
Review of Ofgem's initial cost of equity proposals for RII0-2

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Executive summary

In its framework consultation on the approach to setting price controls for gas and electricity markets in Great Britain,¹ Ofgem lays out its initial methodology for estimating the forward-looking real post-tax cost of equity, and indicates that this produces a range of 3–5% were price controls to be set under today's market conditions. Ofgem's proposals draw on a report by CEPA, as well as a separate report produced for the UKRN. In light of this framework consultation, the Energy Networks Association (ENA) has asked Oxera to review Ofgem's approach and key assumptions for the cost of equity.

Our review finds that the indicative range for the cost of equity estimate is inconsistent with the cost of debt. Specifically, the implied risk premium on unlevered equity is lower than the risk premium on debt, which is inconsistent with the relative priorities of claims in the event of distress or default. The risk premium on equity must be larger than the risk premium on the debt of the same company, because debt has a more senior claim than equity on the company's cash flows and assets.

Our examination of the parameters underlying the indicative 3–5% range suggests that the following main issues contribute to the inconsistency noted above.

First, the methodology to estimate the risk-free rate (RfR) is unreliable, for the following reasons.

- The lower bound of CEPA's RfR estimate is based on observed spot rates on index-linked gilts (ILGs), which are lower than the forward rates for the relevant RIIO-2 period. This is not an appropriate ex ante estimate if the cost of equity allowance is to be fixed for the duration of the price control.
- CEPA does not make any allowance for uncertainty over how the RfR will evolve between now and the end of the RIIO-2 control period, which increases the probability of underestimating the actual RfR if the allowance for the cost of equity is to be fixed on an ex ante basis for the duration of the price control.

Second, Ofgem and CEPA's methodology for estimating the total market return (TMR) range is problematic, for the following reasons.

- In interpreting the UKRN's historical estimates for equity market returns, Ofgem and CEPA assume that the 6.0–7.0% range is stated in CPI-linked terms. This is not clear in the UKRN report, and some of the cross-checks undertaken in the report suggest that it is in RPI-linked terms. If Ofgem were minded to deduct the difference between RPI and CPI inflation from the 6.0–7.0% equity market return range presented in the UKRN report, this would implicitly assume that investors in UK regulated utilities (and, in particular, GB energy networks) target returns relative to inflation as measured by CPI rather than by RPI, without good supporting evidence. This would represent a structural break in the regulatory methodology towards setting the allowed cost of capital, and would not be neutral on a net present value (NPV) basis. In light of this, it is appropriate that Ofgem's consultation does not adopt a 5.0–6.0% RPI-linked range for the TMR, and considers a range that extends to 6.5%.

¹ Ofgem (2018), 'RIIO-2 Framework Consultation: Our approach to setting price controls for GB gas and electricity networks', March. Hereafter referred to as Ofgem (2018).

- Ofgem has implicitly increased the weight placed on geometric averages of historical equity market returns, thereby lowering the TMR estimate. This change is based on reasoning in the UKRN report that regulators will set allowed returns on a consistent basis over time. The UKRN's reasoning is not transparent and is contradicted by the academic literature, which is broadly supportive of placing more weight on the arithmetic averages for estimating equity market returns for the purposes of appraising investment opportunities. It is also contradicted by Ofgem's re-interpretation of the historical evidence on equity market returns (among other methodological changes currently being consulted on by Ofgem).
- Further, CEPA's use of a dividend discount model to derive estimates of the TMR is based on an inappropriate view of dividend growth expectations for companies in the FTSE All-Share index. The TMR estimate is below the point estimate of 7.5% presented in Oxera's February 2018 report, based on a dividend growth model (DGM) constructed by Oxera with reference to the methodology developed by the Bank of England.

Finally, with respect to the beta analysis, the following problems are noted.

- CEPA's approach to re-lever the upper end of the derived asset beta range is incorrect, as it is based on an unrealistic notional gearing assumption of 50%.
- CEPA's comparator set for estimating the equity beta range excludes any analysis of observed betas for European energy networks. This ignores valuable evidence and limits the beta analysis to three water companies plus National Grid.
- The GARCH analysis considered by the UKRN report is one way to improve the sophistication of beta analysis. However, it is not a technique that is widely employed by capital market participants and academic practitioners to estimate the cost of equity. The UKRN's use of quarterly data is unusual. Under more standard assumptions of data frequency (e.g. daily) and time period (e.g. five-year), the GARCH approach produces similar beta estimates to the more conventional ordinary least squares regression (OLS) approach.
- In the context of UK energy networks, uncertainty has been created over the future configuration of the energy system by the extent and nature of the changes required to both electricity and gas distribution and transmission networks to facilitate energy decarbonisation and the necessary innovations in technologies. Consideration of these risks facing energy networks merits a cautious approach to a point within the beta range.

Furthermore, Ofgem has not expressed a view on the appropriate notional gearing assumption, and appears to consider it as a parameter that can be determined independently of the cost of equity. This presents a high risk that the cost of equity and the WACC will be estimated in a way that is inconsistent with standard finance theory and hence lead to an incorrect estimate of the cost of equity—this further underlines the importance of developing the cost of equity methodology before publishing an updated set of estimates.

The cost of equity methodology has been developed in parallel with other major changes to the RIIO framework that Ofgem has put out to consultation, such as:

- whether to index the price control to CPI or CPIH rather than RPI;
-

- whether to index the cost of equity;
- whether to distinguish the regulatory allowed return from the regulatory expected return—in particular, whether taking an ex ante view of outperformance and incorporating that into the allowed returns for equity investors is appropriate;
- whether to modify the incentive properties of the RIIO framework.

At the heart of the RPI - X model of regulation is the fact that it encourages and incentivises companies to outperform. To the extent that regulators believe that levels of outperformance are unjustified, this needs to be addressed directly via other mechanisms such as the efficiency challenges, incentive mechanisms, and the extent to which companies are allowed to retain outperformance. It would reduce transparency and distort investment decisions if the allowance for the cost of equity were adjusted to address concerns about the potential for outperformance in other parts of the regulatory framework.

In light of the ongoing consultation on fundamental elements of the RIIO-2 framework, the lack of methodological consensus among Ofgem's advisers, and the absence of a well-defined methodological framework from Ofgem, it appears premature to present estimates for the cost of equity before all of these regulatory uncertainties have been resolved.

1 Introduction

In its framework consultation on the approach to setting price controls for gas and electricity markets in Great Britain,² Ofgem has laid out its initial position for the forward-looking cost of equity (based on analysis presented by CEPA and UKRN). The methodology and estimates imply significant reductions to the allowed cost of equity relative to Ofgem's RIIO-1 determinations.³ This is shown in the table below.

Table 1.1 Comparison of Ofgem's current cost of equity proposals

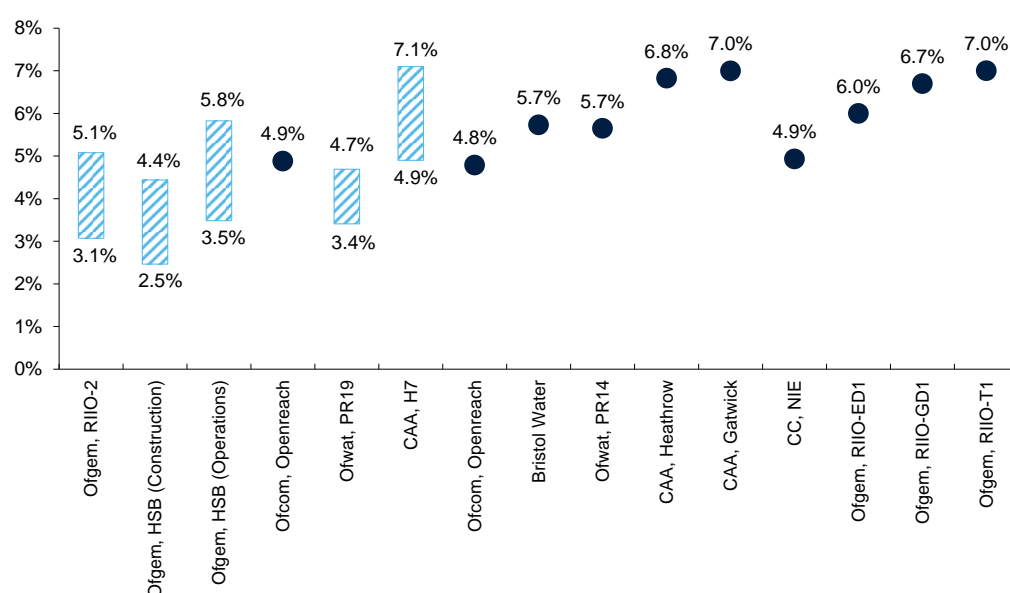
	Cost of equity, real post-tax
RIIO-T1 ¹	7.0%
RIIO-GD1	6.7%
RIIO-ED1	6.0%
RIIO-2 (initial proposals)	3.1–5.1%

Note: ¹ Based on the allowed cost of equity for NGET.

Source: Ofgem (2012), 'RIIO-T1: Final Proposals for National Grid Electricity Transmission and National Grid Gas'; Ofgem (2012), 'RIIO-GD1: Final Proposals Finance and uncertainty supporting document'; Ofgem (2014), 'RIIO-ED1: Final determinations for the slow-track electricity distribution companies – Overview'; CEPA (2018), 'Review of cost of capital ranges for Ofgem's RIIO-2 for onshore networks', February.

Figure 1.1 illustrates the allowed cost of equity for prevailing and past regulatory determinations in the UK.

Figure 1.1 Real cost of equity allowances by UK regulators



Note: The determinations above are set out in reverse chronological order. The striated bars indicate consultation proposals. The bars indicate the initial cost of equity range proposed by regulators. RIIO-T1's reported cost of equity is the cost of equity for NGET. The recent cost of equity determination by Ofcom and the CC's NIE determination are based on lower gearing assumptions than that proposed for RIIO-2, and the cost of equity estimate would be higher if re-stated based on a notional gearing in line with CEPA's proposals for RIIO-2.

Source: Oxera analysis based on various regulatory determinations.

² Ofgem (2018).

³ Ofgem (2012), 'RIIO-T1: Final Proposals for National Grid Electricity Transmission and National Grid Gas', 17 December.

As shown above, the mid-point of Ofgem's proposals in its framework consultation document is broadly in line with Ofwat's initial consultation on the cost of equity for the water sector in England and Wales. Both of these proposals set a new lower bound for the allowed cost of equity for sector-wide regulatory determinations in the UK. In light of this, the ENA has asked Oxera to review Ofgem's proposals for estimating the allowed cost of equity and the underlying parameters.

This report presents Oxera's review of Ofgem's proposals for the cost of equity. It is structured as follows.

- Section 2 discusses a key inconsistency in CEPA's analysis regarding the allowed returns to asset holders.
 - Section 3 reviews Ofgem's and its advisers' approach to estimating the RfR and TMR.
 - Section 4 provides a critique of CEPA's and the UKRN's approach to estimating beta.
 - Section 5 comments on other key issues raised in Ofgem's framework consultation.
 - Section 6 concludes.
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2 Risk premium for asset holders

CEPA's analysis has produced an inconsistency in its estimates of the cost of equity and cost of debt for RIIO-2.

Its analysis suggests that the remuneration required for the risks associated with energy network assets is lower than that accorded to the debt on the same assets. Given that debt has a higher priority over equity in the payment of interest and also in the event of financial distress or bankruptcy, investors in the assets (unlevered equity) should be more highly rewarded. This is not the case in CEPA's analysis.

Table 2.1 below provides the empirical evidence underlying the inconsistency.

$$DRP = CoD - RfR \quad (1)$$

$$ARP = \beta_a * ERP \quad (2)$$

where:

DRP = Debt risk premium; *ARP* = Asset risk premium;
RfR = Risk – free rate; *ERP* = Equity risk premium; β_a = Asset beta;
CoD = Cost of debt

Table 2.1 Implied asset and debt risk premium based on CEPA's proposals

Parameter	RIIO-2 proposals— low	RIIO-2 proposals— high	RIIO-2 proposals— mid-point
Real risk-free rate	-1.75%	-0.6%	-1.2%
Real cost of debt	0.30%	2.15%	1.2%
Equity risk premium	6.75%	7.10%	6.9%
Asset beta	0.25	0.40	0.325
Asset risk premium	1.7%	2.8%	2.3%
Debt risk premium	2.1%	2.8%	2.4%

Source: Oxera analysis of CEPA's estimates presented in CEPA (2018), 'Review of cost of capital range for Ofgem's RIIO-2 for onshore networks', February, Table 7.1.

As shown above, the low and mid-point estimates of CEPA's cost of equity and cost of debt proposals are inconsistent with the hierarchy of claims on assets and cash flows.

Specifically, at the lower bound the reward for risk on offer to debt holders in RIIO-2 is 2.1%, and the reward for the assets is 1.7%. Similarly, at the mid-point of the proposals, the reward for risk faced by debt holders is 2.4% compared with 2.3% for the return on assets. The latter must be greater than the former because, for a given company, equity is riskier than debt.

The inconsistency between the cost of equity and the cost of debt suggests that CEPA's cost of equity estimate for RIIO-2 needs to be revised upwards. This is a replication of the inconsistency in Ofgem's minded-to position for the forward-looking WACC for the operational phase of the Hinkley-Seabank project (also based on analysis conducted by CEPA).⁴

The remainder of this report examines the components of the cost of equity in an attempt to understand the source of this inconsistency.

⁴ Ofgem (2018), 'Hinkley-Seabank project: minded-to consultation on delivery model', 23 January.

3 Risk-free rate and total market returns

This section reviews the RIIO-2 proposals for the RfR (section 3.1) and the TMR (sections 3.2 and 3.3). Section 3.4 concludes.

3.1 Risk-free rate

Ofgem's proposed methodology (based on CEPA's analysis) for estimating the ex ante RfR is to consider spot and derived forward trailing averages on ILGs. This evidence indicates a range of -1.75% to -0.60%.

In contrast, Oxera's February 2018 report considered nominal spot and forward rates on UK government bonds and derived real forward rates using a long-term inflation assumption of 3.0% based on a long-term RPI inflation forecast produced by the Office for Budget Responsibility (OBR). We considered that a range of -0.5% to 0.0% for the real RfR would be appropriate at this stage, as it allowed for uncertainty in how yields on UK government bonds will evolve between now and the end of the RIIO-2 price control period.⁵

The differences between Oxera's and CEPA's analysis can be largely attributed to CEPA's use of current spot rates, and a lack of allowance for uncertainty over how the RfR will evolve between now and the end of the RIIO-2 control period.

First, Oxera does not consider CEPA's choice of a lower bound for the RfR estimate to be an appropriate ex ante estimate. This view appears to be shared by CEPA:

For the low-end of our range, we consider that the current spot rate on 10yr ILGs is an appropriate basis. This is **less likely to be relevant in an ex-ante setting of the cost of equity**, but more relevant with cost of equity indexation, or alternatively if a regulator considers that forward curves lack of predictive power means that current rates are most appropriate for using in estimations.⁶
[emphasis added]

In light of cost of equity indexation being at an early stage of consultation, it is premature to condition the cost of equity estimate on an assumption that the cost of equity will be indexed. Therefore, at this stage no weight should be placed on the spot rate.

Further, CEPA does not make any allowance for uncertainty over how the RfR will evolve between now and the end of the RIIO-2 control period. This is in contrast to the uncertainties prevailing in UK capital markets (e.g. due to Brexit and bank rate increases), which suggest that current market evidence may not remain representative of capital market conditions in the RIIO-2 period, especially as several years are yet to elapse before the start of RIIO-GD2/T2, and then RIIO-ED2, in 2021 and 2023 respectively.

3.2 Summary of Ofgem's proposed methodology to estimate the total market returns

The Ofgem consultation on the TMR draws on the analysis presented in the UKRN and CEPA reports, but does not provide a framework to ensure consistency between the two reports. For instance, CEPA's estimate of the TMR relies on historical averages, DGMs and survey evidence, whereas the UKRN report explicitly recommends estimating the TMR based on long-term

⁵ Oxera (2018), 'The cost of equity for RIIO-2', 28 February.

⁶ CEPA (2018), 'Review of cost of capital range for Ofgem's RIIO-2 for onshore networks', February, p. 46.

returns. CEPA further identifies four key assumptions, including the time horizon of the price control, which influences the weight on the various sources of evidence reviewed to inform the TMR.⁷ Given the differences between the methodologies presented in the two reports, there is a risk that trying to combine the recommendations of both reports will lead to an inconsistent estimate of the TMR.

Specifically, the UKRN report states:

the best means—one that satisfies the twin criteria of implementability and defensibility—to estimate the EMR is to assume that it is constant, and to look at realised historic real returns in a range of stock markets and over long samples.⁸

It further recommends:

a modest downward adjustment of the original range proposed by MMW, to a range of 6-7%, primarily reflecting a smaller adjustment from geometric to arithmetic returns.⁹

The UKRN report also recommends that the real cost of equity is calculated in CPI terms and then adjusted into an RPI-based cost of equity if required. It then goes on to observe that this requires 'a robust mechanism to adjust observable RPI based yields into CPI based yields'.¹⁰ In recognition of the fact that the RPI–CPI adjustment is sensitive to the approach adopted, the UKRN report considers four alternative mechanisms for this adjustment. The UKRN report does not conclude on which mechanism is most appropriate, but leans towards using OBR forecasts. The UKRN report does not provide estimates of the RPI–CPI adjustment for the RIIO-2 period.

CEPA's approach considers a wide range of evidence in estimating the TMR, including long-run historical data, the Competition Commission's (CC) determination for Northern Ireland Electricity in 2014, recent regulatory precedent, survey evidence, and forward-looking evidence derived from various DGMs. After examining the merits of the evidence base, CEPA essentially anchors its estimate of the TMR to the CC's 2014 determination, and proposes a range of 5.0–6.5% for the real TMR.¹¹

Ofgem's framework consultation draws on the CEPA and UKRN reports.

In interpreting the UKRN's historical estimates for equity market returns, Ofgem and CEPA assume that the 6.0–7.0% range is stated in CPI-linked terms. This is not clear in the UKRN report, and some of the cross-checks undertaken in the report suggest that it is in RPI-linked terms. If Ofgem were minded to deduct the difference between RPI and CPI inflation from the 6.0–7.0% equity market return range presented in the UKRN report, this would implicitly assume that investors in UK regulated utilities (and, in particular, GB energy networks) target returns relative to inflation as measured by CPI rather than by RPI, without good supporting evidence. This would represent a structural break in the regulatory methodology towards setting the allowed cost of capital, and would not be neutral on an NPV basis. In light of this, it is

⁷ CEPA (2018), 'Review of cost of capital range for Ofgem's RIIO-2 for onshore networks', February, p. 23.

⁸ UKRN (2018), 'Estimating the cost of capital for implementation of price controls by UK regulators', p. 48.

⁹ UKRN (2018), 'Estimating the cost of capital for implementation of price controls by UK regulators', p. 48.

¹⁰ UKRN (2018), 'Estimating the cost of capital for implementation of price controls by UK regulators', p. 118.

¹¹ This range is developed from ex ante and historical estimates of the TMR, and it is not evident whether the range is relative to CPI or RPI. It is also not clear whether CEPA's range advocates an arithmetic or a geometric average of market returns.

appropriate that Ofgem's consultation does not explicitly adopt a 5.0–6.0% RPI-linked range for the TMR, and considers a range that extends to 6.5%.

Lastly, on the debate relating to the degree to which the expected equity risk premium (ERP) adjusts to offset changes in the RfR, Ofgem appears to lean towards the view that the TMR is stable over time:

One way of indexing the cost of equity calculation would be to treat it as a weighted average of the risk-free rate and the total market return, with the weight equal to the beta factor. **If we then assume that the total market return and beta values remain stable over the life of the price control**, then it becomes straightforward to index simply the risk-free rate, and allow (1-beta) times the change in the risk-free rates to feed through into the cost of equity. [emphasis added]¹²

The remainder of this section discusses the key issues underlying the TMR proposals put forward by Ofgem and its advisers.

3.3 Review of the TMR and key methodological issues

As noted by the CC in its NIE determination, there is no universally accepted method for deriving the TMR.¹³

Notwithstanding the debate on the stability of the TMR, there appears to be a lack of consensus between the UKRN and CEPA reports in terms of the appropriate methodology to estimate the TMR and Ofgem's interpretation of the same. Ofgem's consultation document does not provide a framework to resolve the different approaches in the UKRN and CEPA reports.

Specifically, we identify the following key issues with Ofgem's and its advisers' proposals regarding the TMR.

- In interpreting the historical evidence on equity market returns, Ofgem has changed the assumption about how investors measure inflation for the purpose of setting return targets, which has a significant negative impact on returns and is not consistent with market practice, CC precedent or previous advice provided to Ofgem.
- Ofgem has implicitly increased the weight placed on geometric averages based on reasoning in the UKRN report that regulators will set allowed returns on a consistent basis over time—this is contradicted by Ofgem's re-interpretation of the historical evidence on equity market returns.
- CEPA's DGM is based on underlying dividend growth assumptions that are based on an inappropriate view of dividend growth expectations for companies in the FTSE All-Share index.

The Oxera report published in February 2018 provided an estimation of TMR, and we compare its findings with those presented in Ofgem's consultation below.¹⁴

3.3.1 Treatment of inflation

As noted above, the UKRN report recommends that the real cost of equity is calculated in CPI terms and then adjusted into an RPI-based cost of equity if

¹² Ofgem (2018), p. 93.

¹³ Competition Commission (2014), 'Northern Ireland Electricity Limited price determination – A reference under Article 15 of the Electricity (Northern Ireland) Order 1992', Final determination, 23 March, https://assets.digital.cabinet-office.gov.uk/media/535a5768ed915d0fdb000003/NIE_Final_determination.pdf.

¹⁴ Oxera (2018), 'The cost of equity for RIIO-2', 28 February.

required. However, the report does not provide a definitive recommendation for the adjustment that would be appropriate.

The CEPA report states:

We consider that investors are more likely to target real returns than nominal returns, consistent with principles of Financial Capital Maintenance (FCM).¹⁵

This statement does not define the measure of inflation that investors are likely to consider when setting targets for returns.

In interpreting the historical evidence on equity market returns, Ofgem and CEPA then proceed by reducing the historical TMR by their preferred estimates of the forward-looking differential between RPI and CPI inflation. In particular, Ofgem applies a reduction of 100bp,¹⁶ while CEPA considers this differential to be 120bp. Specifically, CEPA notes that:

The UKRN draft report estimates that the use of CPI within the longest available time series for the UK from DMS would lead to a reduction in the outturn historic return by c.30bps (taking the geometric mean from 5.5% in real terms based on a blend of indices to 5.2% in CPI-real terms). In order to translate this into an implied forward-looking value in RPI-real terms, we would need to adjust for the expected RPI-CPI wedge. **If this is assumed to be 120bps**, this approach could give a c.4.0% geometric mean RPI-real return.¹⁷ [emphasis added]

At the outset, the lack of consensus between Ofgem and CEPA regarding the value of the forecast RPI–CPI differential underlines the sensitivity of the differential to the forecasting methodology. More fundamentally, this adjustment:

- incorrectly assumes that the UKRN's 6.0–7.0% range for the TMR is stated in CPI terms—this is not clear in the UKRN report, and some of the cross-checks undertaken in the UKRN report suggest that it is in RPI-linked terms;
- assumes that investors in UK energy assets consider CPI as the relevant inflation metric when developing return targets, despite the fact that these assets have historically been regulated by reference to RPI;
- is inconsistent with the CC's methodology in the NIE determination;
- contradicts academic opinion previously provided by some of the UKRN authors.

Investors have committed capital to UK regulated utilities that have historically been regulated by reference to RPI. When developing real return targets, it is likely that RPI has been a focal point for investors—for example, with return targets being expressed as RPI plus a margin. Were such targets to be redefined in terms of CPI, it is likely that the margin would increase.

While the CC acknowledged the existence of the RPI–CPI differential in the NIE appeal,¹⁸ it did not adjust for the differential when concluding on a range of 5.0–6.5% for the TMR.

Ofgem's adjustment of the full RPI–CPI differential also contradicts academic opinion. In particular, in advising Ofgem previously, Wright and Smithers (c. 2014–15) focused on adjusting the real return to offset the impact of the

¹⁵ CEPA (2018), 'Review of cost of capital range for Ofgem's RIIO-2 for onshore networks', February, p. 110.

¹⁶ Ofgem (2018), p. 126.

¹⁷ CEPA (2018), 'Review of cost of capital range for Ofgem's RIIO-2 for onshore networks', February, p. 110.

¹⁸ Competition Commission (2014), op. cit., pp. 13–24.

recent changes to the RPI calculation methodology, and not on correcting for the difference between RPI and CPI. They noted that the change introduced by the ONS in 2010 in calculating RPI is not the first change to have been introduced, and the long-term history of these changes is not well documented. It is therefore not possible to ascertain whether this source of 'bias' simply offsets the impact of other biases due to changes introduced previously in estimating RPI.¹⁹ They conclude by stating:

we would argue that, other things being equal, a cautious approach should be applied. We would therefore argue for a downward correction due to RPI bias of *at most* 0.4 percentage points, with a preference for a smaller adjustment on grounds of caution.²⁰

They further emphasise:

The adjustment should again be *at most* of 40 basis points. **A cautious approach would suggest a further downward correction of 25 basis points to correct for the formula effect.**²¹ [emphasis added]

Ofgem and CEPA's proposed approach for RIIO-2 is to make a downward adjustment of 100–120bp (the forecast RPI–CPI wedge) to the long-run historical average, which is significantly higher than the 25bp adjustment for the 'formula effect' recommended by Ofgem's advisers a few years ago.

Overall, there appears to be little basis for deviating from the interpretation of the historical evidence presented in Wright and Smithers (c. 2014–15),²² which recommended a range of 6.0–7.0% for the RPI-deflated TMR based on a 25bp adjustment for the 'formula effect'.

3.3.2 Geometric and arithmetic averages of the historical TMR

Ofgem's view of 5.0–6.0% historical TMR (RPI-based, arithmetic mean)²³ in its framework consultation draws on a CPI-based TMR range of 6.0–7.0% (arithmetic mean) presented in the report for the UKRN. However, in arriving at this range, the UKRN report clearly states the following assumption, which implicitly increases the weight on the geometric average:

the case for an adjustment to arithmetic averages as large as 2 percentage points (which was implied by the upper end of MMW's range) is distinctly weakened **if regulators wish to set returns on a consistent basis at a relatively long (e.g., 10-year) horizon**²⁴ [emphasis added]

Ofgem's proposals in its consultation contradict this assumption that regulators will set returns on a consistent basis over time. As discussed above, the approach to inflation and the historical evidence on equity market returns in the RIIO–2 framework consultation are inconsistent with previous practice. Given the lack of regulatory consistency over time, the more appropriate TMR range

¹⁹ Indeed, Figure D4 in the UKRN's 2018 report suggests that the RPI–CPI differential has not been stable over the long term, which further lends itself to the argument identified by Wright and Smithers (c. 2014–15). Wright, S. and Smithers, A. (undated), 'The Cost of Equity Capital for Regulated Companies: A Review for Ofgem', <https://www.ofgem.gov.uk/ofgem-publications/86100/wrightsmithersequitymarketreturnpdf>.

²⁰ Wright S. and Smithers A. (undated), 'The Cost of Equity Capital for Regulated Companies: A Review for Ofgem', <https://www.ofgem.gov.uk/ofgem-publications/86100/wrightsmithersequitymarketreturnpdf>, p. 11.

²¹ Ibid.

²² Ibid.

²³ Ofgem (2018), p. 126.

²⁴ UKRN (2018), 'Estimating the cost of capital for implementation of price controls by UK regulators', p. E-125.

to be considered in the UKRN paper is 6.0–7.0% (real, RPI-based), as in Wright and Smithers (c. 2014–15).²⁵

CEPA also refers to the geometric mean of the TMR range recommended by the UKRN, implying a preference for this averaging methodology.

As explained in Oxera's February report, the academic literature is broadly supportive of placing more weight on the arithmetic averages for estimating equity market returns for the purposes of appraising investment opportunities.²⁶

3.3.3 Review of CEPA's DGM methodology

CEPA has developed a multi-period DGM as one of the sources of evidence for informing the real TMR assumption. Specifically, CEPA's DGM analysis suggests a range of 4.3–4.8% for the real TMR.²⁷ This is below the point estimate of 7.5% presented in Oxera's February 2018 report, based on a DGM constructed by Oxera with reference to the methodology developed by the Bank of England.

It is widely recognised that the DGM is sensitive to underlying parametric assumptions, in particular the forward-looking estimates of dividend growth. While the overall formulations of the Oxera and CEPA DGMs are consistent, the main source of the difference in results is the fact that CEPA has adopted a different set of assumptions, as follows.²⁸

- **Short-term dividend growth assumption.** CEPA's analysis is based on the OBR's Economic and Fiscal outlook projections. However, Oxera's specification of the DGM is based on Institutional Brokers' Estimate System (IBES) forecasts of dividend growth for the FTSE All-Share index, which provides a direct consensus measure of expected dividend growth.
- **Long-term dividend growth assumption.** CEPA's analysis is based on historical real UK GDP growth (4.5%, nominal). In contrast, Oxera's specification of the DGM uses weighted-average international GDP growth forecasts, where the weights represent the proportion of revenues generated by FTSE All-Share companies across different regions (5.6%, nominal). The dividend growth rate assumption used by Oxera is consistent with the expected growth in the markets that companies listed on the London Stock Exchange derive their revenue from.²⁹

We also note that CEPA applies a smoothing approach to the equity and dividend yields. While CEPA states that this approach is applied in order to maximise data availability and reduce the impact of different companies

²⁵ Wright, S. and Smithers, A. (undated), op. cit.

²⁶ Oxera (2018), 'The cost of equity for RIIO-2', 28 February, Box 2.1.

²⁷ CEPA's report presents a nominal TMR range of 7.4–7.9%. We have converted the nominal TMR range into a real basis using an RPI inflation assumption of 3.0% in order to ensure comparability with Oxera's February report. CEPA (2018), 'Review of cost of capital range for Ofgem's RIIO-2 for onshore networks', February, p. 114.

²⁸ CEPA (2018), 'Review of cost of capital range for Ofgem's RIIO-2 for onshore networks', February, Annex F.

²⁹ This assumption is consistent with the methodology used in the DGM prepared by the Bank of England. The Bank of England notes that the FTSE All-Share has a high degree of international exposure. Firms in the index generate around 70% of their revenues outside of the UK. As a result, the Bank of England's dividend discount model attempts to capture the influence of the overseas growth outlook on the prospects for an equity index's dividend growth. The model assumes that at long horizons dividends are expected to grow in line with a weighted average of the long-term GDP forecasts for different regions. See Dison, W. and Rattan, A. (2017), 'An improved model for understanding equity prices', *Quarterly Bulletin* 2017 Q2, p. 91.

operating on different financial years,³⁰ it is not clear exactly what this entails, and merits further clarification.

In summary, Oxera's analysis is based on the view that dividend growth expected by investors in UK listed companies will be linked to economic growth in the markets where these companies operate, while CEPA's analysis implicitly assumes that the growth of FTSE All-Share companies will be linked only to UK economic growth.

3.4 Conclusion

There is a lack of consensus between the UKRN and CEPA on the appropriate estimation methodologies, and the Ofgem consultation does not provide a framework for ensuring consistency between them.

Our review has highlighted the following issues with the RfR methodology.

- The lower bound of the RfR range is not an appropriate ex ante estimate if the cost of equity is to be fixed for the duration of the price control.
- The RfR range makes no allowance for uncertainty over how the RfR will evolve between now and the end of the RIIO-2 control period.

In addition, our review has highlighted the following issues with the TMR methodology.

- In interpreting the historical evidence on equity market returns, Ofgem has changed the assumption about how investors measure inflation for the purpose of setting return targets, which is not consistent with market practice, CC precedent or previous advice provided to Ofgem.
- Ofgem has implicitly increased the weight placed on geometric averages based on reasoning in the UKRN report that regulators will set allowed returns on a consistent basis over time—this is contradicted by Ofgem's re-interpretation of the historical evidence on equity market returns.
- CEPA's DGM is based on underlying dividend growth assumptions that are based on an inappropriate view of dividend growth expectations for companies in the FTSE All-Share index.

³⁰ CEPA (2018), 'Review of cost of capital range for Ofgem's RIIO-2 for onshore networks', February, p. 115.

4 Beta

This section begins by summarising the key methodological issues with the RIIO-2 proposals for the beta (section 4.1). Section 4.2 reviews CEPA's beta analysis; section 4.3 reviews the GARCH analysis in the UKRN report; and section 4.4 looks at the distinction between equity and asset betas. Section 4.5 concludes.

4.1 Review of Ofgem's proposals and key methodological issues

Ofgem's proposals for estimating the cost of equity for RIIO-2 continue to advocate using the Capital Asset Pricing Model (CAPM).³¹ However, in a departure from accepted regulatory practice and its RIIO-1 methodology, Ofgem proposes to extend the beta estimation methodology beyond standard OLS:

We propose to inform our estimate of beta by making use of sophisticated econometric techniques such as those referenced in the UKRN report to filter out noise from the underlying datasets.³²

In particular, Ofgem refers to the analysis by Stephen Wright and Donald Robertson (UKRN GARCH analysis), which suggests that equity betas in the range of 0.3 to 0.5 would be 'econometrically defensible'.³³

Finally, Ofgem's consultation also discusses the CEPA analysis, which recommends an equity beta range of 0.7–0.8 based on an asset beta range of 0.25–0.4.³⁴ The individual asset betas for the comparator set (Figure 5.4 in the CEPA report) show a wider range, with an upper bound of 0.5 driven by the observed asset beta of National Grid.

Having reviewed the various submissions on beta estimation, we identify the following three key issues with the propositions put forward by Ofgem and its advisers.

- The methodology adopted by CEPA for re-levering the upper end of the derived asset beta range is incorrect, as it is based on an unrealistic notional gearing assumption of 50%.
- CEPA's exclusion of beta evidence from non-UK comparators is inconsistent with regulatory and market practice. This ignores valuable evidence and limits the beta analysis to three water companies plus National Grid.
- It is not evident that the estimates from the GARCH analysis presented in the UKRN report are appropriate for use in RIIO-2. Under more standard assumptions of data frequency (e.g. daily) and time period (e.g. five-year), the GARCH approach produces similar beta estimates to the more conventional OLS approach. The UKRN report states:

if we first calculate the implied conditional betas from the GARCH estimates, and then take five-year moving averages, the resulting patterns quite closely resemble those of the rolling 5-year beta estimates for both stocks³⁵

³¹ Ofgem (2018), para. 7.33.1.

³² Ofgem (2018), para. 7.33.5.

³³ Ofgem (2018), para. 7.46. UKRN (2018), 'Estimating the cost of capital for implementation of price controls by UK Regulators', Appendix G, p. 152.

³⁴ Ofgem (2018), para. 7.45. CEPA (2018), 'Review of cost of capital ranges for Ofgem's RIIO-2 for onshore networks', February, Table 7.1.

³⁵ UKRN (2018), 'Estimating the cost of capital for implementation of price controls by UK regulators', p. G-144.

The remainder of this section expands on and discusses CEPA's approach to estimating betas, and the GARCH analysis in the UKRN report.

4.2 Review of CEPA's beta analysis

The OLS methodology employed by CEPA to estimate betas is similar to that employed by Oxera in its February report.³⁶ However, there are two differences that have a significant impact on the estimates, as discussed below.

4.2.1 Re-levering the asset beta

In deriving the range for a forward-looking equity beta, CEPA relies on its estimated asset beta range of 0.25–0.40 and a historical gearing range of 50–65%.³⁷

Using the above numbers, CEPA derives the lower bound of its cost of equity estimate by re-levering the low asset beta estimate (0.25) with the high gearing assumption (65%). Similarly, the upper end of the cost of equity range is based on re-levering the high asset beta estimate (0.40) using the low gearing assumption (50%). The resulting equity beta range spans from 0.7 to 0.8.³⁸

The error in this approach is that the asset beta needs to be re-levered using a forward-looking notional gearing that is consistent with the rest of the regulatory price control, not historical gearing. As Table 6.1 of the CEPA report shows, notional gearing set by Ofgem in the past has been at least 55%.³⁹ This indicates that a 50% gearing assumption for re-levering of the asset beta results in an underestimation of forward-looking equity beta and, consequently, the cost of equity and the weighted average cost of capital.

At this stage it is not possible to definitively correct CEPA's proposals, because Ofgem has not expressed a view on the appropriate notional gearing assumption and appears to view it as a parameter that can be determined independently of the cost of equity. This presents a high risk that the cost of equity and the WACC will be estimated in a way that is inconsistent with standard finance theory, and further underlines the importance of developing the cost of equity methodology before publishing an updated set of estimates.

4.2.2 Choice of comparators

In selecting the comparators for estimating the beta, CEPA argues that:

it is most appropriate to focus on UK-based evidence, as the assets generating returns are based in the UK. While the use of other international energy networks may increase the breadth of the comparator set, more adjustments are required in light of regulatory and commercial regimes and use of a different relative index.⁴⁰

As a result, CEPA's comparator sample contains only four listed GB utility companies, three of which are water companies. While the regulatory regimes of the water sector in England and Wales and the GB energy networks are similar, they are not identical. Moreover, the companies are exposed to

³⁶ Oxera (2018), 'The cost of equity for RIIO-2', February.

³⁷ CEPA (2018), 'Review of cost of capital ranges for Ofgem's RIIO-2 for onshore networks', February, Table 7.1.

³⁸ CEPA (2018), 'Review of cost of capital ranges for Ofgem's RIIO-2 for onshore networks', February, Table 7.1.

³⁹ CEPA (2018), 'Review of cost of capital ranges for Ofgem's RIIO-2 for onshore networks', February, Table 6.1.

⁴⁰ CEPA (2018), 'Review of cost of capital ranges for Ofgem's RIIO-2 for onshore networks', February, section 5.1.3, p. 51.

different markets and different fundamental risks. It is not immediately obvious why water companies in England and Wales represent a better reflection of the asset risk for GB energy networks than European (and other global) energy networks do, and it is tantamount to ignoring relevant and good data.⁴¹ The UKRN report also advocates that:

regulators should continue to use...a wide range of comparator stocks⁴²

From a statistical viewpoint, too, it is advisable to have a larger and balanced dataset. Given the scarcity of listed GB energy companies, European comparators operating within the liberalised energy market provide valuable additional observations which, at the very least, merit some consideration in assessing the beta for RIIO-2. Indeed, the UKRN's own recommendation advises incorporating as many data points as possible.⁴³

Further, UK and overseas regulators have routinely included overseas comparators for the purposes of informing the beta estimate, as in the following examples.

- In its input methodologies for electricity distribution and gas pipeline services, the Commerce Commission of New Zealand considers overseas firms from industries with a similar risk profile to be relevant comparators⁴⁴—in practice, it considers nearly 80 energy companies from around the world including those based in Australia, Europe and North America.
- In its recent determination for the wholesale local access market review, Ofcom considered European telecoms operators to be relevant for benchmarking the beta of the 'other UK telecoms' part of BT's business.⁴⁵
- In the aviation sector, the CAA employed comparators from Europe, New Zealand and Australia in benchmarking the beta for Heathrow Airport.⁴⁶

In addition to regulatory precedent, market analysts routinely consider comparisons with European comparators in analysing GB energy companies. For example:

- UBS considers Enagás, Red Eléctrica, Snam and Terna alongside UK regulated utilities in its European utilities comp sheet;⁴⁷
- RBC Capital Markets and Morgan Stanley use the same list of companies as UBS in their European utilities comp. sheet, with the addition of Italgas;⁴⁸

⁴¹ Without the evidence on betas from European energy networks, it is important to examine the individual betas of the four UK utilities in its sample more carefully—in particular, identifying the impact of National Grid's overseas business on the group beta.

⁴² UKRN (2018), 'Estimating the cost of capital for implementation of price controls by UK Regulators', Appendix F, p. 137.

⁴³ UKRN (2018), 'Estimating the cost of capital for implementation of price controls by UK Regulators', Appendix F, pp. 137–8.

⁴⁴ Commerce Commission of New Zealand (2010), 'Input methodologies (electricity distribution and gas pipeline services)', reasons paper, December, para. H8.14 and Table H17.

⁴⁵ Ofcom (2018), 'Wholesale local access market review. Draft statement', February.

⁴⁶ PwC (2017), 'Estimating the cost of capital for H7. A report prepared for the Civil Aviation Authority (CAA)', November, Table 5.8.

⁴⁷ UBS (2018), 'European utilities comps sheet – 6 April 2018', Figure 5.

⁴⁸ RBC Capital markets (2018), 'RBC European Utilities Morning Lightbulb', 20 March, European Utilities comp. sheet. Morgan Stanley (2018), 'German catalysts', 9 March, Exhibit 12: Industry valuation matrix.

- lastly, Deutsche Bank's February 2018 report on RIIO-2 also considered National Grid and English water companies alongside other European energy companies in assessing investment opportunities.⁴⁹

Overall, we recommend that relevant European comparators are used to inform the benchmarking of the beta for RIIO-2.

4.3 Review of GARCH analysis in the UKRN report

As mentioned above, Ofgem proposes:

to inform our estimates of beta by making use of sophisticated econometric techniques such as those referenced in the UKRN report to filter out noise from the underlying datasets.⁵⁰

While Ofgem does not elaborate on specific techniques that it intends to employ, the consultation explicitly refers to UKRN's GARCH analysis.⁵¹

First it needs to be recognised that the GARCH analysis in the UKRN report compares beta derived from the GARCH model ('GARCH beta') against standard five-year rolling betas for two companies—Severn Trent and United Utilities—and finds that the GARCH beta tracks the rolling beta relatively well. This suggests that the differences in estimates are due primarily to how GARCH has been applied (for example, in terms of choice of data frequency, and choice of estimation window) rather than the choice of GARCH as opposed to OLS.⁵² For example, the UKRN report recommends that:

rather than taking a snapshot of the rolling beta in the most recent rolling sample (whether 2 or 5 year), we should examine the properties implied by the full sample.⁵³

We note that GARCH analysis is not a technique that is widely employed by regulators to estimate the cost of equity. Notwithstanding this, there are a number of issues to consider before using the GARCH analysis in the UKRN report for the purposes of beta estimation:

- GARCH is not necessarily the best alternative or complement to OLS;
- as with OLS, the application of GARCH requires several additional methodological choices to be made.

These points are in discussed in detail below.

4.3.1 Alternatives and complements to OLS

As Ofgem is considering introducing other econometric techniques to estimate the beta in addition to OLS, it would be advisable to consider a wide range of available techniques and not restrict these to one or two specific econometric models. Once the range of potential new techniques has been identified, their advantages and limitations relative to OLS can be examined, thus allowing the

⁴⁹ Deutsche Bank (2018), 'Idea of the week: Ofgem review framework to bear down on incentive outperformance', February, Valuation matrix, p. 9.

⁵⁰ Ofgem (2018), para. 7.33.5.

⁵¹ Ofgem (2018), para. 7.46.

⁵² UKRN (2018), 'Estimating the cost of capital for implementation of price controls by UK Regulators', Appendix G, p. 146.

⁵³ UKRN (2018), 'Estimating the cost of capital for implementation of price controls by UK Regulators', Appendix G, p. 146.

most effective techniques to be shortlisted to complement the standard OLS analysis.

The UKRN study explores GARCH only as an alternative technique, and provides two empirical examples to demonstrate its benefits.⁵⁴ However, the UKRN paper does not consider other econometric and empirical asset pricing techniques used by academia and industry. Some examples of these techniques are given below.

- **Bayesian beta adjustments based on cross-sectional data**—these include Blume and Vasicek adjustments. The idea behind these adjustments is to mitigate the estimation error exhibited by OLS estimates. The adjustments allow one to systematically weigh the prior belief that equity betas tend towards one against the empirically estimated betas. Interestingly, CEPA dismisses the use of this adjustment on the grounds that it is uncertain to what extent the trend towards one is representative of a pure-play regulated utility.⁵⁵ However, this concern does not in itself invalidate these techniques, since the value of the prior can always be adjusted in line with expectations.
- **Bayesian time series models**—these include more sophisticated techniques such as the Kalman filter. These models allow the beta to vary over time, without relying on a rolling window estimation. In addition, similarly to Bayesian adjustments, these models provide a systematic way to reconcile intuitive judgement (reflected in the form of a prior) with the empirical data.
- **Implied beta**—the implied beta estimate is derived from the option price data, using an option pricing formula such as Black–Scholes. Similar to DGM estimates of TMR, the implied beta has a forward-looking nature.
- **More sophisticated multivariate econometric models**—there are other techniques that could enable a more sophisticated modelling of joint dependence between the stock and the market index. For example, copulas are used for the pricing of structured products to model the joint dependence between defaults on different entities. Using copulas allows return asymmetry (a stylised fact acknowledged by CEPA)⁵⁶ to be better captured, as well as changing correlations across the market cycle.

4.3.2 Challenges arising with the application of GARCH

Notwithstanding the debate around the more sophisticated econometric models that best complement OLS, the use of GARCH for beta estimation poses a number of issues that need to be addressed. These are briefly discussed below.

Consistency of GARCH with the CAPM

It is important to ensure that the regulatory methodologies used in price controls have a strong economic intuition and are internally consistent with each other.

⁵⁴ UKRN (2018), 'Estimating the cost of capital for implementation of price controls by UK Regulators', Appendix G, p. 139.

⁵⁵ CEPA (2018), 'Review of cost of capital ranges for Ofgem's RIIO-2 for onshore networks', February, p. 90.

⁵⁶ CEPA (2018), 'Review of cost of capital ranges for Ofgem's RIIO-2 for onshore networks', February, p. 95.

As noted above, Ofgem proposed using the CAPM for estimating the cost of equity.⁵⁷ Therefore, if GARCH is employed for beta estimation, it must be demonstrated that it is consistent with the CAPM.

The CAPM postulates a clear relationship between return on equity and return on the market. In contrast, in the original GARCH paper, as well as in subsequent extensions (such as EGARCH), the return on equity is in no way related to return on the market. More specifically, return on any given asset is assumed to be white noise.⁵⁸

If consistency is to be maintained, any use of the GARCH model needs to be amended to include the CAPM relationship between equity and market returns.⁵⁹

Determining the return frequency and estimation window

Like OLS, GARCH requires a judgement to be made about the return frequency and the length of the estimation window.

With regard to estimation frequency, UKRN has considered a range of frequencies, with the bottom end of the range (0.3) being based on quarterly data.⁶⁰

While it is not unusual to estimate the beta at a frequency lower than daily, there appears to be no statistical reason to estimate the beta at a frequency as low as quarterly data. On the contrary, the use of quarterly data significantly decreases the sample size, while providing little or no additional benefit over and above the use of weekly data. It is thus unsurprising that there is no regulatory precedent of the beta being estimated based on quarterly data.⁶¹

With regard to the length of the estimation window, it is generally accepted that there is a trade-off between the sample size and the relevance of historical data to the current price control. CEPA acknowledges this point as well.⁶²

In contrast, the UKRN report states that:

rather than taking a snapshot of the rolling beta in the most recent rolling sample (whether 2 or 5 year), we should examine the properties implied by the full sample⁶³

This conclusion assumes that all the historical data is equally relevant and that the underlying time series process is stable. However, the UKRN GARCH analysis does not present any statistical tests to validate this hypothesis.

Determining the functional form of GARCH and GARCH-specific parameters

⁵⁷ Ofgem (2018), para. 7.33.5.

⁵⁸ Bollerslev, T. (1986), 'Generalized autoregressive conditional heteroskedasticity', *Journal of Econometrics*, **31**, pp. 307–27.

⁵⁹ The UKRN GARCH analysis does not explicitly disclose what functional form of GARCH it uses. Based on the fact that the paper does not explicitly mention amending standard GARCH to incorporate the CAPM, it is not unreasonable to assume that the basic specification is used.

⁶⁰ UKRN (2018), 'Estimating the cost of capital for implementation of price controls by UK Regulators', Appendix G, p. 148.

⁶¹ CEPA (2018), 'Review of cost of capital ranges for Ofgem's RIIO-2 for onshore networks', February, p. 51.

⁶² CEPA (2018), 'Review of cost of capital ranges for Ofgem's RIIO-2 for onshore networks', February, p. 88.

⁶³ UKRN (2018), 'Estimating the cost of capital for implementation of price controls by UK Regulators', Appendix G, p. 146.

There are several (at least ten) variations of the GARCH functional form. The more well-known versions include GJR-GARCH, EGARCH and QARCH.⁶⁴

The results of the UKRN GARCH analysis are based on one specific functional form, which indicates that a more comprehensive review needs to be undertaken to examine the robustness of GARCH beta estimates before relying on the results that they generate.

Even if the most appropriate functional form of GARCH is known and agreed upon, GARCH requires a number of additional assumptions before the beta can be estimated.

In its simplest form, GARCH requires an assumption on the number of variance lags. More sophisticated versions of the model involve making other additional assumptions.

The results of the UKRN GARCH analysis are based on one specific set of assumptions. Again, in the interests of robustness, we would advocate testing alternative assumptions for a given GARCH specification and comparing the resultant beta values.

4.3.3 Averaging of rolling betas

In deriving the beta range, CEPA has taken an average of historical rolling betas, rather than estimating betas based on the latest data:

With this variation and in the absence of a clear rationale as to why the figures are moving, we consider that the medium term average beta is a better estimate than the spot beta.⁶⁵

Oxera disagrees with this approach, as it involves relying on historical data outside of the normal estimation window—i.e. two to five years. For example, if an average of rolling betas were considered in Figure 5.4 of the CEPA report, this would mean relying on data points that go back to 2003.⁶⁶

4.4 Distinction between equity and asset betas

At a high level, there is a risk that the distinction between equity betas and asset betas is lost. Specifically, in the RIIO-2 consultation Ofgem stated that:

there are a number of reasons to expect network company (non-diversifiable) risk to be significantly lower than the market-average (where equity beta = 1).⁶⁷

In substantiating this proposition, Ofgem provided the following reasons:⁶⁸

- the price control regime protects network companies from the risk that energy demand will decrease;
- network companies are protected from inflation risk;
- network company share prices can rebound within days of large downward or upward movements;

⁶⁴ See Teräsvirta, T. (2006), 'An introduction to univariate GARCH models', SSE/EFI working papers in economics and finance, No. 646, 7 December.

⁶⁵ CEPA (2018), 'Review of cost of capital ranges for Ofgem's RIIO-2 for onshore networks', February, p. 52.

⁶⁶ Figure 5.4 presents two-year rolling betas from 2005, which means that the data goes back to 2003. See CEPA (2018), 'Review of cost of capital ranges for Ofgem's RIIO-2 for onshore networks', February, p. 52.

⁶⁷ Ofgem (2018), para. 7.49.

⁶⁸ Ofgem (2018), para. 7.49.

- network companies benefit from stable cash flows to service debt and equity costs and typically stable investment programmes.

While the above observations may point to a level of business risk that is lower than the market average, this does not necessarily imply that the equity beta of energy networks has to be below one. Since equity beta rises with financial leverage, a company with a low asset beta can see its equity beta rise above one, once leverage reaches a high enough level.

To illustrate, consider an asset beta of 0.4 (at the top end of the CEPA range), a debt beta of zero (as in CEPA's assumption), and a gearing of 65% (at the top end of the CEPA range).⁶⁹ Under these parameters, the equity beta amounts to 1.14, despite the fact that the asset beta is way below one.

To summarise, the relevant business risk for comparing across industries is captured by the asset beta, and not the equity beta. Therefore, in determining the relative riskiness of transmission and distribution networks to the market, it is necessary to benchmark the asset beta, not the equity beta.

4.5 Conclusion

Oxera's review of the equity beta proposals in Ofgem and its advisers' reports can be summarised as follows.

Ofgem has not expressed a view on the appropriate notional gearing assumption, and appears to consider it as a parameter that can be determined independently of the cost of equity. This presents a high risk that the cost of equity and the WACC will be estimated in a way that is inconsistent with standard finance theory, and further underlines the importance of developing the cost of equity methodology before publishing an updated set of estimates.

As a consequence, CEPA's approach to re-lever the derived asset beta range is incorrect, as it is not based on a realistic notional gearing assumption.

Further, CEPA's comparator set for estimating the equity beta range excludes any analysis of observed betas for European energy networks, and therefore ignores valuable evidence.

Finally, the GARCH analysis considered by the UKRN report is one way out of many that the sophistication of beta analysis can be increased. However, it is not a technique that is widely employed by capital market participants and academic practitioners to estimate the cost of equity. In fact, the GARCH approach produces similar beta estimates to the more conventional OLS approach if a more standard data frequency (e.g. daily) and time period (e.g. five-year) is employed.

⁶⁹ CEPA (2018), 'Review of cost of capital ranges for Ofgem's RIIO-2 for onshore networks', February, Table 7.1.

5 Other issues

5.1 Cost of equity indexation

Ofgem discusses the following three options for indexing the cost of equity, based on suggestions made by CEPA.

1. Index RfR only
2. Index RfR with offsetting adjustment for the ERP
3. Index RfR and TMR

Ofgem's preferred approach to a possible cost of equity indexation mechanism considers indexing the RfR while fixing the TMR and beta. This effectively assumes a perfectly negative relationship between the RfR and ERP.

In general, the assumptions underpinning the three options above differ, and it is important to first gain conceptual clarity about the central issue in the current debate regarding the degree to which the expected ERP adjusts to offset changes in the RfR.

Oxera's February 2018 report presents our conclusion that an appropriate TMR assumption would place more weight on the view that the expected TMR is relatively stable. On this basis, we would not expect significant changes in the TMR over a price control period. The estimation of the TMR requires a periodic reassessment of a range of sources of evidence, including historical evidence, forward-looking models, and survey evidence. Therefore, we do not consider that the TMR parameter should be subject to mechanistic indexation during a price control period.

In determining the most suitable choice of mechanism, one also needs to consider the trade-off between conceptual accuracy and practical feasibility. As summarised in CEPA's report,⁷⁰ the RfR is the most directly observable parameter within the CAPM framework, and has a directly representative measure. As a result, it is practically more feasible to index only the RfR.

Overall, a move to cost of equity indexation would represent a considerable change in methodology. Such a change would need to fully take into account more detailed analysis evaluating the merits of both approaches and the wider implications of each of the indexation methodologies in order to determine the most suitable approach for RIIO-2. Any adoption of an indexation methodology needs to be appropriately signalled and introduced with appropriate transitional arrangements such that it does not undermine investor confidence.

5.2 Regulatory allowed returns versus regulatory expected returns

In its framework consultation, Ofgem proposes the following:

We propose to distinguish the regulatory allowed return from the regulatory expected return. The UKRN report highlights that our expectation of returns can be different from our (ex ante) baseline allowed return as far as we expect companies, individually or collectively, to benefit from other financial incentives (positive or negative). This could include reasonable expectations of outperformance across all the areas of the price control including our incentive mechanisms, the cost of debt, and tax.⁷¹

⁷⁰ CEPA (2018), 'Review of cost of capital ranges for Ofgem's RIIO-2 for onshore networks', February, Table 5.2.

⁷¹ Ofgem (2018), para. 7.33.7.

Ofgem's proposal is based on the premise presented in the UKRN report that, on the basis of evidence from recent bid-premia for regulated assets, the regulatory expected returns have substantially exceeded regulatory allowed returns. The UKRN report considers historical outperformance by regulated companies to be a key driver of the observed bid-premia in acquisitions, and proposes that the regulator explicitly estimates the outperformance factor on an ex ante basis and incorporates this in determining the regulatory allowed return.

At the heart of the RPI - X model of regulation is that it encourages and incentivises companies to outperform. To the extent that the UKRN believes that the levels of outperformance being allowed by regulators are unjustified, this needs to be addressed directly via other mechanisms such as efficiency challenges, incentive mechanisms, and the extent to which companies can retain outperformance. It would reduce transparency and distort investment decisions if the allowance for the cost of equity were adjusted to address concerns about the potential for outperformance in other parts of the regulatory framework.

In addition, the practical feasibility of the UKRN's proposals also appears to be challenging.

For example, Outperformance is observed only ex post. Aiming to explicitly target this upfront leads to many uncertainties. For instance:

- what is the appropriate methodology to determine the 'aiming-up' wedge?
- at what level should this should be set? Implicitly, this is equivalent to asking about the appropriate level of bid-premia;
- can future outperformance be forecast based on historical outperformance? Also, given the asymmetry in information as stated by the authors of the UKRN report, is the regulator best placed to estimate this?

In fact, the UKRN report concedes that the regulator is likely to get this wrong.⁷² What the UKRN report fails to identify is the potential cost of the error.

Overall, the proposals in the UKRN report appear to have limited practical applicability and need to be reviewed with caution.

⁷² UKRN (2018), 'Estimating the cost of capital for implementation of price controls by UK Regulators', p. 74.

6 Conclusions

The analysis presented in the UKRN and CEPA reports illustrates some of the different ways of approaching the estimation of the cost of equity for RIIO-2. Importantly, there is a lack of consensus in the methodologies that they adopt. Ofgem's consultation on the cost of equity for RIIO-2 does not provide a framework under which these different views can be assessed in a consistent manner to underpin estimates of the cost of equity for RIIO-2.

The differences in opinions and methodologies have contributed to the following key limitations of Ofgem's proposals.

- The indicative range for the cost of equity estimate is inconsistent with the proposed cost of debt. Specifically, the implied risk premium on unlevered equity is lower than the risk premium on debt, which is inconsistent with the relative priorities of claims in the event of distress or default.
- CEPA's methodology to derive the RfR range is not relevant for setting an ex ante cost of equity that will be fixed for the duration of the RIIO-2 price control period.
- In interpreting the UKRN's historical estimates for equity market returns, Ofgem and CEPA assume that the 6.0–7.0% range is stated in CPI-linked terms. This is not clear in the UKRN report, and some of the cross-checks undertaken in the report suggest that it is in RPI-linked terms. If Ofgem were minded to deduct the difference between RPI and CPI inflation from the 6.0–7.0% equity market return range presented in the UKRN report, this would implicitly assume that investors in UK regulated utilities (and, in particular, GB energy networks) target returns relative to inflation as measured by CPI rather than by RPI, without good supporting evidence. This would represent a structural break in the regulatory methodology towards setting the allowed cost of capital and would not be neutral on an NPV basis. In light of this, it is appropriate that Ofgem's consultation does not explicitly adopt a 5.0–6.0% RPI-linked range for the TMR, and considers a range that extends to 6.5%.
- CEPA's approach to re-lever the asset beta range is incorrect, as it is based on an unrealistic notional gearing assumption of 50%.
- Ofgem has not expressed a view on the appropriate notional gearing assumption, and appears to consider it as a parameter that can be determined independently of the cost of equity.
- The GARCH analysis considered by the UKRN report is one way out of many that the sophistication of beta analysis can be increased. It is not a technique that is widely employed by capital market participants, and merits further consideration. The GARCH approach produces similar beta estimates to the more conventional OLS approach if a more standard data frequency (e.g. daily or monthly) or time period (e.g. two- or five-year) is employed.

In parallel, Ofgem is also consulting on major changes to the RIIO framework relating to the relevant price index, cost of equity indexation, differentiating between allowed and expected returns, and modifications to the incentive properties of the RIIO framework.

Overall, these concerns relate to fundamental elements of the methodology, and it therefore appears premature to present estimates for the cost of equity before the concerns regarding these elements have been addressed.

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