). These multi-stage models allow dividends to deviate from their long term trend over an explicit forecast period before moving back to the long term trend into perpetuity.

5.13 The DGM is an established model that is often used in commercial contexts to value shares in publicly traded and private businesses. It is also used by regulators in the United States to estimate the cost of equity⁶⁹.

5.14 In this subsection, we discuss the strengths and weaknesses of the DGM, comment on National Grid's estimates of the cost of equity using DGM and set out own estimates using the DGM.

⁶⁹ Sudarsanam (2011), page 37.

Strengths and weaknesses

- 5.15 The principal advantages of DGM are that:
- (1) DGM provides a forward-looking estimate of investors' required return on equity; and
 - (2) DGM requires fewer parameter estimates than CAPM.
- 5.16 However, estimating cost of equity for a company using the DGM has a number of drawbacks. In particular:
- (1) it is highly sensitive to the assumptions about the future growth rate of dividends. In our view, it is an imprecise tool for estimating the cost of equity at the level of an individual firm;
 - (2) analyst estimates of earnings (and dividends) often suffer from optimism bias⁷⁰, which may lead to the model overstating the cost of equity;
 - (3) estimates are sensitive to the specification of the model, including the number of stages considered;
 - (4) estimates are sensitive to changes in the share price of the underlying company. This can be problematic if market factors cause the share price to deviate significantly from fundamental value at the time of assessment;
 - (5) real options increase uncertainty of earnings estimates⁷¹; and
 - (6) estimates for individual companies are significantly less robust than for indices or industries.
- 5.17 There are also a number of drawbacks specific to regulated utilities⁷²:
- (1) investors' expectations of returns are conditioned on the regulatory framework the company operates in. Accordingly regulatory estimates of cost of equity using DGM may introduce circularity into the process of identifying a reliable cost of equity figure;
 - (2) the estimate relates to the whole business, not just the regulated units; and
 - (3) if cost of equity is determined using comparable companies, there may only be a limited number of directly comparable companies.

⁷⁰ See discussion in Sudarsanam (2011), pages 11 to 12.

⁷¹ Sudarsanam (2011), page 14.

⁷² We note that to some extent, these may also apply to the CAPM.

- 5.18 As a result, we consider that the DGM is more useful as a cross-check for understanding what a particular cost of equity implies in terms of input assumptions and therefore whether the estimate appears reasonable, rather than being a primary method for determining the cost of equity.

National Grid's estimates of the cost of equity using DGM

- 5.19 National Grid estimated the cost of equity for SSE and National Grid PLC to be 8.7% and 9.2%, respectively. These estimates were based on a one-stage DGM using a long-term dividend growth rate of 2.2%, using estimates of forecast growth of UK Gross Domestic Product ("GDP")⁷³. These estimates are higher than the cost of equity range estimated using CAPM in the RIIO Strategy Decision.
- 5.20 National Grid also presented sensitivities using a long-term dividend growth rate of zero%, resulting in estimates of 6.5% and 7.0% for SSE and National Grid PLC. While the assumption of nil growth might be extreme, this analysis shows that a change in the growth rate can have a large effect on the estimate of cost of equity.
- 5.21 National Grid also presented results of a two-stage DGM used to estimate the cost of equity for SSE and National Grid PLC over the period 2000 to 2010. The estimates of cost of equity in 2011 for SSE and National Grid PLC using this model are approximately 8.0%, and the average cost of equity for National Grid PLC over the last 10 years was estimated to be 7.5%.

⁷³ NGET: paragraph 499.

Our assessment of the cost of equity of National Grid PLC and SSE using DGM

- 5.22 We have performed our own calculations of the cost of equity using the DGM. We have estimated the implied cost of equity using a DGM model for National Grid PLC and SSE. Our model is specified as:
- A two-stage model using three years of explicit dividend forecasts, after which we apply a dividend growth rate to calculate a terminal value.
 - Consensus analyst estimates of dividend per share using ‘Bloomberg Estimates’⁷⁴.
 - Long-term real dividend growth rates of 0.46% (the historical long-term dividend growth rate for the UK)⁷⁵ to 2.4% (long-term historical GDP growth rate over the period 1950 to 2010)⁷⁶. We note that the average of consensus forecast UK GDP growth in 2012 to 2016 is approximately 1.8%, i.e. it lies within this range⁷⁷.
 - Share price and consensus forecast data as at 29 November 2011 for National Grid PLC and 27 July 2011 for SSE, being the ex-dividend date for the most recent final dividend paid for each.
- 5.23 We estimate the cost of equity, using growth rates of 0.46% and 2.4%, to be:
- 6.8% to 8.6% for National Grid PLC.
 - 6.3% to 8.1% for SSE.
- 5.24 By comparison, the estimates presented by National Grid were approximately 8.0%⁷⁸, for both companies.
- 5.25 We note that we would not expect the cost of equity for these companies to be the same. This is because there are differences in the risk exposure of the listed entities.

⁷⁴ Consensus estimates as at last available date prior to the ex-dividend date.

⁷⁵ “*Equity Premia around the World*”, DMS, 9 October 2011 update.

⁷⁶ “*Bristol Water plc, A reference under section 12(3)(a) of the Water Industry Act 1991*”, Competition Commission, August 2010, Appendix N, paragraph 89(b).

⁷⁷ “*Forecasts for the UK economy: a comparison of independent forecasts*”, HM Treasury, May 2012.

⁷⁸ NGET: paragraph 500.

- 5.26 We have also assessed the sensitivity of our estimates to changes in the key input parameters – in particular, the long term dividend growth rate and the value of the share price used in the analysis. Our sensitivity analysis for National Grid PLC is set out at Appendix 2⁷⁹.
- 5.27 In summary, we find that our model is sensitive to both the long term dividend growth rate and the share price at the date of estimation. We estimate the cost of equity for National Grid PLC ranges between 6.8% and 8.6%, assuming dividend growth between 0.46% (the historical long-term dividend growth rate for the UK) and 2.4% (forecast long-term GDP growth in the UK). Decreasing and increasing the share price used in the DGM by 15% points around the price as at 1 June 2011, results in a range of 7.8% to 9.7% for the cost of equity, around a central case of 8.6%.
- 5.28 These estimates are for the listed companies. We have not attempted to use these to develop specific estimates of the network companies' cost of equity.
- Our assessment of the cost of equity of water companies using DGM***
- 5.29 Ofgem have asked us to estimate the cost of equity of listed water companies using a DGM. They consider this to be a relevant reference point for considering the cost of equity of the network companies.
- 5.30 We have estimated the implied cost of equity using a DGM model for three listed water companies: Severn Trent, Pennon Group (owner of South West Water Limited), and United Utilities.
- 5.31 We have specified the DGM in the same way as for National Grid PLC and SSE, as described above.
- 5.32 In the table below, we set out the cost of equity for each of the listed water companies, estimated using a DGM, assuming dividend growth of 0.46% (the historical long-term dividend growth rate for the UK), 1.8% (forecast GDP growth), and 2.4% (historical long-term GDP growth in the UK).

⁷⁹ The results are similar for SSE. For simplicity, we present only the results for National Grid.

Table 5-1 – Estimates of cost of equity for Water Companies using a DGM

Year	Long-term GDP growth rate		
	0.5%	1.8%	2.4%
Severn Trent	5.5%	6.7%	7.3%
Pennon Group	4.6%	5.9%	6.4%
United Utilities	6.0%	7.2%	7.8%

Notes: We have used the most recent price and forecast data as at the ex-dividend date for each of these companies, being 22 June 2011, 10 August 2011 and 20 June 2011 for each company respectively.

- 5.33 The cost of equity estimated for the listed water companies using a DGM lies in the range 4.6% to 7.8%. By comparison, the cost of equity for National Grid PLC and SSE using the same range of long-term GDP growth rates is 6.3% to 8.6%. The cost of equity, estimated using a DGM, of the listed water companies is lower than the cost of equity estimated for National Grid PLC and SSE. It is possible that this reflects the larger share of regulated activities in the listed water companies.

Conclusions on DGM

- 5.34 For the reasons discussed above, we consider that the DGM is more useful as a cross-check for understanding what a particular cost of equity implies in terms of input assumptions and therefore whether the estimate appears reasonable, rather than being a primary method for determining the cost of equity.
- 5.35 We consider that as a cross-check to the CAPM, a reasonable range of estimates for National Grid PLC using a DGM lies in the range **6.8% to 8.6%**. This is the range of estimates using terminal growth rates between the historical long-term dividend growth rate for the UK (0.46%) and the GDP growth rate (2.4%). The range of estimates for SSE using these terminal growth rates is **6.3% to 8.1%**. Whilst these estimates are higher than Ofgem's range using the CAPM, we would expect the DGM to provide higher results due to the optimism bias in analysts' estimates. Accordingly, we conclude that the range of estimates using a DGM is consistent with Ofgem's range of estimates of the cost of equity using the CAPM.

Residual Income Model

- 5.36 The RIM is normally used to estimate the value of the equity of a company. The value of a company's equity is estimated by discounting residual income to a present value which is added to the book value of equity. Residual income is calculated as a company's earnings in excess of its cost of capital. As a result, the residual income component of share holder value tends to be small relative to the component attributed to the book value of equity.

- 5.37 In summary, the RIM estimates the value of a company as the initial book value (i.e., invested capital) plus the present value of residual income (i.e., value expected to be created), with residual income discounted at the cost of equity:

Key assumptions of RIM

Market value of equity = Book value of equity + Present value of future residual income

Residual income = Net Income – (Book value of equity x Required return on equity)

- 5.38 In a similar way to the DGM, the RIM can be respecified to calculate an implied cost of equity given the current market price of a share and estimates of the future residual income from the company in question. However, the RIM also requires information on the book value of equity for the company in question.
- 5.39 The model assumes that changes in the book value of a company can be calculated using a 'clean surplus' relationship, such that:

Book value at time (t) = Book value at time (t-1) + Net income in (t-1)
– Dividends paid in (t-1)

Advantages and disadvantages of the Residual Income Model

- 5.40 The principal advantages of the RIM are that:
- (1) the RIM provides a forward-looking estimate of investors' required return on equity; and
 - (2) the RIM recognises a large proportion of the value of a business in the book value of equity. Compared to some other forward looking methods (such as the DGM), this makes the estimate less sensitive to estimates of future earnings growth. However, it has the disadvantage that it is more dependent on the quality of accounting data and the assumption that book value reflects economic value.

- 5.41 The drawbacks listed in paragraphs 5.16 to 5.17 above in respect of the DGM also apply to the RIM. Further issues with the RIM, in particular, include:
- (1) the RIM relies on accounting measures of earnings and book value. This can be problematic because: (a) estimates are influenced by accounting standards; (b) accounting earnings can be subject to manipulation; (c) the clean surplus rule is often violated due to accounting rules that allow direct-to-equity adjustments; (d) the book value of equity may not reflect the impact of off-balance sheet assets and liabilities, the fair value of assets and liabilities, and the value of intangible assets⁸⁰; and
 - (2) earnings forecast by analysts often differ from earnings calculated in accordance with accounting standards.

Estimates of the cost of equity using the RIM

- 5.42 KPMG estimated a range for the real cost of equity for National Grid PLC of 6.1% to 7.9%, which it adjusted to 6.6% to 8.5%, based on assumed gearing of 55.0% as set out in National Grid's business plan⁸¹. KPMG used a three-stage model, and calculated the cost of equity for each year from 2006 to 2011. The main parameters of the model are:

- **years 1-3:** used analyst forecasts of earnings per share ("EPS") and dividends per share ("DPS");
- **years 4-8:** estimated earnings by assuming the growth rate declines gradually from the rate in years 1 to 3 (estimated to be 10%) to a long-term growth term rate of 4%, assuming a dividend payout ratio of 60%⁸²; and
- **Terminal value:** estimated earnings using a terminal growth rate of 4%, and a dividend payout ratio of 60%.

⁸⁰ We note that these issues are likely to be particularly acute for KPMG's estimate for the FTSE 100. By contrast, utility companies are less likely to have significant intangible assets on their balance sheets that are not captured in this analysis.

⁸¹ KPMG also prepared estimates of cost of equity, based on the FTSE 100 index. We do not consider those estimates here. See: KPMG report, 'A Residual Income Model estimate of the cost of equity', dated February 2012.

⁸² The EPS forecasts we have seen do not include growth rates of 10% for the three year forecast period for any of the years 2006 to 2010.

- 5.43 We have performed sensitivity analysis of the findings of the KPMG model. We have tested the sensitivity of this model to changes to:
- the long-term earnings growth rate; and
 - the share price at the date of estimation.
- 5.44 Our sensitivity analysis is set out in Appendix 3. Based on our sensitivity analysis, we consider that a reasonable range based on this model would be 5.0% to 9.0%.

Conclusions on RIM

- 5.45 As explained above, the RIM is heavily dependent on the quality of accounting information that is used to calculate book value. For companies with significant intangible assets or assets that are not recorded at market values, this can lead to distortions in the implied cost of equity. This is especially the case if RIM is used to estimate ERP (as KPMG has done).
- 5.46 The RIM is not as widely used as the DGM or the CAPM (by a significant order of magnitude) in either commercial or regulatory contexts.
- 5.47 Our analysis suggests that the RIM model used by KPMG is likely to be sensitive to the long term growth rate and share price used to estimate the cost of equity. In this respect, it is subject to many of the same drawbacks as the DGM, including the possible optimism bias inherent in analyst views which may lead to the model overstating the cost of equity.
- 5.48 Using a reconstructed version of the KPMG model, and based on our own sensitivity analysis, we estimate a range for the cost of equity of **5.0% to 9.0%** using the RIM model. We consider that this range is too wide to provide a reliable basis for estimating cost of equity for the 2013/21 Price Controls. In addition, given the reliance of the model on accounting data and the other issues outlined above, we place relatively little weight on this result.

6. Risk during the 2013/21 Price Controls relative to previous price controls

Introduction

- 6.1 The cost of equity represents the rate of return required by equity investors for taking on risk. In particular, it is the return required for taking on non-diversifiable risk. If the level of non-diversifiable risk to equity investors will be higher during the 2013/21 Price Controls relative to previous price control periods, then the required rate of return of equity investors will also increase.
- 6.2 The 2013/21 Price Controls differ from previous price control periods in a number of significant aspects, including the introduction of the RIIO Framework, the adoption of Ofgem's revised pension principles, and significant levels of new investment by some network companies. Some of these differences may affect the level of risk faced by the network companies.
- 6.3 In their business plan submissions, the network companies have raised a number of issues regarding the relative level of risk between the 2013/21 Price Controls and previous price controls. Additionally, several network companies have used risk modelling to estimate changes in risk from these factors quantitatively, by estimating variability (in terms of the standard deviation) of returns or cash flows they expect to generate, and the corresponding required increase in the cost of equity.
- 6.4 In this section, we comment on specific points raised by the network companies in their business plan submissions about changes in risk during the 2013/21 Price Controls that we have been asked to consider by Ofgem. Specifically, we consider the effect of the following changes on risk:
- (1) The increase in the length of the price control period under the RIIO Framework.
 - (2) Changes to the arrangements for funding of pension costs, including the requirement for network companies to bear the risk of unforecasted pension liabilities arising from the start of the 2013/21 Price Controls.
 - (3) The large capital investment programme that some network companies will be required to undertake during the 2013/21 Price Controls.

- 6.5 For each change, we: (1) explain our understanding of the change, (2) summarise the views set out by the network companies, and (3) comment on the impact of that change on the level of risk faced by the network companies.
- 6.6 In the next section of this report, we comment on the risk modelling used by the network companies to quantify the impact of changes in risk between the 2013/21 Price Controls and previous price controls.

Length of price control period

- 6.7 Under the RIIO Framework, the length of the price control period has been increased from five to eight years.
- 6.8 The network companies have raised a number of points as to how these changes may increase or decrease the level of risk they face. The following issues raised by the network companies suggest that the level of risk will increase with a longer price control period⁸³:
- (1) **There is greater parameter uncertainty:** Network companies and Ofgem are required to estimate costs that are further in the future, and hence there will be greater uncertainty around these parameter estimates.⁸⁴ This risk will be increased in price controls where the network companies are required to undertake large amounts of capital expenditure, the scope of which may be incorrectly forecast⁸⁵. We agree that this may increase the level of risk faced by network companies.
 - (2) **The effect of estimation errors will persist for a longer period:** If there are any cost or revenue shocks that materially affect the network companies, a longer period will elapse before the price control can be reset. This may increase the volatility of potential returns over the price control period⁸⁶. Again, we agree in principle that this may increase the level of risk faced by network companies.

⁸³ National Grid raised the issue that any increases in variability of returns may increase financeability risks (see NGET: paragraph 329). We do not comment on this issue, as issues of financeability are outside the scope of this report.

⁸⁴ NGET: paragraph 327, NGGD1: paragraph 2.16.

⁸⁵ NGET: paragraph 338.

⁸⁶ WWU1: pages 20 and 23.

- (3) **The passage of time may increase regulatory risk:** *“the longer elapsed time between reviews may encourage the regulator to consider it appropriate to change the regime, and will almost certainly reduce the ‘corporate memory’ among the regulatory staff”*⁸⁷. We agree that the passage of time may reduce ‘corporate memory’. Although, it is not clear why, on the face of it, a longer period elapsed between price controls should increase the incentives to change the regulatory regime to the detriment of network companies.
- 6.9 The network companies also mentioned issues that suggest that the level of risk will decrease with a longer price control period:
- (1) **More certainty about regulatory framework:** Longer price control periods provide investors and management of network companies with certainty about the regulatory framework for a longer period of time⁸⁸. We agree that this may decrease the level of risk faced by the network companies.
- (2) **Reduced number of price controls:** The reduced frequency of price controls *“reduces the scope for bad regulatory outcomes by reducing the number of price reviews”*⁸⁹, where the ‘bad outcomes’ identified are changes to established policies or changes to the ‘regulatory contract’.
- 6.10 Some network companies have argued that the risks discussed above will have an overall upwards effect on the cost of equity. For example, one network company estimated that the impact of the increased length of price control periods would be to increase asset beta by up to 0.05⁹⁰.
- 6.11 On balance, we consider that the increased length of the price control will increase the variability of returns of the network companies. This is because of the effect of increased parameter uncertainty and the potential for such forecasting errors to persist over a longer period.
- 6.12 This increase in risk may be mitigated by the inclusion of efficiency incentives and uncertainty mechanisms in the 2013/21 Price Controls.
- 6.13 The effect of any increase in risks should only increase the cost of equity if these risks are non-diversifiable.

⁸⁷ NGET: paragraph 246.

⁸⁸ NGET: paragraph 80(c).

⁸⁹ NGET: paragraph 246.

⁹⁰ WWU1: section 4.2.1.1, page 23. We do not know the basis for WWU’s view that asset beta should be increased by 0.05.

- 6.14 In the following paragraphs, we comment on the effect of certain uncertainty mechanisms, and the extent to which these risks are non-diversifiable.

Factors mitigating additional risks

- 6.15 Under the RIIO Framework, revenue allowances will be updated annually to adjust for a number of factors, including the effect of:
- (1) efficiency incentives; and
 - (2) uncertainty mechanisms, including ‘revenue drivers’.
- 6.16 We describe each of these, and their effect on the increased risks faced by the network companies identified above⁹¹.
- 6.17 Under the RIIO Framework, operating costs and capital expenditure (collectively ‘totex’) will be subject to an efficiency incentive mechanism. As a result, network companies will share the consequences of any over- or underspend with consumers; Ofgem has indicated that the sharing rate will be in the range of 40% to 60%⁹².
- 6.18 In the context of the RIIO Framework, “Revenue Drivers” are defined as: “A means of linking revenue allowances under a price control to specific measurable events which are considered to influence costs.”⁹³ For example, if additional entry/exit capacity will be required on the network.

⁹¹ We discuss these mechanisms as described in the RIIO Strategy Documents. We do not consider any changes of these relative to previous price controls.

⁹² RIIO Strategy Decision, paragraph 5.27.

⁹³ “*Glossary of terms: RIIO-T1 and GD1 review*”, Ofgem, 17 December 2010.

6.19 We comment below on the effect of these mechanisms on the arguments that risks will be increased, identified in paragraph 6.8:

- (1) **There is greater parameter uncertainty:** The efficiency incentive mechanisms will reduce the extent to which network companies bear the risk of variations or forecasting error in cost estimates. Accordingly, this will mitigate some though not all of the increased risk of parameter uncertainty.
- (2) **The effect of estimation errors will persist for a longer period:** The annual updating of revenue allowances will mean that efficiency incentives will be reflected in revenues sooner than in previous price controls. However, if there are systematic errors in cost forecasts, the increased length of the price control period will increase the period of time that elapses before these can be reset. Systematic errors in cost forecasts may occur, for example, due to a permanent shift in input prices. The use of Revenue Drivers will reduce risks around the scale of certain investments.
- (3) **The passage of time may increase regulatory risk:** Ofgem will need to monitor the performance of the network companies in order to carry out the annual updates of revenues allowances. Accordingly, this may limit the extent of any reductions in '*corporate memory*' amongst regulatory staff.

6.20 Additionally, we note that the change in the level of risk arising out of a longer price control period is limited to the last three years of the price control that would not have been included in a five-year price control.

Extent to which risks are diversifiable

6.21 The effect of the increases in risks described above on the cost of equity depends on the extent to which these new risks are diversifiable. The returns required by equity investors are determined by risks that are not diversifiable. Many of the effects described above appear to be, at least in part, diversifiable. In particular:

- (1) **Parameter uncertainty:** Network companies may have overestimated or underestimated forecast costs. However, to the extent this occurs, it is likely to be firm-specific or sector specific (e.g. if there is a collective understatement of the likely costs of certain expenditures). Such forecasting errors are unlikely to be correlated with the wider economy in all circumstances. However, we note that where an under- or overstatement occurs because of a general macro-economic cost shock, then it is possible that parameter uncertainty increases non-diversifiable risk.

- (2) **The effect of estimation errors will persist for a longer period:** This issue is linked to the issue of parameter uncertainty. To the extent that estimation errors are diversifiable, the length of time they last will not affect a company's cost of equity. However, any non-diversifiable parameter uncertainty will be affected by the longer price control period.
- (3) **Regulatory risk:** Some network companies have argued that regulatory risk is related to governments and regulators' response to consumers' willingness/ability to pay, which is determined by wider economic factors⁹⁴. This risk is more likely to occur at the extremes of macro-economic trends (such as, in times of economic distress or high inflation) rather than under normal conditions.

6.22 One network company presented an estimate of the proportion of additional risk during the 2013/21 Price Controls that is diversifiable. We comment on that analysis in Section 7.

Conclusion on length of price control

- 6.23 Overall, we consider that the level of variability of returns is increased by the increase in the length of the price control. However, the extent to which this increase in risk should increase the required return on equity depends on whether these additional risks are diversifiable.
- 6.24 The extent of any increases in risks will be mitigated, in part, by factors including sharing and uncertainty mechanisms, and a reduction in the level of regulatory risk.

Pension risk

- 6.25 In the 2013/21 Price Control, Ofgem is introducing changes to the treatment of pension costs relative to previous price controls⁹⁵. Several network companies consider that these changes increase the level of risks they face.
- 6.26 In the paragraphs below, we consider the extent to which risk has been increased by these changes. First, we explain the relevant proposed changes in the 2013/21 Price Control. Then, we explain and comment on the arguments raised in relation to these changes.

⁹⁴ NGET: paragraph 247.

⁹⁵ Ofgem conducted a review of allowances for pensions in 2008 and 2009. The RIIO Strategy Decision adopted the principles established in that review. Accordingly, the general conclusions of this review was known to network companies several years in advance of the RIIO Strategy Consultation.

Background

- 6.27 Some of the employees of the network companies are included in defined benefit pension schemes. Some or all of the defined benefit pension schemes operated by the network companies are in deficit.⁹⁶
- 6.28 In previous price controls (“TPCR” and “GDPCR”⁹⁷), we understand that Ofgem set allowances that fully passed through to consumers: (1) the ongoing costs of funding pension costs; and (2) the costs of funding the deficits, providing that these costs were ‘economic and efficient’⁹⁸.
- 6.29 The changes to the rules for pension costs in the RIIO Strategy Decision include⁹⁹:
- (1) Deficits in relation to pension liabilities that arose prior to the start of the 2013/21 Price Controls, referred to as “established deficits”, will continue to be funded through charges. These will be funded over a period of 15 years. Allowances for funding the deficit will be reassessed every three years, to take into account any changes in the deficit.
 - (2) No specific allowance will be made for deficits in relation to incremental pension liabilities¹⁰⁰ that arise from the start of the 2013/21 Price Control, referred to as “incremental deficits”. These will be treated as part of overall employment costs, and will be subject to the same sharing mechanisms as applied for other employment costs.
 - (3) The ongoing service costs of pensions, and incremental deficits will be treated as part of overall employment costs. Allowances for these costs will be based on cost benchmarking. Any variance between actual and forecast pension service costs will be reflected in charges based on the same sharing mechanisms as applied for other employment costs.

⁹⁶ A deficit is where the value of future pension liabilities exceeds the value of the assets set aside to fund the pension scheme. Conversely, where the value of future liabilities exceeds the value of assets, this is known as a surplus.

⁹⁷ These are the most recent price controls conducted for electricity and gas transmission (TPCR4) and gas distribution (GDPCR), which were concluded in 2006 and 2007 respectively.

⁹⁸ “Price Control Treatment of Network Operator Pension Costs Under Regulatory Principles”, Ofgem, June 2010, paragraph 3.4.

⁹⁹ “Price Control Treatment of Network Operator Pension Costs Under Regulatory Principles”, Ofgem, June 2010, paragraphs 3.5, 3.7, 3.22 and 3.32. RIIO Strategy Decision – Financial Issues Annex, paragraph 6.2.

¹⁰⁰ These are pension liabilities arising from active scheme members.

- 6.30 In effect, we understand that previously ‘economic and efficiently incurred’ ongoing service and deficit repair costs were fully passed through to consumers through charges. In the forthcoming price control, charges will include a benchmarked allowance for pension costs. Pension costs may not be fully funded through charges if they differ from forecast costs, although they will be subject to the sharing mechanisms as applied for other employment costs.
- 6.31 The benchmarked pension cost allowance in the 2013/21 Price Controls will not include the cost of funding ‘incremental deficits’.
- 6.32 Some network companies argued that these changes will increase the level of risk during the 2013/21 Price Controls. They argue that risk will be increased because¹⁰¹:
- (1) the network companies will now be responsible for funding any ‘incremental deficits’ that arise after the start of the 2013/21 Price Controls¹⁰²;
 - (2) the timing of allowances for funding the ‘established deficit’ may differ from the timing of actual deficit reduction payments to the pension schemes; and
 - (3) the ‘established deficits’ may move into surplus. In this case, Ofgem may seek to reflect this in allowances, although network companies may not be able to agree to reduce contributions with pension trustees.
- 6.33 We comment on item (1) below. Items (2) and (3) are outside the scope of this report. We note that Ofgem has previously commented on item (3)¹⁰³.

Funding of incremental pension deficits

- 6.34 Under the 2013/21 Price Control, network companies will be responsible for any ‘incremental deficits’ that arise after the start of the price control, until benchmarked allowances are reset at the next control. The costs associated with funding any ‘incremental deficits’ will be subject to the sharing mechanisms as applied for other employment costs.

¹⁰¹ NGET: paragraph 418-419, NGGD1: paragraph 2.26 to 2.29.

¹⁰² WWU1: paragraph 4.2.1.2.

¹⁰³ RIIO Strategy Decision – Financial Issues Annex, Appendix 7, paragraphs 1.10 to 1.12.

- 6.35 Pension deficits or surpluses can be caused by fluctuations in financial markets that cause the value of the investments held by pension schemes to differ from the value of future liabilities. If the value of scheme assets falls due to a downturn in the financial markets, the network companies will be required to make additional contributions to the pension fund. Conversely, if the value of scheme assets rises when markets rise, this could create a surplus, which could mean the network companies are able to reduce their contributions.
- 6.36 Pension deficits or surpluses can be caused by factors that affect the assessment of the value of liabilities, for example, interest rates, and assumptions about growth rate of future earnings. These factors are intended to reflect long-term trends, however, assessment of these assumptions may be influenced by short-term economic factors.
- 6.37 The pattern of increasing costs and thus lower profits when financial markets perform poorly, and reduced costs and higher profits when financial markets perform well, increases the variability of earnings with the market. Therefore, exposure to pension fund risks can increase the correlation of companies' returns to the market, and accordingly the beta of these companies. Companies with defined benefit pension schemes are exposed to this risk whether or not the scheme is in surplus or deficit.
- 6.38 In principle, under the 2013/21 Price Controls a downturn in the financial markets is likely to lead to the emergence of an 'incremental deficit' that will be subject to the sharing mechanisms and therefore will reduce the returns of a network company. Conversely an upturn in the financial markets is likely to lead to an 'incremental surplus' and therefore an increase in the returns of the network company. All other things equal, this increases the risk faced by the network companies.
- 6.39 It is important to emphasise that this incremental liability or surplus only relates to incremental pension liabilities from the start of the 2013/21 Price Controls. To the extent there is a reduction in the value of the assets held in relation to pension liabilities that existed prior to the 2013/21 Price Controls, such that network companies face an additional funding deficit with respect to these liabilities, the costs of funding that deficit will be fully funded through charges.

- 6.40 The extent to which the increase in risk associated with 'deficits' will affect the overall risk of the network companies depends on:
- (1) **the size of the incremental pension liabilities relative to the companies' assets:** Initially, the 'incremental liabilities' will represent a small proportion of the network companies' assets. Accordingly, the impact of this risk is likely to be relatively small. The risk may increase if the scheme liabilities grow significantly. However, this may be limited as nearly all the pension schemes are closed to new participants¹⁰⁴. As an example, NGET forecast pension costs over the entire price control period of £9.4 million per year, or £75 million over the period¹⁰⁵. This represents less than 1% of opening RAB¹⁰⁶.
 - (2) **the beta of the pension assets relative to the beta of pension liabilities, and relative to the network companies' asset beta:** the beta of the company will be increased if (a) the beta of the pension scheme assets exceeds the beta of the scheme liabilities; and (b) the beta of plan assets exceeds the asset beta of the network companies operating assets. To assess the extent to which the overall risk of the network companies will be affected, Ofgem will need to consider the extent to which the pension scheme risk exceeds the overall asset risk of the network companies.
- 6.41 The extent to which risk will increase depends on the circumstances of individual pension schemes. In light of the first of the two factors above, the effect of this incremental risk is likely to be small initially. However, we consider that Ofgem should monitor the impact of this risk, and consider whether any adjustments to the cost of equity are required in future price controls.
- 6.42 We note that it may be difficult to make any adjustments for this increased risk if it is not possible to make a robust assessment of the effect of pension fund risk on the cost of equity. Ofcom has recently considered the merits for adjusting the cost of capital of BT for pension risk. The academic evidence referred to in that review found that adjustments for the effect of pension fund risk on beta were subject to a high degree of uncertainty¹⁰⁷.

¹⁰⁴ "Price Control Treatment of Network Operator Pension Costs Under Regulatory Principles", Ofgem, June 2010, paragraph 1.7.

¹⁰⁵ "Non-load related detailed plan", NGET, March 2012, footnote 48. We note that only a portion of this amount will contribute to represent ongoing service costs.

¹⁰⁶ NGET: paragraph 825 presents opening RAB of about £8 billion.

¹⁰⁷ "Ofcom Pensions Review Statement", dated 15 December 2010, paragraph 7.14.2.

Requirement to undertake a large capital investment programme

- 6.43 Some of the network companies are expected to undertake significant investments during the forthcoming price control period. The most significant investments will be made by some of the electricity transmission network companies. Some of these investments will be made to achieve ‘outputs’ that have been required by Ofgem as part of the 2013/21 Price Controls.
- 6.44 Some network companies have argued that this requirement to undertake investments increases their risks, potentially to the extent that they are higher than some non-regulated companies in other sectors¹⁰⁸. They argue that this may affect the extent to which the network companies are considered to be ‘low risk’.
- 6.45 In the following paragraphs, we discuss differences in risks between the network companies and non-regulated companies in the context of capital investment.
- 6.46 We consider the difference between network companies and non-regulated companies in the context of a number of categories of risk:
- Project selection risk: the risk of selecting investment projects that are expected to be unprofitable.
 - Revenue risk: variability in revenues that may lead to returns on investment being less than expected.
 - Execution risk: the risk of the cost of the project being higher than forecast, once the project is started.
 - Forecasting risk: the risk of incorrectly forecasting the cost of an investment project.

Project selection risk

- 6.47 Non-regulated companies typically decide whether to undertake investments by assessing whether the returns from undertaking the project are expected to meet or exceed the cost of capital.
- 6.48 By contrast, the network companies are required to undertake certain investment projects. Unlike non-regulated companies, network companies have less scope to choose which projects to undertake given their required outputs.

¹⁰⁸ NGET: paragraphs 367 and 368.

- 6.49 This restriction limits the ability of these companies to manage the risk of selecting projects that would not be undertaken by a non-regulated company. However, if the costs of the projects and the costs of capital are correctly estimated, network companies are guaranteed a return on their investments under the RIIO Framework.
- 6.50 For both network companies and non-regulated companies, the returns on investment depend on whether the expected returns match the actual returns. These are driven by variability in revenues and costs, which are discussed below.

Revenue risk

- 6.51 Non-regulated companies typically face uncertainty about the level of revenues they will be able to achieve in the market. This comprises uncertainty over the volumes that they will be able to achieve, and the prices at which they will be able charge. The level of uncertainty can vary depending on the firm and industry being considered.
- 6.52 By contrast, the network companies' revenues are set under a regulatory framework that aims to provide stability to the level of charges. Additionally, network companies usually have a limited amount of volume risk¹⁰⁹.
- 6.53 The risk to network companies may be reduced by any uncertainty mechanisms based on volumes. We note that Ofgem has decided to apply an uncertainty mechanism in respect of the volumes, in relation to certain investment projects¹¹⁰. This will reduce any revenue risk in respect of those projects.
- 6.54 Consequently, the revenue risk of network companies is likely to be significantly lower than non-regulated companies in other sectors.

Execution risk

- 6.55 This is the risk that the project cost will differ from the expected cost of the project.
- 6.56 Both network companies and non-regulated companies face the risk that the cost of undertaking a project may differ from the expected costs. This may occur due to exogenous shocks such as changes in the prices of inputs, or issues with delivery of the project.
- 6.57 If costs increase above the forecast level, this may reduce the return on the project below the expected level, and vice-versa.

¹⁰⁹ RIIO Strategy Decision – Financial Issues Annex, paragraph 3.49, fourth bullet point.

¹¹⁰ RIIO Strategy Decision – Uncertainty mechanisms annex, table 2.3.

- 6.58 A non-regulated company faces this risk in respect of the full amount of the over/under-spend. However, they may have some flexibility to reduce the impact of this risk by passing some of this cost on to customers via higher prices, or by cutting back on the scope of the project. The ability to pass on higher costs depends on several factors, including the level of competition in the market.
- 6.59 The network companies face this risk in respect of part of the over- or underspend. This is because the 2013/21 Price Controls include a sharing mechanism that means that networks will be pay/receive 40-60% of any variances in costs relative to forecasts. Additionally, the 2013/21 Price Controls include uncertainty mechanisms in respect of the cost of some investments.

Forecasting risk

- 6.60 The network companies have forecast a significant proportion of their investment expenditure before the start of the eight-year price control period. As noted above, estimates that are further in the future are subject to greater uncertainty. Accordingly, they are subject to the risk that these estimates are incorrect, and that they will need to fund any increases in costs.
- 6.61 Some of this risk is mitigated, in part, by the sharing and uncertainty mechanisms described above.
- 6.62 Non-regulated companies are not subject to price controls and accordingly may not be subject to forecasting risk. That is, they may not need to estimate the cost of projects commencing many years in advance. However, they may be subject to these risks if:
- (1) they are undertaking an programme of investment, and are committed to undertaking future expenditure; or
 - (2) they have committed to certain levels of capital expenditure costs as part of their financing arrangements, such as project finance borrowing.
- 6.63 Both regulated and non-regulated companies can take steps to manage these risks, for example, by contracting for goods and services in advance.
- 6.64 This risk primarily applies to the network companies who are required to forecast investment expenditures at longer time horizons than in most other industries.

- 6.65 For a given level of forecasting risk, the increase in risk depends on the ability to pass on the costs on to customers. For network companies, this is achieved through efficiency incentive mechanisms, whereas for non-regulated companies this depends on the ability to raise prices, which is affected by competitive constraints and/or price elasticity. As with execution risk, the relative impact of forecasting risk between network companies and non-regulated companies is likely to depend on the sector being considered and the prevailing market conditions.
- 6.66 We consider that network companies are typically more likely to face forecasting risks. The amount of forecasting risk is increased by the increased length of the price control period.

Conclusion on the risks faced by network companies and other non-regulated companies in relation to capital investment projects

- 6.67 The table below compares the risks faced by network companies and non-regulated companies in relation to capital investment projects.

Table 6-1 – Comparison of risks faced by network companies and non-regulated companies in relation to capital investment projects

Type of risk	Network companies	Non-regulated companies
Project selection risk	Guaranteed that cost of projects will be compensated, subject to other risks.	Can choose whether or not to undertake a project, but the remaining risks may subsequently render a project unprofitable.
Revenue risk	Relatively low or limited revenue risk	Face risks in respect of their prices and volumes
Execution risk	Face the risk that project costs will be higher than forecast. Only a fixed portion of this cost can be passed through to customers.	Face the risk that project costs will be higher than forecast. Uncertain what proportion of this cost can be passed through to customers.
Forecasting risk	Required to forecast costs for a longer period under the RIIO Framework. Accordingly, faces more forecasting risk. A fixed portion of this cost can be passed through to customers.	Less likely to need to forecast costs far in advance (although this depends on the industry considered). Uncertain what proportion of this cost can be passed through to customers.

- 6.68 We have considered the differences in risks between the network companies and non-regulated companies in undertaking capital projects. Both project selection risk and revenue risk are lower than for network companies than non-regulated companies. Execution risk may be lower or higher depending on the sector in question. Network companies are likely to face more forecasting risk, because of the requirement to provide estimates for price controls.
- 6.69 In the round, for an *individual* capital project, risks are likely to be materially lower for a network company than a non-regulated company. However, it is possible that the scale of capital expenditure faced by some network companies in the 2013/21 Price Controls means that across the *aggregate* of all capital projects those companies will face increased risks relative to non-regulated companies than in previous price controls. This increase in risks would likely arise from additional forecasting risk.
- 6.70 This increase may be partially mitigated by the use of uncertainty mechanisms. The effect of this increased risk on the required return on equity also depends on whether or not these costs are diversifiable¹¹¹.

Conclusion

- 6.71 The network companies have raised a number of issues with regards to the level of risk during the 2013/21 Price Controls relative to previous price controls.

¹¹¹ See discussion at paragraph 6.21.

6.72 In summary, our views in relation to the issues we have been asked to consider are as follows:

- (1) **The increased length of price control period will increase the variability of returns and may increase the cost of equity:** The risk has increased due to the forecasting risk of expenditures that are further away and the potential for forecasting errors to persist over a longer period. This will be partially offset by the introduction of annual updating of revenue allowances for uncertainty mechanisms and efficiency incentives. There will be a net increase in risk because the efficiency incentives do not fully protect network companies from the effect of any misestimates of costs. The extent of any increases in risks will be mitigated, in part, by a reduction in the level of regulatory risk. The overall impact on cost of equity will depend on whether any increase in risk is diversifiable.
- (2) **The network companies will bear the risk of funding any unforecasted incremental defined benefit pension liabilities:** we expect the effect is likely to be small initially because the incremental liabilities will be low relative to the overall asset value of the network companies¹¹². Ofgem should monitor the impact of this risk, and consider whether any adjustments to the cost of equity are required in future price controls.
- (3) **The volatility of returns of capital investment projects relative to non-regulated companies will increase during the 2013/21 Price Control in comparison to previous price control periods:** The volatility of returns of capital investment projects is lower for network companies relative to non-regulated companies for individual projects. However, the scale of investment for some network companies means that it is possible that, in aggregate, risks for those network companies will increase relative to non-regulated companies during the 2013/21 Price Controls. We note that not all network companies are expected to undertake more new investment during the 2013/21 Price Controls than in previous price control periods.

¹¹² The extent to which risk will increase depends on the circumstances of individual pension schemes. For example, it depends on the level of participation in defined benefit schemes, and whether these are open to new participants.

7. Risk modelling

Introduction

- 7.1 As discussed in Section 6, some network companies have expressed concerns that they would face more risk during the 2013/21 Price Control, than during previous price controls. Using risk modelling, a number of companies have sought to quantify the additional risk due to RIIO and the impact on their cost of equity. Our comments in this section relate to the network companies' approach to risk modelling rather than changes to individual sources of risk.
- 7.2 In this section, we comment on the methods used in that modelling. We do not consider the implementation of the modelling (such as the accuracy of formulae). Our review considers:
- the appropriateness of Monte Carlo simulation, the modelling simulation approach used by the network companies;
 - the Sharpe ratio approach, used to estimate the increased cost of equity in the network companies' risk modelling; and
 - the "triangulation" of National Grid's cost of equity with other industries' costs of equity and the resulting scaling factor applied to its risk modelling results.

Monte Carlo simulation

- 7.3 A number of companies' Business Plans rely on Monte Carlo simulation to evaluate the impact of changes in variables and related uncertainties on cash flows and other outputs^{113,114}. As we have not analysed the models themselves, we restrict our comments to the models as described by these companies and their consultants.

¹¹³ Companies relying on this methodology include WWU, NGET, NGGD and SG.

¹¹⁴ The methodologies are described in the finance sections of the WWU, NGET and NGGD Business Plans and Oxera's report for SG: "Impact of risk on the cost of capital and gearing", Oxera, November 2011.

- 7.4 An increase in risk due to changes introduced in the RIIO 2013/21 Price Control (some of which were discussed in Section 6) can be assessed by modelling the dispersion (as measured by the standard deviation) of possible future returns to assets or equity. Given a reliable operational model capturing companies' transformation of inputs into outputs, Monte Carlo simulation can produce an estimate of the dispersion of outputs by running a large number of simulations, typically thousands. Each simulation run draws different values according to assumed probability distributions for one or more model input parameters to produce a different potential outcome.
- 7.5 In their analysis, the network companies used operational models as the basis for the Monte Carlo simulation. First they determined a base case dispersion value running simulations with the current regulatory regime conditions. By then introducing one or more features of the 2013/21 Price Control, such as increasing the price control period from five to eight years, and running the simulations again, a new dispersion value was calculated for each feature. An increase in the dispersion indicates an increase in the level of risk.
- 7.6 Using Monte Carlo simulation¹¹⁵, National Grid, Scotia Gas, and WWU estimated the dispersion of asset returns which they then converted to an equity return. Once the increased dispersion was estimated for each scenario relative to the base case, the impact on the cost of equity can be determined. National Grid and WWU input the standard deviation results into a Sharpe ratio based calculation to estimate the RIIO cost of equity (see following subsection for a description of this approach).
- 7.7 A key feature of probabilistic modelling (including Monte Carlo simulation) is the assumptions about the values of the model input parameters, including their probability distributions, and, in the case of the companies' modelling, the scenario parameters used to define the base case and RIIO scenarios. Even models describing a similar operational situation can differ significantly in the choice of, for example, the operational level of modelling, the model input parameters and their probability distributions, the scenario parameters and the correlations between model input parameters. We agree that probabilistic modelling is a reasonable approach to modelling the increase in risk. However, to test the robustness of the results, careful consideration should be given to these modelling choices and a sensitivity analysis conducted where different choices could be considered reasonable.

¹¹⁵ We understand this analysis was prepared by advisors to the network companies.

- 7.8 The importance of sensitivity analyses in Monte Carlo modelling is emphasized by the US Environmental Protection Agency in their guide for the use of Monte Carlo simulation¹¹⁶:

“Once again, numerical experiments should be conducted to determine the sensitivity of the output to different assumptions with respect to the distributional forms of the input parameters.

... Dependencies or correlations between model parameters also may have a significant influence on the outcome of the analysis. The sensitivity of the analysis to various assumptions about known or suspected dependencies should be examined. Those dependencies or correlations identified as having a significant effect must be accounted for in later analyses.

Conducting a systematic sensitivity study may not be a trivial undertaking, involving significant effort on the part of the risk assessor.”

- 7.9 Below we contrast the network companies’ modelling choices and discuss their sensitivity analyses, focusing on the model input parameters, the correlations assumptions and the scenario parameters.

Model input parameters

- 7.10 The choice of model input parameters depends on the operational model being used and the level of detail at which the analyst chooses to implement the modelling. This adds to the variability between models used to estimate similar outputs. We describe, in turn, WWU’s relatively detailed model input parameters and National Grid’s less detailed model input parameters.
- 7.11 WWU specified 10 model input parameters that are common to their GDPCR1 and RIIO scenarios and four that are specific to each of these scenarios, as shown in the table below¹¹⁷. Model input parameters that are specific to each of the scenarios are indicated in bold.

¹¹⁶ “Guiding Principles for Monte Carlo Analysis”, US Environmental Protection Agency (EPA), 1997, pp.11-12.

¹¹⁷ WWU refer to these parameters as ‘volatility drivers’.

Table 7-1: Model input parameters of WWU's Monte Carlo modelling

#	GDPCR1	RIIO
1	Opex volume	Opex volume
2	Capex volume	Capex volume
3	Matrix repex volume	Matrix repex volume
4	Non-matrix repex volume	Non-matrix repex volume
5	Opex price index	Opex price index
6	Capex price index	Capex price index
7	Matrix repex index	Matrix repex index
8	Non-matrix repex index	Non-matrix repex index
9	Interruption cost	Customer satisfaction
10	Shrinkage volume	Complaints handling
11	Leakage volume	Stakeholder engagement
12	Metering volume	Leakage volume
13	Exit capacity – flat volume	Shrinkage volume
14	Exit capacity – flex volume	Asset health score

Sources: RIIO-GD1 Business Plan 2013-2021, Part B2, Financeability, WWU, November 2011, Appendix A.

- 7.12 For each of these model input parameters, WWU assumed a normally distributed random shock with a mean of 0% and a standard deviation of 5% around the business plan value. It might be inappropriate to assume the same proportionate volume shock for each model parameter, or to assume that the probability distribution is symmetric, that is that increases and decrease are equally likely for all parameters. This is because it is likely to be unrealistic, but without further analysis we cannot comment as to whether this assumption has a material impact. One would not, for example, expect the uncertainty surrounding opex volumes to be necessarily similar to that for the capex price index. WWU did consider the sensitivity of their results to the random shock standard deviation, but only by applying the same alternative standard deviation to all the parameters, specifically 2% and 8%¹¹⁸.

¹¹⁸ WWU1: Appendix B

- 7.13 WWU's business plan submission describes their sensitivity analysis which appears to include all the inputs^{119 120}:
- "We tested IQI, WACC, adjustments to opex, capex and repex due to the asset health score index, percentage of totex capitalized and the variation applied to variables in the Volatility Model. The resulting cost of equity ranges from 7.34% to 8.17% with a median of 7.72%, that is, on average higher than the GDPCR's 7.25%. This demonstrates that increase in volatility, and therefore cost of equity, as WWU moves from 5-year GDPCR to 8-year RIIO is a robust result."*
- 7.14 WWU's use of a range of values to conclude on the general direction of the equity return expected for RIIO, appears to be a reasonable approach.
- 7.15 National Grid's modelling relies on a very different set of model input parameters to those selected by WWU¹²¹, as listed below. Each value is drawn from a specified probability distribution¹²²:
- (1) under grounding;
 - (2) design standards;
 - (3) wider works;
 - (4) general connections;
 - (5) network renewal;
 - (6) critical national infrastructure (CNI); and
 - (7) real price effects (RPE).

¹¹⁹ WWU's modelling was conducted by Macquarie (a major shareholder) and the "statistical validity independently reviewed by Oxera". WWU1 , page 24.

¹²⁰ WWU1: Section 4.3.

¹²¹ National Grid refer to these as 'uncertainties'.

¹²² NGET: page.93.

- 7.16 These appear to be higher level parameters than those selected by WWU. The CNI parameter, for instance, refers to CNI spending in any given year for which National Grid assumed a normal distribution with a standard deviation of £7.9m in each year of RIIO-T1¹²³. According to National Grid, each parameter's probability distribution includes consideration of specific management actions to mitigate particular risks. In the case of CNI, the relevant management action appears to be "*pro-active engagement with [the Department of Energy and Climate Change] on the priority assigned to each of the sites to ensure that the overall programme is deliverable*"¹²⁴. Clearly, the specification of probability distribution is complicated further by the need to consider the impact of management actions.
- 7.17 National Grid's sensitivity analysis appears to have focused on the correlation matrix (as discussed in the next sub-section) and on the use of a different, lower TPCR4 allowed rate of return of 7.0% as opposed to their preferred 7.5%.¹²⁵ These TPCR4 rates are used as the starting point before considering the impact of changes in the 2013/21 Price Control. In addition, "*[i]n many cases, the sensitivity of uncertainty mechanism performance to various parameters has also been tested*"¹²⁶. It is not clear what the results of these latter sensitivity analyses were.
- 7.18 In its analysis for Scotia Gas, Oxera appears to have relied on similar volume and price input parameters to WWU: "*separate volume and price shocks are modelled for OPEX, REPEX, CAPEX and business support costs, exposing the company to eight independent shocks in each year of the price control*"¹²⁷. The random shock assumed for each parameter was normally distributed with a standard deviation of 5%, as assumed by WWU. Oxera state that "*[m]odelling results have been found to be robust to different assumptions for the standard deviation of shocks*", suggesting they have performed some sensitivity analysis around their results¹²⁸. It is not clear what variation in standard deviation was considered and how significant the cost of equity impact is.
- 7.19 The different model input parameter assumptions chosen by the three network companies illustrate a subset of the universe of reasonable choices available to companies. This variety serves to increase the importance of providing a robust rationale for the choices made and of a well-documented sensitivity analysis.

¹²³ "*Managing risk and uncertainty*", NGET, July 2011, paragraph 342.

¹²⁴ "*Managing risk and uncertainty*", NGET, July 2011, paragraph 347.

¹²⁵ NGET: table on page 83.

¹²⁶ "*Managing risk and uncertainty*", NGET, July 2011, paragraph 443.

¹²⁷ "*Impact of risk on the cost of capital and gearing*", Oxera, November 2011, page 2.

¹²⁸ "*Impact of risk on the cost of capital and gearing*", Oxera, November 2011, footnote 1.

Correlations between model input parameters

- 7.20 Typically, at least some model input parameter values are correlated. For example, spending on customer complaints is likely to be positively correlated with customer satisfaction. The model input parameter set selected for each simulation run should, therefore, specify the correlation between every pair of model parameters. Both WWU and National Grid specified a correlation matrix for their respective model input parameters. Oxera, in their report for Scotia Gas, do not mention a correlation assumption.
- 7.21 WWU estimated the correlation between each of the model input parameters. Below we reproduce WWU's assumed correlations for the first seven parameters listed in Table 7-1 above.

Table 7-2: WWU's correlation matrix for the first seven GPCR and RIIO model input parameters

	1	2	3	4	5	6	7
1	100%						
2	0%	100%					
3	0%	0%	100%				
4	0%	0%	0%	100%			
5	(25%)	0%	0%	0%	100%		
6	0%	0%	0%	0%	75%	100%	75%
7	0%	0%	(25%)	0%	75%	75%	100%

Sources: RIIO-GD1 Business Plan 2013-2021, Part B2, Financeability, WWU, November 2011, Appendix A.

Notes: Table 7-1 above identifies the parameters associated with each of the numerals in this table.

- 7.22 It does not appear that WWU attempted to evaluate the sensitivity of its results to alternative correlation matrix assumptions. Such sensitivity analysis is important as alternative, perhaps equally plausible, correlation assumptions may exist. For instance, network companies are often faced with a trade-off between opex volume, say in the form of active management, and capex volume, that is network investment. It is therefore possible that an increase in capex prices ('6' in Table 7-2) might be positively correlated with opex volumes ('1' in Table 7-2), whereas WWU consider there to be no correlation between these parameters. A correlation sensitivity analysis would increase the confidence in the results of the model.
- 7.23 National Grid arrived at their correlation matrix, shown below, based on their experience because "it has not been possible to conduct sufficient analysis to define correlations between different uncertainties"¹²⁹.

¹²⁹ "Managing risk and uncertainty", NGET, July 2011, paragraph 417.

Table 7-3: National Grid's model input parameter correlation matrix

	1	2	3	4	5	6	7
1	100%						
2	0%	100%					
3	30%	30%	100%				
4	12%	0%	30%	100%			
5	0%	12%	-12%	0%	100%		
6	0%	0%	0%	0%	0%	100%	
7	30%	12%	30%	30%	30%	12%	100%

Sources: "Managing risk and uncertainty", NGET, July 2011, p.93.

Notes: Paragraph 7.16 above identifies the parameter associated with each of the numerals in this table.

- 7.24 National Grid did perform a sensitivity analysis to test its correlation assumptions. The results of the sensitivity analysis are shown in the table below.

Table 7-4: National Grid's model input parameter correlation sensitivity analysis

Scenario	Standard deviation of RIIO return on equity
Correlation assumptions based on experience	0.77%
No correlations	0.66%
100% correlation	1.29%

Sources: "Managing risk and uncertainty", NGET, July 2011, p.93.

- 7.25 National Grid concludes that "the correlations in the table above have a relatively small impact on the standard deviation of the return on equity"¹³⁰. We note that the standard deviation ranges from -0.11% below to +0.52% above its assumed correlation scenario, and that this does not consider negative correlations. Although small, even this range of variation can have a significant impact on the results of the Sharpe ratio calculation, as discussed below.

¹³⁰ "Managing risk and uncertainty", NGET, July 2011, paragraph 419.

Scenario parameters

- 7.26 WWU, National Grid and Scotia Gas each assumed a slightly different set of scenario parameters to specify their TPCR / GDPCR and 'RIIO' scenarios¹³¹. All three considered the increase in the price control period from five to eight years and the incentive rates, but only Scotia Gas took the depreciation profile for post-2002 assets into consideration. WWU was the only company to model the impact of the percentage of spend impacted by the health score¹³².
- 7.27 The combined effect of the longer price control period (under the RIIO Framework) and the uncertainty modelling of the price control variables is that the dispersion of cash flows and returns is almost guaranteed to be greater than the GDPCR / TPCR dispersion. The reason is that the models assume the levels of certain variables, for example price, are dependent on their past values, which is a reasonable assumption. As Oxera explains in their report on Scotia Gas: "*price levels are assumed to be path-dependent, ie, a price shock in year one of the price control carries over to year two and so forth.*"¹³³ The longer the period, the further the level of the price can move from the initial level due to the compounding effect of successive annual variations assumed in the model.

¹³¹ "*Finance (Annex to Business Plan)*", NGET, pages 66 and 67.
WWU1: Appendix 1, Section 3.1.

"Impact of risk on the cost of capital and gearing", Oxera, November 2011, page 3.

¹³² We assume that WWU refers to the secondary deliverable related to asset condition which will be measured through an "asset health index".

"Strategy for the next transmission price control - RIIO-T1 Outputs and incentives", Ofgem, March 2011, paragraph 3.20.

¹³³ *"Impact of risk on the cost of capital and gearing"*, Oxera, November 2011, page 2.

Monte Carlo estimates

- 7.28 For each RIIO change scenario the output of the Monte Carlo simulation as presented by the network companies is a point estimate of standard deviation. In our view, given the complexity of the operational models, the range of assumptions about model input parameters, probability distributions, correlation matrices and scenario parameters used in the simulation and the impact on the simulation outcomes, the results are best viewed as indicative. Indeed, in reporting their analysis for Scotia Gas, Oxera acknowledges the uncertainty around the point estimate results, stating that “[t]he model is intended to capture the main features of SGN’s business plan, and thereby to indicate the direction and order of magnitude of changes in risk rather than to provide an exact analysis.”¹³⁴ Similarly, as discussed above, WWU used the range of values produced by its sensitivity analysis to conclude that an increase in equity return is a likely result¹³⁵.
- 7.29 In summary, Monte Carlo simulation is a useful tool to obtain a probabilistic view of the impact of changes to a well specified operational model. The companies’ description of their models appears to be consistent with a well specified model using reasonable inputs but, without a detailed review of the models themselves, we are unable to comment further on the actual models.
- 7.30 However, we would caution that the results of this analysis are sensitive to input assumptions and that there are likely to be equally reasonable alternative sets of model assumptions.
- 7.31 As discussed below, the Sharpe ratio cost of equity calculations are particularly sensitive to relatively small changes in the standard deviation estimates which can amplify the impact of a different set of assumptions.
- 7.32 We also observe that an increase in the period of the price control is almost guaranteed to result in a greater dispersion of returns through, for example, the compounding effect of successive random shocks to price level.

¹³⁴ “Impact of risk on the cost of capital and gearing”, Oxera, November 2011, p.2.

¹³⁵ “RIIO-GD1 Business Plan 2013-2021, Part B2, Financeability, Appendix 1. Volatility Model Study”, WWU1: Section 4.3.

Sharpe ratio approach to estimating cost of equity

- 7.33 To estimate the impact on its cost of equity of the additional risk it “*could be asked to accept during the RIIO-T1 period*”¹³⁶, National Grid employed Sharpe ratios. WWU conducted a similar analysis¹³⁷. The Sharpe ratio measures the excess return of an asset over the risk free rate per unit of (standard) deviation of returns on that asset¹³⁸. In this context, the asset being considered is the regulatory business. This approach sets the Sharpe ratio for the existing regulatory regime base case equal to the Sharpe ratio for various RIIO regulatory scenarios to estimate the impact on the return for each scenario. The main inputs to the calculation are the standard deviations of returns estimated for both the base case and the scenarios using the Monte Carlo simulation described above.
- 7.34 In their analysis for Scotia Gas, Oxera used an alternative approach to translate the asset risk into a return on equity by “first increasing the ‘WACC risk premium’ — the difference between the WACC and the risk-free rate — in proportion to the increase in asset risk. This gives an estimate of the RIIO-GD1 WACC, from which an estimate of the RIIO-GD1 cost of equity can be calculated, assuming that WACC parameters other than the asset beta are unchanged between GDPCR and RIIO-GD1”¹³⁹. In practice this approach is similar to the Sharpe ratio approach which effectively adjusts the cost of equity risk premium (cost of equity less the risk free rate) in proportion to the risk increase.
- 7.35 When interpreting the results of Sharpe ratio analysis, it is important to understand that even relatively small changes to the standard deviation estimates in a Sharpe ratio calculation can have a significant impact on the estimated return on equity. As a result, small variations in the Monte Carlo modelling used to generate the inputs to the ratio can result in markedly different outcomes.

¹³⁶ NGET: paragraph 309.

¹³⁷ “RIIO-GD1 Business Plan 2013-2021, Part B2, Financeability, Appendix 1. Volatility Model Study”, WWU, November 2011.

¹³⁸ “*Principles of corporate finance*”, Brealey R., Myers S., and Allen F., McGraw-Hill, Ninth edition, page 213.

¹³⁹ “*Impact of risk on the cost of capital and gearing*”, Oxera, November 2011, p.4.

- 7.36 To illustrate the potential impact of small changes in the standard deviation estimates we have constructed a simplified example based on the Sharpe ratio approach. The underlying equation used to derive the implied required return under RIIO, as described by National Grid sets the Sharpe ratio for TPCR4 equal to that for RIIO:

$$\frac{\text{Return}_{\text{TPCR4}} - \text{Return}_{\text{Risk free}}}{\sigma_{\text{TPCR4}}} = \frac{\text{Return}_{\text{RIIO}} - \text{Return}_{\text{Risk free}}}{\sigma_{\text{RIIO}}}$$

where σ represents the standard deviation of returns¹⁴⁰.

- 7.37 We assume values similar to those derived by National Grid to see the impact of small variations in the input values on the estimated pre-tax equity return¹⁴¹. The resulting sensitivity of the $\text{Return}_{\text{RIIO}}$ to changes in σ_{TPCR4} is tabulated below.

Table 7-5: Illustrative sensitivity of Sharpe ratio approach to modelling the impact of risk on equity returns

	Change in σ_{TPCR4} (percentage pts)	Change in calculated $\text{Return}_{\text{RIIO}}$ (percentage pts)	Multiplication factor implied by the change
Scenario σ_{TPCR4} -0.05%	-0.05%	+0.43%	-8.52
Scenario σ_{TPCR4} +0.05%	+0.05%	-0.36%	-7.10

Notes: This example assumes a TPCR4 case with equity risk premium of 5.5% and a risk free rate of 2.0%. The standard deviation outputs of the Monte Carlo simulation are assumed to be 0.55% for the TPCR4 and 0.60% for RIIO. These values are not dissimilar to those described by NGET¹⁴². We assume that the 71% scaling factor is applied to the increase in the standard deviation, in this case reducing the RIIO standard deviation from 0.60% to 0.59%¹⁴³.

¹⁴⁰ NGET: paragraph 344.

¹⁴¹ To take account of the degree to which some risks might be diversifiable, National Grid applied a 71% scaling factor to the additional risk in the 2013/21 Price Controls. In the absence of more information about the implementation of this adjustment, we have applied the factor to the standard deviation increase in Table 7-5.

¹⁴² NGET: table on page 67.

¹⁴³ $0.55 + (0.60 - 0.55) * 0.71 = 0.59\%$

- 7.38 The table above demonstrates that even small changes in the estimated TPCR4 standard deviation, e.g. a 0.05 percentage point decrease, can have a much larger impact on the calculated RIIO equity return, e.g. a 0.4 percentage point increase. In National Grid's case this would imply that if the σ_{TPCR4} estimate were 0.5914% instead of 0.5414% the implied post tax cost of equity would be 7.9% instead of 7.5%.¹⁴⁴ This is much larger than the effect of the "changes to the incentive rate mechanism" which National Grid calculated as increasing the cost of equity to 7.69%¹⁴⁵. We note that our +/-0.05% variability assumption for the standard deviation is considerably smaller than the -0.11% to +0.52% range that resulted from National Grid's correlation sensitivity analysis described in the previous subsection.
- 7.39 By its very nature the Sharpe ratio calculation is sensitive to small changes in the standard deviation inputs. Given the range of standard deviation estimates that would result from a sensitivity analysis of Monte Carlo simulation assumptions, we believe the results of the Sharpe ratio calculation could best be presented as a range.

"Triangulation" of National Grid's cost of equity and the resulting scaling factor

- 7.40 National Grid's initial risk modelling was challenged on the basis that "most risks had been included in the impact on the cost of equity without a specific discussion of whether they were non diversifiable or not"¹⁴⁶. In response, National Grid commissioned a study by Frontier Economics "to find an appropriate scaling factor to apply to the risk model results, a factor that would reflect the prior concerns that the risk modelling exaggerated the impact on equity returns by considering all risks in full"¹⁴⁷. National Grid applied the scaling factor to the relative risk calculation to scale down the impact of the additional risk in the 2013/21 Price Controls under the assumption that a part of this risk is diversifiable.
- 7.41 Frontier Economics derived the scaling factor by a comparative analysis of National Grid's risk and return that it termed "triangulation" which we discuss below.

¹⁴⁴ For argument sake we have assumed the relationship presented for pre-tax equity returns in Table 6-2 holds for post tax cost of equity.

¹⁴⁵ NGET: table on page 67.

¹⁴⁶ NGET: paragraph 297.

¹⁴⁷ NGET: paragraph 307.

“Triangulation” of National Grid’s increase risk and equity return

- 7.42 To calibrate National Grid’s required rate of return, Frontier Economics performed a “triangulation exercise” with reference to a number of sectors that were selected from the larger universe of sectors to have broadly similar risk characteristics to National Grid during the 2013/21 Price Controls¹⁴⁸. Through a qualitative comparison covering five risks identified as facing National Grid during the 2013/21 Price Controls, Frontier Economics classified eleven broadly similar sectors as being either of relatively “lower”, “slightly lower”, “similar”, “slightly higher”, or “higher” risk than National Grid during the 2013/21 Price Controls. The cost of equity of the sectors is calculated on a similar basis as for National Grid effectively to create similar but low, very similar and similar but high bands of comparison for National Grid. Frontier Economics considers the rates of return for the low and high bands to be the lower and upper bounds for National Grid under RIIO.
- 7.43 This triangulation analysis is based on 11 sectors of the economy selected out of approximately 100 for *“similar risk characteristics to NG under RIIO [...] sectors which satisfy minimum criteria in terms of asset intensity and complexity of capex programmes”*¹⁴⁹. The sectors selected cover very diverse industries, ranging from “Metals and mining”, through “Computer services” to “Aerospace/defence”. Except for “Utilities (general), Utilities (water)”, “Air transport, Railroad, Transportation, Trucking” and perhaps “Telecoms networks”, most of the sectors lack a regulatory regime in any way comparable to National Grid’s. Companies in the other sectors, such as “Aerospace/defence” and Oil/Gas (integrated), Oil/Gas (production & exploration), while they do face similarly long term investments, also face vastly different operational challenges and market forces to National Grid.
- 7.44 In our view, it is difficult to draw quantitative conclusions by making a qualitative comparison of industrial sectors that have such significant differences to each other and to National Grid. As a result, we would not recommend relying on the cost of equity ranges derived as part of this “triangulation” exercise.

¹⁴⁸ “Risk, volatility and the cost of equity”, Frontier Economics, March 2012, Section 4.

¹⁴⁹ “Risk, volatility and the cost of equity”, Frontier Economics, March 2012, Section 4.3.2, p.26.

National Grid's use of Frontier Economics' scale factor

- 7.45 The cost of equity outcome of Frontier Economics "triangulation" exercise was used to calculate NGET's scaling factor. Frontier Economics started by calculating the increase in the cost of equity implied for NGET. This increase equals the difference between the estimated TPCR4 baseline cost of equity, i.e. 7.5%, and the "triangulation" exercise's average for the sectors with a similar risk profile to National Grid during the 2013/21 Price Controls, i.e. 11.4%^{150 151}. The resulting 3.9% was then divided by the cost of equity increase calculated by NGET in their July 2011 risk modelling, i.e. 5.47%, to arrive at a scaling factor of 71%^{152 153 154}.
- 7.46 At this point we reiterate our observation as set out earlier in this section, that there is sensitivity to input assumptions that affect National Grid's Monte Carlo risk modelling and Sharpe ratio analysis used to arrive at the 5.47% figure featuring in the scaling factor calculation.
- 7.47 It is not clear from National Grid's description how exactly the scaling factor was applied, whether to the cost of equity increase or the standard deviation increase. National Grid only states that: "[w]e have therefore applied a scaling factor to reflect 71% of the change in risk through to the cost of equity."¹⁵⁵ What is clear is that effect of the scaling factor is to reduce the increase in the cost of equity for each of the RIIO scenarios considered.
- 7.48 Given our concerns about the reliability of the "triangulation" analysis (see above) used to derive the scaling factor, we do not have confidence that the scaling factor adjustment provides a reliable method for removing the diversifiable risk component from National Grid's estimated cost of equity.
- 7.49 The differences between National Grid and the comparator sectors are simply too extensive to believe that the estimation of increased risk can be combined with the result of the, also imprecise, Monte Carlo simulation to arrive at an indicator of the diversifiability of the increased risk.

¹⁵⁰ "Risk, volatility and the cost of equity", Frontier Economics, March 2012, Table 5, p.34.

¹⁵¹ This value represents the middle of the range which was used by NGET in their risk modelling.

¹⁵² In its July 2011 risk modelling, NGET calculated the RIIO cost of equity to be 12.97% before taking account of mitigating factors. This represents a 5.47% increase relative to the 7.5% cost of equity assumed for the TPCR4 base case.

¹⁵³ "Finance (Annex to Business Plan)", NGET, July 2011, second table on page 51.

¹⁵⁴ "Risk, volatility and the cost of equity", Frontier Economics, March 2012, Table 5, p.34.

¹⁵⁵ NGET: paragraph 346.

Conclusion

- 7.50 The network companies performed relative risk modelling to calculate the increased risk and associated cost of equity that it expects to face due to the RIIO regulatory regime. We have not reviewed the models themselves, but having reviewed the companies' presentation of their modelling we find that:
- (1) Our limited review suggests that companies drew on their business models and experience to develop well specified models using reasonable inputs. However the Monte Carlo simulations are sensitive to multiple input assumptions for which there are likely to be equally reasonable alternative sets of assumptions that would affect the results.
 - (2) the Sharpe ratio calculation is by its nature sensitive to small changes in the standard deviation inputs. To the extent that Monte Carlo simulations produce a range of standard deviation estimates, then the most appropriate output of the Sharpe ratio calculation should also be a range.
- 7.51 Given the sensitivity of the risk modelling conducted to the input assumptions, we consider that the results provide a useful indication of the extent of additional risk carried by the network companies during the 2013/21 Price Controls, but should not be used in a deterministic way with respect to Ofgem's decision regarding an appropriate cost of equity.
- 7.52 In addition, we note that directionally, to a certain extent, the results of the modelling are inevitable given the compounding effect of, for example, annual price shock assumptions on the dispersion of returns faced over a longer price control period. This aims to capture the additional uncertainty existing in the real economy over longer relative to shorter periods, although it is unclear to what extent the regulatory protection from such uncertainty has been captured in the models.
- 7.53 An important factor in interpreting the results of the risk modelling exercise is to consider the extent to which additional risk modelled (and therefore the increase in cost of equity) is diversifiable. Frontier Economics have used a triangulation method to attempt to reach a view on the extent to which the additional risks are diversifiable for NGET. However, this analysis relies on a comparator set which, in our view, cannot produce an accurate scaling factor to remove the diversifiable component of NGET's additional risk in the 2013/21 Price Controls.

8. Cost of debt indexation - matching and risk

8.1 The network companies have raised a number of issues in relation to the proposed approach to cost of debt, including:

- (1) Concerns that annual updates to the debt allowance on the basis proposed by Ofgem (referred to as “indexation” by Oxera) causes increased variability in the return on equity, and potentially causes shortfalls in the recovery of costs of efficiently issued debt.
- (2) The possibility that changes in financial regulation (particularly Basel III and Solvency II) might make the index a less appropriate measure of the cost of debt for network companies.
- (3) The potential that certain financing costs will not be recouped through the indexation mechanism.
- (4) Concerns that the real cost of debt allowance may be understated because of the effect of an inflation risk premium in the measure of inflation used to adjust the index for inflation.

8.2 By reference to some of the issues above, certain network companies have suggested that adjustments, such as collars, be applied to the cost of debt indexation mechanism.

8.3 In this section, we review certain points raised by the network companies in relation to item (1) above. The issues considered are based on the agreed scope of our work with Ofgem. We first describe some general background to the cost of debt allowance, and consider the key differences in risk between the previous fixed allowance and Ofgem’s decisions for the 2013/21 Price Control. We then organise our discussion under these headings:

- Headroom between the cost of debt index and the cost of debt allowance.
- Potential procyclical effects introduced by cost of debt indexation.
- Other issues raised by network companies.

8.4 We consider items (2) to (4) in Sections 9 to 11 of this report.

Background

- 8.5 As context for our discussion, in the following paragraphs, we explain previous approaches to the cost of debt applied by Ofgem and the approach in the 2013/21 Price Controls.

Approach to the cost of debt in previous Ofgem determinations

- 8.6 In previous price control determinations, Ofgem set the cost of debt component of WACC at a fixed rate applicable over the length of the price control period.
- 8.7 In the most recent price controls (TPCR4, GDPCR, and DPCR5), Ofgem determined the cost of debt largely by reference to historical trailing averages of market interest rates¹⁵⁶.
- 8.8 Ofgem has historically set the allowed cost of debt above the trailing average index value¹⁵⁷. The amount of this 'headroom' has historically been about 30 basis points. Ofgem has explained its historical practice of allowing 'headroom' in the RIIO Strategy Decision¹⁵⁸:

“Headroom exists when a fixed allowance is set in order to account for the risk of the cost of debt rising during the price control period to the extent that the trailing average rises above its level at the time of Final Proposals.”

- 8.9 We understand that the 30 basis point headroom has been estimated relative to an index of corporate bond yields published by Bloomberg¹⁵⁹. Ofgem have informed us that relative to historical values of the relevant iBoxx index, historical headroom was approximately 20 basis points.

¹⁵⁶ “Electricity Distribution price control review, final proposals”, Ofgem, December 2009, (“DPCR5 Final Proposals”), paragraph 3.84.

¹⁵⁷ We refer to ‘index’ as the underlying index/indices themselves, and ‘trailing average index’ as the trailing average of the indices.

¹⁵⁸ RIIO Strategy Decision – Financial Issues Annex, paragraph 3.51.

¹⁵⁹ RIIO Strategy Consultation – Financial Issues Annex, Figure 3.7.

- 8.10 Ofgem has not made an allowance for other costs associated with debt financing, such as debt issuance costs, in previous determinations¹⁶⁰. However, Ofgem has recognised that the network companies have typically been able to issue debt at rates that are below the index values, and has considered that these costs are funded through this difference¹⁶¹:

“Over the history of the iBoxx index, network companies have been able to issue debt at coupons that are on average 58bps below the market cost of debt on the day.”

- 8.11 To summarise, the allowed cost of debt set by Ofgem in previous price control reviews has historically been above the network companies average cost of debt; this difference has comprised two elements. The first is ‘headroom’ in the allowed cost of debt above a trailing average corporate bond index. The second is an amount by which network companies have outperformed the trailing index on average.

Approach to the cost of debt allowance in the 2013/21 Price Controls

- 8.12 Ofgem has decided that under the RIIO Framework, the cost of debt allowance will be reset annually based on the values of a trailing average index of market interest rates¹⁶². This decision was influenced by the need to consider the cost of debt eight years ahead rather than five years, as in previous price controls. In the context of the 2013/21 Price Controls, following the recent financial crisis, Ofgem considers that indexation to historical data is the best available option to setting the allowance for cost of debt¹⁶³. Ofgem has decided¹⁶⁴:

- to use the average of the iBoxx Non-Financials 10-year trailing indices with credit ratings of broad A and broad BBB;
- to update the cost of debt allowance annually, based on a simple trailing average (although network companies may propose alternative weighting to the trailing average index);
- to convert the indices into a real cost of debt using 10-year breakeven inflation data published by the Bank of England; and

¹⁶⁰ DPCR5 Final Proposals, Allowed Revenue and Financial Issues appendix, paragraph 1.28.

¹⁶¹ RIIO Strategy Decision – Financial Issues Annex, paragraph 3.49. We note that the index previously applied has not been the iBoxx index.

¹⁶² Handbook for implementing the RIIO model – paragraph 12.15.

¹⁶³ RIIO Strategy Decision – Financial Issues Annex, paragraph 3.23.

¹⁶⁴ RIIO Strategy Decision – Financial Issues Annex, paragraph 3.1.

- to make no adjustments in the index for debt issuance fees, liquidity management fees, new issue premiums, or the inflation risk premium.

Comparison of risks with previous price controls

- 8.13 In previous price controls, network companies were subject to the risk that their cost of new debt could be higher than the fixed allowance. All other things equal, increases in the cost of debt during a price control period would reduce the returns earned by equity holders in the business.
- 8.14 This continues to be the case under the RIIO Framework. Therefore, the risk of rises in the market cost of debt is not a risk that is new in the 2013/21 Price Controls.
- 8.15 Ofgem considers that the responsibility for management of risks of changes in the market cost of debt resided¹⁶⁵, and continues to reside, with the network companies¹⁶⁶. For example, by managing the timing of their debt issuance¹⁶⁷.
- 8.16 In the 2013/21 Price Control, the cost of debt indexation mechanism means that the allowed costs of capital of network companies will vary over the price control period. This variability is a new feature in the 2013/21 Price Controls.
- 8.17 Another relevant risk is the possibility that changes in the network companies' actual cost of debt will not track the allowed cost of debt in the 2013/21 Price Controls. Under the RIIO Framework, the cost of debt faced by a network company can only perfectly match the index given a particular profile of existing debt and future debt refinancing, and that the benchmark index is appropriate¹⁶⁸. In practice, therefore, it will not do so. However, it was also not possible to perfectly match the cost of debt allowance under a fixed allowance. Matching is likely to be somewhat closer under the indexation mechanism since the interest rate environment of new debt issued will be reflected in the cost of debt allowance during the current price control period, to the extent of its weighting in the index.

¹⁶⁵ DPCR5 Final Proposals, Allowed Revenue and Financial Issues appendix, paragraph 1.29.

¹⁶⁶ RIIO Strategy Consultation – Financial Issues Annex, paragraph 3.18.

¹⁶⁷ DPCR5 Final Proposals, Allowed Revenue and Financial Issues appendix, paragraph 1.29.

¹⁶⁸ We note that network companies have historically been able to issue debt at costs below the relevant indices. Accordingly, network companies may seek to 'track' the performance of the index, rather than match it exactly.

8.18 In summary:

- (1) With both fixed allowances and indexed allowances, network companies are subject to the downside risk that the cost of new debt will be higher than the cost of debt allowance. Similarly, there is an upside risk for the network companies if the cost of new debt is below the cost of debt allowance.
- (2) In principle, this risk is reduced under the RIIO Framework because the market interest rates that new debt is issued at will be taken into account in the annual update of the debt allowance.
- (3) Similarly, under both approaches network companies are subject to the risk that existing debt at the start of a price control period (known as 'embedded' debt) is not funded by the cost of debt allowance. Under the fixed allowance, network companies will know with certainty whether this is the case at the start of a price control period (but will not know whether this is the case for future price control periods). Under the RIIO Framework, recoverability of embedded debt costs may be uncertain over the course of the price control period.
- (4) More generally, during the 2013/21 Price Control, the cost of debt indexation will cause changes in the revenues allowance from year to year.

Effect of cost of debt indexation on risk faced by network companies

8.19 The network companies have raised a number of points in their business plans suggesting that the level of risks they face will be higher with an indexed cost of debt allowance. In the paragraphs below, we discuss the points that we have been asked to consider by Ofgem.

8.20 We focus our discussion on risks that are incremental under the RIIO Framework.

Removal of headroom

- 8.21 In previous determinations, Ofgem has allowed a headroom between the value of the trailing average index (around the time the allowance was set) and the allowed cost of debt¹⁶⁹. We understand that this has been approximately 30 basis points^{170, 171, 172}. Several network companies have interpreted this margin as a return to equity holders for bearing the risk that actual debt costs differ from allowed debt costs.
- 8.22 Some network companies consider that to the extent that cost of debt indexation does not fully remove the risk to equity holders of the actual cost of debt being higher than the allowed cost of debt, a margin should be added to the cost of debt allowance in the 2013/21 Price Controls¹⁷³:

“In TPCR4, the risks to equity associated with a fixed cost of debt allowance were remunerated not through the cost of equity included in the WACC but by including headroom within the cost of debt allowance itself...

...The practice of setting the cost of debt allowance approximately 30 basis points or so higher than the value that would be derived from market data at the time (the cost of debt index) effectively provided reward to compensate for the equity risk that came with a fixed cost of debt allowance.

If the index perfectly matches the cost of debt, then it is appropriate to remove this reward. However, if the risk is not totally removed, then some of that reward should be retained to compensate for the residual risk.”

¹⁶⁹ DPCR5 Final Proposals, paragraph 3.84

¹⁷⁰ “What is the link between debt indexation and allowed returns, Prepared for Energy Networks Association”, Oxera, July 2011, executive summary.

¹⁷¹ Note, 100 basis points = 1.00%, accordingly 30 basis points = 0.30%.

¹⁷² As noted above, this was 30 basis points above a Bloomberg index. The headroom measured relative to a different index may differ.

¹⁷³ NGET: paragraphs 376 to 378.

- 8.23 This argument was based on a report prepared by Oxera for the Energy Networks Association (“ENA”) ¹⁷⁴. Oxera assessed the risks of the cost of debt not being funded under the indexation mechanism relative to the same risks under the fixed allowance. The report analysed the impact of certain factors on residual risk ¹⁷⁵:
- The proportion of existing debt that is refinanced during the price control.
 - The size and profile of the investment programme.
 - The frequency of debt issuance.
- 8.24 Using this analysis, Oxera considered what proportion of the headroom should be retained to account for ‘residual risk’ not removed by using the index.
- 8.25 The analysis by Oxera found that variability of return on equity ¹⁷⁶ is decreased under cost of debt indexation relative to a fixed cost allowance in all cases considered, except in one scenario that assumes that less than 40% of debt is refinanced and there is no RAV growth during the price control period ^{177,178}.
- 8.26 We agree that the factors considered by Oxera, such as the impact of small or very large borrowing requirements, are relevant to consideration of the market cost of debt faced by network companies.
- 8.27 We agree with Oxera that indexation does not remove all risk of movements in the cost of debt. Depending on the profile of the network companies’ debt, and future movements in interest rates, companies may be better or worse off under indexation than a fixed allowance over the course of the 2013/21 Price Controls.

¹⁷⁴ *‘What is the link between debt indexation and allowed returns?’*, July 2011, Oxera. We note that several network companies have referred to additional analysis they have commissioned in relation to this report; we have not reviewed these additional analyses.

¹⁷⁵ *‘What is the link between debt indexation and allowed returns?’*, July 2011, Oxera, pages 1 and 2.

¹⁷⁶ Oxera measured risk as the normalised standard deviation of modelled return on equity.

¹⁷⁷ *‘What is the link between debt indexation and allowed returns?’*, July 2011, Oxera, Executive Summary.

¹⁷⁸ We note that we have not reviewed Oxera’s modelling in detail.

- 8.28 However, the analysis is based upon the premise that the headroom allowed in previous price controls represented a return for the risk borne by equity holders. We understand that Ofgem's conclusions in the RIIO Strategy Decision did not depend on the cost of debt allowance removing all risk faced by the network companies. That is, Ofgem's decision in the consultation process for the 2013/21 Price Controls was not intended to remove all risk faced by the network companies. Therefore, it is not clear to us that this is the correct interpretation of the margin applied.
- 8.29 According to Ofgem, the headroom allowed above the trailing average index value in previous determinations represented an allowance for changes in the cost of debt after the time of the determination¹⁷⁹. That is, an allowance for the chance that the value of the trailing average index (that was used at the time the price control was set) was not a representative estimate of the cost of debt over the price control period. In other words, it reduces the risk that the network companies' cost of debt will be lower than the cost of debt allowance over the price control period.
- 8.30 Cost of debt indexation is an alternative form of reducing this risk for network companies against increases in rates¹⁸⁰.
- 8.31 The figure below shows the cost of debt allowances offered by both indexation and an headroom allowance in the case of rising interest rates. The figure presented is a stylised example in which interest rates rise from 2% to 3% between year 1 and year 2 of the price control period. The chart assumes that interest rates have been constant at 2% for the past ten years prior to the start price control period.

¹⁷⁹ RIIO Strategy Decision – Financial Issues Annex, paragraph 3.51.

¹⁸⁰ RIIO Strategy Consultation – Financial Issues Annex, paragraph 3.21.

Figure 8-1 – Illustrative comparison of fixed and floating cost of debt allowances when interest rates rise



Note: Year 0 represents the year before the price control period.

- 8.32 The chart above shows that both a fixed allowance with headroom and an indexed allowance both provide protection against a rise in the index. In the example above, the network company is better off because the rise in the index of 80 basis points exceeds the headroom of 30 basis points.
- 8.33 Both a fixed allowance (with headroom) and an indexed allowance provide some protection against rising cost of debt. The application of a margin above a trailing average cost of debt allowance that is updated annually (i.e. an indexation mechanism) may give network companies two forms of protection against rising costs of debt. Providing two forms of protection against the same risk would effectively transfer risk from shareholders of network companies to consumers, without any corresponding benefit. Over the long run we consider that indexation provides protection against rising interest rates and that an additional allowance is likely to be duplicative of that protection.

Procyclicality of returns resulting from the indexation mechanism

- 8.34 Some network companies have raised the point that cost of debt indexation may increase the correlation of their returns to the market, and thus increase their equity beta¹⁸¹.
- 8.35 One network operator explains the rationale as follows¹⁸²:
- “the distribution of equity returns from the above analysis [of cost of debt indexation] is pro-cyclical. So, for example, if the economy recovers strongly from recession and interest rates rise, shareholders will make money. If recovery falters and interest rates remain low, shareholders will lose money.”*
- 8.36 We agree with the economic reasoning presented above that interest rates may rise when the economy is performing well, due to inflationary pressures¹⁸³, and strong economic performance may be accompanied by strong performance of stock markets. Since increases in interest rates will increase revenues for network companies, this may increase the correlation of movements in returns of the network companies to the market. As a consequence the beta would rise.
- 8.37 However there are several reasons why the relationship causing procyclicality may not hold in practice, or may be weakened such that it causes a small or no increase in the beta:
- (1) The overall effect of cost indexation on charges may be relatively small, as changes in the index will be muted by the use of a 10-year average, which will reflect average rates over the course of the business cycle.
 - (2) The relationships between economic growth, inflation, interest rates and stock market performance may be subject to time lags¹⁸⁴. Accordingly, there may be little or no increase in the observed covariance between interest rates and the market, and so the beta.

¹⁸¹ NGET: paragraph 394.

¹⁸² WWU1: page 13.

¹⁸³ *“Discretion versus policy rules in practice”*, Taylor J. B, Carnegie-Rochester Conference Series on Public Policy 39, 1993, pp.195-214. The paper argues that policymakers increase interest rates when output and inflation are above their target levels.

¹⁸⁴ *“Optimal Interest-Rate Smoothing”*, Woodford M., June 2002. Revised excerpt from *“Optimal Monetary Policy Inertia,”* published in *Review of Economic Studies* 70: 861-886 (2003).

- (3) Depending on the debt profile of the network company, the increase in allowed revenues may be accompanied by an increase in interest costs on new or floating rate debt. Accordingly, procyclicality of revenues may not cause procyclicality of returns. For example, suppose that in response to economic recovery market interest rates on the index increased from 5% to 7% (illustrative figures only). If at the same time a network company issued new bonds at say 6.5%, whereas its previous bonds had been issued at 4.5% then there would be two effects. First, the cost of debt allowance would increase at the next annual update to take into account the 7% level. Second, the weighted average cost of debt that the company was paying would increase, reflecting the higher interest on its new debt issue. In such circumstances this would not correspond to an increase in volatility of returns. The increase in allowed revenues would be partially or wholly offset by the increase in the cost of debt borne by the company. Whether that results in an overall increase or decrease in returns would depend on the profile of new and embedded debt issued by the company.
- (4) The relationships between economic growth, inflation, interest rates and stock market performance can breakdown at times of market dislocation / crisis. As an example, during the 'credit crunch' the yields on many bond indices, including the iBoxx, rose at the same time as stock market performance fell.

8.38 In our view, cost of debt indexation may have a procyclical effect on returns and so increase the beta of the network companies. However, the effect may be reduced due to the reasons discussed above. Accordingly, the procyclical effect of indexation may or may not materially increase the beta of the network companies.

Funding the costs of embedded debt in the 2013/21 Price Control

- 8.39 The network companies have raised concerns that the cost of their existing or ‘embedded’ debt may not be funded by the cost of debt allowance – i.e. that the allowance in the 2013/21 Price Controls will be lower than the interest costs of embedded debt. The arguments raised include:
- Borrowing requirements are low and/or issuance of debt is infrequent, which reduces the extent to which the company’s cost of debt tracks the index (we comment on this argument in the following sub-section).
 - Embedded debt cannot easily be refinanced, which reduces the extent to which the company’s cost of debt tracks the index¹⁸⁵.
 - Embedded debt may now be sub-optimal with regards to matching the index¹⁸⁶.
 - Certain network companies have issued debt at higher cost than the level of the trailing average index¹⁸⁷.
- 8.40 Embedded debt forms a part of network companies’ weighted average cost of debt. Network companies have limited ability to manage the costs of any fixed rate embedded debt. Where embedded debt was entered into at rates that are higher than current levels, this will make it harder for them to outperform the cost of debt allowance.
- 8.41 This is the case regardless of whether the cost of debt allowance is fixed or indexed. Network companies have entered previous price control periods with embedded debt. The indexed cost of debt allowance will not guarantee that the costs of embedded debt will be funded, and so the risks relating to the funding of embedded debt are not new in the 2013/21 Price Controls. However, the magnitude of the differences between the cost of embedded debt and cost of debt allowance changes depending on whether the allowance is fixed or indexed.

¹⁸⁵ WWU1: Section 3.1.

¹⁸⁶ WWU1: Section 3.2.

¹⁸⁷ WWU1: Section 3.2.

- 8.42 If embedded debt was taken on at times of relatively high market rates of interest, and interest rates are falling over the course of a price control period, then as the trailing average is updated each year, the position of the network company will worsen relative to its position under a fixed allowance. Conversely, if the index is stable, or interest rates are rising over the course of a price control period then position of the network company will be the same or better under the indexation mechanism.
- 8.43 In both circumstances (rising or falling interest rates), the effect on the returns of the network company will be muted by the use of a 10 year trailing average index, which should generally include rates across the economic cycle.
- 8.44 Therefore it seems to us that this issue does not in principle require any adjustment to the cost of debt allowance in times of normal market conditions. It reflects risks that were present with a fixed allowance and continue to exist in the 2013/21 Price Controls.
- 8.45 However, we recognise that the particular circumstances of some network companies in combination with the unusual conditions in the financial markets during the ‘credit crunch’ may make it appropriate to adjust the cost of debt allowance.

Impact of recent low yields on trailing average index values

- 8.46 UK corporate bond yields are currently low relative to average levels in the 2000s. Further, some network companies consider that the market cost of debt is expected to rise¹⁸⁸. Network companies have argued that the inclusion of these relatively low values in the index will reduce the trailing average index. They argue that this will lead to the cost of debt allowance not sufficiently funding their cost of debt¹⁸⁹:

“overall funding of our debt over GD1 will be insufficient given the influence of historical lows in a ten year index in the current price control period continuing into GD1.”

- 8.47 The substance of the argument is that the trailing average index may fall as higher earlier rates are removed from the trailing average and are replaced by potentially lower rates over the next few years. We agree that the recent level of the market cost of debt relative to the average values in the 2000s is likely to cause the trailing average index to fall over the next few years.

¹⁸⁸ For example, SGN1: section 11.2.1, page 105.

¹⁸⁹ SGN1: section 11.2.1, page 105.

- 8.48 The effect of low yields on the cost of debt allowance is not a new risk arising due to the RIIO Framework. With a fixed allowance, set based on a trailing average, a period of low interest rates would also reduce the cost of debt allowance at future price control periods. The difference in the mechanisms effects when the network companies bear the low cost of debt allowance.
- 8.49 In normal circumstances, we consider that a 10 year average is likely to reflect yields across a full economic cycle, and therefore there should be no reason to adjust the average for periods of low (or high) interest rates. However, we agree that recent low yields are extremely low by historical standards, and may not be representative of a normal economic cycle. Moreover, current low levels of growth may continue for longer than normally expected in the economic cycle. Consequently it is possible that the divergence between embedded and new debt costs will become more pronounced during the 2013/21 Price Controls.
- 8.50 That said, we note the following points:
- 8.51 First, if interest rates rise over the price control period from their current low rates, the increased rates will be incorporated into the trailing average index.
- 8.52 Second, the current low rate environment also offers potential benefits to the network companies, in that they can lock in a lower cost of debt by issuing debt, and so reducing their average cost of debt. We note that some network companies plan to increase their borrowing significantly over the next few years. For these companies the recent low rates may form a large part of their average cost of debt; if interest rates subsequently rise, they will benefit from the rise through an increase in the cost of debt allowance.
- 8.53 Third, the market cost of debt rose significantly in the period 2008 and 2009 due to the credit crisis. These rates will also be included in the trailing averages for a significant portion of the price control period. These high costs will partially offset some of the lower values.

Low borrowing requirements

- 8.54 Some network companies have argued that they have low borrowing requirements and therefore intend to borrow infrequently in order to borrow at efficient scale. They argue that this reduces the extent to which their average cost of debt will track that of the index. As a consequence, the cost of embedded debt is a more significant proportion of their cost of debt. Since current rates of borrowing are low relative to historical levels, this may increase the risk of the companies' cost of debt being above the trailing average index^{190,191}.

¹⁹⁰ WWU2: page 5.

- 8.55 As a result, certain network companies have argued that their infrequent borrowing pattern warrants applying a weighting to the index.
- 8.56 We note that the risk identified is a symmetric risk. When rates are rising, with infrequent borrowing, the cost of debt allowance may rise faster than the cost of debt faced by the company. In these circumstances, the company will outperform this index.
- 8.57 However, the low/infrequent borrowing requirements of some network companies make it more difficult for them to track the index. This increases the risk of these companies relative to those who will issue debt more regularly.
- 8.58 Overall, we agree that given expectations of a decrease in the trailing average, low future borrowing requirements lead to the possibility that the cost of debt for some network companies will be higher than the cost of debt allowance. We note that Ofgem has stated that in exceptional circumstances companies may propose alternative weightings of the trailing average index. We consider that this approach is capable of addressing this issue.

Changes in the constituents of the iBoxx indices

- 8.59 Several network companies raised concerns about actual or potential changes in the constituents of the iBoxx indices used to set the cost of debt allowance.
- 8.60 In the RIIO Strategy Decision, Ofgem identified the relevant iBoxx indices as being a representative benchmark for the costs of debt of the network companies¹⁹².
- 8.61 The relevant iBoxx indices are made up of a large number of bonds. The bonds included in the indices may change over time, as new bonds are issued, or credit ratings change for example. These changes will typically have a small impact on the overall value of the index.
- 8.62 However, structural changes to the make-up of the index may make the index a less appropriate benchmark for the costs of the debt of the network companies.

¹⁹¹ NGN2: page 229.

¹⁹² RIIO Strategy Decision – Financial Issues Annex, paragraph 3.36.

- 8.63 Network companies identified two types of actual or potential changes in the indices:
- (1) **Index methodology:** There could be changes in the classes of bonds that are included in the index due to changes in index construction methods by the index administrators. For example, whole business securitisation bonds have been included in the index from January 2012¹⁹³.
 - (2) **Average maturity of index:** A trend towards issuing bonds with a 10-year maturity, potentially leading to a reduction in the average maturity of the bonds in the indices¹⁹⁴.
- 8.64 The networks identified that the potential for such changes cause uncertainty¹⁹⁵, and could be to the detriment of network companies.
- 8.65 We discuss each of the types of change in the indices in turn.
- 8.66 A change in index construction methodology could have a negative effect if it materially changes the value of the index or the average characteristics of the index. Such a change could reduce the extent to which the index is representative of the costs of debt of network companies.
- 8.67 Additionally, if the impact of the change is large, it could cause volatility in charges. Although, this is unlikely given that the effect of changes are muted by the use of a 10-year average.
- 8.68 One network company has suggested that Ofgem ‘locks’ the constituents of the index over the course of the 2013/21 Price Controls. In our view, although this could mitigate this risk, it would be complex and would reduce transparency of the index construction method.
- 8.69 Additionally, a ‘locking’ of the index constituents could introduce additional risks if characteristics of the index constituents changed over the period, such that the index was a less suitable benchmark for the cost of debt of the network companies. For example, if bonds included in the index changed credit rating or, due to the passage of time, were of a different maturity to the average maturity of the debt of the network companies. Bond indices are typically updated regularly. A ‘locking’ of the index constituents would, by definition, preclude such updating of the index that allows it to remain a relevant benchmark for the cost of debt. This may make it harder for network companies to match the index.

¹⁹³ “*Markit iBoxx GBP Benchmark Index Guide*”, Markit, March 2012, page 3.

¹⁹⁴ NGN revised financial proposals, section 8.3.2.ii, page 200.

¹⁹⁵ WWU1: section 3.3.3, page 18.

- 8.70 We consider that no such adjustments should be made unless the effect of changes in methods for index construction is significant¹⁹⁶. If there are occasional changes that have a limited effect on the yields of the index, then the additional complexity from 'locking' the composition of the index outweighs any benefits to be gained. However, if a change is significant, then we agree with the arguments of the network companies that Ofgem should consider measures to ensure consistency of the index over time.
- 8.71 One network company raised concerns about a potential change in the average maturity of the index. They noted that¹⁹⁷:
- “a significant proportion of recent corporate bond issues in sterling markets [were] clustered around a maturity of 10 years. If this trend continues, this will likely skew the average maturity of the pertinent iBoxx indices downwards from the current averages of c.17-21 years... This would lead to a consequential lowering of the index yields to the detriment of GDNs whose natural preference has been to finance long term assets with long term debt.”*
- 8.72 This reduction in the average maturity of the index could cause the trailing average to be less representative of the cost of debt of the network companies. However, this would only have a significant effect if (i) the trend identified is not temporary, that is, it relates to a sustained reduction in the average; and (ii) the effect on yields is significant.
- 8.73 We do not know whether the trend observed will be sustained over the course of the price control.
- 8.74 The effect of the reduction in yields may not be significant. In the RIIO Strategy Consultation, Ofgem noted that¹⁹⁸:
- “the cost of debt for 10-year bonds and longer issues do not tend to be materially different from each other.”*

¹⁹⁶ We note that some changes in the index may increase the suitability of the index as a benchmark for the cost of debt of the network companies. However, this consideration needs to be weighed against a requirement to reduce regulatory uncertainty.

¹⁹⁷ NGN1: section 8.3.2.ii, page 200.

¹⁹⁸ RIIO Strategy Consultation – Financial Issues Annex, paragraph 3.26.

- 8.75 Whether or not the yields on 10-year bonds are significantly different from bonds on longer term bonds depends on the shape of the yield curve. Yields on longer dated bonds may be higher or lower than 10-year bonds. The current real government yield curve indicates a difference of close to zero¹⁹⁹. Accordingly, this trend may not represent a structural change in the index on the basis that the effect may not be material.
- 8.76 We note that indices such as the iBoxx are used as benchmarks for assessment of the performance of bond investments. The index provider will be incentivised to ensure that the index remains relevant by making required changes that maintain or improve the relevance of the index. However, they will also be incentivised to minimise any the number of structural changes made to the index.
- 8.77 We agree that structural changes in the index could have a negative effect if they make the index a less appropriate benchmark and if they create uncertainty for network companies. We do not expect the effect of such changes to be material. However, we recommend that Ofgem retains a provision to change the indexation mechanism if there are any extreme changes to the index.

Lagging effects

- 8.78 National Grid argued that the trailing average index value will follow the index value with a lag, and that this delays the recovery of the costs of debt by the networks²⁰⁰:
- “The cost of debt index uses a trailing average of spot rates. By definition, if there is a sustained increase in the spot rates the trailing average will be behind the spot due to a lagging effect.*
- With interest rates currently at historically low levels the expectation is that they will rise during the RIIO period. Notwithstanding the concerns documented above, the index would normally be expected to cover debt costs over time but there is a significant risk that the cost of debt index will fail to adequately cover debt costs for a prolonged period.”*
- 8.79 National Grid argued that this increases the equity risk of the network companies and could lead to concerns about financeability²⁰¹.
- 8.80 We consider that this point repeats points addressed above in relation to allowing headroom to reward network companies for risk.

¹⁹⁹ Bank of England, “UK instantaneous implied real forward curve”, 13 July 2012.

²⁰⁰ NGET: paragraphs A54 and A55.

²⁰¹ NGET: paragraphs A57 and A58.

- 8.81 In our view, this will not have a significant impact on the equity risk of the network companies. We set out our reasoning for this below. We note that we have not been asked to consider issues of financeability in this report. Accordingly, we do not comment on that aspect of the comments above.
- 8.82 The cost of debt of a network company is an average of the cost of the debt it has issued over time. Therefore, the cost of debt for network companies is also subject to a lagging effect, which may offset the lagging effect identified by National Grid. The extent to which a lagging effect causes sustained differences in average cost of debt depends on the debt maturity profile and the rate of new borrowing and refinancing.
- 8.83 Under a fixed allowance, no adjustment would be made to the cost of debt allowance during the price control period. In contrast, under cost of debt indexation the network companies receive higher revenues as a result of an increase in the cost of debt.
- 8.84 Further, we note that the lagging effect is not just a downside risk for the network companies. The risk identified by National Grid is symmetrical. In periods where interest rates are falling, the cost of debt allowance may exceed the cost of debt of the network companies for prolonged periods.

Incentives to alter profile of debt issuance

- 8.85 One network company has argued that the introduction of cost of debt indexation might incentivise network companies to issue bonds of shorter maturities²⁰²:

“The iBoxx index selected incorporates bonds with maturity of at least 10 years. Now, given a normal shaped yield curve, it is expected that yields on longer maturities will exceed those on shorter maturities, all else being equal. An issuer would therefore increase his potential to outperform the index by selecting shorter-dated maturities.”

- 8.86 We note that this incentive was available to network companies under previous price controls. Previously, network companies could have issued bonds of a shorter maturity in order to achieve a larger headroom between cost of debt and the cost of debt allowance. We consider network companies will always face an incentive to reduce their cost of debt, unless these costs are fully passed through to consumer. It is not clear, why this incentive would be increased by the introduction of cost of debt indexation in the 2013/21 Price Controls.
- 8.87 Further, a switch towards issuing bonds of shorter maturity would increase the refinancing risk and issuance costs faced by the network companies.

²⁰² SHETL: page 24.

- 8.88 Overall, given that this incentive to reduce the maturity of their borrowing is not introduced by cost of debt indexation, and that there are material risks of reducing the maturity of their borrowing, we do not consider this to be a material concern.

Conclusion

- 8.89 The network companies have raised a number of issues with regards to the level of risk under the cost of debt indexation mechanism proposed by Ofgem.
- 8.90 In summary, our views in relation to the issues we have been asked to consider are as follows:
- (1) **Application of a margin above the indexed cost of debt allowance to take into account for risks of changes in the market cost of debt:** Cost of debt indexation does not remove all risk of movements in the cost of debt, but it may materially reduce the risk faced by the network companies. We understand that Ofgem's conclusions in the RIIO Strategy Decision did not depend on the cost of debt allowance removing all risk faced by the network companies. An allowance for "headroom" in the 2013/21 Price Controls would be duplicative of the protection an indexed allowance provides against rising interest rates.
 - (2) **Cost of debt indexation may increase correlation of network companies' returns with the market:** This is unlikely to have a significant effect on beta. This is because changes in the index will be muted by the use of a 10-year average, which will reflect average rates over the course of the business cycle. Further, the effect on returns will depend on the borrowing profile of companies, since the average cost of debt of the network companies will also change in response to movements in the market cost of debt. The relationship identified will also be subject to time lags and the effect of other shocks, which will mitigate any increase in correlation with the market.

- (3) **For some network companies, the cost of existing or 'embedded' debt may not be funded by the cost of debt allowance:** The indexed cost of debt allowance will not guarantee that the costs of embedded debt will be funded, however, the risks relating to the funding of embedded debt are not new in the 2013/21 Price Controls. This risk does not, in principle, justify an adjustment to the cost of debt allowance, because the trailing average index should generally include rates across the business cycle. However, where efficiently-acquired debt was acquired during the recent financial crisis at rates that are unlikely to recur during the price control period, it may mean that certain costs of embedded debt may not be financed through the indexed allowance.
- (4) **Recent low yields will reduce the trailing average index, and so the cost of debt allowance may not fund the cost of debt of network companies:** In general, an indexation mechanism based on 10 years of data will reflect average rates over the course of an economic cycle, and no adjustment would be required for low (or high) rates in any one period. However, we recognise that recent interest rates have been at historically low levels that may be unrepresentative of a normal economic cycle. Depending on the future pattern of interest rates, the inclusion of these rates in the index may, therefore, not reflect the efficient costs of debt for a network company over the 2013/21 Price Controls.
- (5) **The cost of debt of network companies that have low or infrequent borrowing requirements will be less likely to track the index:** For companies with low borrowing requirements, the cost of embedded debt is likely to represent a more significant proportion of their cost of debt than if they borrowed or refinanced debt more frequently. If market rates continue to be lower than historical rates, we agree that companies with low borrowing requirements may face a cost of debt that is higher than the cost of debt allowance. We note that Ofgem has stated that in exceptional circumstances companies may propose alternative weighting of the trailing average index; we consider that this could address this issue.
- (6) **Changes in the composition of the relevant iBoxx indices may reduce the comparability of the indices to the network companies' cost of debt:** Structural changes in the index could make the index a less appropriate benchmark, and the potential for such changes could create uncertainty for network companies. We do not expect the effect of such changes to be material. However, we recommend that Ofgem retains a provision to change the indexation mechanism if there are any extreme changes to the index.

- (7) **The trailing average index value will follow the index value with a lag:** Compared to a fixed allowance, no adjustment would be made to the cost of debt allowance during the price control period. In contrast, under cost of debt indexation the network companies receive higher revenues as a result of an increase in the cost of debt. Further, the cost of debt for network companies is also subject to a lagging effect, which may offset the lagging effect identified. In our view, this will not have a significant impact on the equity risk of the network companies.
- (8) **Cost of debt indexation might incentivise network companies to issue bonds of shorter maturities:** Given that the incentive to reduce the maturity of borrowing is unaffected by the introduction of cost of debt indexation (network companies will always face an incentive to reduce their cost of debt, unless these costs are fully passed through to consumers), and that there are material risks of reducing the maturity of their borrowing, we do not consider this a material concern.

9. Basel III and Solvency II

Introduction

- 9.1 Basel III is shorthand for the package of measures included in the September 2010 agreement between the 27 member countries of the Basel Committee on Banking Supervision “*to effectively triple the size of the capital reserves that the world’s banks must hold against losses*”²⁰³.
- 9.2 The new Solvency II rules harmonise the insurance industry’s regulatory regime across the EU introducing “economic risk-based solvency requirements across all EU Member States for the first time. These new solvency requirements will be more risk-sensitive and more sophisticated than in the past, thus enabling a better coverage of the real risks run by any particular insurer”²⁰⁴.

²⁰³ Financial Time Lexicon.
[/lexicon.ft.com/Term?term=Basel-III](http://lexicon.ft.com/Term?term=Basel-III)

²⁰⁴ “*Solvency II: Frequently Asked Questions (FAQs)*”, European Commission Internal Market and Services DG, paragraph 2.
ec.europa.eu/internal_market/insurance/docs/solvency/solvency2/faq_en.pdf

- 9.3 Network companies have raised concerns that Basel III and Solvency II could increase their debt finance costs under the new cost of debt index methodology^{205 206 207}. Ofgem has stated that it is committed to monitoring the future impact of these regulatory regimes, but that the bulk of companies' financing will be unaffected since it consists of existing fixed rate debt²⁰⁸:

“We will continue to monitor issues such as the introduction of the Basel III banking supervision accords to ensure that the index will be robust to potential changes that might affect the bond market. However, since the network companies are primarily financed through existing fixed-rate debt, their cost of debt is less likely to be materially impacted by such changes.”

- 9.4 In our view the impact of Basel III and Solvency II on the network companies cost of debt can be examined from two perspectives. First, whether the impact results in an increased cost of debt to corporations in general. Second, whether the cost of debt of the network companies increase disproportionately relative to the iBoxx index used to set is cost of debt allowance²⁰⁹.
- 9.5 We focus on addressing the second point as the network companies cost of debt allowance will automatically reflect any general cost of debt increase captured in the iBoxx index, albeit gradually due to the use of a ten year trailing average.
- 9.6 In this section we will address the concerns raised by the companies as they relate specifically to Basel III and Solvency II, in particular:
- The increased cost of liquidity facilities under Basel III.
 - The increased cost and decreased demand for longer dated and lower rated debt under Solvency II.
- 9.7 A detailed exposition of the workings of Basel III and Solvency II is beyond the scope of this report.

²⁰⁵ NGET: paragraph 420.

²⁰⁶ SGN1: section 11.2.1, page105.

²⁰⁷ NGGD1: paragraph 2.30.

²⁰⁸ RIIO Strategy Consultation – Financial Issues Annex, paragraph 3.20.

²⁰⁹ Ofgem strategy decision document sets out the RIIO cost of debt indexing mechanism's use of the iBoxx indices for GBP Non-Financials of 10+ years maturity, with broad A and broad BBB credit ratings:
RIIO Strategy Decision – Financial Issues Annex, pages 19 to 30.

Increased cost of liquidity facilities under Basel III

- 9.8 As issuers of commercial paper, network companies are obliged to have backup liquidity facilities in case they are unable to roll over, or issue, more commercial paper. National Grid argues that, under Basel III, the additional capital requirements placed on banks providing such backup facilities will lead to their capital charge being 100%. We interpret this as a reference to the Basel III stipulation that banks assume such general-purpose credit facilities are fully drawn, requiring higher capital requirements, as explained by Standard and Poor's²¹⁰:

“Under Basel III rules, banks will have to assume that such general-purpose credit facilities [e.g. back-up for short-term commercial paper, working capital requirements, capital spending, or any other treasury purposes] are fully drawn, and will hence require higher capital requirements. In turn, they will probably require higher pricing to maintain the same profitability target.”

- 9.9 Specifically, Standard and Poor's' simulation results indicate a 10% to 20% increase in interest costs for corporate borrowers²¹¹. Network companies are likely to face this increased cost even when, as National Grid states, they have never drawn and don't intend to draw on these facilities.²¹² National Grid contends that, since Ofgem's cost of debt index does not explicitly allow for this increased cost, their cost of debt will be underfunded requiring additional compensation for equity holders^{213,214}.

²¹⁰ “Why Basel III And Solvency II Will Hurt Corporate Borrowing In Europe More Than In The U.S.”, Standard and Poor's, 27 September 2011, page 6.

²¹¹ “Why Basel III And Solvency II Will Hurt Corporate Borrowing In Europe More Than In The U.S.”, Standard and Poor's, 27 September 2011, p.2.

²¹² Annual Report and Accounts 2010/11, National Grid, 2011, p.72.

²¹³ NGET: paragraphs 422-423.

²¹⁴ NGGD2: paragraphs 4.4 to 4.6.

- 9.10 There appear to be mitigating actions available to corporate treasurers, according to Standard and Poor's. Specifically, general purpose credit facilities which, under Basel III, have a 100% capital requirement for banks providing the facilities could be replaced with dedicated facilities which would likely be cheaper due to their lower 10% Basel III capital requirement²¹⁵. More generally the increased cost of bank borrowing could be avoided by companies going to the capital markets for other forms of debt that are not as short term in nature. Standard and Poor's reports seeing European companies obtain such funding "*at very favorable conditions*" over the past two years²¹⁶.
- 9.11 In conclusion, we believe it is likely that Basel III will increase the cost of bank funded general lines of credit, but there will be scope to fund back-up facilities for commercial paper through cheaper dedicated credit facilities. Accordingly, we do not consider that Basel III will affect the extent to which the allowance is a representative benchmark for the cost of debt of the network companies.

Increased cost and decreased demand for longer dated and lower rated debt under Solvency II

- 9.12 Solvency II places additional capital requirements on insurers holding assets which are longer dated or have a lower credit rating²¹⁷. As some of National Grid's bonds are up to 50% owned by insurers, National Grid believes it could be exposed to both an increased cost of debt and lower demand for its bonds, possibly affecting its ideal capital structure^{218, 219}. Similarly, WWU expects reduced demand for utilities' long dated bonds will eliminate any advantage that network companies previously had in being able "*to raise debt finance more cheaply than peers with a comparable credit rating*"²²⁰.

²¹⁵ "Why Basel III And Solvency II Will Hurt Corporate Borrowing In Europe More Than In The U.S.", Standard and Poor's, 27 September 2011, p.6.

²¹⁶ "Why Basel III And Solvency II Will Hurt Corporate Borrowing In Europe More Than In The U.S.", Standard and Poor's, 27 September 2011, p.11.

²¹⁷ "Solvency II and Basel III - Reciprocal effects should not be ignored", Deutsche Bank Research, September 2011, p.1.

²¹⁸ NGET: paragraphs 424 to 426.

²¹⁹ NGGD2: paragraphs 4.4 to 4.6, p.23.

²²⁰ WWU1: page17.

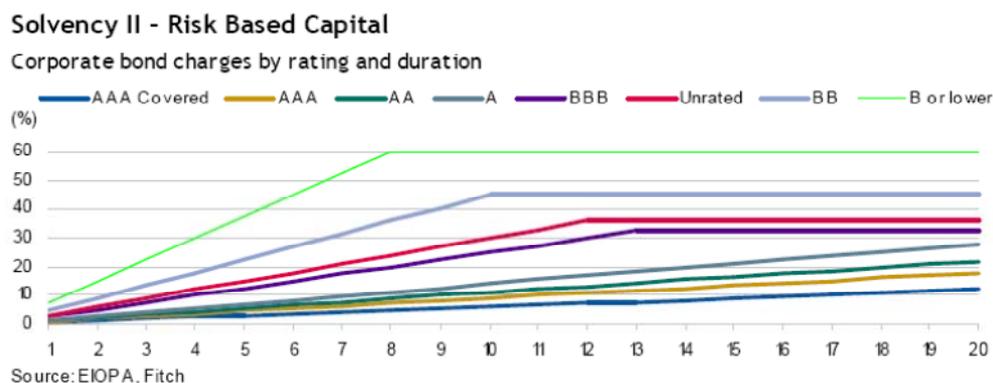
9.13 National Grid also speculates that not only the cost of 'BBB' debt might increase as a result of Solvency II's credit risk dependent capital charges, but also 'A' rated debt^{221 222}.

9.14 Standard and Poor's agree with network companies assessment that the demand for longer duration bonds will likely be reduced²²³:

"It will likely also reduce availability for funds with a longer tenor of seven years and above because they attract higher capital weights under both Basel III and Solvency II."

9.15 It is also clear that the capital charges imposed on insurers under Solvency II will increase with reduced credit rating as well, resulting in a joint impact of duration and credit rating on corporate bond charges as illustrated by Fitch Ratings below.

Figure 8-1: Corporate bond charges by rating and duration under Solvency II



Sources: "Solvency II Set to Reshape Asset Allocation and Capital Markets", Fitch Ratings, 22 June 2011, Figure 4, p.3.

Notes: Fitch's calculation was made before the publication of the draft Level 2 text which might affect their results.

9.16 The corporate bond charges charted above, indicate that even 'A' rated bonds of longer duration will see significant capital charges. Fitch Ratings observed, in particular, that this effect will make infrastructure and utility company debt less attractive to insurance companies that have typically supported demand for them.

²²¹ NGET: paragraph 425.

²²² Original Finance Proposals – Appendix A12.1, NGGD, November 2011, para 4.5, p.23.

²²³ "Why Basel III And Solvency II Will Hurt Corporate Borrowing In Europe More Than In The U.S.", Standard and Poor's, 27 September 2011, p.11.

- 9.17 We note that Solvency II stipulations as currently envisioned might be softened and will probably take up to 10 years to fully implement, as observed by Fitch Ratings²²⁴:

“Fitch considers it unlikely that large-scale reallocations will happen in the short term, as transitional arrangements are likely to phase in the implementation of Solvency II over several years. Transitional arrangements may give insurers up to ten years to adapt their business and investment strategies to the new regime. The calibration of Solvency II is still under discussion, so the capital charges for asset risk and price volatility may not be as onerous as the current draft, mitigating the impact on investment markets. Nevertheless, many insurers are already anticipating the proposed changes and have started aligning investment strategies accordingly”.

- 9.18 In an IMF working paper, Darwish et al. (2011) note the reduced attractiveness of longer duration debt but are ambivalent about the overall impact because of implicit tradeoffs:²²⁵

“For instance, it is unclear if and to what extent the demand from insurers for long-term maturity instruments will actually decrease. The tradeoff between maturity mismatches, capital charges, and the impact of the duration multiplier will likely be different across entities with different structures of liabilities.”

²²⁴ “Solvency II Set to Reshape Asset Allocation and Capital Markets”, Fitch Ratings, 22 June 2011, p.1.

²²⁵ “Possible Unintended Consequences of Basel III and Solvency II”, A. Al-Darwish, M. Hafeman, G. Impavido, M. Kemp, and P. O’Malley, IMF Working Paper, August 2011, p.47.

- 9.19 We consider it likely that there will be a drop in demand for long-dated infrastructure company debt due to Solvency II. The extent of this impact on the bond market, in particular due to Solvency II, is still unclear due to the possibility that final capital charge requirements might be less onerous than currently envisioned. To the extent that the iBoxx index used in the 2013/21 Price Controls captures the increase in bond rates for longer rated bonds then the network companies will not be exposed to an unfunded increase in their cost of debt. We note that Ofgem's analysis of the maturity of the bonds in the iBoxx index suggests that risk of network companies' cost of debt increase outstripping the index is likely to be negligible²²⁶:

“The average remaining maturity (weighted by outstanding amount) in iBoxx's A rated index is currently 21.6 years. On the iBoxx BBB rated index it is currently 17.2 years. This is broadly in line with the 18.6 years that we estimated in the strategy consultation document as the weighted average tenor of network company debt issuances.”

- 9.20 A risk that does remain is that there will simply not be sufficient demand for the longer-dated debt typically issued by infrastructure companies to fund their asset investments. It seems likely that there will be some reduced demand from insurers due to the increased capital charges envisioned but the impact of the reduced demand is not clear.

Conclusion

- 9.21 Having reviewed the current understanding of Basel III and Solvency II's implications for the cost of bank lending, bond rates and the demand for longer-dated debt, we believe it is unlikely that companies will be left exposed to a higher cost of debt than that represented by the iBoxx index used in the 2013/21 Price Controls.
- 9.22 We view the biggest risk of the new regulatory regimes to be to network companies' debt structure as Solvency II's capital charges for longer duration bonds may reduce insurer demand for such bonds. The current uncertainty about the final form that the Solvency II regulations will take, and about the insurers' response, make it impossible, in our view, to adjust the cost of debt mechanism to effectively address this issue. In the light of this uncertainty, we suggest the consideration of a mid-price control review of the extent to which companies' financeability has been affected by Solvency II.

²²⁶ RIIO Strategy Decision - Financial Issues Annex, paragraph 3.34.

10. Other costs of debt financing

Introduction

- 10.1 In the previous sections, we have discussed the direct costs of debt financing, that is, interest costs. Companies also incur other costs relating to debt financing, such as debt issuance costs. These costs form part of the overall cost of debt of the network companies.
- 10.2 Ofgem has not made an allowance for the non-interest costs associated with debt financing in previous determinations²²⁷:
- “We do not think it is appropriate to make an explicit allowance for these costs. But there is a spread (approximately 30bps) between our allowed cost of debt and the trailing average which creates headroom to fund any transaction costs.”*
- 10.3 Similarly, in the RIIO Strategy Decision, Ofgem did not consider it necessary to make an explicit allowance for such costs. Ofgem has recognised that the network companies have typically been able to issue debt at rates that are below the index values, and has considered that such costs are funded through this difference²²⁸:
- “Over the past 15 years, UK utilities have been able to issue debt consistently below the proposed Bloomberg index. We deemed the difference between the cost of issued debt and the index, which in the strategy consultation paper was noted as 30bps, to be sufficient to cover the costs of issuing debt.”²²⁹*
- 10.4 The network companies have raised concerns in their business plans that there will be no or insufficient outperformance against the cost of debt index, in order to fund the costs other costs associated with debt financing.

²²⁷ DPCR5 Final Proposals, Allowed Revenue and Financial Issues appendix, paragraph 1.28.

²²⁸ RIIO Strategy Consultation – Financial Issue Annex – paragraph 3.14. The 30 basis points is calculated relative to a Bloomberg index; the average level of outperformance relative to the relevant iBoxx index may be different.

²²⁹ We note that this refers to outperformance relative to a Bloomberg index. Ofgem’s Strategy Decision noted average outperformance of 58bps relative to the iBoxx index.

- 10.5 In this section, we:
- (1) describe the types of costs referred to by the network companies, and their estimates of such costs; and
 - (2) comment on issues raised by the network companies about the difference between the index and the cost at which network companies are able to borrow.

Other costs of debt financing

- 10.6 The network companies have identified the following categories of costs associated with debt financing²³⁰:

- “- Issuance costs – i.e. bank fees and rating agency fees;*
- Liquidity costs – i.e. the upfront and commitment fees associated with maintaining a capex facility;*
- New issuance premium/concession – i.e. the discount required to support the performance of new issues in the secondary market; and*
- Cost of carry – i.e. the cost of investing pre-funding amounts at a relatively low short term interest rate.”*

- 10.7 We organise our discussion of these costs under two headings:
- Issuance and liquidity management costs (comprising issuance costs, liquidity costs and cost of carry)²³¹; and
 - new issue premia.

- 10.8 We note that new issue premia are not a non-interest cost. Rather, they are a factor that affects the extent to which the cost of network companies' new bonds is greater than the secondary market yields on existing debt.

Issuance and liquidity management costs

- 10.9 The issuance and liquidity management costs consist of a mix of ongoing costs of maintaining debt provision, and costs associated with new issuances of debt.

²³⁰ These are the categories of costs presented in SHETL: section 5. The costs are categorised differently in submissions by other network companies, but they comprise materially the same types of costs. We note that the cost of maintaining liquidity facilities need not be specific to the financing of capital expenditure.

²³¹ These may represent costs of either bond financing or bank financing.

- 10.10 The table below summarises the estimates of costs that the network companies have included in their business plans.

Table 10-1 – Estimates of issuance and liquidity management costs in network companies’ business plan submissions

Network company	Estimate Basis points per year
National Grid	30bps
NGN	30bps
SGN	55bps to 80bps
SHETL	13.6bps (liquidity costs)
WWU	25bps

Notes: (1) Estimate for NGN comprises costs of maintenance of liquidity, and issuance costs and ongoing costs of maintaining funding arrangements.

(2) The estimate for SGN was 75bps to 80bps, including 20bps in respect of new issue premia.

Sources: NGET: A53, NGGD2: 8.14, NGN2: figure 8.4, SGN1: section 11.2.2, SHETL: Section 5, WWU1: Section 3.3.2.

- 10.11 In relation to the table above, we note:
- National Grid proposed an adjustment to the indexation mechanism if the difference between yields on indices of utility bonds and corporate bonds is less than 30 basis points, then the cost of debt index should be adjusted to restore the differential²³². This was not an estimate of the issuance and liquidity management costs they expect to face.
 - SHETL modelled the costs of maintaining liquidity over the price control period; using this modelling they estimated an average cost of 13.6 basis points per year. They noted that the cost varied over the price control period, and was as high as 30 basis points per year at times.
 - SGN proposed that they be allowed to use an iBoxx index with a BBB-rating instead of the proposed indices²³³. The difference in yield, based on averages as at 31 December 2010 and 31 December 2011, is 26 basis points.
- 10.12 We expect these costs will vary between network companies. They depend, in part, on the scale of existing and planned borrowing over the price control period. However, most estimates are about 30 basis points or below.

²³² NGET: paragraph A53.

²³³ SGN2: page 168.

- 10.13 Various networks have stated that the cost of carry has increased, or will be higher during the 2013/21 Price Controls. The cost of carry refers to the interest rate differential between borrowings and interest received on deposits for amounts of pre-funding. The reasons cited for the increases are that:
- increased volatility in the debt markets means that network companies are increasingly prefunding investments²³⁴;
 - some network companies have higher capital expenditure requirements and correspondingly higher borrowing requirements during the 2013/21 Price Control; and
 - the rates on deposits are currently very low, which could mean that the interest rate differential between borrowings and deposits is increased.

New issue premia

- 10.14 New issue premia refer to cases where companies price new debt at a premium over existing debt. For example, if a company had an existing bond that was trading with a yield to maturity of 5%, it may have only been able to issue a new bond at a premium, say at a rate of 5.5%. In the context of the network companies, it would mean that bonds are issued at rates above the benchmark levels captured in the index.
- 10.15 In normal circumstances, one would not expect to observe a material new issue premium. There would be no reason for investors to view new debt as carrying any more risk than existing debt (assuming that the holders of the new debt had the same rights as the holders of the existing debt). The risk associated with both the new and existing debt would be determined by the overall default risk of the issuing company.
- 10.16 Given the unusual characteristics of the capital markets during the financial crisis, however, it is possible that the limited appetite of investors to lend money (and the liquidity constraints many investors faced) caused borrowers to issue debt with a new issue premium.
- 10.17 Some of the network companies consider that new issuers are typically required to pay a new issue premium²³⁵. They consider that new issue premia may mean that they issue new debt at rates above the index, or at a reduced discount to the index.

²³⁴ SGN1: section 11.2.2, page 106.

²³⁵ For example, NGN1: section 8.3.2.i, page 199.

- 10.18 The network companies have estimated recent new issue premia of 20 to 30 basis points²³⁶, although they point out that higher values have been observed during the peak of the financial crisis. They consider an estimate of the new issue premium should be added to the cost of debt allowance.
- 10.19 We note that the estimation of new issue premia must be performed with caution. In order to properly estimate a new issue premium, this should be conducted by reference to an estimate of the fair value yield for a bond in issue. In some cases, a generic bond index might not provide a suitable reference point.
- 10.20 We agree that evidence of new issue premia does exist and that premia can be material at times of heightened market instability, for example, during the recent financial crisis. However, we consider that new issue premia are typically transitory phenomena that are unlikely to continue once stability returns to the bond markets.
- 10.21 It is possible that new issue premia may continue to be observed during 2012 and beyond pending resolution of the Eurozone crisis. Whilst we expect that new issue premia will disappear once stability returns to the bond markets, Ofgem should continue to monitor evidence on new issue premia up to the time of final proposals.

Level of outperformance of the index available to fund the liquidity and financing costs

- 10.22 In the RIIO Strategy Decision, Ofgem did not set an allowance to fund the issuance and liquidity management costs associated with debt financing. Instead, they considered that such costs could be funded through the margin by which network companies' bond yields are lower than the index²³⁷:

“the level of outperformance relative to the index is sufficient to cover debt issuance costs, and consider this to remain the case with the iBoxx index. Our decision, therefore, is to maintain an implicit allowance for the cost of issuing debt.”

- 10.23 Ofgem refers to the outperformance of the index as the 'halo effect' experienced by network companies. They consider that network companies offer stable returns under an established regulatory framework. Further they consider²³⁸:

“the main reasons for the halo effect are to do with the fundamental nature of regulated utilities and will remain in place under RIIO”

²³⁶ For example, NGN1: Section 8.3.2.i and SGN1: Section 11.2.2, page 105.

²³⁷ RIIO Strategy Decision – Financial Issues Annex, paragraph 3.52.

²³⁸ RIIO Strategy Decision – Financial Issues Annex, paragraph 3.50.

10.24 Some network companies consider that while their cost of debt may have been lower than the index in the past this does not suggest it would continue to be the case in the future and suggest reasons that might mean the ‘halo effect’ would not persist.

10.25 In the following paragraphs, we consider views presented by the network companies:

- (1) that there is little or no outperformance of the index available to fund these costs; and
- (2) that the halo effect will not hold in the future.

Current outperformance of the cost of debt index

10.26 Network companies have referred to a number of sources to conclude that the average level of outperformance of the cost of debt index has fallen or has been reduced to nil. The evidence presented includes:

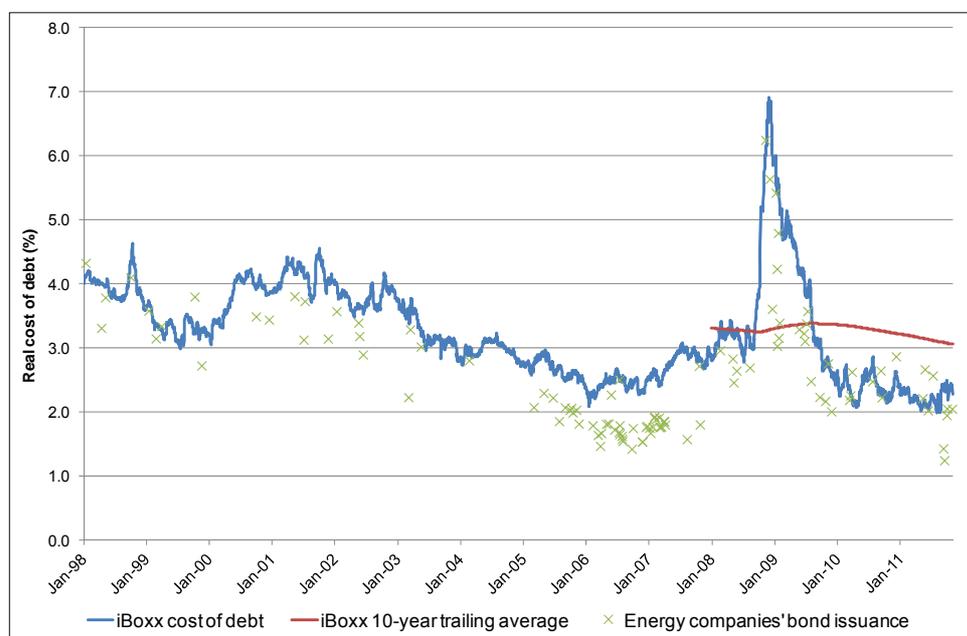
- comparisons of coupons of bonds issued by energy companies in 2010 and 2011 with the iBoxx index;
- a comparison of projections of cost of new debt for SGN with projections of the trailing average index; and
- a comparison of the SGN weighted average yield and the iBoxx index in 2010 and 2011.

10.27 We comment on each of these in turn.

10.28 National Grid, WWU and SHETL have considered data on bonds issued by energy companies in 2010 and 2011. The figure below presents the data referred to by the network companies²³⁹. This is Figure 3.9 of the Financial Issues annex to the RIIO Strategy Decision, updated to October 2011 using data provided by Ofgem.

²³⁹ NGET and WWU1 refer to Figure 3.9 of the Financial Issues Annex to the RIIO Strategy Decision. SHETL refers to a table of the underlying data, updated to October 2011.

Figure 10-1 – Comparisons of coupons of energy companies' bonds with the yields on the relevant iBoxx index



Source: (1) Markit Financial Information Services. (2) Bank of England. (3) Iboxx data from “The Cost of Debt Indexation Model: RIIO-T1 and GD1” spreadsheet published with the RIIO Strategy Decision. (4) Data on bond issuance by UK energy licensees and their parent companies provided by Ofgem.

- 10.29 Based on the data for 2010 and 2011, several network companies concluded that the level of outperformance of the index was too low (approximately 7 basis points), and too variable to be relied upon to fully fund the other costs of debt financing²⁴⁰.
- 10.30 One explanation provided for the reduction in the outperformance of the index was that the ‘halo effect’ was a feature of the financial crisis, which is now subsiding²⁴¹:

“The financial crisis meant that utilities offered a safe haven for bonds, as compared to general corporate bonds.”

²⁴⁰ NGET: paragraph A48. WWU1: section 3.3.2, pages 16 and 17. SHETL: section 5, pages 24 to 26.

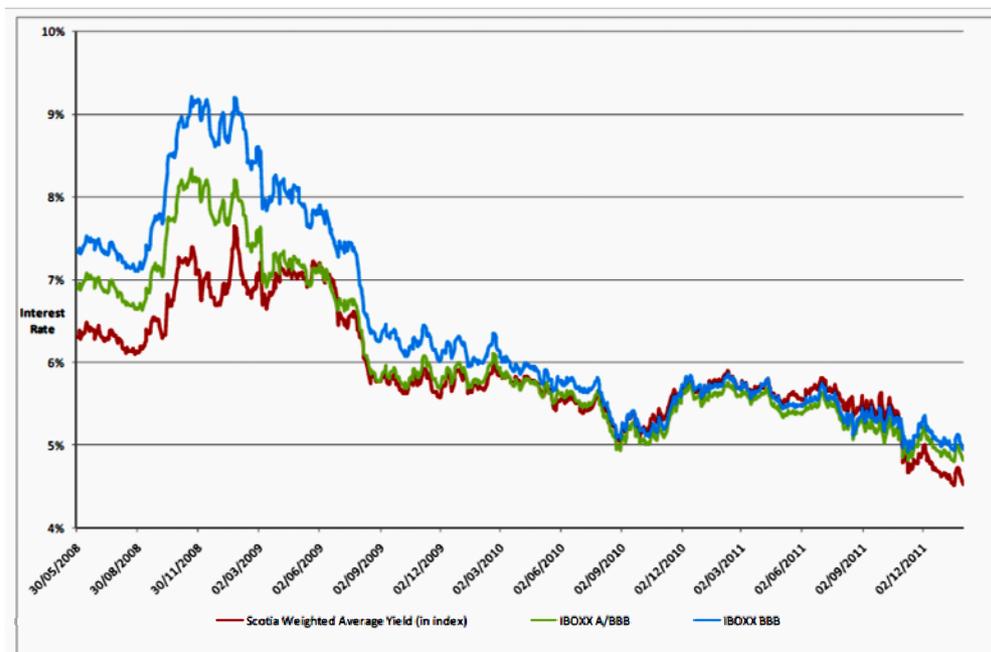
²⁴¹ SGN2: page 166.

- 10.31 This explanation appears to suggest that the ‘halo effect’ is a recent phenomenon. In this respect, we note that average outperformance of the iBoxx index by the energy companies’ bonds from 1998 to 2006 was over 50 basis points²⁴².
- It is possible that the reduction in the average outperformance of the cost of debt index observed in 2010 and 2011 is temporary and is explicable by an increased interest by investors in the overall investment grade corporate bond market, reflecting a widespread flight to safety – particularly as some sovereign debt is perceived to be increasingly risky. As a consequence, the ‘halo effect’ may have been extended to a wider group of investment grade bonds, with the relative outperformance of energy companies bonds being smaller²⁴³. If so, this effect is likely to be temporary.
 - The bond issues included in the analysis may have been affected by new issue premia, which would reduce the extent of outperformance of the index.
- 10.32 SGN has presented a projected scenario for values of the cost of new debt and the trailing average index over the 2013/21 Price Control. We agree that if the cost of new debt is consistently above the trailing average over the period, as suggested by SGN, then there will be insufficient margin provided to fund transaction costs. SGN have not provided any information on the interest rate scenario they provide. Accordingly, we cannot comment further on this analysis.
- 10.33 SGN has also presented a comparison of the weighted average yield on its debt and the relevant iBoxx indices. We consider this to be relevant information to this issue and represent this chart below.

²⁴² This is about 60 basis points using data for 2002 to 2006, that is, excluding the period including the dot com bubble and its after-effects.

²⁴³ “Bond funds: is it time to jump ship?”, 27 September 2010, The Telegraph. [Link](#).

Figure 10-2 - comparisons of SGNs weighted average cost of debt and the relevant iBoxx indices



Source: SGN2: page 166.

- 10.34 Considering the development of the level of outperformance of the index chronologically, we note that the chart above does not show the level of outperformance in periods before 2009, including periods before the financial crisis. Indeed, in 2005 to 2009, SGN issued bonds with a coupon of consistently 40 to 50 basis points below the spot values of the index.
- 10.35 From March 2009, the difference between SGN's average yield and the iBoxx index fell significantly (compared to the period before March 2009). This continued until around December 2011. SGN's average yield was higher than the relevant iBoxx indices for parts of the period.
- 10.36 The reduction in the SGN's outperformance of the index over the period between 2009 and 2010²⁴⁴ is consistent with the evidence discussed in paragraphs 10.29 to 10.31 above, which shows that the average outperformance of the index was lower in 2010 and 2011, than in earlier periods.

²⁴⁴ We agree that the yield is an indicator of the rate at which the company could issue new debt (previous discussion of new issue premia notwithstanding).

- 10.37 The average level of outperformance of the index appears to have increased at the end of 2011 to more than 30 basis points. In this context, we note that SGN issued a bond in September 2011 at a yield to maturity 37 basis points below the index value²⁴⁵.
- 10.38 As a result, it may be the case that the reduction in SGN's outperformance of the index was temporary and will not be sustained.
- 10.39 The evidence presented does not provide sufficient grounds to conclude that the level of outperformance of the index available to fund the costs associated with debt financing have been permanently removed or diminished. The evidence suggests that the outperformance achieved in 2010 and 2011 may have been lower than historical periods, but that this may not persist in the longer term.
- 10.40 However, there is also significant uncertainty over the way in which market conditions will develop through to the final proposals and over the price control period, particular with the ongoing crisis in the Eurozone.
- 10.41 We consider that Ofgem should continue to monitor the level of outperformance of the index by network companies during the forthcoming price control period. For example, it may be worthwhile incorporating a review of the level of outperformance of the index into a mid-period review process. If the level of outperformance of the index observed in 2010 and 2011 occurs again, and is sustained, this may provide a basis for Ofgem to make a specific allowance for the other costs of debt financing, providing that these are efficiently incurred.
- 10.42 Including a mid-period review has both advantages and disadvantages. The advantages include providing an indication of regulatory intent to ensure that other costs of debt financing, efficiently incurred, would be funded. If the criteria for the mid-period are clearly defined in the price control, this would maintain transparency and avoid the need for regulatory discretion.
- 10.43 The disadvantages include that it (1) increases the need for regulatory intervention; (2) imposes costs on the regulator; (3) further increases complexity of the price control; and (4) could dampen the efficiency incentives for network companies, although we do not think this is likely to be the case.

²⁴⁵ This bond was issued by Southern Gas Network PLC, which is part of SGN. The yield to maturity at issue for this bond, reported on Bloomberg, is 4.91%.

Level of outperformance of the index in the future

10.44 The network companies have raised a number of points as to why the level of outperformance of the index, with which to fund other costs of debt financing, may be reduced or removed in the future. The main issues raised were:

- (1) The RIIO Framework introduces a higher level of risk.
- (2) Network companies will need to raise large amounts of new finance, which will increase the spreads on their debt.
- (3) Network companies will form a larger part of the index, making it harder for network companies to outperform the index.
- (4) The inclusion of rates that are low by historical standards will reduce the trailing average.
- (5) The Basel III and Solvency II regulation will increase the costs of debt for utilities relative to the index.

10.45 In the following paragraphs, we comment on the arguments raised. We commented on items (4) and (5) in Section 8 and Section 9, respectively. Our comments on these items in this section are limited to the effect they have on transaction costs.

(1) Higher levels of risk²⁴⁶

10.46 The network companies consider that the level of risk they face will rise during the 2013/21 Price Controls. They consider that this in turn will cause their cost of debt to rise relative to the index.

10.47 In previous sections, we have commented on the effect of some changes introduced in the 2013/21 Price Controls on the risk to equity holders. We concluded that the increased length of the price control period, the increased pension risk, and the need to undertake large capital investments may increase the risk of the network companies. However, we note that this discussion is focussed on a subset of the changes introduced in the 2013/21 Price Control.

10.48 These considerations are relevant to the risks considered by debt holders; however debt holders also place weight on other factors in the assessment of risks.

10.49 There is no empirical basis for determining the extent to which the halo effect is a function of a stable regulatory regime or more fundamental characteristics of network companies.

²⁴⁶ NGET: paragraph A47.

10.50 We note that when assessing credit ratings for regulated energy network companies, Moody's places a weight of 15% on the "*Stability and Predictability of Regulatory Regime*"²⁴⁷. That is consistent with the regulatory regime contributing to the halo effect but being only one of a number of factors that are important.

10.51 Standard & Poor's, a credit rating agency, has commented on the initial proposals for Scottish Power Transmission Limited ("SPTL") and SHETL published by Ofgem. They consider that various factors including the capital expenditure programmes will increase risk, but that these will be partly mitigated through the use of transitional arrangements. They conclude that²⁴⁸:

"the outcome of Ofgem's draft proposals is credit neutral for SPT and SHET, and therefore we do not anticipate taking any rating actions on these companies as a result...Nevertheless, we think that the initial proposals are important for investors as they signal Ofgem's approach in applying the new RIIO regulatory framework."

10.52 That is, Standard & Poor's consider the RIIO Framework will have no overall impact on their assessment of credit risk for SPTL and SHETL, but they also consider this to be relevant to assessing the impact for other network companies. This suggests that investors' perception of risk may similarly not increase as a result of the introduction of the RIIO Framework.

10.53 In summary, it is possible that perceptions of increased regulatory risk and, more generally, increased risks under the RIIO Framework lead to a diminution in the halo effect. However, preliminary indications from Standard & Poor's, suggest that they do consider that the risk under the RIIO Framework has not increased significantly.

(2) The need to raise new debt finance²⁴⁹

10.54 The network companies have argued that they will need to issue significant amounts of new debt during the 2013/21 Price Control, which would place upward pressure on their costs of debt.

10.55 We agree that, other things being equal, an increase in the level of gearing of a company would increase the risk it faces. If investors perceive this increase in risk, they will require a higher return for assuming that risk.

²⁴⁷ "*Moody's Global Infrastructure Finance, Regulated Electric and Gas Networks Rating Methodology*", Moody's, August 2009, page 5.

²⁴⁸ "*Ofgem's RIIO Draft Proposals Deliver A Balanced Credit Outcome For Two U.K. Grid Utilities*", Standard & Poor's, 9 February 2012, page 2.

²⁴⁹ NGET: paragraph A47.

10.56 If the level of borrowing by some network companies increases during the 2013/21 Price Control, this may have an impact on the credit rating of these companies. To the extent that this affects their credit rating relative to the average credit rating of the bonds in the index, this may increase their cost of debt relative to the index²⁵⁰. Even in the absence of a change in credit rating, if investors perceive the company to be more risky, they will require a higher return. Accordingly, in that case, the cost of debt would be higher relative to the index.

10.57 However, one of the key principles under the RIIO Framework is that investment should be funded through equity as well as debt financing. Accordingly, while network companies may raise additional debt financing during the 2013/21 Price Control, this may not lead to a rise in gearing ratios.

(3) Network companies will form a larger part of the index²⁵¹

10.58 The network companies consider that outperformance of the index will be diminished if network companies become a larger part of the iBoxx index. We agree that if this effect was significantly large this would make outperformance of the index more difficult, and thus reduce the margin available to fund other costs of debt financing.

(4) Inclusion of historic lows²⁵²

10.59 We commented on the inclusion of historic low rates in the calculation of the 10-year trailing average index in Section 8²⁵³. We concluded that that recent interest rates have been at historically low levels that may be unrepresentative of a normal economic cycle. We agree that if this persists, outperformance of the trailing average index may become more difficult.

²⁵⁰ Although network companies are required to maintain an investment grade credit rating under the RIIO Framework, the cost of debt may differ within the range of credit ratings that the network companies are expected to maintain. For example, credit spreads are typically significantly wider for companies that have credit ratings on the border of the spectrum of investment grade ratings.

²⁵¹ SGN2: page 166.

²⁵² SGN1: section 11.2.1, page 105.

²⁵³ See paragraphs 8.48 to 8.53.

(5) Effect of Basel III and Solvency II²⁵⁴

10.60 We commented on the effect of the Basel III and Solvency II regulation in Section 8. We concluded that the effect of the Solvency II regulations is uncertain, and that in the light of this uncertainty, we suggest the consideration of a mid-price control review of the extent to which companies' financeability will have been affected by Solvency II.

Conclusion

10.61 The network companies have argued that additional costs of debt financing, such as issuance and liquidity management costs are significant and are not adequately funded by the cost of debt allowance.

10.62 We have reviewed estimates of the additional costs of debt financing. These estimates presented mostly lie in the range of 20 to 30 basis points.

10.63 In summary, our views in relation to the main points raised are as follows:

- (1) **The level of outperformance of the cost of debt index may be lower than in the past due to new issue premia:** New issue premia can exist and may have emerged as a consequence of the recent financial crisis, albeit they are typically a short term phenomena that disappear once stability returns to the bond markets. However, pending resolution of the Eurozone crisis, Ofgem may wish to continue to monitor evidence on new issue premia up to the time of final proposals.
- (2) **Recent data suggests that outperformance of the cost of debt index may have been diminished / removed:** During 2010 and 2011, the ability of the network companies to issue debt below the index was lower than in previous periods. However, the most recent evidence indicates that the level of outperformance of the index available to fund the costs associated with debt financing has returned.
- (3) **The level of outperformance of the cost of debt index may fall in the future:** There is significant uncertainty over the way in which market conditions will develop through to the final proposals and over the price control period. We consider that Ofgem may wish to continue to monitor the level of outperformance of the index by network companies during the forthcoming price control period; for example by incorporating a review of the headroom into a mid-period review process.

²⁵⁴ SGN1: section 11.2.1, page 105.

11. Inflation risk premium

Introduction

- 11.1 Network companies have raised concerns that the inflation assumption used by Ofgem to convert the nominal iBoxx yields to real yields includes an inflation risk premium, which causes the real cost of debt to be understated. The inflation risk premium is a margin included in the nominal yield of conventional bonds to compensate bondholders for the risk that the inflation expectations built into the yield turn out to be different from the actual inflation. Ofgem considers that the inflation risk premium's impact on its cost of debt calculation is immaterial as it is offset by a liquidity risk premium²⁵⁵.
- 11.2 Below we set out our view of the inflation risk premium's impact on Ofgem's real cost of debt calculation. We organise this section under the following headings:
- Context to the inflation risk premium issue.
 - Available estimates of the inflation risk premium.
 - Evidence for a liquidity risk premium.
 - Conclusion.

Context to the inflation risk premium issue

- 11.3 To calculate the network companies' real cost of debt Ofgem deflates the nominal bond yields by the estimated inflation rate and then calculates a ten year trailing average. The network companies have argued that the estimated inflation rate used to deflate is overstated due to the inclusion of an inflation risk premium. As a result, the network companies consider that the allowed real cost of debt would be under-estimated.

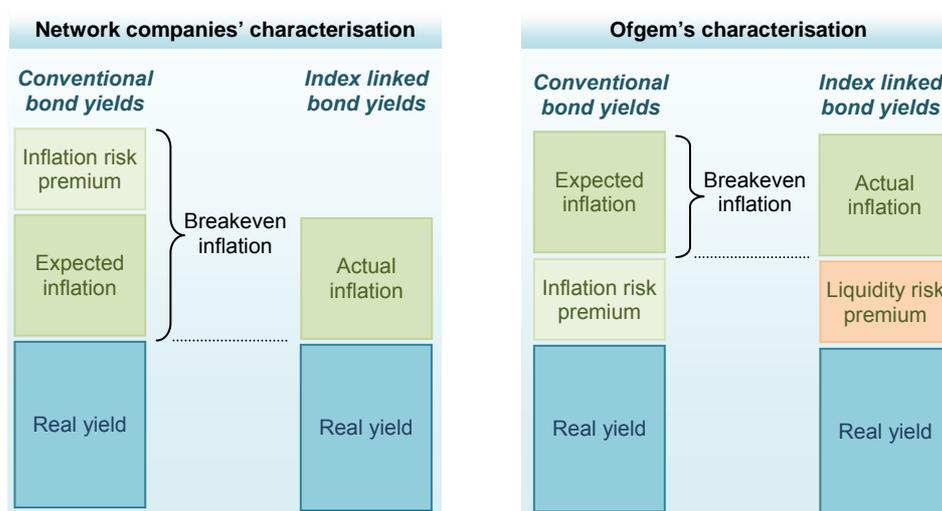
²⁵⁵ RIIO Strategy Decision - Financial Issues Annex, paragraphs 3.56 to 3.58.

- 11.4 Ofgem estimates inflation by calculating the difference between the nominal yield on conventional UK government bonds and the real yield on UK ILGs, referred to as the “breakeven inflation rates”²⁵⁶. Besides comprising an inflation expectation, the nominal yield on conventional bonds includes an inflation risk premium that compensates bond holders for the risk of actual future inflation diverging from present inflation expectations. As ILGs make inflation adjusted payments, bond holders are not exposed to inflation risks and the yield on these bonds does not include an inflation risk premium.
- 11.5 Ofgem acknowledges that breakeven inflation rates implicitly include an inflation risk premium²⁵⁷. Ofgem considers that the premium does not have a material impact as it is offset by a “liquidity risk premium” included in the yields of ILGs. The liquidity premium compensates holders of ILGs for the relatively lower levels of liquidity in the ILG market than the conventional (that is nominal) government bond market. In effect, the liquidity risk premium raises the index linked bonds’ real yields and the inflation risk premium raises the conventional bonds’ nominal yields. Since the breakeven inflation rates are the difference between these yields, the two premiums will offset each other to a lesser or a greater extent. The figure below illustrates the decomposition of the bond yields into these components.

²⁵⁶ The rates are referred to as breakeven because they represent the value at which investors are indifferent to whether they buy nominal or index linked bonds. If inflation averages more than the breakeven rate then index linked bonds will be preferred to nominal bonds and vice versa. Figure 11-1 helps to illustrate this point.

²⁵⁷ RIIO Strategy Decision - Financial Issues Annex, paragraph 3.56.

Figure 11-1: Comparison of network companies' and Ofgem's respective characterisations of the breakeven interest rate calculation



- 11.6 In their most recent revised finance proposals, the network companies have raised this issue again.

Inflation risk premium estimates

- 11.7 The inflation risk premium component of breakeven inflation rates is widely acknowledged²⁵⁸ but, in the case of UK government bonds, there is limited analysis estimating the size of this premium²⁵⁹. Even the sign of the premium, whether negative or positive, is the subject of debate, as indicated by Grishchenko 2011²⁶⁰:

“Campbell, Shiller, and Viceira (2009) provide a detailed and comprehensive overview of inflation-indexed markets in the U.S. and also in the U.K. In another recent comprehensive survey paper, Bekaert and Wang (2010) note that the estimates of the inflation risk premium in the literature vary depending on the data, models, and methods used. As such, there appears no consensus so far in the literature as to not only the magnitude of the inflation risk premium but also its sign.”

²⁵⁸ “A reference guide to inflation linked bonds”, Goldman Sachs Asset Management, page 5.

²⁵⁹ “Inflation Risk and the Inflation Risk Premium”, G. Bekaert and X. Wang, 2010, Exhibit 18, page 52.

²⁶⁰ “Inflation Risk Premium: Evidence from the TIPS market”, O.V. Grishchenko and Jing-zhi Huang, Finance and Economics Discussion Series, Divisions of Research & Statistics and Monetary Affairs, Federal Reserve Board, Washington, D.C., 2011.

- 11.8 National Grid references one recent analysis presented in a 2009 Bank of England working paper from which it quotes an approximately 30 basis point²⁶¹ inflation risk premium on five year government bonds^{262,263,264}. Indeed, since the Bank of England's independence in 1997, the time trend derived for these bonds has been fairly consistently between about 20 and 50 basis points. This could be ascribed to investors' increased confidence in the Bank's commitment to hitting its inflation target. The authors' preferred specification of the model includes survey data of long-term inflation expectations to help "*identify whether movements in breakevens are due to inflation expectations or inflation premia*"²⁶⁵. We reproduce the relevant chart from the Bank's working paper below, showing the model results with and without taking account of the survey results.

²⁶¹ We assume that this value is taken from Figure 11-2 which accounts for the difference between the 30 basis points quoted by NGET and the 34 basis points quoted by NGGD.

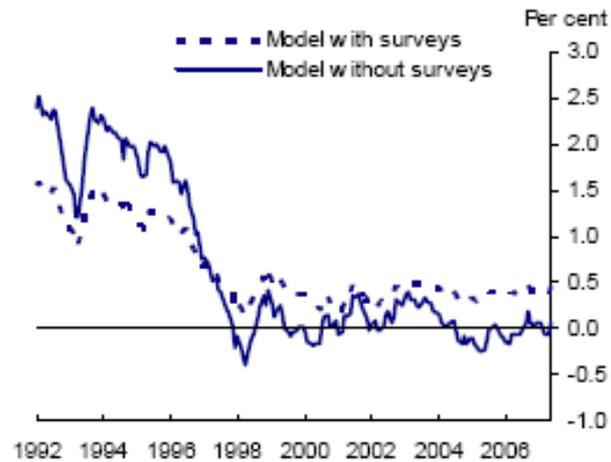
²⁶² "*Extracting inflation expectations and inflation risk premia from the term structure: a joint model of the UK nominal and real yield curves*", M. Joyce, P. Lidholdt, and S. Sorensen, Bank of England working paper 360, 2009.

²⁶³ NGET: paragraph 389.

²⁶⁴ NGGD2: paragraph 2.19.

²⁶⁵ "*Extracting inflation expectations and inflation risk premia from the term structure: a joint model of the UK nominal and real yield curves*", M. Joyce, P. Lidholdt, and S. Sorensen, Bank of England working paper 360, 2009, p.15.

Figure 11-2: Inflation risk premium on five-year inflation rates, five years forward



Sources: “Extracting inflation expectations and inflation risk premia from the term structure: a joint model of the UK nominal and real yield curves”, M. Joyce, P. Lidholdt, and S. Sorensen, Bank of England working paper 360, 2009, Chart 7B.
 Notes: The preferred specification in Joyce et al (2009) is the “Model with surveys” which include the results from surveys of inflation expectations.

- 11.9 The Bank of England working paper described above applies a model that is novel in its application to UK data, to estimate, among other parameters, the inflation risk premium²⁶⁶. The authors themselves indicate that there is a need for “[*more careful analysis of] the economics behind the determinants of term premia and expected risk-free interest rates*” and makes a limited claim about the values estimated, stating that their model “*add insights on which components have accounted for changes in short, medium and long-term forward interest rates since 1992*”²⁶⁷. As a result, some caution must be applied to the results published in the working paper. Despite its value to this area of research we believe it may be premature to rely on the values estimated in the working paper in the context of a price control.

Evidence for a liquidity risk premium

- 11.10 As explained above, breakeven inflation rates are calculated by subtracting index linked bonds’ real yields from conventional bonds’ nominal yields. If a liquidity risk premium on index linked bonds relative to nominal bonds exists then this will raise the real yield of index linked bonds as illustrated in Figure 11-1 above. As a result, the breakeven inflation rates will be understated by the value of the liquidity risk premium. Ofgem argues that the understatement of the breakeven inflation rate due to the liquidity risk premium sufficiently offsets the overstatement due to the inflation risk premium to result in an immaterial aggregate impact on the inflation estimate²⁶⁸.

²⁶⁶ The working paper concludes that: “*In this paper, we developed a joint, essentially affine, model of the UK real and nominal term structures, which allows us to decompose forward rates into expected real risk-free rates, expected inflation, real term premia and inflation risk premia. To our knowledge, **this is the first study to estimate an essentially affine no-arbitrage model of this nature for the United Kingdom over the period since October 1992 when UK monetary policy adopted an explicit inflation target.** [our emphasis]*” “Extracting inflation expectations and inflation risk premia from the term structure: a joint model of the UK nominal and real yield curves”, M. Joyce, P. Lidholdt, and S. Sorensen, Bank of England working paper 360, 2009, page 34.

²⁶⁷ “*Extracting inflation expectations and inflation risk premia from the term structure: a joint model of the UK nominal and real yield curves*”, M. Joyce, P. Lidholdt, and S. Sorensen, Bank of England working paper 360, 2009, p.4.

²⁶⁸ RIIO Strategy Decision - Financial Issues Annex, paragraph 3.56.

- 11.11 Bond holders would require a liquidity risk premium on index linked bonds as compensation if the market was less liquid than the nominal bond market. There is much evidence that this is the case in the US due, in part, to nominal US government bonds' status as a safe haven for investors²⁶⁹. The evidence for the UK is less clear.
- 11.12 In the UK, the index linked government bond market is undoubtedly smaller than the conventional government bond market which, all other things being equal, might indicate less liquidity²⁷⁰. However, the UK government has consistently supported the ILG market, providing a steady supply of bonds²⁷¹.
- 11.13 One way of determining the existence of a liquidity premium is to analyse the bid-ask spreads for ILGs relative to conventional bonds. If bid-ask spreads are consistently wider for ILGs than conventional (nominal) bonds, that would provide some support for the existence of a premium. Deacon et al. (2004), Garcia and Van Rixtel (2007) and Bekaert and Wang (2010) report that this is the case for UK bonds^{272,273,274}.

²⁶⁹ *"Nevertheless, the difference in liquidity between Treasuries and TIPS remains an issue even to date. When there is a flight to safety, as there is in the current crisis, investors flock to the most liquid security and liquidity premiums rise."*
"Inflation Risk and the Inflation Risk Premium", G. Bekaert and X. Wang, 2010, p.21.

²⁷⁰ *"Developing a Liquid Market for Inflation-Indexed Government Securities: Lessons from Earlier Experiences"*, P. Shen, Economic Review Federal Reserve Bank of Kansas City, 1st quarter 2009, Table 1, p.91.

²⁷¹ In 1998, the government committed to make at least \$2.5 bn of index linked government bonds available each year for the foreseeable future according to the UK Debt Management Office.
 Source: <http://www.dmo.gov.uk/index.aspx?page=gilts/indexlinked>

²⁷² *"Inflation-indexed Securities: Bonds, Swaps and Other Derivatives"*, M. Deacon, A. Derry, and D. Mirfendereski, 2004, England: John Wiley & Sons, Ltd., 2nd ed.

²⁷³ *"Inflation-linked bonds from a central bank perspective"*, J.A. Garcia and A. van Rixtel, ECB, Occasional paper series, No. 61, June 2007, footnote 12, p.13.

²⁷⁴ *"Inflation Risk and the Inflation Risk Premium"*, G. Bekaert and X. Wang, 2010, p.21.

- 11.14 Relatively few estimates exist for the liquidity risk premium for UK index linked government bonds, in part due to methodological challenges. One recent study by Christensen and Gillan (2011) estimated an upper limit for the liquidity risk premium on UK index linked bonds. Their results show this upper limit oscillating around zero between 2005 and the Lehman Brothers collapse in 2008, after which it was significantly elevated and more volatile. The most recent value reported is around 50 basis points for 5 year index linked bonds and around 10 basis points or less for 10 year bonds recorded towards the end of 2010.²⁷⁵
- 11.15 Bringing together the arguments relating to the liquidity risk premium and the inflation risk premium, Shen (2009) finds that the liquidity risk premium could be of an equivalent size to the inflation risk premium, but is likely smaller²⁷⁶:
- “[t]he outstanding [UK index linked government bonds] represent close to 30 percent of total government debt, and the secondary trading market is active. While there are most likely still liquidity premia in yields of index-linked gilts, their magnitudes are likely no larger than inflation-risk premia in conventional gilts (Shen and Corning).”*
- 11.16 In particular, Shen and Corning’s 2001 paper referenced above states that²⁷⁷:
- “the yield spread is typically higher than survey forecasts of inflation, implying that in contrast to the U.S., [in the UK] the liquidity premium on indexed debt is smaller than the inflation risk premium on conventional debt.”*
- 11.17 An additional finding with bearing on the stability of the offset between inflation and liquidity risk premia is that liquidity appears uncorrelated with the inflation risk premium both in the US and the UK²⁷⁸. It is, therefore, possible that any current offset between inflation and liquidity risk premia might not continue to hold in the future.

²⁷⁵ “A Model-Independent Maximum Range for the Liquidity Correction of TIPS Yields”, J.H.E. Christensen and J.M. Gillan, Federal Reserve Bank of San Francisco, Working paper 2011-16, p.16

²⁷⁶ “Developing a Liquid Market for Inflation-Indexed Government Securities: Lessons from Earlier Experiences”, P. Shen, Economic Review Federal Reserve Bank of Kansas City, 1st quarter 2009, p.102.

²⁷⁷ “Can TIPS help identify long-term inflation expectations?”, P. Shen and J. Corning, Economic Review Federal Reserve Bank of Kansas City, 4th quarter 2001, p.79.

²⁷⁸ “An Empirical Decomposition of Risk and Liquidity in Nominal and Inflation-Indexed Government Bonds”, C.E. Pflueger, L.M. Viceira, HBS Working paper 11-094, March 2011, Abstract.

- 11.18 As with inflation risk premium, the evidence on the value of the liquidity risk premium for UK index linked bonds is limited. The table below summarises the relevant findings from the papers discussed in this and the preceding subsections.

Table 11-1: Summary of selected papers' findings relating to inflation and liquidity risk premia

Finding	Paper/s
To date there is no consensus on the value of the inflation risk premium	Grishchenko and Huang (2011)
The inflation risk premium on five year UK ILGs is estimated at between about 20 and 50 basis points since 1998	Joyce et al. (2009)
Bid-ask spreads for UK ILGs are larger than for conventional bonds suggesting the existence of a liquidity risk premium	Deacon et al. (2004), Garcia and Van Rixtel (2007) and Bekaert and Wang (2010)
There is a 50 basis point upper limit on UK five year ILG's liquidity risk premium	Christensen and Gillan (2011)
The UK liquidity risk premium may be equivalent but is likely smaller than the inflation risk premium	Shen (2009), Shen and Corning (2001)
Liquidity and the inflation risk premium are uncorrelated	Pflueger and Viceira (2011)

- 11.19 We note that Ofgem has set out a calculation based on historic average CPI and RPI rates and the Bank of England's 2% target for CPI to review whether the inflation risk premium is offset by the liquidity risk premium²⁷⁹:

"Since the Bank of England began pursuing an explicit inflation target (May 1997), breakeven inflation (ie the difference between the yield on nominal gilts and the yield on ILGs) has been on average 2.9 per cent at 10-year maturity. Over the same time period, the difference between Retail Price Index (RPI) inflation and Consumer Price Index (CPI) inflation was 0.9 per cent. Hence, the Bank of England's 2.0 per cent inflation target for CPI would imply 2.9 per cent on RPI – exactly matching the measure by which we deflate our index.

The above suggests that the inflation risk premium is countered by a liquidity premium on ILGs of a similar magnitude."

²⁷⁹ RIIO Strategy Decision - Financial issues, paragraphs 3.57 to 3.58.

- 11.20 We make two observations with respect to this calculation:
- (1) We have performed similar calculations over different time periods. Our calculations indicate that Ofgem's calculation would yield different results depending on the period selected. For example, the 'net' inflation premium offset is -0.3% for 1999 to 2008 and +0.2% for 2002 to 2011.
 - (2) We consider that market expectations of RPI inflation in the short to medium term are likely to differ from the CPI target plus the average difference between RPI and CPI.
- 11.21 Consequently, we do not consider that one can conclude definitively, based on our analysis and research, that the inflation risk premium is entirely offset by a liquidity risk premium.

Conclusion

- 11.22 The UK inflation breakeven rates used to discount the nominal cost of debt values appear likely to include an inflation risk premium. To date, however, the research has failed to coalesce around either an estimation methodology or a consensus value for the inflation risk premium.
- 11.23 We find that there is enough evidence to presume the existence of an inflation risk premium and the possible existence of a liquidity risk premium. These premia will both impact Ofgem's calculated inflation estimate but with one offsetting (to a greater or lesser extent) the other's effect. The net effect of the two premia is unclear. Although it seems likely that the inflation risk premium is larger than the liquidity premium.

Appendix 1 Business plan documents provided to us by Ofgem

- A1.1 In this report, we refer to business plan submissions and consultants' reports using abbreviations.
- A1.2 We list the documents we have been provided with, and the abbreviations we use in A1-1 below.

A1-1 – Business plan submissions and consultants' report provided

Document title and date	Type	Abbreviation
National Grid Electricity Transmission – Finance Annex, March 2012	Business plan	NGET
National Grid Gas Distribution, Chapter 12 - Financing Our Plan, November 2011	Business plan	NGGD1
National Grid Gas Distribution, Appendix 12.1 - Revenue Requirements, November 2011	Business plan	NGGD2
National Grid Gas Distribution, Supporting Document J1 – Financing Our Plan, April 2012	Business plan	NGGD3
RIIO-GD1 Business Plan , Northern Gas Networks, November 2011	Business plan	NGN1
RIIO-GD1 Business Plan , Northern Gas Networks, March 2012	Business plan	NGN2
RIIO-GD1 Price Control review Business Plan Submission, Business Plan, Scotland Gas Networks, 30 November 2011	Business plan	SGN1
RIIO-GD1 Price Control review Business Plan Submission, Appendices, Scotland Gas Networks, 27 April 2012	Business plan	SGN2
Wales & West Utilities, RIIO-GD1 Business Plan 2013-2021, Part B2, Financeability	Business plan	WWU1
Wales & West Utilities, RIIO-GD1 Business Plan 2013-2021, Part B2 Addendum, Financeability	Business plan	WWU2
Financial Assumptions December Update	Business plan	SHETL
“Estimating The Cost Of Capital For Gd1, A Note For Centrica”, CEPA LLP, 30 March 2012	Report	N/A
“A Residual Income Model estimate of the cost of equity, Prepared for National Grid”, KPMG, February 2012	Report	N/A

Document title and date	Type	Abbreviation
"Impact of risk on the cost of capital and gearing, Note prepared for Scotia Gas Networks", Oxera, 14 November 2011	Report	N/A
"What is the link between debt indexation and allowed returns, Prepared for Energy Networks Association", Oxera, July 2011	Report	N/A

Source: RIIO Strategy Decision – Financial Issues Annex, Figure 3.1

Appendix 2 DGM sensitivity analyses for National Grid PLC

- A2.1 In this appendix, we show the sensitivity of the results of the DGM for National Grid PLC to changes in the long-term real dividend growth rate estimate and the initial share price.
- A2.2 The table below sets out the effect on the estimated cost of equity of changing the long-term real dividend growth rate used in the analysis. We have considered a range of values between 0.46% and 2.4%, being the range between the real long-term historical growth rate of dividends for the UK estimated by DMS in 2011 of 0.46%²⁸⁰ and historical long-term real GDP growth of 2.4%²⁸¹.

Table A2-1: Sensitivity of DGM cost of equity estimates of National Grid PLC to the long-term real dividend growth rate

Real long-term growth rate	2011
0.46%	6.8%
0.90%	7.2%
1.40%	7.7%
1.90%	8.1%
2.40%	8.6%

- A2.3 The historical long-term dividend growth rate for the UK (0.46%) is likely to provide a lower bound, whereas the GDP growth rate (2.4%) represents an upper bound to the range of reasonable values.

²⁸⁰ "Equity Premia around the World", DMS, 9 October 2011 update.

²⁸¹ "Bristol Water plc, A reference under section 12(3)(a) of the Water Industry Act 1991", Competition Commission, August 2010, Appendix N, paragraph 89(b).

- A2.4 If National Grid PLC's share price is particularly volatile, then the results of the DGM may be materially affected by share price movements, as the price used in the analysis may not reflect the value of the business. Our analysis shows that the normalised standard deviation of daily share prices in 2011 was 3% (calculated as the standard deviation of daily prices in year divided by the average daily price for year). This figure ranged from 3% to 11% in the calendar years 2006 to 2011. Given that level of normalised standard deviation, we have assessed the effect of 5% increments to the share price on the estimated cost of equity in National Grid PLC's DGM calculations.
- A2.5 The table below sets out the effect on the estimated cost of equity of changing the share price used in the analysis.

Table A2-2: Sensitivity of DGM cost of equity estimates of National Grid PLC to the share price at the date of estimation

Share price	2011
-15%	9.7%
-10%	9.3%
-5%	8.9%
Price as at 1 June 2011	8.6%
+5%	8.3%
+10%	8.0%
+15%	7.8%

Appendix 3 RIM sensitivity analyses for National Grid PLC

- A3.1 KPMG estimated a range for the real cost of equity for National Grid PLC using a RIM. In this appendix, we show the sensitivity of the RIM results for National Grid PLC to changes in the nominal long-term dividend growth rate estimate and the initial share price.
- A3.2 To perform sensitivity analysis on the findings of the KPMG model, we sought to replicate the KPMG model. Using the information provided, we have not been able to replicate the results of KPMG's analysis exactly. We estimate a range of real cost of equity of 5.6% to 7.9%²⁸², compared to KPMG's range of 6.1% to 7.9%²⁸³.
- A3.3 The table below sets out the effect on the estimated cost of equity of changing the nominal long-term dividend growth rate used in the analysis in increments of 0.5% points.

Table A3-1 - Sensitivity of RIM cost of equity estimates of National Grid PLC to the nominal long-term earnings growth rate

Nominal long-term earnings growth rate	Low	High
3.0%	4.8%	7.1%
3.5%	5.2%	7.5%
4.0% - KPMG estimate	5.6%	7.9%
4.5%	6.0%	8.3%
5.0%	6.5%	8.6%

- A3.4 The KPMG estimate of the long-term earnings growth rate of 4.0%, comprises real earnings growth of 1.5% and RPI inflation of 2.5%. The estimate of 1.5% is an average of long-term real growth forecasts of 2.5%, and historical UK dividend growth rates of 0.6%²⁸⁴. The range of 3% to 5% applied in the table above broadly shows the effect of using a real-long term growth rate of 0.6% to 2.5%, assuming RPI inflation of 2.5%.

²⁸² The estimate for 2011 is 7.1% in real terms.

²⁸³ This is KPMG's estimate before adjusting for differences between actual gearing and gearing proposed in the NGET business plan.

²⁸⁴ 'A Residual Income Model estimate of the cost of equity', KPMG, February 2012, slide 2.

- A3.5 The table below sets out the effect on the estimated cost of equity of changing the share price used in the analysis. We have estimated the effect of 5% increments to the share price on the estimated cost of equity.

Table A3-2: Sensitivity of RIM cost of equity estimates of National Grid PLC to the share price at the date of estimation

Share price	Low	High
-15%	6.4%	9.0%
-10%	6.1%	8.6%
-5%	5.8%	8.2%
Price as at 31 March 2011	5.6%	7.9%
+5%	5.4%	7.6%
+10%	5.2%	7.3%
+15%	5.1%	7.0%

- A3.6 In paragraph 5.44, we conclude that the reasonable range of estimates drawn from this RIM analysis lies in the range 5.0% to 9.0%. This is approximately the range observed by decreasing and increasing nominal dividend growth by 1% point around the values used by KPMG, and decreasing and increasing the starting share price by 10% points around the values used in KPMG's analysis.