Oxera

Determining efficient financing costs for RIIO-ED1

Prepared for the Energy Networks Association

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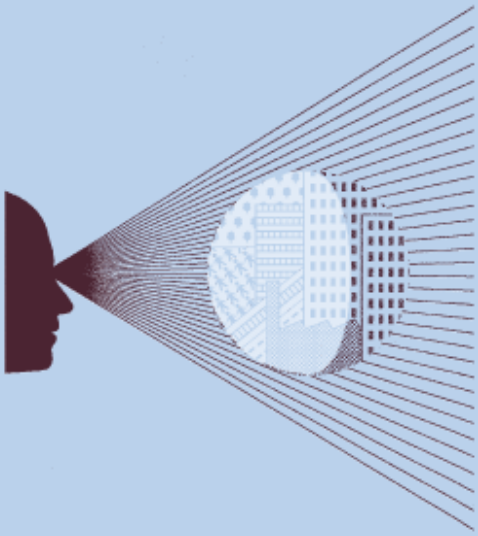

Executive summary

This report builds on the foundations established by Ofgem's first price control reviews under the new RIIO (Revenue = Incentives + Innovation + Outputs) framework and suggests a number of areas where the RIIO approach could be enhanced and refined for the new electricity distribution price control review—RIIO-ED1. The main themes of this report can be summarised as follows.

Reflecting business plan risk in the cost of equity

- The primary driver of the results of the risk analysis in the Initial Proposals for transmission and gas distribution price reviews (RIIO-T1 and RIIO-GD1, respectively) appears to be the ratio of capital expenditure (CAPEX) to regulatory asset value (RAV). While Ofgem has assessed a broader range of factors that could affect the risk profiles of individual companies and sectors, it is not clear how these factors have been reflected in the results of the risk analysis.

- For electricity distribution networks (DNOs), there are multiple factors that suggest that risk will be higher in RIIO-ED1 than in DPCR5, all else being equal. The key factors to consider in the risk analysis include:

  - increased length of the price control and the potential for increased divergence of outcomes from forecasts, particularly where outcomes are driven by non-diversifiable shocks;

  - increase in regulatory asset lives and the duration of cash flows, resulting in greater exposure of the net present value of the cash flows to both changes in the market cost of capital and regulatory risk;

  - scale of investment, including the ratio of CAPEX to RAV and the impact on the volatility of net cash flows and the level of operational risk;

  - uncertainty around the uptake of low-carbon technologies and the impact on the nature and timing of investment required by DNOs; changes in the strength of efficiency incentive rates as well as a widening of the scope of incentivised costs to include Business Support costs;

  - changes to the design of the broader package of incentive and uncertainty mechanisms, combined with uncertainty around how these incentives will interact with changes in technology and the market, for example, the introduction of smart meters.

- The impact of these factors on efficient financing costs will need careful consideration by Ofgem in the assessment of company business plans.

- The drivers of the required rate of return on assets are the risk characteristics of a company's assets, which are independent of the financing structure of the company. Therefore, understanding differences in the risk of energy networks, both across sectors and between price control periods, is most reliable and transparent when analysis is undertaken at the level of the asset beta.

- Undertaking risk analysis at the level of the asset beta is also consistent with the view of credit rating agencies, which is that higher cash-flow volatility will increase the thresholds for achieving a given credit rating. Furthermore, as changes in asset risk will

change the risk of both debt and equity, if the cost of debt is set according to a generic debt index that implicitly assumes network company debt yields continue to reflect a DPCR5 level of cash-flow volatility, changes in asset risk will need to be fully reflected in the cost of equity.

– Analysis of RoRE (return on regulatory equity) is a helpful tool to understand the range of potential outcomes for equity returns, and hence to sense-check the notional gearing assumption; however, it does not provide a sense-check on the underlying asset beta assumption.

– Risk modelling of the underlying cash-flow volatility of the business can provide a helpful indication of the direction and extent of changes in risk, and therefore an indication of the level of asset beta that is consistent with the range of risk factors faced by the business.

– For these reasons, Ofgem's risk analysis should focus on, or at least be transparent in regard to the assumptions relating to underlying asset risk.

Ensuring that efficient debt costs are recoverable

– Regulators have tended to recognise the asymmetric consequences of the companies' cost of capital deviating from the regulatory allowance during the price control period. This has generally been recognised in the cost of debt by setting a fixed allowance slightly above the central estimate of the efficient cost of debt for the price control period, after allowing for issuance costs.

– Ofgem's approach to indexation is intended to reduce the risk of error in the estimate of the cost of debt, and hence reduce the gap between the allowance and the central estimate of the cost of debt.

– In fact, for DNOs, indexation of the allowed cost of debt is likely to lead to a significantly smaller reduction in uncertainty than anticipated by Ofgem, and will even increase uncertainty relative to the alternative of a fixed cost of debt allowance if either of the following conditions hold:

  – the value of debt to be raised during RIIO-ED1 is low relative to the value of existing debt;

  – intra-year volatility in yields persists or increases, exposing companies to deviations between yields on the date of issuance and the annual average yield reflected in the index.

– For RIIO-ED1 it is important to re-evaluate the design of the debt index against the criteria in the RIIO-T1/GD1 strategy consultation, taking into account data on the specific circumstances of DNOs. It is important that residual uncertainty in the cost of debt is reflected in the allowed return, for example, through a company-specific or a sector-specific adjustment to the cost of equity. Additionally, it would be appropriate to include cost of debt as one of the uncertainties in the RoRE analysis.

– Under the RIIO-T1/GD1 debt indexation proposals, debt issuance costs are assumed to be funded through network companies continuing to achieve lower issuance yields relative to the iBoxx corporate index. The historical evidence suggests that DNOs have experienced higher issuance yields than the average network company and recent evidence suggests that the difference to the iBoxx index has narrowed. An explicit allowance for debt issuance costs might be considered as a means to ensure that these costs continue to be recoverable during RIIO-ED1.Above all, given the combination of unusual capital market circumstances and the innovative nature of debt indexation, it is important to monitor the implementation of the debt index during RIIO-ED1 in order to

guard against unforeseen consequences and to ensure that companies are able to recover their efficient financing costs. A tightly focused mid-price control review of the evolution of the debt index relative to companies' actual cost of debt would be one way of mitigating unforeseen consequences.

Achieving consistency across sectors

– It is important that consistent investment incentives and signals for consumption are provided across the price controls for gas and electricity, distribution and transmission. Ensuring that investment and consumption choices are not distorted across different forms of energy and stages of the value chain requires that the financial parameters for the different price controls are determined using similar fundamental assumptions.

– Continuing to use the RIIO-T1/GD1 range of 6.0–7.2% for the allowed return on equity in RIIO-ED1 would seem to provide consistent signals for investment and consumption across the energy sectors. Moreover, the market parameters (the risk-free rate and the equity risk premium) in the RIIO-T1/GD1 Initial Proposals are the same as in DPCR5, and therefore the DPCR5 cost of equity assumption of 6.7% reflects both DPCR5 asset risk and the market parameters in the RIIO-T1/GD1 Initial Proposals.

– The precise number for the cost of equity will depend on the details of the business plans of the individual DNOs, the implications of these plans for cash-flow volatility, and the evidence produced in support of the plans. However, there are multiple factors that suggest that risk will be higher in RIIO-ED1 than in DPCR5. For this reason, a cost of equity higher than 6.7% for RIIO-ED1 would appear to be appropriate, all else being equal.

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1 Introduction

The next electricity distribution price review (RIIO-ED1) will be based on Ofgem's new regulatory model, known as RIIO (Revenue = Incentives + Innovation + Outputs). The process for determining efficient financing costs under the new RIIO framework will be different in several respects to the last price review (DPCR5).

– The allowed return on equity and the notional gearing assumption need to reflect the underlying cash-flow volatility of the business, which in turn might vary between companies depending on their proposed package of incentives, uncertainty mechanisms and investment needs.

– The allowed cost of debt will be indexed annually based on movements in the ten-year trailing average of the market cost of debt.

– The financial parameters will need to reflect new investment challenges facing regulated energy networks. For electricity distribution network operators (DNOs), investing to accommodate the uncertain demand for network capacity from new locally connected low-carbon technologies (such as heat pumps, photovoltaics and smaller scale, distribution connected wind farms) as well as developing smart grid technologies are likely to be the key priorities.

The electricity and gas transmission, and the gas distribution networks (GDNs) were the first companies to prepare their business plans under the new RIIO model as part of the RIIO-T1 and GD1 price controls. This process (which is ongoing) has provided some useful insights into how Ofgem has applied the RIIO model in practice.

Ofgem is due to publish a RIIO-ED1 strategy consultation in September 2012, which will consult on its proposed framework for determining efficient financing costs in RIIO-ED1 and is likely to set out Ofgem's initial thinking on the allowed return on equity.

Taking into account the RIIO-T1 and GD1 precedent, this report suggests a number of areas where the RIIO approach could be enhanced and refined for RIIO-ED1. The report also evaluates the implications of the RIIO financing principles for the initial range for the allowed return on equity in RIIO-ED1. The preliminary range for the allowed return on equity presented in this report is based on a high-level assessment of the issues discussed and is not based on a detailed bottom-up analysis of the individual parameters.

The rest of the report is structured as follows:

– section 2 discusses how to appropriately reflect the risk of the business plan in the allowed rate of return, and what this implies for the risk and return analysis in RIIO-ED1;
– section 3 examines how to ensure that efficient debt costs are recoverable in RIIO-ED1, taking into account the RIIO principle of cost of debt indexation;
– section 4 evaluates the implications for the initial range for the allowed return on equity in RIIO-ED1, taking into account the relevance of achieving consistency across sectors as well as the findings of the previous sections.

2 Reflecting business plan risk in the cost of equity

A key financing principle of the RIIO framework is to ensure consistency between cash-flow risk and the allowed rate of return. In particular, the RIIO decision states a commitment that '[a]ny increase in cash flow risk will be remunerated appropriately through the allowed return'.[1]

In the RIIO framework, it is for the companies to propose financial packages that contain an appropriate balance of risks and incentives. In other words, the RIIO framework accommodates different appetites for taking risk by allowing companies to propose different incentive and financial packages, provided that the overall package is calibrated in such a way that 'those companies that deliver for consumers earn attractive rates of return, whilst those that demonstrably do not deliver, will earn low rates of return'.[2] This means that assessing the risk of the individual business plans and translating it into an allowed rate of return consistently across companies is one of the key priorities of the RIIO model.

This section reviews how this translation could be done in practice, and is structured as follows:

– section 2.1 provides more background on the RIIO framework in relation to this issue;
– section 2.2 reviews how business plan risk has been linked to the cost of equity in RIIO-T1 and GD1;
– section 2.3 discusses how cash-flow volatility could be assessed for RIIO-ED1;
– section 2.4 proposes an approach for translating cash-flow volatility into a cost of equity assumption in RIIO-ED1;
– section 2.5 summarises the key findings of this section.

2.1 Background

The level of cash-flow risk to which a regulated energy network is exposed is a function of several elements of the price control. According to the RIIO decision document, the key elements that affect the risk exposure of an individual company within the price control period include the efficiency incentive rate, the use of uncertainty mechanisms, and the potential scale for penalties and rewards for output delivery (Box 2.1).

Box 2.1 Elements of the price control that have a link to the cost of capital

According to Ofgem, in the RIIO framework three elements of the price control are closely linked to the cost of capital, and would therefore be expected to feed into the allowed rate of return.

– **The efficiency incentive rate**. 'The higher the efficiency incentive rate, the more investors are exposed to the risk that a company needs to spend more than envisaged at the price control review to deliver outputs. In setting the efficiency incentive rate, **we will take account of the impact of variation in the incentive rate on the cost of capital**.' [emphasis added]
– **The use of uncertainty mechanisms**. 'Uncertainty mechanisms can be used to reduce investors' exposure to the risk that a network company needs to spend more than envisaged at the price control review to deliver outputs. **The justification for including a specific uncertainty mechanism within the price control may be to reduce the cost of capital that consumers will need to fund**' [emphasis added]
– **The potential scale of penalties and rewards for output delivery**. 'The greater the

[1] Ofgem (2010),'RIIO: A new way to regulate energy networks', Final decision, October 4th, p. 4.
[2] Ofgem (2010),'RIIO: A new way to regulate energy networks', Final decision, October 4th, p. 40.

penalties and rewards, the greater is investors' exposure to a company's performance in delivering outputs. Where possible, we will set the levels of penalties and rewards upfront at the price control review. In other cases, we will provide guidance at the price control review on how penalties will be determined in the event of under-delivery. In setting the levels and guidance on penalties and rewards, **we will take account of the potential scale of penalties and rewards and their impact on the cost of capital that consumers will need to fund**. It will be important to recognise that, for some output incentive arrangements, the appropriate levels of penalties and rewards are based on estimates of the value of these outputs. For instance, an output incentive scheme might be calibrated based on data regarding the willingness of consumers to pay for marginal improvements in a particular output measure. In these cases, the link between the output incentive and the cost of capital is one-way: we will need to set the allowed return at a level that fairly compensates investors for the risks from that incentive scheme. It is unlikely to be appropriate to scale up or scale down an incentive scheme based on willingness to pay data in order to address concerns that the implied cost of capital will be too high or too low.' [emphasis added]

Source: Ofgem (2010), 'Handbook for implementing the RIIO model', October 4th, pp. 105–6.

Since companies are able to propose different combinations of the three elements described in Box 2.1, individual companies within the same sector could be exposed to different levels of cash-flow risk, and therefore in principle might need to be remunerated using different allowed rates of return to ensure internal consistency between risk and return.

The allowed rate of return, measured by the weighted average cost of capital (WACC), is a function of three components: the cost of debt, the cost of equity and the gearing ratio. In the RIIO framework the cost of debt will be indexed annually to a pre-specified market benchmark (explained in more detail in section 3), meaning that once the benchmark is set, Ofgem will have no control over this input into the WACC. The cost of equity is a function of the asset beta and the gearing ratio, and therefore both of these elements of the WACC need to be determined jointly to adhere to the RIIO principle of ensuring an appropriate balance of risk and reward. The RIIO decision describes how cash-flow risk is linked to the allowed rate of return only through the gearing ratio, but not the asset beta.[3]

> Once we have determined the level of risk, we will use this information to derive how much equity is required in the notional capital structure of an efficient company. In this way, a company's risk exposure will directly relate to their notional gearing and thus the calculation of their allowed return. The greater the potential variance in financial returns, the greater the cash flow risk that companies bear, and hence the greater the requirement for equity finance within their capital structure. Equity will thus be acting as a buffer to absorb any variance in the baseline allowed return.

Ensuring consistency between the assumed asset beta, the gearing ratio and cash-flow risk is a critical step in achieving the right balance of risk and reward.

The rest of this section identifies areas where the RIIO approach for linking business plan risk and the allowed rate of return could be enhanced and refined for RIIO-ED1, taking into account any relevant implications from the ongoing RIIO-T1 and GD1 price reviews.

2.2 Risk analysis in RIIO-T1 and GD1

To identify the way forward for RIIO-ED1, the starting point is the approach used to assess the balance of risk and reward in RIIO-T1 and GD1. Based on Ofgem's strategy decision for RIIO-T1 and GD1, the process for formulating a coherent financial package consists of the following steps (Figure 2.1).[4]

[3] Ofgem (2010), 'Handbook for implementing the RIIO model', October 4th, p. 106.

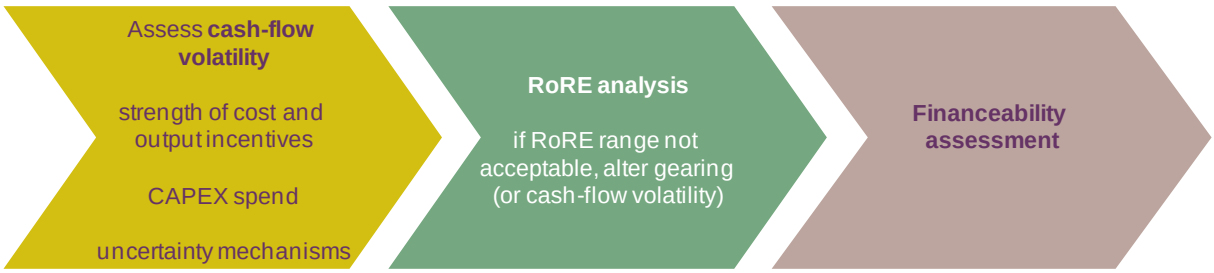
[4] Ofgem (2011), 'Decision on strategy for the next transmission and gas distribution price controls - RIIO-T1 and GD1 Financial issues', March 31st, p. 17.

– **Assess cash-flow volatility**—taking into account the strength of cost and output incentives, capital expenditure (CAPEX) needs, and the use of uncertainty mechanisms.

– **Perform RoRE analysis**[5]—this requires assumptions on the cost of equity and the notional gearing, which are informed by the analysis in the previous step. If the RoRE range produced is not acceptable, the remedy is to alter gearing or cash-flow volatility through uncertainty mechanisms.

– **Perform the financeability assessment**—if the results are not satisfactory, this suggests that some of the previous steps need to be revisited and suitable changes need to be made.

Figure 2.1 Ofgem's suggested approach in RIIO-T1 and GD1 strategy decision



Source: Oxera analysis.

In the Initial Proposals for National Grid Electricity Transmission (NGET) and National Grid Gas Transmission (NGGT) and for the GDNs, Ofgem has re-affirmed that, in principle, depending on cash-flow risk, companies across and within sectors could have different financial packages.[6]

> One of the key principles introduced as part of the RIIO approach is that the (base) allowed return for network companies should reflect their exposure to cash flow risk. This principle means that, where there are material differences in cash flow risk, the allowed return may be different across and within sectors.

The assessment of cash-flow risk in the Initial Proposals was based on a qualitative comparison of a number of factors that could contribute to differences in risk between sectors (companies) and in relation to previous price reviews. These factors included:[7]

– scale of investment;
– complexity of investment;
– incentive rate;
– TOTEX approach;
– focus on outputs;
– incentives;
– pension costs;
– cost of debt approach;
– length of the price control;
– timing of revenue adjustments.

From this list, Ofgem identified the scale of investment—measured by the CAPEX to regulatory asset value (RAV) ratio—'as the most significant differentiator of risk affecting both

[5] RoRE is a tool that Ofgem developed in DPCR5 that is meant to illustrate the range of potential returns to equity over the price control period under a range of reasonable scenarios.
[6] Ofgem (2012), 'RIIO-T1: Initial Proposals for National Grid Electricity Transmission plc and National Grid gas plc', finance supporting document, July 27th, p. 10.
[7] Ofgem (2012), 'RIIO-T1: Initial Proposals for National Grid Electricity Transmission plc and National Grid gas plc', finance supporting document, July 27th, p. 16.

the asset beta (and, therefore, the cost of equity) and the appropriate level of notional gearing.'[8] The point estimates for the allowed cost of equity for the individual companies would therefore appear to be largely driven by the comparison of CAPEX to RAV ratios across the sectors.

The Initial Proposals suggest that there is a material risk differential between sectors, and compared to previous price reviews (Table 2.1). In particular, the implied asset betas for all companies have decreased (with the exception of the fast-tracked electricity transmission operators SHETL and SPTL).

Table 2.1 Asset betas implied by Ofgem's decisions

	Electricity transmission		Gas transmission	Gas distribution
	SHETL and SPTL	NGET	NGGT	Industry
Asset beta, RIIO	0.43	0.38	0.34	0.32
Asset beta, previous price control	0.40	0.40	0.40	0.38

Note: Asset betas are derived from Ofgem's assumptions on equity beta (β_{equity}) gearing (g), and a debt beta (β_{debt}) of zero using the following formula $\beta_{asset} = (1-g) * \beta_{equity} + g * \beta_{debt}$
Source: Ofgem (2012), 'RIIO-T1: Initial Proposals for National Grid Electricity Transmission plc and National Grid gas plc', finance supporting document, July 27th; and Ofgem (2012), 'RIIO-GD1: Initial Proposals', finance and uncertainty supporting document, July 27th.

As noted, the CAPEX to RAV ratio appears to be the primary driver of these risk differentials between sectors and across time. However, cash-flow risk is a complex function of many different factors, requiring an in-depth analysis of the range of risk factors. Overall, the experience of RIIO-T1 and GD1 suggests that RIIO-ED1 would benefit from a more holistic approach to analysing differences in cash-flow risk and the impact on asset beta. The following sub-sections discuss how such an approach could be developed.

2.3 Assessing cash-flow volatility for RIIO-ED1

The purpose of assessing cash-flow volatility is to identify a company's underlying business risk exposure. In the capital asset pricing model (CAPM) framework, the proportion of total business risk that is systematic (ie, cannot be diversified away) is measured by the asset beta.

For listed companies, asset betas can be derived from equity betas estimated using share price data and gearing estimates. None of the DNOs are listed as stand-alone entities, and other listed energy companies are not directly comparable to the DNOs (given the differences in the business mix as well as, in some cases, the regulatory framework). The lack of suitable listed comparators has always been a major challenge in estimating the asset beta for regulated energy networks.

This suggests that comparing the risk profile of RIIO-ED1 with the risk profile of DPCR5 is a helpful starting point. Assuming that the DPCR5 asset beta of 0.32 was an appropriate reflection of the business risk of the DNOs at the time, changes to the asset beta assumption in RIIO-ED1 need to be based on sufficient evidence that the risk profile of the DNOs has indeed changed.

[8] Ofgem (2012), 'RIIO-T1: Initial Proposals for National Grid Electricity Transmission plc and National Grid gas plc', finance supporting document, July 27th, p. 11.

For RIIO-ED1, changes in the following main elements of the price control might be expected to have some impact on the DNOs' business risk profile:[9]

– increased length of the price control;
– increase in regulatory asset lives;
– scale of investment;
– TOTEX efficiency incentive rate;
– strength and design of output delivery incentives;
– use of uncertainty mechanisms.

With the exception of the increase in regulatory asset lives, all of these factors were considered in the RIIO-T1 and GD1 Initial Proposals. Some additional elements considered in the RIIO-T1 and GD1 Initial Proposals, such as a focus on outputs and the switch to a TOTEX approach, are likely to be less relevant in the context of RIIO-ED1 as DPCR5 had, to some degree, foreshadowed these elements of the RIIO framework. The impact of one specific uncertainty mechanism on risk—indexation of the cost of debt—is considered separately in section 3.

2.3.1 Increased length of the price control

The RIIO-ED1 price control will be an eight-year (or potentially nine-year) price control[10]—an increase of three (or four) years compared with DPCR5.

A longer price control increases the risk that a regulated company will under- or out-perform the assumptions of the business plan. The regulatory regime largely protects the electricity DNOs from demand risk. Therefore, the main driver of cash-flow volatility is cost volatility.

On the costs side, a longer price control increases the exposure to cost over- and under-spends over the period. The extent to which this increases cash-flow volatility depends on the nature of the shock.

– **Persistent shocks**—some cost shocks would be expected to persist throughout the price control period, which would tend to increase the deviations of outturn costs from forecast. An unexpected increase in input prices might reasonably be expected to persist for longer than one year, as prices tend to be sticky, at least in the short term. For example, labour contracts would only be renegotiated periodically. Similarly, material costs might be fixed by supply contracts. Therefore, the effect of higher input prices would compound over time, increasing the exposure to cost over-runs.

– **One-off shocks**—even if the unexpected shock to costs is a one-off occurrence, there is still a greater probability of a company being exposed to more one-off cost shocks over a longer price control period, increasing exposure to cost over-runs, and hence increasing cash-flow volatility. However, the impact of a longer control on risk from one-off shocks is likely to be less pronounced than the impact of risk from persistent shocks.

– **Asymmetry of cost shocks**—it is plausible that costs are stickier on the downside than upside. One example is labour costs. Negotiating wage decreases is likely to be more challenging than allowing for wage increases. In addition, implementing a redundancy programme could be difficult and in some cases undesirable, if the costs of re-training specialist staff are material. This suggests that the impact on cash-flow volatility could be asymmetric with greater risk on the downside.

The potential for higher cash-flow volatility under a longer price control has been recognised by Ofgem and its consultants:[11]

[9] Note that this is not an exhaustive list of all risk factors.

[10] Ofgem (2012), 'Open letter consultation on the way forward for the next electricity distribution price control review – RIIO-ED1', February 6th.

> 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 period. [...] we agree in principle that this may increase the level of risk faced by network companies.

In the Initial Proposals, Ofgem notes that the risk that regulatory assumptions might prove incorrect can be effectively mitigated through uncertainty mechanisms.[12] While uncertainty mechanisms may mitigate some of the risk to forecasting error, it is important to analyse the net impact on cash-flow volatility on a company-specific basis. There is also a limit to how much risk can be reduced through uncertainty mechanisms. In the RIIO framework, uncertainty mechanisms are to be used sparingly, and only when they 'will deliver value for money for existing and future consumers while also protecting the ability of networks to finance efficient delivery.'[13]

As it is not yet known which uncertainty mechanisms will be used in RIIO-ED1, it remains to be assessed whether they will mitigate the increase in risk as a result of a longer price control. The increased potential for companies to out- or under-perform increases their risk profile to a potential investor, which would lead to an increase in the required rate of return.

2.3.2 Increase in regulatory asset lives

Consistent with Ofgem's decision for electricity transmission, in RIIO-ED1, regulatory asset lives on new assets will be extended from 20 to 45 years.[14] This change has the effect of increasing the duration of cash flows.[15]

There is a relationship between cash-flow duration and returns required by investors. Being a one-period model, the CAPM is not a framework that can explicitly capture this relationship; however, multi-period asset pricing models can overcome these limitations. Oxera has previously produced a range of theoretical and empirical evidence that supports the relationship between cash-flow duration and required returns, and that predicts that an increase in cash-flow duration for regulated energy networks is likely to lead to an increase in the cost of capital.[16] This is because the net present value of longer-duration cash flows is more sensitive to changes in the market cost of capital and is more exposed to regulatory risk.

The net impact on cash-flow duration in RIIO-ED1 compared with DPCR5 will depend on other factors, such as the scale of investment and whether the DNOs are permitted to propose transitional arrangements, in addition to the increase in regulatory asset lives for new investments. The net increase in cash-flow duration will determine the net increase in the cost of capital.

2.3.3 Scale of investment

Significant changes in the scale of investment between two price control periods could have an impact on risk. A large CAPEX programme could increase cash-flow volatility as effects of cost shocks on net cash flows are likely to be magnified.

[11] FTI Consulting (2012), 'Cost of capital study for the RIIO-T1and GD1 price controls', July 24th, p. 56.

[12] Ofgem (2012), 'RIIO-T1: Initial Proposals for National Grid Electricity Transmission plc and National Grid gas plc', finance supporting document, July 27th, p. 10.

[13] Ofgem (2010), 'Handbook for implementing the RIIO model', October 4th, p. 96.

[14] Ofgem (2011), 'Decision on strategy for the next transmission and gas distribution price controls - RIIO-T1 and GD1 Financial issues', March 31st, p. 10.

[15] For a single cash flow, duration is simply the time to realisation of that cash flow. For cash flows at multiple points in time, duration is the money-weighted average time to realisation.

[16] Oxera (2010), 'What is the impact of financeability on the cost of capital and gearing capacity?', report prepared for Energy Networks Association, June 9th; Oxera (2011), 'What is the cost of equity for RIIO-T1 and RIIO-GD1?, report prepared for Energy Networks Association, February 4th; Oxera (2011), 'The impact of longer asset lives on the cost of equity: estimating cash flow betas', July.

A large CAPEX programme also increases the proportion of new assets relative to existing assets, hence the average 'age' of the asset base decreases. This means that a larger proportion of initial investment will be recovered in future regulatory periods. Since regulators are unable to write 'complete' regulatory contracts covering all eventualities, there is inherent uncertainty around the recovery of cash flows that fall outside the current regulatory period.

The scale of investment in RIIO-ED1 is not yet known. However, it is likely that the DNOs' investment requirements will increase in order to adapt to the needs of a low-carbon economy. There is likely to be greater uncertainty around the nature and timing of investment required by the DNOs in RIIO-ED1 due to uncertainty around the government's low-carbon economy targets. This uncertainty around the uptake of low-carbon technologies increases risk around output delivery compared with the previous price review, which will need to be given sufficient weight in risk assessment.

An absolute increase in the scale of investment could also increase unit price risk, if the increase is sufficiently large such that it puts pressure on capacity on the supply side to deliver the projects. Given a number of other infrastructure initiatives in the UK, including significant investments required in the transmission sector, this risk could be material.

Some of the risk associated with a large CAPEX programme could be mitigated through uncertainty mechanisms, although they are unlikely to eliminate the increase in risk completely. For example, volume drivers reduce volume risk only, but not unit cost risk. For RIIO-ED1, it would be important to assess the net impact of CAPEX on cash-flow risk, taking into account any uncertainty mechanisms proposed.

2.3.4 Efficiency incentive rate, design of incentives and use of uncertainty mechanisms

An increase in the efficiency incentive rate exposes the company to a greater share of cost variances, which would be expected to increase cash-flow volatility. Similarly, the scale of penalties and rewards under other incentive schemes, and the use of uncertainty mechanisms affect cash-flow volatility and therefore the risk profile.

At this stage, it is not known how the design of the various incentives will change in RIIO-ED1. The efficiency incentive rate and the uncertainty mechanisms are for the companies to propose and justify in their business plans.

However, providing strong and clear incentives is one of the priorities of the RIIO model. In addition, the scope of incentivised costs will increase due to the inclusion of Business Support costs. These factors suggest that substantial de-risking of the business plan via incentives and uncertainty mechanisms might be inconsistent with the principles of RIIO.

In addition, there is uncertainty around how the broader package of incentive and uncertainty mechanisms needs to change to adapt to new developments in technology and the market (eg, the introduction of smart meters). DNOs are likely to be faced with new types of risks associated with the transition to a low-carbon economy, which will need careful consideration in the risk assessment and the design of the incentive package.

2.4 Translating cash-flow volatility into a cost of equity assumption

The drivers of the required rate of return are the risk characteristics of a company's assets. Therefore, changes in risk can only be reliably and transparently measured by analysing changes in asset risk (ie, pre-financing). In the CAPM framework, a change in asset risk may translate into a change in asset beta and the WACC—ie, a change in both the costs of debt and equity.

Credit rating agencies have stated that higher cash-flow volatility will increase the thresholds for achieving a given credit rating. This is consistent with the expectation that increased volatility of cash flows would increase the cost of debt component of the cost of capital. However, the allowed cost of debt in RIIO-ED1 will be indexed to a general corporate bond

index. Therefore, the only way to reflect a change in asset risk in the regulatory allowance for the WACC is through a change in the cost of equity, holding the cost of debt constant.

Most importantly, this requires translating changes in cash-flow volatility into changes in the asset beta. The gearing ratio can also be adjusted to reflect changes to cash-flow volatility, but this is of secondary importance and reflects a transfer of risk between debt and equity.[17] For example, Ofgem concludes that RIIO-GD1 is likely to be of similar or lower risk compared to DPCR5. [18] This suggests that the appropriate notional gearing level for RIIO-ED1 might be lower than the 65% figure proposed for RIIO-GD1 (assuming that RIIO-ED1 is at least as risky as DPCR5).[19]

2.4.1 Estimating the change in the asset beta

Risk modelling of the underlying cash-flow volatility of the business can provide a helpful indication of the direction and extent of changes in risk and therefore an indication of the level of asset beta that is consistent with the range of risk factors faced by the business. Different approaches to risk modelling can be adopted, which will in turn need to reflect the specifics of the individual business plans.

One approach is to model a range of plausible scenarios for key uncertainties affecting the individual network in question under both DPCR5 and RIIO-ED1 price control assumptions, and to compare the resulting volatilities (ie, standard deviations) of the return on assets. Changes in the volatility of the return on assets can be used to assess changes in asset risk between two price control periods.

To estimate the change in the cost of equity as a result of the change in the asset beta, the asset (or the WACC) risk premium—measured as the difference between the WACC and the risk-free rate—needs to be changed proportionally to changes in asset risk. The asset risk premium updated for changes in asset risk gives an estimate of RIIO-ED1 WACC. The updated WACC can then be used to back out the updated cost of equity, using DPCR5 values for all other WACC components.

The difference between the updated cost of equity and the DPCR5 cost of equity is the change in the cost of equity that is required solely due to changes in the regulatory regime (such as the length of the price control, changes in incentives, and uncertainty mechanisms) between DPCR5 and RIIO-ED1. In other words, this change in the cost of equity reflects the change in asset risk between DPCR5 and RIIO-ED1. To estimate the RIIO-ED1 cost of equity, this change needs to be combined with updated evidence on other parameters of the cost of capital (the risk-free rate, equity risk premium, gearing and cost of debt).

For example, suppose the risk modelling shows that there is a 10% increase in asset risk. In DPCR5, the implied asset risk premium was 2.7% (based on a vanilla WACC of 4.7% and a risk-free rate of 2%). Therefore, the asset risk premium in RIIO-ED1 increases to approximately 3%. Assuming the same risk-free rate as in DPCR5 (ie, 2%), this would imply an updated WACC of 5%. This is equivalent to a 77bp increase in the cost of equity, assuming the same capital market conditions as in DPCR5 (ie, the same risk-free rate, equity risk premium, cost of debt and gearing), which in turn is equivalent to a 0.05 increase in the asset beta compared to DPCR5 (as demonstrated in Table 2.2).

[17] For a given asset beta, changes in gearing will result in changes to the equity and debt betas as can be observed from the following relationship: $\beta_{asset} = (1 - gearing) * \beta_{equity} + gearing * \beta_{debt}$

[18] Ofgem (2012), 'RIIO-GD1: Initial Proposals', finance and uncertainty supporting document, July 27th, p. 16.

[19] Ofgem (2012), 'RIIO-GD1: Initial Proposals', finance and uncertainty supporting document, July 27th, p. 17.

Table 2.2 Translating asset risk changes into asset beta changes—using an illustrative assumption of a 10% increase in asset risk

	DPCR5	RIIO-ED1	Change
Risk-free rate (%)	2.0	2.0	-
Equity risk premium (%)	5.25	5.25	-
Equity beta	0.90	1.05	0.15
Gearing (%)	65	65	-
Asset beta	**0.32**	**0.37**	**0.05**
Cost of equity, post-tax (%)	**6.7**	**7.5**	**0.77**
Cost of debt, pre-tax (%)	3.6	3.6	-
Vanilla WACC (%)	4.7	5.0	0.27
Asset risk premium (%)	**2.7**	**3.0**	**0.27**

Source: Oxera. Ofgem (2009), 'Electricity Distribution Price Control Review Proposals', December 7th. The risk-free rate, equity risk premium and equity beta assumption underlying the DPCR5 cost of equity were provided by Ofgem in Ofgem (2011), 'Decision on strategy for the next transmission and gas distribution price controls - RIIO-T1 and GD1 Financial issues', March 31st, p. 35, Figure 3.3.

In the framework described above, a change in the standard deviation of the return on assets is translated into a change in the asset beta. In the CAPM framework, this is equivalent to assuming that the change in risk is a change in systematic risk. By considering relative changes rather than absolute levels of the standard deviation of the return on assets, this approach implicitly assumes that the proportion of total cash-flow risk that is systematic stays constant between price control periods. Assuming that the starting point (ie, the DPCR5 asset beta) appropriately reflects the proportion of total cash-flow risk that is systematic, and in the absence of strong reasons why the ratio of systematic to total risk should change in RIIO-ED1 compared to DPCR5, the results are likely to provide a reasonable estimate of the change in risk.

The results of any risk-modelling exercise are a function of the underlying assumptions, and it will be important to ensure that the modelling assumptions are robust and to test the sensitivity of results to the modelling assumptions. However, the overall approach of assessing changes in risk using cash-flow modelling under a range of plausible scenarios is a useful framework to trace changes in cash-flow risk, across both time and companies and/or sectors.

2.4.2 Cross-checking the results using the RoRE analysis

Once companies have determined their cash-flow volatility and translated it into an asset beta, they need to check if the range of returns to equity is acceptable, using Ofgem's RoRE tool. In the Initial Proposals, the RoRE analysis was used primarily as a cross-check on the assumptions for the cost of equity and gearing.[20]

The asset beta combined with a notional gearing assumption informed by the analysis of cash-flow volatility can be translated into a cost of equity assumption, which will form the central RoRE estimate.

Although Ofgem has already used the RoRE tool at DPCR5, there are a number of areas where more clarity on the assumptions behind the RoRE analysis would be helpful. These include:

– confidence level—how likely is the outturn RoRE to fall within the estimated range?

[20] Ofgem (2012), 'RIIO-T1: Initial Proposals for National Grid Electricity Transmission plc and National Grid gas plc', finance supporting document, July 27th, p. 28.

– measurement period—how does the RoRE range vary across the price control period?
– calibrating the range—how is a 'good' and a 'bad' rate of return determined?

Since Ofgem places significant weight on the RoRE analysis in calibrating the package, providing greater clarity on how RoRE is constructed would help to ensure that the analysis is performed consistently across companies.

Confidence level

The RoRE analysis performed in DPCR5 captured the impact on equity returns of certain variances from price control assumptions. The following causes of variance were examined:[21]

– deviations against forecast costs (TOTEX and pensions);
– companies' performance against various output incentives (which include the interruptions incentive scheme, the losses incentive, broad measure of customer performance, and the guaranteed performance standards measure);
– impact of certain exogenous factors, such as market-wide changes in the cost of debt, and industry-wide changes in the tax rules.

The analysis did not include the impact of company-specific variations in gearing, tax and debt costs, as the RoRE measure is meant to illustrate performance at a notional capital structure.

To allow for a meaningful interpretation of RoRE, the range needs to be associated with a particular confidence level. For example, suppose Ofgem were to define the confidence level at 95%. This would mean, assuming that distributions underlying TOTEX numbers are normal, that there is a 95% probability that the outturn RoRE would fall within the estimated range. This would allow for a more meaningful analysis of whether the range of returns is too wide or too narrow.

The RoRE range is also influenced by specific penalties and rewards, which may have pre-defined caps and collars. In this case, it may be possible to specify the minimum and maximum RoRE achievable. However, the probability of earning the maximum reward or penalty could also be assessed, provided robust data is available for such an assessment.

Measurement period

Ofgem estimates RoRE over the entire price control period. Investors, however, might also care about intra-period volatility of returns. In the RIIO-T1 and GD1 Initial Proposals, Ofgem noted that there is a degree of annual variability in returns that is not evident from the overall RoRE range, and in particular, that '[t]ypically, a wider range of returns is available in the early years.[22]

Depending on the time profile of revenues and costs, some companies might be exposed to more variation in the annual RoRE than others, which would not be apparent by simply comparing the total RoRE ranges. Therefore, for RIIO-ED1 understanding the interaction between the timing and size of shocks and expenditure profile could be important in comparing RoRE ranges for different price control periods, and for different companies.

[21] Ofgem (2009), 'Electricity Distribution Price Control Review Final Proposals', December 7th.

[22] See, for example, Ofgem (2012), 'RIIO-T1: Initial Proposals for National Grid Electricity Transmission plc and National Grid gas plc', finance supporting document, July 27th, p. 29.

Calibrating the range

Ofgem expects the best-performing companies to be able to earn double digit post-tax real returns on equity, while the worst-performing companies should be earning the cost of debt or less.[23]

First, as explained above, the probability of earning the top or the bottom end of the estimated RoRE range needs to be defined. Otherwise, it is not possible to assess how likely it is that a company can indeed earn the maximum or the minimum RoRE estimated.

Second, Ofgem considers that an observation of similar RoRE ranges across companies ensures that Ofgem 'selected the right levels of cost of equity and notional gearing for the cash-flow risk of the businesses.'[24] However, the RoRE ranges will reflect the underlying cash-flow volatility as well as the notional gearing assumption, meaning that similar RoRE ranges could be consistent with different cash-flow volatilities, and hence different asset betas and asset risk premiums. Observing similar RoRE ranges is therefore not sufficient to conclude that the cost of equity and notional gearing assumptions appropriately reflect differences in cash-flow volatility across companies.

In principle, if the asset beta assumption is commensurate with the cash-flow risk of a regulated network, then it can be argued that the pre-financing package is calibrated properly. A wider range of RoRE for one company (sector) relative to another could then be a consequence of (i) higher cash-flow volatility, which would be expected to be reflected in a higher asset beta, assuming some of the additional cash-flow risk is systematic; and/or (ii) a higher notional gearing assumption.

The acceptability of a notional RoRE range then becomes a question of how much financial risk is appropriate for a particular network to take. The answer to this question is linked to the financeability assessment—the last step in ensuring that the proposed financial package is appropriate. Adjustments to improve financeability—including, potentially, a reduction in notional gearing—might be required if the forecast levels of key credit and equity metrics are not satisfactory. The feedback from any financeability adjustments to cash-flow risk should be considered. Ensuring that the financial parameters are internally consistent will therefore require an iterative procedure. Consequently, assuming that there are no financeability concerns, companies could have different RoRE ranges depending on equity investor risk appetite.

For RIIO-ED1 it is important that the analysis of risk is performed at the level of the asset beta, and the distinction between asset risk and financial risk is clear. While RoRE is a helpful tool to understand what equity returns might be achievable under a range of plausible scenarios over the price control period, and may be used to sense-check the gearing assumption, it does not provide a sense-check on the underlying asset beta assumption.

2.5 Summary

The RIIO framework is meant to allow companies to propose financial packages that contain an appropriate balance of risks and incentives. This requires an analysis of the underlying business risks faced by the networks, how these risks are amplified or mitigated through the regulatory framework, and then translating this analysis into a required rate of return on assets.

The experience of RIIO-T1 and GD1 to date suggests that for RIIO-ED1 there are a number of areas in the risk assessment framework that could be enhanced and refined.

[23] Ofgem (2012), 'RIIO-T1: Initial Proposals for National Grid Electricity Transmission plc and National Grid gas plc', finance supporting document, July 27th, p. 28.
[24] Ofgem (2012), 'RIIO-T1: Initial Proposals for National Grid Electricity Transmission plc and National Grid gas plc', finance supporting document, July 27th, p. 18.

– The primary driver of the results of the risk analysis in the RIIO-T1 and RIIO-GD1Initial Proposals appears to be the ratio of CAPEX to RAV. While Ofgem has assessed a broader range of factors that could affect the risk profiles of individual companies and sectors, it is not clear how these factors have been reflected in the results of the risk analysis.

– A useful framework for analysing risk is to consider the impact of key changes from the previous price control on cash-flow volatility. There are multiple factors that suggest the risk profile of the DNOs will be higher in RIIO-ED1 than in DPCR5, all else equal. These factors include the lengthening of the price control and extension of asset lives for new assets. It will be important to take these factors into account in the assessment of efficient financing costs for RIIO-ED1.

– Understanding differences in business risk, both across sectors and between price control periods, is most reliable and transparent when analysis is undertaken at the level of the asset beta. A number of techniques, including risk modelling, can be used to quantitatively assess differences in business risk, across both time and companies. As long as the cash-flow risk of an energy network is commensurate with the asset beta assumption, the pre-financing package will be calibrated properly. The gearing ratio can also be adjusted to reflect changes in cash-flow volatility, but this is of secondary importance to a robust determination of the asset beta.

– Analysis of RoRE is a helpful tool to understand the range of potential outcomes for equity returns, and hence to sense-check the notional gearing assumption; however, it does not provide a sense-check on the underlying asset beta assumption, which requires analysis of the underlying cash-flow volatility of the business.

3 Ensuring that efficient debt costs are recoverable

One of the underlying financeability principles of RIIO is for 'the cost of debt assumed in the WACC to be based on a long-term trailing average and updated annually within a price control.'[25]

An underlying assumption behind debt indexation is that, from the perspective of the company, this is a less risky proposition compared with a fixed cost of debt allowance, since changes in the market cost of debt feed into allowed cost of debt faster than under a fixed cost of debt allowance. This section reviews to what extent this assumption holds for the electricity DNOs and how the debt indexation mechanism may need to be refined to accommodate the specific circumstances of the DNOs. The rest of this section is structured as follows:

– section 3.1 provides more background on the RIIO framework on this issue;
– section 3.2 reviews how debt indexation has been applied in RIIO-T1 and GD1;
– section 3.3 discusses what impact debt indexation is likely to have on risk in RIIO-ED1;
– section 3.4 examines how transaction costs are recovered under debt indexation;
– section 3.5 summarises the key findings of this section.

3.1 Background

In setting a fixed cost of capital allowance for the duration of the price control period, there is a risk due to forecasting uncertainty that the allowance will under- or overestimate the cost of capital that will prevail during the price control period. UK regulators have tended to regard the costs of underestimating the cost of capital as greater than the costs of overestimating it. This is because an increase in the cost of capital during the price control period could make equity investment a negative net present value decision, and hence create an underinvestment problem.

To recognise the asymmetric consequences of the companies' cost of capital being either above or below the regulatory allowance during the price control period, UK regulators have tended to set the fixed cost of capital allowance above the central estimate of the cost of capital derived from market data. For example, in choosing a point estimate for the WACC in the last price review for Stansted, the Competition Commission (CC) noted that one of the main considerations was:[26]

> asymmetric consequences from setting returns too high and too low. Specifically, there was a significant detriment to users if Stansted was deterred by inadequate financial returns from investing in new facilities which more than outweighed the costs of setting returns too high and asking users to pay higher charges than strictly necessary.

This argument influenced the CC's recommendation to the Civil Aviation Authority (CAA) to choose a point estimate at the 81st percentile of the range.[27]

Since this approach is applied to the WACC, this means that for the cost of debt, this has generally led to a fixed cost of debt allowance that is slightly above the central estimate of the efficient cost of debt for the price control period, after allowing for issuance costs.

[25] Ofgem (2010), 'Handbook for implementing the RIIO model', October 4th, p. 105.
[26] Competition Commission (2008), 'Stansted Airport Ltd, Q5 price control review', Appendix L 'Cost of capital', October 23rd, p. L27.
[27] The CAA used the CC's recommendation on the WACC in its final decision.

Ofgem is the first UK regulator to introduce a cost of debt allowance that will be updated annually. Cost of debt indexation is meant to be a signal of stronger regulatory commitment to funding efficiently incurred debt costs compared with a fixed cost of debt allowance, which should bring long-term financeability benefits.[28]

> Our approach, under the RIIO model, is to extend the concept of regulatory commitment to the estimation of the cost of debt. We believe that if there is a commitment to remunerating efficiently incurred debt costs, it will facilitate a greater role for equity in the capital structure of regulated companies going forward. We also believe that such an approach will mean a higher likelihood of getting the WACC 'right' thus leading to better investment decisions by companies.

In other words, debt indexation is intended to reduce the risk of error in the estimate of the cost of debt, and hence reduce the gap between the allowance and the central estimate of the cost of debt. In its strategy consultation for RIIO-T1 and GD1, Ofgem confirmed its position that debt indexation should be less risky than a fixed cost of debt allowance, and, in particular, should remove the necessity for Ofgem to set the cost of debt allowance slightly higher than the central estimate of the efficient cost of debt.[29]

> It is important to note that, as regulators have typically set a fixed cost of debt, they have tended to aim up from observed market rates in order to account for the risk of the cost of debt rising during the price control period. The introduction of indexation removes the need for such so-called 'headroom' in the cost of debt allowance.

The intention to remove the margin ('headroom') between the allowance and the central estimate suggests that debt indexation should remove all cost of debt risk for an average efficiently financed company.

The rest of this section examines to what extent debt indexation is an appropriate mechanism for remunerating efficient debt costs in RIIO-ED1. It takes into account the practical design of the indexation mechanism in RIIO-T1 and GD1and the practical financing constraints of the electricity DNOs, and how the mechanism might be refined to ensure efficient debt costs are recoverable.

3.2 Debt indexation mechanism applied in RIIO-T1 and GD1

In its strategy consultation for RIIO-T1 and GD1, Ofgem reaffirmed its commitment to debt indexation, reiterating that indexation 'should provide comfort to companies and their investors that efficiently incurred new debt - even at levels higher than the level of the index at the time - will be fully funded in the future.' [30]

In the RIIO-T1 and GD1 strategy decision document, Ofgem made a number of important choices regarding the practical design of the cost of debt index, which are summarised in Box 3.1 below.

[28] Ofgem (2010), 'Handbook for implementing the RIIO model', October 4th, p. 108.

[29] Ofgem (2011), 'Decision on strategy for the next transmission and gas distribution price controls - RIIO-T1 and GD1 Financial issues', March 31st, p. 33.

[30] Ofgem (2010), 'Consultation on strategy for the next transmission and gas distribution price controls—RIIO-T1 and GD1 Financial issues', December 17th, p. 26.

Box 3.1 Ofgem's derivation of the real cost of debt

Arriving at a nominal cost of debt

Use an average of yields on iBoxx A and BBB 10+ GBP non-financials indices. Criteria used in the decision included coverage, transparency of methodology, representativeness of the networks, objectivity, transparency, predictability, user familiarity, and risk of discontinuation.

Arriving at a real cost of debt

Use ten-year break-even inflation index published by the Bank of England to deflate the nominal cost of debt. Although average maturity of bonds in the iBoxx indices is longer than ten years, Ofgem determined that ten-year break-even inflation should be sufficiently representative of longer-term inflation expectations.

Arriving at the allowed cost of debt

Use a simple ten-year trailing average of the real cost of debt.

– A ten-year window is consistent with the methodology used to set the cost of debt in previous price reviews, and implicitly is intended to provide an allowance for efficiently incurred embedded debt costs.

– While a simple, rather than a weighted, average will not accurately reflect the debt profiles of individual companies, a simple average is easy to implement and, according to Ofgem's analysis, is still the best option to protect against changes in the cost of debt for most companies. However, companies can propose a weighted average mechanism with a transition to a simple ten-year average, if they can show in their business plans why a simple ten-year average is not appropriate. However, this caveat only applies to companies with 'exceptional circumstances'.

Transaction costs

No explicit allowance for transaction costs, which include direct issuance costs, pre-funding and liquidity management costs, and new issue premia. In Ofgem's view, utilities have typically issued debt at lower rates compared with yields on the chosen index. The gap between the index and utility issuances is meant to be sufficient to cover any additional costs associated with accessing debt markets.

Source: Ofgem (2011), 'Decision on strategy for the next transmission and gas distribution price controls - RIIO-T1 and GD1 Financial issues', March 31st, pp. 18–30.

For one of the fast-tracked electricity transmission companies (SHETL) Ofgem allowed a bespoke cost of debt index by permitting bespoke weighing of the index that tracks the investment profile.[31] The sizeable scale of SHETL's CAPEX programme (which will lead to approximately a five-fold increase in the RAV) satisfied Ofgem's criteria for 'exceptional circumstances'. However, for the other transmission companies and the GDNs, no changes to the debt indexation mechanism were made in the Initial Proposals.

For RIIO-ED1, it is important to bear in mind that the indexation mechanism in RIIO-T1 and GD1 and the definition of 'exceptional circumstances' were designed to suit transmission and gas distribution companies, and did not specifically consider the financing constraints of the electricity DNOs. For example, the choice of a simple trailing average and a ten-year window was partially based on analysis of how the index would perform for different notional companies that reflected typical TOs and GDNs, not the DNOs.[32] For RIIO-ED1, it is important to re-evaluate the design of the debt index against the criteria in the RIIO-T1/GD1

[31] Ofgem (2012), 'RIIO-T1: Final Proposals for SP Transmission Ltd and Scottish Hydro Electric Transmission Ltd', April 23rd, p. 23.
[32] Ofgem (2011), 'Decision on strategy for the next transmission and gas distribution price controls - RIIO-T1 and GD1 Financial issues', March 31st, pp. 25–8.

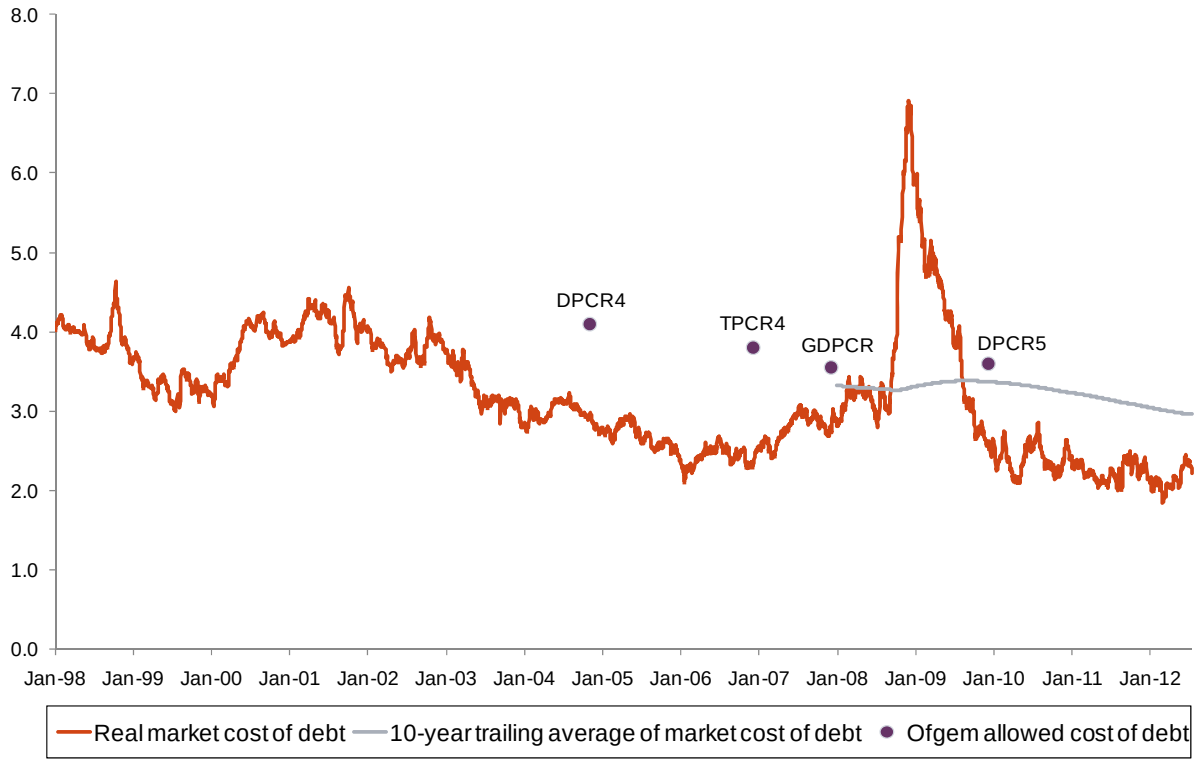
strategy consultation, taking into account data on the specific circumstances of DNOs in order to ensure that companies are allowed to recover efficiently incurred costs.[33]

3.3 Impact of cost of debt indexation on risk

For a regulated network with a cost of capital allowance fixed for the duration of the price control period, there is a risk that actual financing costs deviate from costs that the company recovers via regulated charges. Any shortfall between the allowed cost of debt and actual cost of debt is borne by equity holders, and so the cost of debt risk would be expected to be priced into required equity returns.

As explained above, in the past, Ofgem allowed a margin between the allowed cost of debt and its central estimate of the efficient cost of debt (measured by the ten-year trailing average of the market cost of debt) thereby providing some compensation to equity investors for the cost of debt risk (Figure 3.1). In DPCR5, this margin was approximately 30bp.[34] Note that this margin is distinct from the gap between the spot market cost of debt and utilities' debt issuance yields, which is intended to cover debt issuance costs in RIIO-T1/GD1.

Figure 3.1 Market cost of debt versus Ofgem determinations, (%)



Source: Datastream, Bank of England, Ofgem, and Oxera.

This margin can be considered as a form of insurance premium for equity investors. The required size of the margin depends on the company's residual exposure to cost of debt risk. To the extent that debt indexation might be expected to change this exposure, it would be appropriate to make a corresponding adjustment to the margin in the cost of debt.

[33] Ofgem (2010), 'Consultation on strategy for the next transmission and gas distribution price controls—RIIO-T1 and GD1 Financial issues', December 17th.
[34] Ofgem (2009), 'Electricity Distribution Price Control Review', Final Proposals—Allowed Revenues and Financial Issues, December 7th, p. 10.

The underlying principle is to provide network companies with the same level of protection as with a fixed cost of debt allowance. Should indexation reduce risk, the insurance premium in the allowed return will be correspondingly lower. Allowing a margin in the allowed return of appropriate magnitude will not duplicate protection against changes in the cost of debt in cases where the company has residual exposure to cost of debt risk under indexation.

While the allowed cost of debt is meant to represent the cost of debt of an average efficiently financed company, and not of individual companies in the industry, there are a number of constraints on companies' financing choices that are largely outside their control (eg, the size and profile of CAPEX) and that are likely to result in the 'tracking error' between the allowed and the actual cost of debt. Therefore, it is unlikely that the appropriate adjustment under indexation would be to eliminate the margin altogether. This view is shared by credit rating agencies:[35]

> A key aim of indexation is to transfer the risk of changes in the market cost of debt away from the utility companies. However, we believe that the effectiveness of the mechanism will vary between companies depending on several factors, including the size and profile of a company's capex program, the frequency of debt issuance, and the proportion of debt that is refinanced over the price control period.

3.3.1 Change in risk for RIIO-ED1

Previous work on cost of debt indexation submitted to Ofgem showed that Ofgem's proposed index is a perfect match for the actual cost of debt if the following set of assumptions holds:[36]

- debt outstanding at the start of the price control consists of ten bonds, each of ten-year maturity issued in each of the preceding ten years, implying that 10% of existing debt needs to be refinanced each year to keep the RAV constant;
- existing and new debt is issued at the annual average of the market cost of debt;
- no real RAV growth.

Under this restrictive set of assumptions, the allowed cost of debt tracks perfectly the actual cost of debt, and so the company is not exposed to cost of debt risk. In this extreme case, it would be appropriate to remove the margin in the cost of debt allowance completely. This scenario, however, is unlikely to be representative of an average regulated energy network, and, in particular, of an average electricity DNO.

Using a set of assumptions that is more representative of an average DNO, Figure 3.2 shows the distribution of the average return on equity (ROE) under debt indexation and under a fixed cost of debt allowance. The main differences from the no-risk scenario are as follows.

- **A re-financing profile** that is more reflective of the actual composition of DNO bonds. On average, 27% of the value of the bonds outstanding is due to be re-financed over the RIIO-ED1 period.[37]

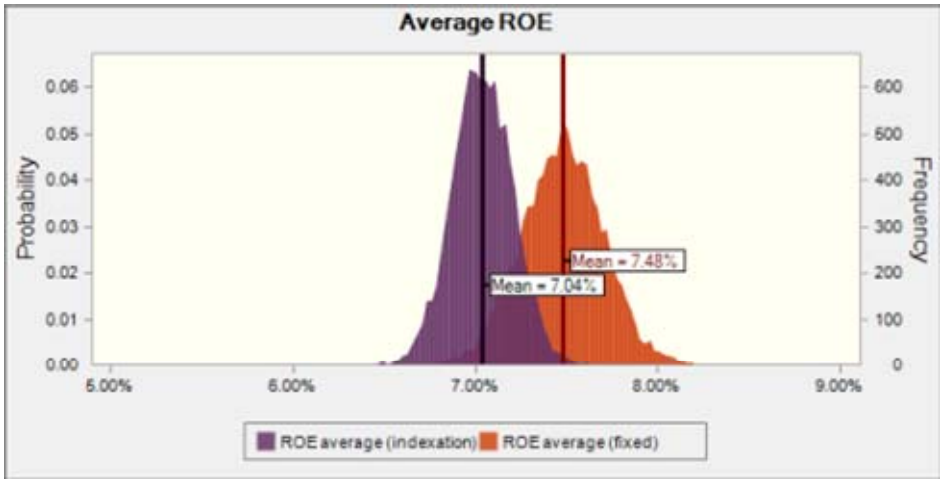
- **A growing asset base**. The RAV is assumed to grow annually by 3.1% in real terms, based on average real RAV growth in DPCR5.

- **Intra-year cost of debt risk**. The base case assumes that companies issue debt at exactly the annual average of daily market yields, such that in any given year, the cost of new debt is equal to the value that enters Ofgem's ten-year trailing average calculation. In practice, in any given year when the DNOs have issued debt, they have

[35] Standard & Poor's (2011), 'How The Proposed RIIO Regulatory Framework Could Affect Ratings On U.K. Energy Utilities', September 13th, p. 7.
[36] Oxera (2011), 'What is the link between debt indexation and allowed returns?', report prepared for Energy Networks Association, July.
[37] Based on data from Dealogic on DNO bonds issued by DNOs on a stand-alone basis as at July 11th 2012 (see Appendix A2 for bond details).

done so only once a year,[38] so a more realistic assumption is that there is a spread between the issuance yield on any new debt, and the annual average yield.[39]

Figure 3.2 Average ROE distribution—a stylised DNO



Source: Oxera.

The overarching principle of the analysis is for companies to be faced with the same trade-off between risk and expected return under debt indexation as under the current fixed allowance regime. The normalised standard deviation of ROE is 21% lower under debt indexation compared with a fixed cost of debt allowance.[40] This suggests that while the exposure to cost of debt risk under debt indexation is indeed lower than under a fixed allowance, the reduction in uncertainty is relatively modest.

Therefore, if Ofgem's decision to remove the margin from the cost of debt allowance is carried over to RIIO-ED1, it would leave the DNOs with cost of debt risk that they are not compensated for in the allowed rate of return.

A simple way of accounting for the residual cost of debt risk in RIIO-ED1 would be to include an additional margin (either in the allowed cost of debt or equity) that compensated investors for this risk. Based on the stylised example of an average DNO presented above, the required margin to be included in the cost of debt could be around 24bp.[41] Alternatively, this risk can be reflected in the cost of equity allowance. In the example above, this would translate into 44bp in the cost of equity.[42]

Consistent with the spirit of RIIO of allowing companies flexibility to propose different financial packages, it would seem appropriate to allow companies to propose adjustments to the cost of equity based on their individual circumstances.

The size and profile of CAPEX is, to a large extent, determined by the current state of the network and expected new capacity, and not the management of the company. Not recognising the differences in the exposure to cost of debt risk based on CAPEX needs of the networks would be inappropriate.

Similarly, unless there is strong evidence that the maturity and issuance sizes of companies' existing debt portfolios are inefficient, penalising companies for having either very low or very

[38] Based on data from Dealogic on DNO bonds issued by DNOs on a stand-alone basis as at July 11th 2012.

[39] The spread is assumed to be normally distributed, with an expected value of zero and standard deviation of 0.5% (calibrated against historical data). The values for the spread are randomly determined during the Monte Carlo analysis.

[40] Normalised standard deviation is equal to standard deviation divided by the mean.

[41] Calculated as 30*(1–0.21).

[42] Calculated as 24*0.65/(1–0.65), where 65% is the notional gearing assumption.

high re-financing needs by not compensating them for the cost of debt risk would be inappropriate.

As a corollary, it would also be appropriate to include cost of debt as one of the uncertainties that affects the RoRE range. In DPCR5 Ofgem calculated the dispersion in RoRE resulting from annual deviations between the ten-year trailing average of corporate bond yields and the fixed cost of debt allowance.[43]

Since the cost of debt allowance in RIIO-ED1 will be based on the ten-year trailing average of corporate bond yields, according to Ofgem's methodology, this automatically removes the cost of debt as one of the uncertainties affecting RoRE (indeed, Ofgem's RoRE analysis in RIIO-T1 and GD1 excludes cost of debt risk). However, since debt indexation does not remove all cost of debt risk, there is a rationale for retaining cost of debt in the RoRE analysis.

3.3.2 Options to reduce risk in RIIO-ED1

Two options to reduce risk relative to the cost of debt index might be considered for RIIO-ED1.

– a weighted average debt index;
– adjustment of company financing policies to match the index better.

Weighted average index

In RIIO-T1 and GD1 Ofgem left an option for companies to propose a weighted averaging mechanism with a transition to a simple ten-year trailing average, if they can show why a ten-year trailing average is not suitable to their circumstances.

This option was put forward in recognition that for a company with a rapidly growing asset base a simple ten-year trailing average may provide inadequate protection against rising interest rates in the future. The bespoke weighting scheme adopted for SHETL takes this into account by putting more weight on more recent data. Such an approach deals with one important factor—the scale and profile of RAV growth—that affects the tracking error between the allowed cost of debt and the company cost of debt.

A second important factor affecting the tracking error is the amount of existing debt that needs re-financing during the price control period. This risk factor is not dealt with in the SHETL approach.

For the DNOs this is likely to be the key risk factor, as only a relatively small proportion of existing debt needs re-financing over RIIO-ED1 (based on the maturity profile of currently outstanding stand-alone DNO bonds). Therefore, using a weighted average approach similar to SHETL's would increase complexity without providing an appreciable reduction in uncertainty for the DNOs.

In order to reduce the uncertainty, a bespoke weighting scheme would need to take into account both the proportion of existing debt that needs re-financing, and the scale and profile of RAV growth. Such an approach would be even more complex than the SHETL index. A more transparent and simple approach would be to ensure that any residual uncertainty in the cost of debt is reflected in the allowed rate of return.

Adjustment of company financing policies

Another option to reduce the exposure to the cost of debt risk would be for the companies to adjust their financing policies over time so as to more closely match the index. However, even if companies match the index in terms of size and maturity of their bond issuances, they

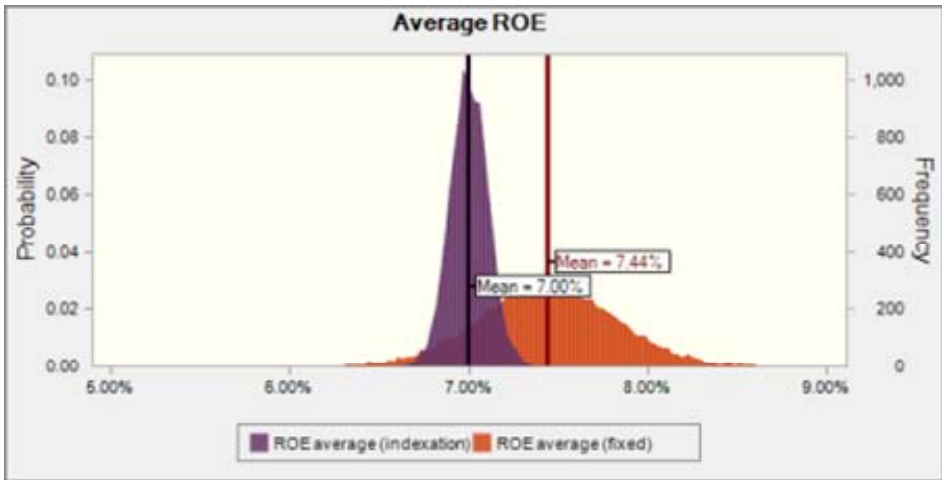
[43] Ofgem (2008), Electricity Distribution Price Control Review Policy paper – Supplementary appendices', December 5th, p. 128.

will still be exposed to the risk that the issuance yield differs from the annual average yield that goes into Ofgem's calculation of the ten-year trailing average.

On any particular day of the year, the value of the index can exceed the annual average of yields for that year. Assuming no out-performance relative to the market cost of debt, even if companies issue debt more frequently than once a year, there is still a reasonable chance that the average cost of new debt issued in that year exceeds the annual average.

Figure 3.3 below shows the distribution of the average ROE under debt indexation and under a fixed cost of debt allowance when the assumption that companies issue debt at the annual average of the market cost of debt is relaxed, and all other assumptions unchanged from the no-risk scenario.

Figure 3.3 Average ROE distribution—intra-year cost of debt risk



Source: Oxera.

The normalised standard deviation of ROE is 70% lower under debt indexation compared with a fixed cost of debt allowance. This suggests that it would still be appropriate to retain a significant margin in the allowed rate of return. The appropriate margin to be included in the cost of debt is around 9bp, or, alternatively, it can be expressed as a margin on the cost of equity, which would be equal to 17bp. Therefore, matching the index would not eliminate the exposure to intra-year cost of debt volatility and some compensation for cost of debt risk would still be required.

3.4 Allowance for transaction costs

In the RIIO-T1 and GD1 strategy decision, Ofgem noted that utilities had typically been able to issue debt at lower yields compared to the iBoxx index, and that this difference relative to the index should be sufficient to cover all costs associated with issuing debt and any new issue premia.[44] The historical difference relative to the spot market cost of debt was estimated to average 58bp over the history of the iBoxx index.[45]

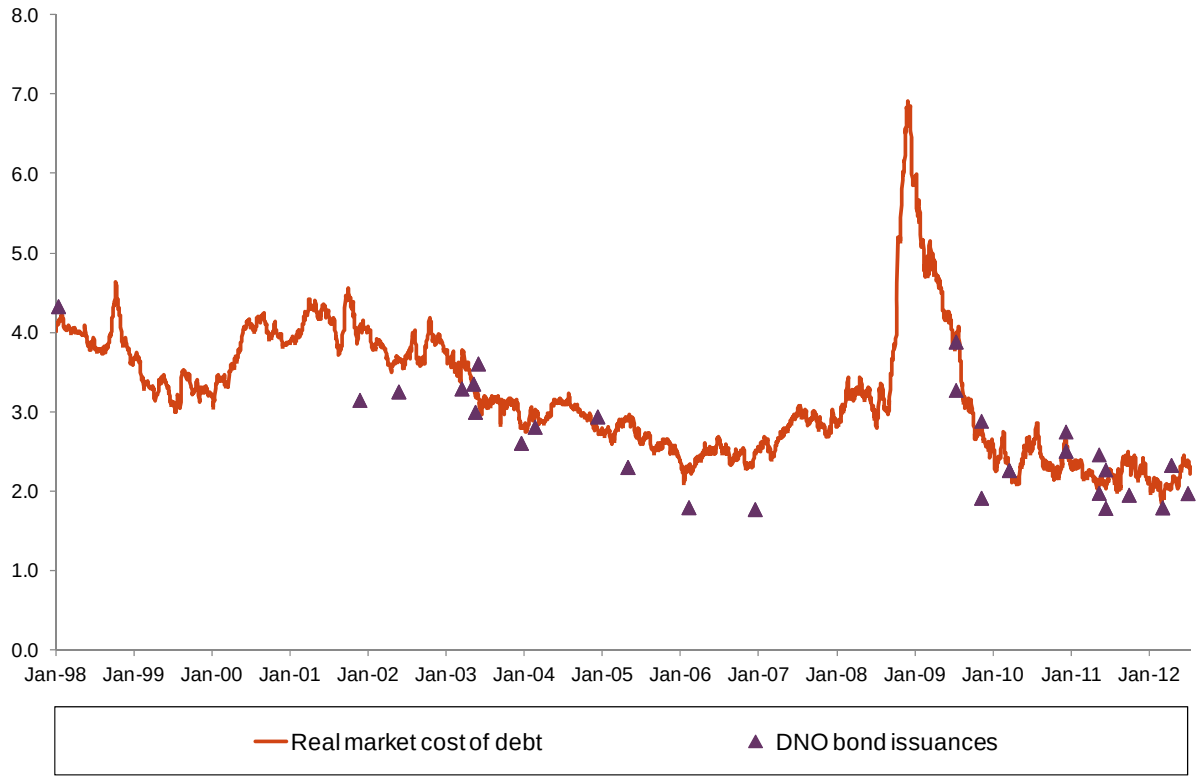
3.4.1 Trends in DNOs' debt costs

For the electricity DNOs, the historical difference between the spot market cost of debt and the DNOs' issuance yields has been lower and has averaged only 28bp.[46] Further, recent

[44] Ofgem (2011), 'Decision on strategy for the next transmission and gas distribution price controls—RIIO-T1 and GD1 Financial issues', March 31st, pp. 28–9.
[45] Ofgem (2011), 'Decision on strategy for the next transmission and gas distribution price controls—RIIO-T1 and GD1 Financial issues', March 31st, p. 28.
[46] Based on data from Dealogic on DNO bonds issued by DNOs on a stand-alone basis since the inception of the iBoxx index, as at July 11th 2012.

evidence shows this gap narrowing, with DNO bonds being issued at rates closer to the market cost of debt. This narrowing of the gap can be seen in Figure 3.4.

Figure 3.4 Market cost of debt versus DNO bond issuance yields, (%)



Source: Datastream, Bank of England, Ofgem, and Oxera.

The same trend has been noted by Ofgem in the RIIO-T1 and GD1 Initial Proposals for the TOs and the GDNs. At this stage, it has not warranted a shift in Ofgem's position, but it is intended for the matter to be kept under review until Final Proposals.[47]

With only a few more months of extra data that will become available between the Initial and Final Proposals, it will be equally as challenging to judge if the recent narrowing of the gap is a temporary phenomenon, or a structural shift. For RIIO-ED1, it would seem more appropriate to take a more explicit approach to ensure that efficient debt costs, including issuance costs, are recoverable regardless of the market conditions. A separate allowance would be a suitable means of achieving this.

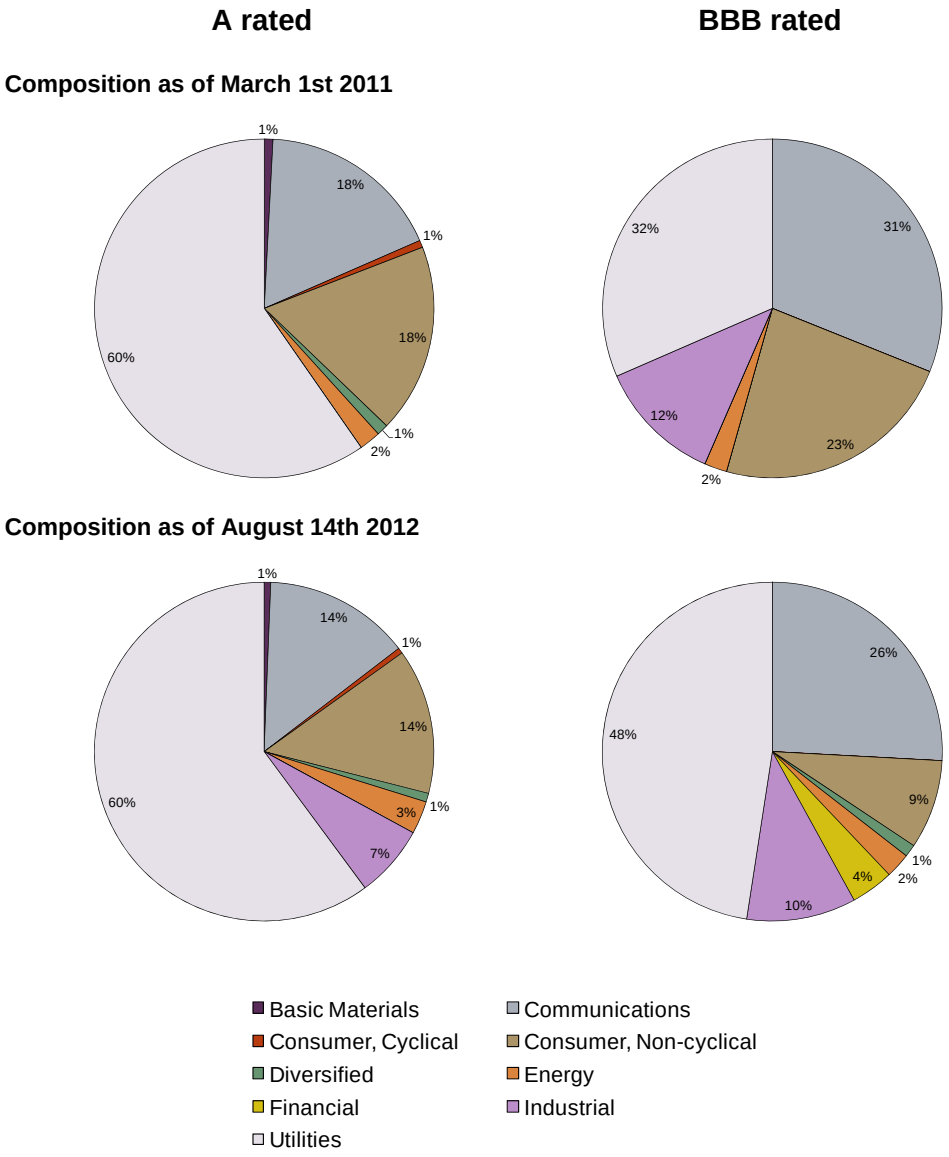
In addition, changes in the composition of the iBoxx index over time could also affect the ability of the DNOs to issue debt below the index. Compared with the analysis presented in the RIIO-T1 and GD1 strategy document, utilities now make up a larger share of the two iBoxx indices used to set the allowed cost of debt. Since the strategy decision, the number of utilities bonds has increased from 40 and 20 to 61 and 35 for the iBoxx 10+ A and iBoxx 10+ BBB indices, respectively.[48]

The value of the iBoxx indices is calculated as the weighted average of all bonds in the index. As measured by the value of the bonds outstanding, utilities' share of the two indices

[47] See, for example, Ofgem (2012), 'RIIO-GD1: Initial Proposals', finance and uncertainty supporting document, July 27th, p. 20.
[48] Ofgem (2011), 'Decision on strategy for the next transmission and gas distribution price controls—RIIO-T1 and GD1 Financial issues', March 31st, p. 22. Updated analysis is based on data as at August 14th 2012.

has on average increased. The shares are 60% and 48% of the iBoxx 10+ A and iBoxx 10+ BBB indices, respectively, compared with 60% and 32% in March 2011 (Figure 3.5).

Figure 3.5 Composition of iBoxx indices, GBP Non-financial 10+



Source: Datastream, Bloomberg, and Oxera.

An increase in the weight of utilities in the index over time could mean that issuing bonds at yields below the index would be more difficult going forward. For RIIO-ED1, it will be important to re-evaluate the design of the debt index, to ensure that efficient debt costs, including issuance costs, continue to be recoverable.

An explicit allowance for debt issuance costs might be considered a more appropriate means to ensure that debt issuance costs continue to be recoverable during RIIO-ED1 regardless of the market conditions and regardless of changes to the index.

3.4.2 Changes to transaction costs as a result of 'matching' the index

As shown in section 3.3, the debt indexation mechanism as applied in RIIO-T1 and GD1 does not provide adequate compensation for the cost of debt risk. This could incentivise companies to try to match the index, which, in turn, will have implications for transaction costs.

Matching the index would require issuing bonds of ten-year maturity on an annual basis of equal value. Examining data on individual bonds issued by DNOs shows that, on a stand-alone basis, each DNO has on average issued between one and seven bonds.[49] Although this excludes parent-company debt which may form an important source of financing for some networks, it illustrates that it is likely that the frequency of debt issuance would need to increase if the companies were to match the index. All else equal, this also implies that each debt issuance would be of a smaller size.

Some transaction costs associated with issuing debt, such as broker, legal and credit rating agency fees are likely to be largely fixed. Issuing debt more frequently and in smaller size is therefore likely to lead to an increase in transaction costs as a proportion of the bond value. Furthermore, the new issue premium is likely to increase as compensation for lower liquidity in the secondary market.

Over the life of the iBoxx index, the DNOs have on average issued debt at 28bp below the index. Assuming that 28bp is indeed a reasonable approximation of historical transaction costs, Table 3.1 illustrates that, if companies issue debt in smaller sizes, the historical margin may be no longer sufficient.

Table 3.1 Change in transaction costs from issuing in smaller sizes

Fixed costs component of transaction costs	50%
A bond with a face value of £200m	
Total transaction costs (£,000)	560
Fixed transaction costs (£,000)	280
Variable transaction costs (£,000)	280
As a proportion of bond face value (bp)	28
A bond with a face value of £100m	
Total transaction costs (£,000)	420
Fixed transaction costs (£,000)	280
Variable transaction costs (£,000)	140
As a proportion of bond face value (bp)	42

Note: Transaction costs for a £200m bond are assumed to be 28bp, or £560,000. Then it is assumed that, regardless of size, the fixed transaction costs in pound terms associated with each issue are equal to £280,000 (50% of £560,000).
Source: Oxera.

While this is simply an illustration and is not based on actual data, this example does show that matching the index could increase the costs of raising debt. Depending on the magnitude of the increase, it is plausible that the historical margin of 28bp will not be sufficient to cover transaction costs going forward.

3.5 Summary

Regulators have tended to set a fixed cost of debt allowance that is slightly above the central estimate of the efficient cost of debt for the price control period, after allowing for issuance costs. Ofgem's approach to indexation is intended to reduce the risk of error in the estimate of the cost of debt, and hence reduce the gap between the allowance and the central estimate of the cost of debt.

[49] Based on data from Dealogic on DNO bonds issued by DNOs on a stand-alone basis as at July 11th 2012.

- In fact, for DNOs, given the practical constraints on their financing strategies, indexation of the allowed cost of debt—as applied in RIIO-T1 and GD1—is likely to lead to a significantly smaller reduction in uncertainty than anticipated by Ofgem, and will even increase uncertainty relative to the alternative of a fixed cost of debt allowance if either of the following conditions hold:
  - the value of debt to be raised during RIIO-ED1 is low relative to the value of existing debt;
  - intra-year volatility in yields persists or increases, exposing companies to deviations between yields on the date of issuance and the annual average yield reflected in the index.
- Refining the index by applying a weighted average will increase complexity without providing an appreciable reduction in uncertainty. Adjusting financing policies so as to minimise the tracking error between the allowance and the actual cost of debt will still leave companies exposed to the risk that the cost of new debt deviates from the annual average used to calculate the cost of debt allowance. In addition, this will also increase transaction costs.
- For RIIO-ED1 it is important to re-evaluate the design of the debt index against the criteria in the RIIO-T1/GD1 strategy consultation taking into account data on the specific circumstances of DNOs. It is important that residual uncertainty in the cost of debt is reflected in the allowed return, for example, through a company-specific or a sector-specific adjustment to the cost of equity. Additionally, it would be appropriate to include cost of debt as one of the uncertainties in the RoRE analysis.
- Under the RIIO-T1/GD1 debt indexation proposals, debt issuance costs are assumed to be funded through network companies continuing to achieve lower issuance yields relative to the iBoxx corporate index. The historical evidence suggests that DNOs have experienced higher issuance yields than the average network company and recent evidence suggests that the difference to the iBoxx index has narrowed. An explicit allowance for debt issuance costs might be considered as a means to ensure that these costs continue to be recoverable during RIIO-ED1.
- Above all, given the combination of unusual capital market circumstances and the innovative nature of debt indexation, it is important to monitor the implementation of the debt index during RIIO-ED1 in order to guard against unforeseen consequences and to ensure that companies are able to recover their efficient financing costs. A tightly focused mid-price control review of the evolution of the debt index relative to companies' actual cost of debt would be one way of mitigating unforeseen consequences.

4 Achieving consistency across energy sectors

One of the fundamental goals of the RIIO model is to support the development of a sustainable energy sector, defined by Ofgem as:[50]

> an energy sector that meets the broad needs of existing and future consumers. This includes delivery of low carbon energy and other environmental objectives, delivery of secure safe supplies, and delivery of value for money including meeting the needs of vulnerable consumers

Ensuring the development of a sustainable energy sector requires a regulatory environment that is able to attract the necessary investments in the sector and apportion it appropriately between gas and electricity, and transmission and distribution. The RIIO-ED1 review is happening against a background of the RIIO-T1 and GD1 reviews. Furthermore, these reviews are happening in the broader context of a large-scale UK infrastructure investment challenge. Ensuring that the allowed rate of return attracts the right level of investment into each segment of the energy sector has been a major theme in the RIIO-T1 and GD1 reviews and is going to continue to be an important theme in the RIIO-ED1 review.[51]

> An important message from consultation has been that returns on equity must be attractive in order to attract investors in the face of competing opportunities in the utilities sector.

There are also new challenges facing energy networks that were not present in previous reviews. For the electricity DNOs, these challenges include the need to accommodate demand for capacity from low-carbon technologies, which is uncertain in both size and timing, as well as dealing with issues such as the introduction of smart grids. This means that rates of return need to be attractive relative to other investments, a point recognised by Ofgem.[52]

> The figures show that our indicative range offers attractive returns on equity compared to European and US regulated utilities. We think that this is appropriate given the need to attract investment into the sector during RIIO-T1 and GD1 in order to finance investment that will facilitate achieving the UK's low carbon objectives.

This means that given the competition for investment with other sectors, as well as within the energy networks themselves, the range for the allowed return on equity for RIIO-ED1 needs to be determined using similar assumptions as Ofgem's range for RIIO-T1 and GD1. This is further supported by the significant overlap in the timing of RIIO-T1, GD1 and ED1—RIIO-T1 and GD1 will cover the period from 2013–21 and RIIO-ED1 will cover the period from 2015–23 (or potentially 2015–24).

It is important that consistent investment incentives and signals for consumption are provided across the price controls for gas and electricity, distribution and transmission. Ensuring that investment and consumption choices are not distorted across different forms of energy and stages of the value chain requires that the financial parameters for the different price controls are determined using similar fundamental assumptions.

[50] Ofgem (2010), 'Handbook for implementing the RIIO model', October 4th, p. 2.

[51] Ofgem (2011), 'Decision on strategy for the next transmission and gas distribution price controls - RIIO-T1 and GD1 Financial issues', March 31st, p. 35.

[52] Ofgem (2011), 'Decision on strategy for the next transmission and gas distribution price controls - RIIO-T1 and GD1 Financial issues', March 31st, p. 36.

Continuing to use the RIIO-T1/GD1 range of 6.0–7.2% for the allowed return on equity in RIIO-ED1 would seem to provide consistent signals for investment and consumption across the energy sectors. Moreover, the market parameters (the risk-free rate and the equity risk premium) in the RIIO-T1/GD1 Initial Proposals are the same as in DPCR5,[53] and therefore the DPCR5 cost of equity assumption of 6.7% reflects both DPCR5 asset risk and the market parameters in the RIIO-T1/GD1 Initial Proposals.

A number of factors suggest that, all else equal, the risk profile of the DNOs will be higher in RIIO-ED1 compared with DPCR5 (as discussed in section 2). In addition, the debt indexation mechanism in its current form provides only minor compensation for the cost of debt risk and is likely to prove insufficient to cover debt issuance costs (as discussed in section 3).

Taking these factors into account, a cost of equity higher than 6.7% for RIIO-ED1 would appear to be appropriate, all else being equal. However, the precise number for the cost of equity will depend on the details of the business plans of the individual DNOs, the implications of these plans for cash-flow volatility, and the evidence produced in support of the plans.

[53] The DPCR5 parameters are shown in Ofgem (2011), 'Decision on strategy for the next transmission and gas distribution price controls - RIIO-T1 and GD1 Financial issues', March 31st, p. 35, Figure 3.3.

A1 Modelling cost of debt risk

A1.1 Analytical framework

The modelling of the cost of debt risk presented in the main body of the report uses the same analytical framework as in Oxera's 2011 report on debt indexation and risk.[54]

The modelling exercise compares two approaches to setting the cost of debt allowance:

– fixed allowance set at 30bp above the current ten-year trailing average of the market cost of debt;
– indexed allowance set at the ten-year trailing average of the market cost of debt, and updated annually throughout the eight-year modelling horizon.

This modelling approach enables a comparison of both risk and expected return under debt indexation against the approach taken in past Ofgem determinations. Moreover, the modelling allows the drivers of residual cost of debt risk under indexation to be analysed, and quantification of the reduction (or increase) in risk that is achieved by moving from a fixed allowance to indexation. The change in risk is defined as the change in the normalised standard deviation of ROE (defined as the ratio of standard deviation to the mean).

Individual companies are likely to vary in their exposure to the different drivers of residual risk under debt indexation, and therefore also experience different changes in risk by moving from a fixed to an indexed allowance. Although there is no analytical model for translating the results of the Oxera model into the appropriate margin over the ten-year average cost of debt index, for individual companies the *percentage change* in the normalised standard deviation of ROE that is the result of the move from the fixed allowance approach to indexation (under scenarios that capture company-specific circumstances) could be taken as a proxy for the appropriate percentage change in the margin. For example, a scenario that models the financing profile of a particular company might result in an expected ROE of 7.5% with a standard deviation of 50bp under the fixed allowance (including a cost of debt margin over the ten-year average yield), and an expected ROE of 7.0% with a standard deviation of 25bp under indexation (with no margin over the ten-year average). The normalised standard deviation—dividing the standard deviation by the expected return—is 6.7 under the fixed allowance and 3.6 under indexation. Since the normalised standard deviation is 46% lower under indexation, the appropriate margin for cost of debt risk is 46% lower. Based on the approximate 30bp margin in the cost of debt that companies have earned in the past, the appropriate margin for residual risk under debt indexation in this example is approximately 16bp.

A1.2 Modelling assumptions

All of the modelling is performed in real terms for a stylised notional company using the following core assumptions:

– no out- or underperformance on regulatory assumptions: actual operating expenditure (OPEX) and CAPEX (and depreciation and RAV growth) exactly match forecast OPEX and CAPEX (and depreciation and RAV growth);
– CAPEX is funded at the notional level of gearing with dividends and net equity issuance adjusting to maintain static gearing;

[54] Oxera (2011), 'What is the link between debt indexation and allowed returns?', report prepared for Energy Networks Association, July.

– a cost of equity of 7% at 65% gearing;
– price control starts in April 2012—this removes uncertainty in the cost of debt over the next three years;
– in the past, companies issued debt at the annual average of Ofgem's cost of debt index, where the historical data for the cost of debt is taken from the spreadsheet published by Ofgem;[55]
– the allowed cost of debt under debt indexation is calculated as the ten-year trailing average up to December 31st of the previous year—this assumes that the index is applied with a three-month time lag;[56]
– the allowed cost of debt under a fixed allowance is set at 3.3%, which is equal to the current ten-year trailing average up to December 31st 2011 plus 30bp of headroom;[57]
– a straight-line depreciation profile consistent with asset lives in Ofgem's latest decision for electricity transmission (20 years for existing assets, 45 years for new assets).

Using the assumptions above, the model calculates key equity and credit metrics, including ROE. To analyse the residual risk under debt indexation versus a fixed allowance, different paths for the annual change in the cost of debt are simulated using Monte Carlo analysis. All scenarios assume that the market cost of debt starts at 2.2%,[58] and that the annual change in the cost of debt is normally distributed with a standard deviation of 0.5%.[59] Various scenarios for the average annual change were considered. The paths of Ofgem's proposed cost of debt index from its starting point of 3.0% were modelled based on the simulated paths for the market cost of debt.

The resulting distributions of the key equity and credit metrics are compared under various scenarios to assess the change in risk. Specifically, the percentage change in the normalised standard deviation under debt indexation compared with a fixed allowance is analysed. Rather than measuring the absolute change in risk under indexation, the normalised standard deviation captures the change in risk relative to the change in expected equity return, thereby allowing the trade-off between risk and expected return to be assessed.

[55] Ofgem (2012), 'Cost of debt indexation model update: RIIO-T1 and GD1'.

[56] In the RIIO-T1/GD1 Initial Proposals, the allowed cost of debt was assumed to equal the ten-year trailing average up to December 31st 2011. In practice, Ofgem will use the ten-year trailing average up to the end of October of the previous year. This assumption does not have an impact on the modelling results.

[57] The ten-year trailing average is based on the data provided by Ofgem.

[58] The average for January–December 2011, based on Ofgem's data.

[59] Based on the historical within-year standard deviation of yields from the annual average yield.

A2 DNO bonds

Table A.1 Bonds issued by the DNOs

Issuer (Dealogic)	Network name	Deal pricing date	Maturity (years)	Nominal issuance yield (%)	Real issuance yield (%)	Face value (GBP m)	Effective rating (launch)
Nominal							
Yorkshire Power Finance Ltd	NPGY	13/01/1998	31	7.3	4.4	200	BBB
Southern Electric Power Distribution plc	SSES	22/11/2001	30	5.5	3.2	250	AA-
London Power Networks plc	LPN	23/05/2002	25	6.2	3.3	200	A+
Western Power Distribution (South West) plc	SWEST	14/03/2003	24	6.0	3.4	200	A-
Western Power Distribution (South West) plc	SWEST	08/05/2003	24	5.8	3.3	50	A-
Seeboard Power Networks plc	SPN	16/05/2003	23	5.9	3.3	300	A
London Power Networks plc	LPN	30/05/2003	24	5.4	2.9	100	A+
Southern Electric Power Distribution plc	SSES	17/12/2003	28	5.2	2.4	100	AA-
EDF Energy Networks (EPN) plc	EPN	19/02/2004	20	5.8	2.8	300	A
EDF Energy Networks (EPN) plc	EPN	08/12/2004	19	5.5	2.7	50	A
Yorkshire Electricity Distribution plc	NPGY	28/04/2005	30	5.2	2.3	200	AAA
Northern Electric Finance plc	NPGN	28/04/2005	30	5.2	2.3	150	AAA
Southern Electric Power Distribution plc	SSES	07/02/2006	31	4.6	1.8	325	AA-
Western Power Distribution (South Wales) plc	SWALES	14/12/2006	31	4.8	1.8	225	BBB+
ENW Capital Finance plc	ENWL	10/07/2009	6	6.9	4.1	300	BBB+
ENW Capital Finance plc	ENWL	10/07/2009	12	6.3	3.5	200	A-
EDF Energy Networks (LPN) plc	LPN	06/11/2009	7	5.2	2.0	300	A
EDF Energy Networks (SPN) plc	SPN	06/11/2009	22	6.3	3.0	300	A
EDF Energy Networks (EPN) plc	EPN	06/11/2009	27	6.1	2.9	300	A
Western Power Distribution (South Wales) plc	SWALES	16/03/2010	30	5.8	2.3	200	A-
Western Power Distribution (South Wales) plc	SWALES	16/03/2010	30	5.8	2.3	200	A-
Central Networks West plc	WMID	06/12/2010	14	5.6	2.6	250	A-

Issuer (Dealogic)	Network name	Deal pricing date	Maturity (years)	Nominal issuance yield (%)	Real issuance yield (%)	Face value (GBP m)	Effective rating (launch)
Central Networks West plc	WMID	06/12/2010	30	5.9	2.9	250	A-
Western Power Distribution (East Midlands) plc	EMID	10/05/2011	12	5.3	2.0	600	BBB+
Western Power Distribution (West Midlands) plc	WMID	10/05/2011	21	5.8	2.6	800	BBB+
UK Power Networks Holdings Ltd	LPN	10/06/2011	12	5.2	1.9	250	A-
UK Power Networks Holdings Ltd	SPN	10/06/2011	19	5.7	2.4	200	BBB+
Eastern Power Networks Ltd	EPN	27/09/2011	10	4.8	2.0	250	BBB+
Eastern Power Networks Ltd	EPN	02/03/2012	10	4.0	1.1	150	BBB+
Western Power Distribution (East Midlands) plc	EMID	12/04/2012	11	4.0	1.1	100	BBB+
Northern Powergrid Ltd	NPGN	28/06/2012	20	4.5	2.1	150	A-
Index-linked							
London Power Networks plc	LPN	23/05/2002	30	-	3.1	150	A+
Seeboard Power Networks plc	SPN	16/05/2003	20	-	3.1	50	A
Scottish Hydro-Electric Power Distribution plc	SSEH	22/09/2006	50	-	1.4	100	AA-
Western Power Distribution (South West) plc	SWEST	22/11/2006	47	-	1.5	105	BBB+
Western Power Distribution (South West) plc	SWEST	22/11/2006	50	-	1.5	120	BBB+

Note: The list only includes bonds issued by the DNOs on a stand-alone basis, ie, it excludes parent company bonds. Real issuance yield for nominal bonds is obtained by deflating the nominal issuance yield by ten-year break-even inflation published by the Bank of England as at the deal pricing date, using the Fisher equation: real yield (%) = (1+nominal yield (%))/ (1+break-even inflation (%)) – 1.
Source: Dealogic, cut-off date July 11th 2012.

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