RIIO-3 cost of equity—CAPM parameters

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Executive summary

Following the publication of the Sector Specific Methodology Decision (SSMD) for the RIIO-3 price controls, Energy Networks Association (ENA) asked Oxera to: (i) review the methodological choices made by Ofgem in the SSMD when estimating the parameters of the capital asset pricing model (CAPM); (ii) provide updates to the report we wrote for the ENA in response to Ofgem's Sector Specific Methodology Consultation (SSMC, and the RIIO-3 SSMC Oxera report) based on, or in response to, further thinking and evidence presented by Ofgem in the RIIO-3 SSMD, and updated market data where relevant.[1]

The work is to be limited to the CAPM parameters that are applicable to all gas and electricity networks (hereafter, the 'baseline estimates')—sector-specific forward-looking risks are outside the scope of this work. We note that the challenges that the energy networks are expected to face during RIIO-3 could have a material impact on the cost of equity estimates for RIIO-3. This suggests that the baseline estimates could be interpreted as a lower bound when setting the cost of equity allowance for RIIO-3.

As discussed in the RIIO-3 SSMC Oxera report, the capital market and macroeconomic contexts today are markedly different from those when the RIIO-2 price controls were being determined. It is therefore critical that the regulatory allowance enables companies to retain existing capital and to attract new capital. This was the premise for the methodology laid out in the RIIO-3 SSMC Oxera report, and the importance of ensuring investability was recognised by Ofgem in the SSMC and reiterated in the SSMD.

In setting the methodology for estimating the CAPM parameters, in the RIIO-3 SSMD, Ofgem critically assessed the evidence presented by stakeholders in response to the RIIO-3 SSMC. We note that as part of this process, Ofgem implemented a series of changes that are consistent with the methodology set out in the RIIO-3 SSMC Oxera report. We welcome these changes, which include:

- using the arithmetic mean as the only approach for calculating the ex post total market return (TMR);

[1] Oxera (2024), 'RIIO-3 cost of equity', prepared for the Energy Networks Association, 23 February.

- using the Consumption Expenditure Deflator (CED) series, new backcast CPIH series, and CPIH estimates from ONS for deflating nominal historical returns;
- including European comparators in the calculation of the beta;
- signalling potential for aiming up within the beta range to reflect the circumstances around RIIO-3.

At the same time, there are still areas where we disagree with Ofgem's approach. In particular, we consider that Ofgem should:

- account for the convenience premium embedded in government bonds when estimating the risk-free rate (RFR);
- remove the Cost of Living Index (COLI)-CED adjustment in the estimation of the ex ante TMR, and instead deflate the nominal data provided by Dimson, Marsh and Staunton (DMS) using the CPIH historical inflation series used by Ofgem;
- exclude the serial correlation adjustment in the calculation of the ex ante TMR;
- inform its TMR allowance predominantly on the basis of the ex post TMR, instead of placing 50% weight on historical ex ante approaches;
- recognise the relationship between the TMR and gilt yields, as has been done in previous regulatory decisions, as it is likely to be required for investability;
- include Pennon in the sample of water companies considered in the estimation of the beta.

In light of these changes, we provide updates to the RIIO-3 SSMC Oxera report based on, or in response to, further thinking and evidence presented by Ofgem in the RIIO-3 SSMD. Our analysis reflects the methodology we consider to be appropriate for RIIO-3 in light of regulatory precedents, developments in capital markets, academic evidence, and the UK Regulators Network (UKRN) cost of capital estimation guidance.

The cut-off date for our analysis is 1 July 2024, which is the same date used by Ofgem to estimate the RFR in the latest WACC Allowance Model for RIIO-3.[2] This cut-off date is different from the one used in the RIIO-3 SSMD (March 2024). For comparison, we have reflected Ofgem's latest estimate of the RFR in the RIIO-3 SSMD cost of equity range.

[2] The latest WACC allowance model prepared by Ofgem was provided to us by ENA.

Below, we summarise the areas of disagreement in relation to Ofgem's intended methodology for the estimation of the CAPM parameters.

Risk-free rate

In the determination of the RFR, Ofgem does not account for the **convenience premium** embedded in the gilts. As we show in section 2.1, the existence of the convenience premium is well documented in academic literature. Moreover, other regulators, including the Competition and Markets Authority (CMA), the Civil Aviation Authority (CAA) and the Utility Regulator (UR), have adjusted the government bond yield for the convenience premium. Although the value of this premium varies over time, making no adjustment for it when setting the RFR introduces a downward bias to the estimate for a five-year price control period. We also note that despite the H7 and Northern Ireland Electricity decisions being published after the RIIO-2 appeals, the CAA and UR still included a convenience premium.[3]

Furthermore, we show that Ofgem's exclusion of the premium rests on a flawed analysis that produces a negative convenience premium. This is inconsistent with the extensive evidence, as presented in this report, supporting a positive convenience premium. Correcting Ofgem's calculations results in a positive convenience premium.

Ofgem's 'early view' on the RFR is 1.18% (1.27% using 1 July 2024 as cut-off date). Including the convenience premium leads to an RFR estimate of 1.54% in CPIH-real terms.

Total market return and equity risk premium

The main areas of disagreement are the estimation and the weight placed on the ex ante TMR estimate and on the relationship between gilts and the TMR.

- **Ex ante TMR**—Ofgem applies a downward adjustment (the COLI-CED adjustment) to the DMS decompositional approach to reflect the difference in the historical inflation series used by DMS and Ofgem. This adjustment is no longer necessary, as DMS provides sufficient data to estimate a nominal dividend growth

[3] CAA (2022), 'Economic regulation of Heathrow Airport Limited: H7 Final Proposals, Section 3: Financial issues and implementation', June, paras 9.247–9.248 (last accessed on 4 September 2024); UR (2024), 'Northern Ireland Electricity Networks Ltd, Transmission and Distribution 7th Price Control (RP7), Final Determination – Main report', 30 October, paras 13.53–13.57 (last accessed on 4 November 2024).

rate which can then be deflated using the same historical inflation series used by Ofgem to estimate the ex post TMR. Removing the COLI-CED adjustment while correcting the inflation series significantly increases the value of the ex ante TMR (see section 3.2.1). In addition, Ofgem applies a downward adjustment for **serial correlation**. However, there is no evidence of serial correlation in the historical data at standard levels of statistical significance (see section 3.2.2). As such, there is no basis for this downward adjustment when calculating the ex ante TMR. Finally, Ofgem gives equal weight to the ex post and ex ante approaches. As discussed in section 3.3, we consider ex ante approaches to be not particularly informative. As such, we consider that it is not correct to place 50% weight on historical ex ante approaches.

- **The relationship between gilts and TMR**—Ofgem proposes not to reflect the higher interest rate environment in the estimation of the TMR, although it accepts that this is a potential issue. In section 3.4, we discuss how this is inconsistent with past regulatory practice of reducing the TMR as interest rates decreased. Following a 'through the cycle' approach that gives no weight to changes in market conditions risks underestimating the TMR and not supporting the companies in retaining and attracting investment in RIIO-3. We consider that Ofgem should reflect the current interest rate environment when setting the TMR range, particularly to ensure that allowed returns are in line with investor expectations to satisfy the requirement for investability.[4]

Ofgem's 'early view' on the TMR is a range of 6.50–7.00%. Our analysis of the historical evidence and current market conditions points towards a TMR range of 7.00–7.50% (CPIH-real) for RIIO-3. This range takes into account the 'through the cycle' estimate, as well as current market conditions.[5] In fact, evidence suggests that at this point in time investors would require higher market returns than the central estimate of 7% for the 'through the cycle' TMR, and we cannot exclude the possibility that values higher than 7.50% would be required.

It is highly likely that the recent increase in gilt yields will not have been entirely offset by a reduction in the equity risk premium, and therefore will have led to upward revisions of investors' expectations of market

[4] For a price control to be 'investable', it must be highly likely that the company can attract and retain the equity capital needed to deliver desired investment.
[5] By 'through the cycle' we refer to the approach of using long-run averages.

returns. We note that when a similar level of gilt yields was last seen, the TMR allowance was above 8.00% in CPIH-real terms. The relationship between gilt yields and TMR has also been analysed by Frontier Economics (Frontier), with its TMR cross-checks also supportive of a TMR range for RIIO-3 of 7.00–7.50%, with a point estimate towards the top of the range.

Beta

While we note, and welcome, the inclusion of the European comparators, we appreciate that Ofgem's decision is not final and that this will be considered further prior to the draft determinations. As discussed in the RIIO-3 SSMC Oxera report, we are supportive of including European comparators, as it is not clear why the asset risk between UK and other European energy networks would be seen as less relevant than the risk of two different industries in the same country, such as UK water and energy networks.

At the same time, we disagree with Ofgem's decision to exclude Pennon from the sample of beta comparators. Ofgem's concerns about Pennon's historical non-water business are not supported by our analysis (discussed in section 4.2). Moreover, Ofgem did not provide sufficient justification for excluding Pennon, especially when considering that the company was part of the sample in RIIO-2. Therefore, and considering also that by the time of the RIIO-3 final determinations there would be more years of Pennon data with a limited level of non-water business, it is appropriate to include Pennon in the sample.

Ofgem's 'early view' on the asset beta is a range of 0.30–0.40, which translates to an equity beta range of 0.64–0.89. However, as discussed in section 4.3, Ofgem is expecting a higher beta for RIIO-3 compared with RIIO-2, and the regulator acknowledged that its preferred approach would result in a point estimate towards the upper end of the 0.30–0.40 asset beta range. On this point, we note that current evidence suggests that there are many factors putting an upward pressure on the risk of energy networks, pointing towards a range of 0.35–0.40 or higher. This includes sector-specific forward-looking risks not reflected in the comparator data.

More broadly, equity returns will need to be set at a level that ensures the investability of the energy sector, not least because of the asymmetric consumer welfare loss in case of under-investment. The choice of beta will be another significant determinant of investability (in addition to TMR).

Taking all of this into account, we consider a narrower beta range of 0.35–0.40 to better reflect the challenges that energy networks will face during RIIO-3. This is consistent with Ofgem's signalled position for RIIO-3. This range differs from the range of 0.323–0.373 previously presented in the RIIO-3 SSMC Oxera report, as we take into account Ofgem's further thinking and evidence presented in the RIIO-3 SSMD as well as the findings of our water sector investability report.[6]

Cost of equity

Ofgem's 'early view' on the allowed cost of equity (CoE) for RIIO-3 is a range of **4.57–6.35%** (CPIH-real, at 60% gearing). This becomes a range of **4.60–6.36%**, using 1 July 2024 as the cut-off date, with a midpoint of 5.45%. We agree with Ofgem's observation that focusing on ten-year betas and adding European companies to the sample would result in an estimate in the upper half of the 0.30–0.40 asset beta range presented in the SSMD, and hence in the upper half of the CoE range. Restating the Ofgem CoE range for the upper end betas results in an Ofgem CoE range of 5.26–6.36%, with a 5.79% midpoint (using 1 July 2024 as the cut-off date).

Adjusting the RFR, TMR and beta for the points discussed above results in an Oxera CoE range of **5.70–6.83%** (CPIH-real, at 60% gearing). The 5.45% midpoint of the range calculated using the Ofgem SSMD methodology is below the bottom of the Oxera CoE range, suggesting that the midpoint of the Ofgem CoE range is too low.

The table below outlines the CAPM parameters underlying the CoE estimates.

[6] Oxera (2024), 'Investability at PR24 – Final report for Water UK', 27 August.

Cost of equity estimates

	Formula	Ofgem (RIIO-3 SSMD)			Oxera		
		Low	High	Midpoint	Low	High	Midpoint
RFR[1]	[A]	1.27%	1.27%	1.27%	1.54%	1.54%	1.54%
TMR	[B]	6.50%	7.00%	6.75%	7.00%	7.50%	7.25%
Asset beta	[C]	0.30	0.40	0.35	0.35	0.40	0.38
Re-levered equity beta at 60% gearing[2]	[D] = {[C] – (gearing*beta debt)} / (1-gearing)	0.64	0.89	0.76	0.76	0.89	0.83
CAPM CoE	**[E] = [A] + [D] × ([B] – [A])**	**4.60%**	**6.36%**	**5.45%**	**5.70%**	**6.83%**	**6.25%**

Note: [1] The value of Ofgem's RFR differs from the value reported in the RIIO-3 SSMD as the value in the table reflects Ofgem's latest estimate of the RFR included in the latest WACC Allowance Model for RIIO-3. [2] The debt beta is assumed to be 0.075. Values may not add up due to rounding.
Source: Oxera analysis and Ofgem (2024), 'RIIO-3 Sector Specific Methodology Decision – Finance Annex', 18 July, table 13 (last accessed on 4 September 2024); Ofgem (2024), 'RIIO-3_WACC_Rates_Model_aligning_to_v7_20240926'.

1 Introduction

In July 2024, Ofgem published its Sector Specific Methodology Decision (SSMD) for the RIIO-3 price control for gas distribution and gas and electricity transmission (GD&T) networks.[7] With the RIIO-3 SSMD, Ofgem defined the methodology it intends to use to set the CoE allowance in RIIO-3, and provided an 'early view' of the CoE range.[8]

The RIIO-3 SSMD expands on the RIIO-3 SSMC published in December 2023. It reflects Ofgem's further analysis of the CoE parameters and its review of the responses received from stakeholders following the RIIO-3 SSMC, including the report we wrote for the ENA in response to the RIIO-3 SSMC.[9, 10, 11]

We note that in defining the methodology for setting the CAPM parameters, Ofgem incorporated some of the suggestions we made in the RIIO-3 SSMC Oxera report,[12] while it was not persuaded by some others, providing further evidence and thinking on these topics.[13, 14]

In this report we review and provide our view on the methodological choices made by Ofgem as part of the RIIO-3 SSMD when estimating the CAPM parameters on behalf of the ENA. We provide updates to the RIIO-3 SSMC Oxera report based on, or in response to, further thinking and evidence presented by Ofgem in the RIIO-3 SSMD. As discussed above, our work is limited to the CAPM parameters that are applicable to all gas and electricity networks, while sector-specific forward-looking risks are outside our scope, whether or not they affect the CAPM parameters.

The report is structured as follows.

[7] Ofgem (2024), 'RIIO-3 Sector Specific Methodology Decision – Finance Annex', 18 July (last accessed on 4 September 2024).
[8] Ofgem (2024), 'RIIO-3 Sector Specific Methodology Decision – Finance Annex', 18 July, section 3 (last accessed on 4 September 2024).
[9] Ofgem (2024), 'RIIO-3 Sector Specific Methodology Decision – Finance Annex', 18 July, para. 1.4 (last accessed on 4 September 2024).
[10] Ofgem confirmed that they will continue to engage with stakeholders on some areas that require further analysis prior to setting a final methodology, and that the 'early view' figures provided in the SSMD will be updated to reflect updated data and evidence as part of the draft and final RIIO-3 determinations in 2025. See Ofgem (2024), 'RIIO-3 Sector Specific Methodology Decision – Finance Annex', 18 July, para. 1.4 (last accessed on 4 September 2024).
[11] Oxera (2024), 'RIIO-3 cost of equity', prepared for the Energy Networks Association, 23 February.
[12] For example, relying exclusively on the arithmetic average for estimating the 'ex post' TMR, and including European companies in the sample used to estimate the beta.
[13] For example, including the convenience premium in the estimation of the RFR and uplifting the TMR to reflect the higher-interest-rate environment.
[14] Ofgem (2024), 'RIIO-3 Sector Specific Methodology Decision – Finance Annex', 18 July, section 3 (last accessed on 4 September 2024).

- Section 2 presents a review of Ofgem's RIIO-3 SSMD position on the RFR, and our response to issues such as the convenience premium. In this section, we also provide an updated estimate of the RFR.
- Section 3 presents a review of Ofgem's RIIO-3 SSMD position on the TMR and equity risk premium (ERP), and our response to issues such as uplifting the TMR to reflect the higher interest rate environment, the weight to place on the 'historical ex ante' method, and the inclusion of the COLI-CED and serial correlation adjustments in the calculation of the 'ex ante' TMR. In this section, we also provide an updated estimate of the TMR.
- Section 4 presents a review of Ofgem's RIIO-3 SSMD position on the beta, and our response to issues such as the inclusion of European companies, the inclusion of Pennon in the sample of UK water companies, and how wide the range for the beta should be at this stage of the RIIO-3 process.
- Section 5 presents our estimate of the CoE range.
- Section 6 concludes the report.

2 The risk-free rate

The RFR measures the expected return on an asset that is free of risk—i.e. a situation where the expected return perfectly predicts the realised return on the investment, such that no risk is incurred. In the CAPM framework, this notional riskless asset is also referred to as a 'zero-beta asset' (i.e. an asset with zero sensitivity to overall market risk). The CAPM assumes that all investors can borrow and lend an unlimited amount at the RFR. In economies with low sovereign default risk, regulators have typically estimated the RFR with reference to the yield to maturity (YTM) on government-issued bonds (also known as 'gilts' in the UK), at least as a basis to which they add premia, or as one of the instruments on which they rely. These bonds are assumed to be notionally free of default and systematic risk.[15]

However, more recently there has been a debate in the UK and elsewhere in Europe as to whether government bonds provide the best estimate of the RFR. It has been observed that private borrowers, even those with very low credit risk, cannot borrow at the same rate as the government—i.e. the yield on the highest-rated corporate bonds (those rated AAA) is usually above the yield on government bonds of the same maturity.[16] It has also been argued that government bond yields are below the return on a zero-beta asset because the bonds have special properties that give rise to a price premium that usually lowers their yields below the RFR.

In this report, we refer to the spread between the government bond yields and the return on a zero-beta asset (which reflects these special properties of the government bonds) as a 'convenience premium'. As discussed in the RIIO-3 SSMC Oxera report, we consider that it is important to account for the convenience premium when estimating the RFR, and that allowing for a convenience premium adjustment in the calculation of the RFR (e.g. by including highly rated corporate bonds in the assessment) is an approach that other UK and European regulators are increasingly using.[17]

[15] In the past, UK regulators have typically followed this approach while allowing for a certain amount of additional headroom above traded (spot) yields to allow for interest rate uncertainty.
[16] For example, see Oxera (2020), 'Are sovereign yields the risk-free rate for the CAPM?', prepared for the Energy Networks Association, 20 May.
[17] Oxera (2024), 'RIIO-3 cost of equity', prepared for the Energy Networks Association, 23 February, section 2.2.1.

In Box 2.1 below, we summarise the approach followed by Ofgem in the RIIO-3 SSMD for estimating the RFR.

Box 2.1 Ofgem's RIIO-3 SSMD approach for estimating the RFR

Ofgem's 'early view' on the RFR is based on the following methodology and set of assumptions.

- **Benchmark yield:** in the RIIO-3 SSMD, Ofgem used the 20-year index-linked gilt (ILG) as a benchmark to set the RFR. As discussed in the RIIO-3 SSMC Oxera report, we consider using the 20-year ILG as a starting point for calculating the RFR to be appropriate.
- **Averaging period and indexation:** in the RIIO-3 SSMD, Ofgem relied on a one-month average of historical 20-year ILG yields. Ofgem confirmed its intention to update the RFR allowance on an annual basis ('RFR indexation'), and, as a result, not to adjust the RFR to take account of implied forward rates (the 'forward premium'). We consider this approach to be appropriate.
- **Inflation:** in the RIIO-3 SSMD, Ofgem estimated the RPI–CPIH wedge using: (i) official forecasts of CPI and RPI from the Office for Budget Responsibility (OBR) up to the point of convergence of the RPI and CPIH rates (assumed to be in February 2030);[1] (ii) a zero wedge for the remaining years until the maturity of the 20-year ILG. Ofgem does not include a CPI–CPIH wedge. While we previously argued for including a CPI–CPIH wedge and for considering the evidence from RPI and CPI swaps, we consider Ofgem's approach to be overall appropriate.
- **Convenience premium:** in the RIIO-3 SSMD, Ofgem clarified that it does not intend to include a convenience premium in the RFR allowance. We consider this decision to be contrary to the evidence, academic literature and regulatory precedents presented in the RIIO-3 SSMC Oxera report.
- Based on the above, **Ofgem's 'early view' on the RFR** is 1.18%. This is equivalent to 1.27% using 1 July 2024 as a cut-off date.

Note: [1] The OBR's forecasts of RPI and CPI cover only the first two financial years of RIIO-3 (2027 and 2028). For 2029, Ofgem considers the same values as 2028 (2.9% RPI and 2.0% CPI). For the financial years 2030 and 2031, Ofgem estimated the value of RPI by taking a weighted average of the OBR's long-term forecast of RPI (2.9%) and CPI (2.0%) to account for the RPI and CPIH convergence.
Source: Oxera (2024), 'RIIO-3 cost of equity', prepared for the Energy Networks Association, 23 February, section 2; Ofgem (2024), 'RIIO-3 Sector Specific Methodology Decision – Finance Annex', 18 July, paras 3.36–3.81 (last accessed on 4 September 2024); Ofgem (2024), 'RIIO-3_WACC_Rates_Model_aligning_to_v7_20240926'.

As reported in Box 2.1, the approach followed by Ofgem to estimate the RFR is broadly consistent with the methodology outlined in the RIIO-3 SSMC Oxera report, with the exception of the inclusion of the convenience premium.

In section 2.1, we discuss in more detail Ofgem's choice of excluding the convenience premium from the RFR estimation. In section 2.2, we present our estimate of the RFR.

2.1 Convenience premium

In the RIIO-3 SSMD, Ofgem raised various arguments to support the exclusion of the convenience premium from the RFR estimate. These are discussed, in turn, below.

The RIIO-2 appeals precedent

Ofgem mentioned how the use of ILGs as the sole proxy for the RFR was 'not considered to be wrong' by the CMA as part of the RIIO-2 appeals.[18] On this point, it is important to explicitly recognise that the CMA did not consider the use of ILGs as the sole proxy of the RFR to be a superior approach compared with the combination of ILG and AAA non-government bonds, which was the approach used by the CMA itself in the context of the PR19 redeterminations.[19, 20]

[18] Ofgem (2024), 'RIIO-3 Sector Specific Methodology Decision – Finance Annex', 18 July, para. 3.44 (last accessed on 4 September 2024).
[19] CMA (2021), 'Network Companies vs GEMA, Final Determination, Volume 2A: Joined Grounds: Cost of equity', para. 5.121 (last accessed on 4 September 2024).
[20] CMA (2021), 'Anglian Water Services Limited, Bristol Water plc, Northumbrian Water Limited and Yorkshire Water Services Limited price determinations, Final report', 17 March, para. 9.162 (last accessed on 4 September 2024).

Drivers of convenience yield

In the RIIO-3 SSMD, Ofgem observed that academic literature has not provided evidence of a convenience premium in longer-term gilts and how the new evidence presented in the RIIO-3 SSMC Oxera report, based on Diamond and Van Tassel (2023), focused on only three-year instruments. Ofgem also highlighted how Diamond and Van Tassel (2023) noted that one of the main drivers of the convenience premium is the money-like features of government bonds. According to Ofgem, it is therefore intuitive that academic literature has not produced evidence of a convenience premium on longer-term instruments as money-like features are strongest on shorter-term instruments. We note that Ofgem has not provided evidence to support its conclusions, but simply stated that 'it would seem illogical to use longer-dated instruments, with significantly higher duration risk, for money-like purposes'.[21]

In the RIIO-3 SSMC Oxera report, we provided evidence from academic papers which have highlighted how the money-like features are just one of the drivers of the convenience yield in government bonds. As outlined below, in addition to the money-like features, the convenience premium also reflects: (i) the use of government bonds as hedging instruments; (ii) government bond holding requirements for financial institutions; (iii) government bonds' high liquidity. These characteristics are irrelevant to the maturity of the underlying instrument, and therefore, equally apply to shorter- and longer-term instruments.

Feldhütter and Lando (2008) explain the convenience yield as follows:[22]

'The premium is a convenience yield on holding Treasury securities arising from, among other things, (a) repo specialness due to the ability to borrow money at less than the GC repo rates, (b) that Treasuries are an important instrument for hedging interest rate risk, (c) that Treasury securities must be purchased by financial institutions to fulfil regulatory requirements, (d) that the amount of capital required to be held by a bank is significantly smaller to support an investment in Treasury securities relative to other securities with negligible default risk, and to a lesser extent (e) the ability to absorb a larger number of transactions without dramatically affecting the price.'

[21] Ofgem (2024), 'RIIO-3 Sector Specific Methodology Decision – Finance Annex', 18 July, para. 3.46 (last accessed on 4 September 2024).
[22] Feldhütter, P. and Lando, D. (2008), 'Decomposing swap spreads', *Journal of Financial Economics*, **88**:2, p. 378.

A Bank of England study found that some investor groups in UK government bonds display the behavioural properties that theory associates with preferred habitat investors.[23] It concludes that these groups of investors, which comprise institutional investors such as life insurers and pension funds, are less sensitive to price movements than other investor groups. This empirical finding is consistent with the academic theories underlying the convenience premium, where investors have reasons to hold government bonds, and these reasons go beyond the rate of return expected on these instruments. It also further supports the existence of a convenience premium in the UK, and for long-term gilts as well as short-term gilts.

Alternative interpretation of the convenience premium

According to Ofgem, the fluctuating spread between AAA non-government bond and gilt yields suggests that 'in times of financial distress, non-government assets are not considered to be risk free (while in times of relative calm, when investors have high confidence in the future, a range of assets might approach the yields on assets considered to be genuinely risk free)'. As a result, Ofgem concluded that 'gilt yields are a significantly better proxy for estimating the RFR than other instruments, including those with a higher credit rating than the UK government, such as AAA non-government bonds'.[24]

On this topic, Acharya and Laarits (2023) assessed the convenience yield of US Treasuries, by decomposing the aggregate stock–bond covariance (as a measure of the treasuries' hedging properties) into terms corresponding to the convenience premium, the frictionless RFR, and default risk, focusing on ten-year maturities. The authors explain that, in general, assets that exhibit convenience yield are those whose secondary market prices or liquidity level rise in times of aggregate risk. They find that an increase in the government bonds' hedging properties—i.e. a decrease in the covariance of returns on Treasury bonds and the aggregate stock market—leads to an increase in the convenience premium.[25] This is consistent with the interpretation that distressed financial markets will push the convenience premium higher

[23] Giese, J., Joyce, M., Meaning, J. and Worlidge, J. (2021), 'Preferred habitat investors in the UK government bond market', Bank of England Research Paper Series, 10 September.
[24] Ofgem (2024), 'RIIO-3 Sector Specific Methodology Decision – Finance Annex', 18 July, para. 3.48 (last accessed on 4 September 2024).
[25] Acharya, V.V. and Laartis, T. (2023), 'When do treasuries earn the convenience yield? – A hedging perspective', *BER Working Paper No. 31863*, November (last accessed on 9 September 2024).

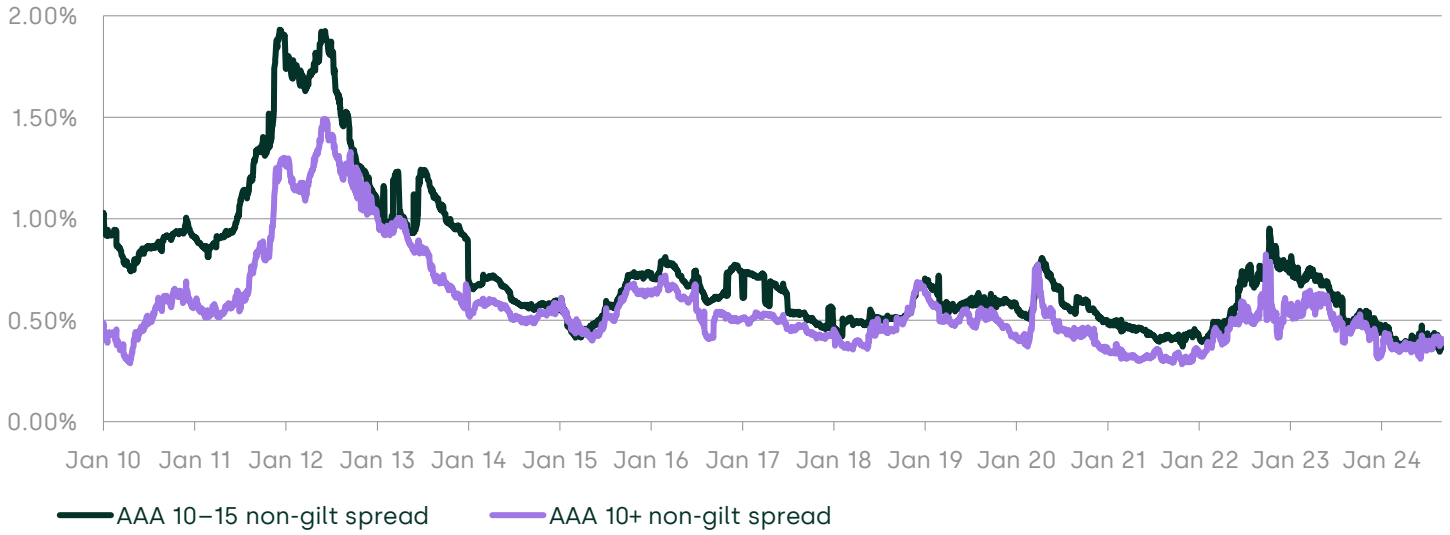
as the demand for the government bonds' convenience properties (e.g. hedging) increases.

While we agree in principle that the convenience properties of government bonds are a function of market conditions and perceived level of safety compared to riskier instruments, Ofgem's alternative interpretation seems to suggest that a convenience premium should only be visible at times of financial distress. However, as presented in the RIIO-3 SSMC Oxera report, a positive convenience premium can be observed during both calm and agitated financial market conditions.

In Figure 2.1 below, we present an updated version of the same figure presented in the RIIO-3 SSMC Oxera report. Our previous analysis compared AAA non-government bond indices with maturity matching gilts, in line with the approach followed by the CAA in the H7 decision.[26] Instead, Figure 2.1 compares AAA non-government bond indices with duration matching gilts. We discuss why matching AAA non-government bond indices with gilts on the basis of duration is an improvement in our methodological approach below. Figure 2.1 further confirms that a positive convenience premium can be observed throughout the period.

[26] CAA (2022), 'Economic regulation of Heathrow Airport Limited: H7 Final Proposals, Section 3: Financial issues and implementation', June, para. 9.247 (last accessed on 4 September 2024).

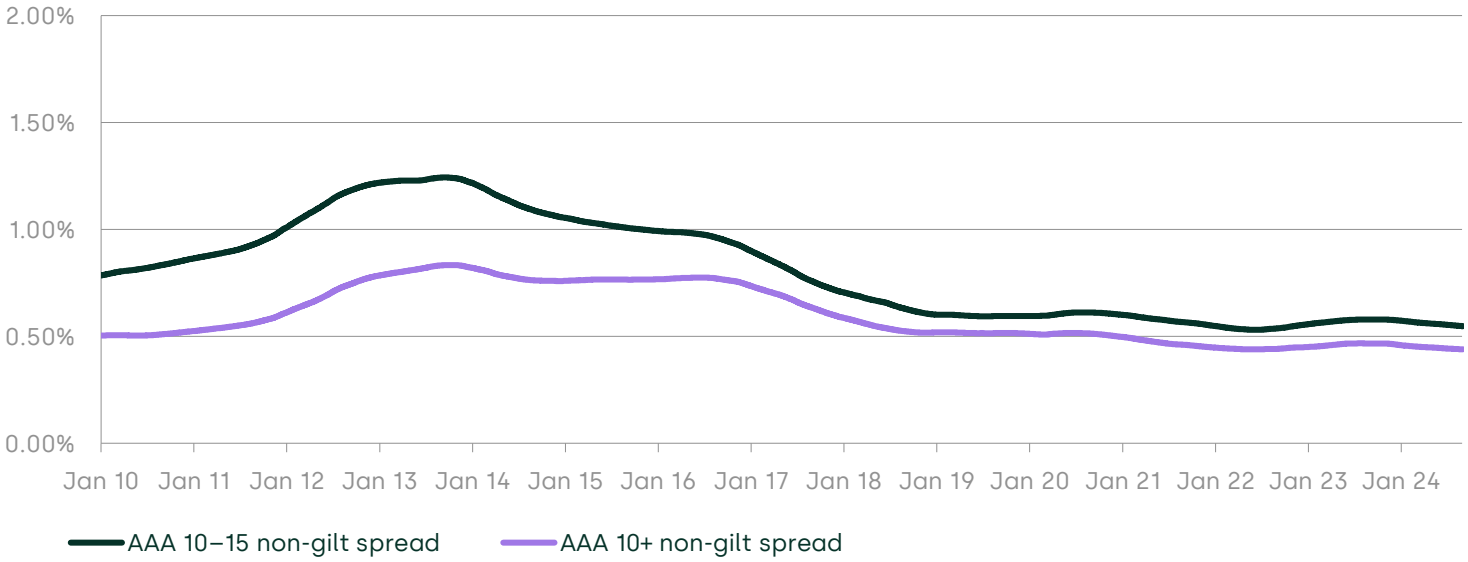
Figure 2.1 Nominal spreads of AAA-rated bond indices relative to benchmark government bonds



Note: The spreads are calculated by deducting yields on duration matching nominal gilts from yields on Non-Gilts AAA 10+ and Non-Gilts AAA 10–15 indices.
Source: Oxera analysis of Bank of England and IHS Markit data.

Furthermore, as shown in Figure 2.2 when looking at the five-year rolling average of the nominal spreads, it is clear that while the convenience premium can fluctuate over time, its value has consistently been well above zero.

Figure 2.2 Nominal spreads of AAA-rated bond indices relative to benchmark government bonds—five-year rolling average



Note: The spreads are calculated by deducting yields on duration matching nominal gilts from yields on Non-Gilts AAA 10+ and Non-Gilts AAA 10–15 indices.
Source: Oxera analysis of Bank of England and IHS Markit.

Based on the above, while we acknowledge that the value of the convenience premium may vary across time and estimation methodology, we do not consider this to be a sufficient argument for ignoring the convenience premium altogether, as suggested by Ofgem. In fact, the evidence presented in Figure 2.1 and Figure 2.2 clearly shows that assuming a zero convenience yield will introduce a downward bias in the estimation of the RFR over the course of a five-year price control period.

Alternative calculation of the convenience premium

In the RIIO-3 SSMD, Ofgem proposed estimating the convenience premium using a slightly different approach. Specifically, Ofgem's suggested methodology includes adjusting the AAA non-government bond yields for credit and liquidity risk and comparing the result to gilt yields.[27] Based on this approach, Ofgem found the adjusted AAA non-government bond yields to be lower than gilt yields, supporting Ofgem's view of a zero convenience premium.

In relation to this alternative methodology, we note that estimating the convenience premium by adjusting non-government bonds for credit and liquidity risk premia, as suggested by Ofgem, is an approach that has been superseded by the CMA, CAA and the UR past determinations. In fact, in the PR19 redeterminations, the CMA considered whether to adjust the AAA non-government bond yields to account for the credit and liquidity risk premia, but ultimately decided not to apply any adjustments. Instead, the CMA ruled in favour of a simpler approach based on the average of gilts and non-government bond yields.[28] Similarly, the CAA, in setting the RFR allowance for Heathrow, considered the evidence from AAA non-government bond yields without adjusting for the credit and liquidity risk premia.[29] A convenience

[27] Ofgem (2024), 'RIIO-3 Sector Specific Methodology Decision – Finance Annex', 18 July, para. 3.49 (last accessed on 4 September 2024).
[28] CMA (2021), 'Anglian Water Services Limited, Bristol Water plc, Northumbrian Water Limited and Yorkshire Water Services Limited price determinations, Final report', 17 March, paras 9.239 and 9.242–9.244 (last accessed on 4 September 2024).
[29] CAA (2022), 'Economic regulation of Heathrow Airport Limited: H7 Final Proposals, Section 3: Financial issues and implementation', June, paras 9.247–9.248 (last accessed on 4 September 2024).

premium was also recognised by the UR when setting the RFR allowance for Northern Ireland Electricity.[30]

More generally, the evidence presented above clearly supports a positive value for the convenience premium. The fact that Ofgem's methodology results in a negative convenience premium demonstrates that something is wrong with its calculations.

Below, we discuss the methodological issues present in Ofgem's alternative methodology.

Methodological issues with Ofgem's alternative calculation of the convenience premium

We note that Ofgem matches AAA non-government bonds with relevant gilts on the basis of the years to maturity of the corporate bonds, i.e. when the principal will be repaid, which will be longer than the average duration of the cashflows on the bond (if the bond carries a coupon payment). The duration in fact measures the weighted average time, in years, to earn all of the cashflows that are to be received on the bond investment, including the coupons and principal. As such, the duration will always be less than the years to maturity for a coupon bond, and equal to the years to maturity for a zero-coupon bond.

On this point, we note that the gilts used by Ofgem are based on the spot curves estimated by the Bank of England, which in turn, reflect the yield on zero-coupon bonds. As a result, the duration on these bonds will equal their maturity.[31] Therefore, Ofgem's matching of coupon-paying AAA-non government bonds with relevant gilts on the basis of the years to maturity of the corporate bonds introduces a mismatch between the duration of the AAA non-government bonds Ofgem considers on the one hand (for which the duration will be lower than the years to maturity), and the duration of the gilts that Ofgem compares them to on the other (for which the duration will be the same as the years to maturity).

The correct approach would therefore be to match AAA non-government bonds and UK gilts with respect to the duration of the AAA non-government bonds—not their maturity.

[30] UR (2024), 'Northern Ireland Electricity Networks Ltd, Transmission and Distribution 7th Price Control (RP7), Final Determination – Main report', 30 October, paras 13.51–13.57 (last accessed on 4 November 2024).
[31] See Bank of England (2024), 'Yield curve terminology and concepts, notes on the Bank of England UK yield curves', August (last accessed on 20 September 2024).

Simply correcting for this issue has a significant impact on the numbers presented by Ofgem. In fact, the average premium and the average adjusted premium calculated by Ofgem increase by 32bps if the AAA non-government bonds and gilts are matched on the basis of the AAA indices' duration. This is shown in Table 2.1 below.

Table 2.1 Adjusted Ofgem analysis of AAA and UK gilts

Issuer	iBoxx rating	Duration[1]	Annual yield (%, March 2024)	Gilt tenor used	Gilt yield (%, March 2024)	AAA premium over equivalent UK gilt	Adjusted premium[2]
Temasek Financial Ltd	AAA	11.3	4.7%	11.0	4.0%	0.73%	0.47%
European Investment Bank	AAA	10.6	4.4%	10.5	3.9%	0.44%	0.18%
European Investment Bank	AAA	13.1	4.5%	13.0	4.1%	0.41%	0.15%
Average premium						**0.53%**	**0.27%**

Note: [1] As at 28 March 2024. [2] The adjusted premium reflects yield minus 13bps for each of credit and liquidity premium, in line with Ofgem's approach. We note that the gilt yields used by Ofgem are as at 28 March 2024. However, based on the data available, it is not possible to verify that the yields on the AAA non-government bonds correspond to those as at 28 March 2024. For consistency, in our analysis we assume that the gilts and the yields on the AAA non-government bonds refer to the same date.
Source: Oxera reproduction of Figure 4 of Ofgem (2024), 'RIIO-3 Sector Specific Methodology Decision – Finance Annex', 18 July, Figure 4 (last accessed on 4 September 2024); and Bank of England data.

In addition to the mismatch between duration and years to maturity, we also note that, as part of its alternative estimation, Ofgem considered a value of 13bps for both the credit and the liquidity risk on the basis of the values mentioned by the CMA in the PR19 redeterminations. Ofgem correctly noted that the values mentioned by the CMA were based on previous Oxera analysis.[32] As illustrated in Table 2.1, under its alternative approach Ofgem first calculated the premium between AAA non-

[32] Ofgem (2024), 'RIIO-3 Sector Specific Methodology Decision – Finance Annex', 18 July, para. 3.49 (last accessed on 4 September 2024).

government bond yields and equivalent (in terms of maturity) UK gilts, with both values calculated with reference to March 2024.[33] From this premium Ofgem then subtracted the 26bps resulting from Oxera's previous estimate of the credit and liquidity risk.[34]

However, the estimation of the credit risk premium is characterised by a significant degree of uncertainty due to the simple fact that AAA-rated corporate bonds do not default very often. As such, relying on a single point estimate can be problematic, and that is also why in our previous submissions we identified a wide range for the credit risk premium. In fact, our estimate of the credit risk premium is based on the work of Feldhütter and Schaefer (2018), which identified an interval between 5bps and 20bps. In the past, we have already pointed out the risk of inconsistencies in using these estimates to make an adjustment to any particular AAA-rated index or bonds, as these are based on long time series that average out any volatility in the premium for expected loss over a short time horizon.[35]

In relation to the liquidity risk premium, we considered the work of Van Loon et al. (2015), who estimated a median liquidity premium between 0bps and 20bps, on the basis of long-term time series (2003 to 2014). In addition to Van Loon et al. (2015), we conducted an analysis on the bid–ask spread, which resulted in a liquidity premium of 3.3bps and 5.5bps over an assumed holding period of 20 years.[36]

It is important to note that academic literature points at high liquidity being one of the main characteristics of government bonds which can be used to explain the embedded convenience properties. Therefore, subtracting an estimate of the liquidity premium from AAA non-government bonds by definition removes one of the components of the convenience premium.

Furthermore, based on our review of Ofgem's calculation, we understand that the yields reported in Figure 4 of the RIIO-3 SSMD refer to AAA non-government bond and gilt spot yields as at 28 March 2024. From the above, it follows that Ofgem is assessing the value of the convenience premium by subtracting the credit and liquidity risk premia

[33] We note that the gilt yields used by Ofgem are as at 28 March 2024. However, based on the data available, it is not possible to verify that the yields on the AAA non-government bonds correspond to those as at 28 March 2024. We assume that the gilts and the yields on the AAA non-government bonds considered by Ofgem refer to the same date.
[34] Ofgem (2024), 'RIIO-3 Sector Specific Methodology Decision – Finance Annex', 18 July, Figure 4 (last accessed on 4 September 2024).
[35] Oxera (2022), 'RFR methodology for PR24', September, p. 15.
[36] Oxera (2022), 'RFR methodology for PR24', September, pp. 15–16.

calculated with reference to long time periods from the spot value of the spread between AAA non-government bond yields and gilts.

Based on the points discussed above, we do not consider Ofgem's alternative estimation to be a consistent and robust approach to estimating the convenience premium, not even as a cross-check once corrected for the duration and years to maturity mismatch. As illustrated above, Ofgem's alternative approach is characterised by a series of methodological issues and it has also been superseded by the CMA's, CAA's and UR's past determinations, which undermine the robustness of this approach. Specifically, we consider that Ofgem should not adjust the yield on AAA non-government bonds for credit and liquidity risk premia, but it should estimate the convenience premium on the basis of a methodology aligned with the CMA, CAA and UR past determinations with duration-matched bond indices.

Our estimation of the convenience premium

Based on the discussion above, we consider that adjusting the gilt yields to account for the convenience premium is a necessary step to provide an accurate estimation of the RFR.

In line with the methodology laid out in the RIIO-3 SSMC Oxera report, we estimate the convenience premium over a five-year horizon, which is aligned with the duration of the RIIO-3 price controls.

Over the past five years, the 10–15 and 10+ AAA non-government bond indices had an average duration of 9.4 and 14.3 years, respectively. Therefore, we calculate the convenience premium by matching the AAA non-government bond indices with zero-coupon gilts with a maturity of 9.5 and 14.0 years.

Based on the above, we estimate a convenience premium of 27bps.[37] The results are presented in Table 2.2 below.

[37] The period that matches the length of the price control period. The cut-off date for the analysis is 1 July 2024.

Table 2.2 Convenience premium estimation

	Formula	Oxera estimates
Five-year average of AAA indices, nominal[1]	[A]	2.61%
Five-year average of 9.5 and 14.0-year gilts, nominal	[B]	2.07%
Average AAA indices, gilts	[C] = avg ([A], [B])	2.34%
Convenience premium estimate (5Y)	[D] = [C] – [B]	0.27%

Note: The cut-off date for the analysis is 1 July 2024. Discrepancies may be due to rounding. [1]We take an average of the average yield for iBoxx AAA 10–15 and iBoxx AAA 10+ bonds.
Source: Oxera analysis using Bloomberg and Bank of England data.

2.2 RFR estimate

As already discussed in this section, while Ofgem's choice of using the 20-year ILG as a starting point for calculating the RFR is appropriate, we consider that not adjusting for the convenience premium embedded in the gilt yields results in underestimating the RFR.

In line with Ofgem's latest WACC Allowance Model for RIIO-3, we calculate the one-month average 20-year ILG yield based on 1 July 2024 as a cut-off date. However, in contrast to Ofgem's RIIO-3 SSMD approach, we add the convenience premium calculated in Table 2.2. Finally, we convert our estimate of the RFR into CPIH-real terms by applying the RPI–CPIH wedge calculated by Ofgem. The results are presented in Table 2.3 below.

Table 2.3 Risk-free rate estimation

	Formula	Ofgem (RIIO-3 SSMD)	Oxera estimates
20Y ILG yields, RPI-real[1]	[A]	1.16%	1.16%
Convenience premium	[B]	-	0.27%
Benchmark RFR estimate, RPI real	[C] = [A] + [B]	1.16%	1.43%
RPI–CPIH wedge	[D]	0.11%	0.11%
RFR, CPIH-real	**[G] = (1+[C]) × (1+[D]) – 1**	**1.27%**	**1.54%**

Note: [1] Based on a cut-off date of 1 July 2024. The value of Ofgem's RFR differs from the value reported in the RIIO-3 SSMD, as the value in the table reflects Ofgem's latest estimate of the RFR included in the latest WACC Allowance Model for RIIO-3.
Source: Oxera analysis and Ofgem (2024), 'RIIO-3 Sector Specific Methodology Decision – Finance Annex', 18 July, Table 3 (last accessed on 4 September 2024).

3 Total market return and equity risk premium

The ERP is a premium above the RFR that investors demand for investing in a market equity portfolio. The ERP is calculated as the difference between the TMR and the RFR. UK regulators and the CMA have tended to follow the view that the expected real TMR is fairly stable over time, and that changes in the real RFR are largely offset by changes in the ERP.[38] While the TMR may indeed be largely stable over time, it is important to consider how the high-interest-rate environment affects the energy networks and their ability to finance their activities in RIIO-3. As discussed in the RIIO-3 SSMC Oxera report, notwithstanding that the TMR has historically been more stable than the ERP, we observe that regulatory precedent on the TMR has supported higher allowances in high-interest-rate environments and vice versa over time, as further discussed in this section—this has important implications for the appropriate cost of equity allowance in RIIO-3.[39]

Keeping the regulatory precedent in mind, the TMR can be estimated using a range of methodologies.

One method of estimating the TMR is the historical ex post approach, which is based on the average of observable historical returns. This is the most widely used method and the one that produces the most robust results.

The other two approaches are as follows.

- **Historical ex ante**, which can be based on either: (i) the average of adjusted historical returns, where the adjustment accounts for 'unexpected' events that generated a return that was lower or higher than expected (the DMS decompositional approach); or (ii) the historical dividend or earnings yields plus expected growth (the Fama–French approach).
- **Forward-looking**, which is based on investors' expectations of future returns. Various methodologies can be used to estimate this, from survey evidence to dividend discount models.

[38] See, for example, Competition and Markets Authority (2021), 'Final determination Volume 2A: Joined Grounds: Cost of equity', 28 October (last accessed on 4 September 2024).
[39] Oxera (2024), 'RIIO-3 cost of equity', prepared for the Energy Networks Association, 23 February 2024, section 2.2.4.

In Box 3.1 below we summarise the approach for estimating the TMR followed by Ofgem in the RIIO-3 SSMD.

Box 3.1 Ofgem's RIIO-3 SSMD approach for estimating the TMR

Ofgem's 'early view' on the TMR is based on the following methodology and set of assumptions.

- **Approaches:** in the RIIO-3 SSMD, Ofgem derived a range for the TMR, placing equal weight on ex post and ex ante approaches. For the ex post TMR, Ofgem relied on the one-year arithmetic mean approach. For the ex ante TMR, Ofgem relied on the DMS decompositional approach. We agree with estimating the ex post TMR based on the arithmetic mean. However, we consider that it is not correct to place 50% weight on historical ex ante approaches.
- **Treatment of inflation:** in the RIIO-3 SSMD, Ofgem used a combination of: (i) the CED series (for the period 1900–49); (ii) the new backcast series for the CPIH (for the period 1950–88); (iii) the CPIH estimates published by the ONS (from 1988 onwards). On this point, we note that Ofgem aligned its methodology with our proposed approach in the RIIO-3 SSMC Oxera report.[1]
- **Relationship between the TMR and gilt yields:** we note that while in the RIIO-3 SSMD Ofgem presented evidence on long-term 'through the cycle' equity market returns, it also recognised that considering returns on a 'through the cycle' basis may cause issues if there is a disconnect with current market conditions. This is discussed in more detail in section 3.4.
- **'Early view' on the TMR:** based on the above, Ofgem set a range for the TMR of 6.50–7.00%. Ofgem is not expecting to change this range when setting the final determinations in 2025, as long as this range remains approximately representative of the underlying data.

Note: [1] Oxera (2024), 'RIIO-3 cost of equity, prepared for the Energy Networks Association', 23 February, p. 42.
Source: Ofgem (2024), 'RIIO-3 Sector Specific Methodology Decision – Finance Annex', 18 July, paras 3.82–3.149, 3.251, 3.265 (last accessed on 4 September 2024).

As discussed in Box 3.1, the approach followed by Ofgem to estimate the TMR is only partially consistent with the methodology outlined in the RIIO-3 SSMC Oxera report. The main differences are related to the weight placed on ex ante approaches and the need to adjust the TMR to reflect the higher interest rate environment.

In the next sub-sections, we discuss in more detail Ofgem's methodological choices in relation to:

- ex post TMR (section 3.1);
- ex ante TMR (section 3.2);
- weight placed on ex ante approaches (section 3.3);
- the relationship between the TMR and gilt yields (section 3.4).

In section 3.5, we present the TMR range that we consider to be most appropriate based on the discussion in the previous sections.

3.1 Ex post total market return

In the RIIO-3 SSMD, Ofgem estimated the ex post TMR on the basis of:

- the DMS dataset;
- the CED inflation series (for the period 1900–49), the new backcast series for the CPIH (for the period 1950–88), and ONS actual CPIH (from 1988 onwards);
- different averaging techniques.

The ex post TMR values estimated by Ofgem are reported in Table 3.1 below.

Table 3.1 Ofgem estimates of ex post TMR

Averaging approach	10yr	20yr	Dataset (based on 1Y averages)
Arithmetic average (dataset)	-	-	6.97%
Geometric average (dataset)	-	-	5.27%
Geometric average + uplift (dataset)	-	-	6.82%
Arithmetic average (overlapping)	6.81%	6.93%	-
Arithmetic average (non-overlapping)	6.65%	6.72%	-
JKM unbiased estimator	6.86%	6.72%	-
JKM minimum MSE estimator	6.58%	6.16%	-
Blume estimator	6.85%	6.71%	-

Source: Ofgem (2024), 'RIIO-3 SSMD Allowed Return on Equity Early View Summary Calculations', Tab 'Ex-post TMR' (last accessed on 4 September 2024).

In setting the ex post TMR, Ofgem decided not to consider JKM and Blume estimators, as the resulting values sit within the range created by the arithmetic and geometric approaches.[40] Ofgem also expressed concerns in relation to using non-overlapping approaches, as this leads to a small dataset and the potential for volatility in long-term estimates based on small changes to the time periods being measured.[41]

In line with our approach in the RIIO-3 SSMC Oxera report, Ofgem ultimately decided to rely on only arithmetic averages. As a result, Ofgem is proposing to set 6.97% (rounded up to 7.00%) as the upper bound of the TMR range.[42]

We agree with Ofgem's approach of solely relying on the one-year arithmetic average, and note that this is also the averaging approach recommended by DMS for estimating the TMR in the context of a regulatory determination:[43]

[40] Ofgem (2024), 'RIIO-3 Sector Specific Methodology Decision – Finance Annex', 18 July, para. 3.118 (last accessed on 4 September 2024).
[41] Ofgem (2024), 'RIIO-3 Sector Specific Methodology Decision – Finance Annex', 18 July, para. 3.119 (last accessed on 4 September 2024).
[42] Ofgem (2024), 'RIIO-3 Sector Specific Methodology Decision – Finance Annex', 18 July, para. 3.123 (last accessed on 4 September 2024).
[43] DMS (2021),'Assessment of BNetzA's/Frontier's position on a DMS-based MRP', 21 August, p. 16 (last accessed on 18 September 2024).

'For the purposes of appraising investment decisions, valuing companies or **setting regulatory requirements**, the choice is therefore clear. The AM [arithmetic mean] is the appropriate measure to use [Emphasis added] [...].'

In section 3.5, we provide our estimate of the one-year arithmetic average TMR.

3.2 Ex ante total market return

In relation to the ex ante TMR, Ofgem considered various ex ante methodologies recently considered by the CMA as part of the PR19 redeterminations and in Ofwat's PR24 methodology. However, Ofgem highlighted its concerns in relation to the role of subjective judgement implied in some of these approaches and the data restrictions applied to the Barclays Equity Gilt Study.[44]

Based on the above, Ofgem decided to set the ex ante TMR on the basis of the DMS decompositional approach, in line with the approach used by the CMA in the PR19 redeterminations.[45] The ex ante TMR estimated by Ofgem is presented in Table 3.2 below.

[44] Ofgem (2024), 'RIIO-3 Sector Specific Methodology Decision – Finance Annex', 18 July, para. 3.132 (last accessed on 4 September 2024).
[45] Ofgem (2024), 'RIIO-3 Sector Specific Methodology Decision – Finance Annex', 18 July, para. 3.133 (last accessed on 4 September 2024).

Table 3.2 Ofgem ex ante TMR based on the DMS decompositional approach

	Formula	Value
Geometric mean dividend yield	[A]	4.55%
Growth rate of real dividends	[B]	0.75%
Geometric mean 'ex ante' TMR	[C]=[A]+[B]	5.30%
Geometric-to-arithmetic conversion	[D]	1.65%
Raw arithmetic ex ante TMR	[E]=[C]+[D]	6.95%
COLI-CED adjustment	F	-0.35%
Serial correlation adjustment	G	-0.10%
Final arithmetic ex ante TMR estimate	**[H]=[E]+[F]+[G]**	**6.50%**

Source: Ofgem (2024), 'RIIO-3 Sector Specific Methodology Decision – Finance Annex', 18 July, table 5 (last accessed on 4 September 2024).

Based on the above, Ofgem is proposing to set 6.50% as the lower bound of the TMR range.

As discussed in the RIIO-3 SSMC Oxera report, we agree that the DMS decompositional approach should be preferred over other ex ante approaches. However, as we will discuss in section 3.3, we consider that it is not correct to place 50% weight on historical ex ante approaches.

The COLI-CED adjustment applied by Ofgem is no longer necessary, given that DMS now provide data to allow the calculation of a nominal dividend growth rate. This can be converted into a CPIH-real growth rate using the same historical CPIH inflation series used by Ofgem to calculate the ex post TMR. We discuss this point in more detail in section 3.2.1.

Furthermore, in relation to the serial correlation adjustment applied by Ofgem, there is no basis for such adjustment given the lack of a statistically significant serial correlation in returns. We discuss this point in more detail in section 3.2.2.

3.2.1 COLI-CED adjustment in DMS decompositional approach

As discussed above, when estimating the ex ante TMR using the DMS decompositional approach, Ofgem includes a downward adjustment to account for the difference in the historical inflation series used by DMS

and Ofgem. In fact, for the 1900–49 period, DMS inflation figures are based on the COLI rather than the CED inflation series used by Ofgem.[46]

To account for this mismatch, Ofgem applies the same 35bps COLI-CED downward adjustment considered by the CMA as part of the PR19 redeterminations.[47]

While we agree that the DMS data should be adjusted to reflect the CED inflation series for the 1900–49 period, a separate COLI-CED adjustment is no longer necessary, as DMS now provides all the necessary data on a nominal basis which can then be deflated using the same historical inflation series used by Ofgem to estimate the ex post TMR.

As illustrated in Table 3.3 below, deflating the nominal DMS data by the same historical inflation series used by Ofgem to estimate the ex post TMR results in a slightly lower growth rate of real dividends, but the reduction is smaller than the 35bps COLI-CED adjustment considered by Ofgem. This results in an overall higher ex ante TMR compared to the value estimated by Ofgem.

Table 3.3 CPIH-real DMS decompositional approach

	Formula	Value
Geometric mean dividend yield	[A]	4.55%
Growth rate of real dividends	[B]	0.65%
Geometric mean 'ex ante' TMR	[C]=[A]+[B]	5.20%
Geometric-to-arithmetic conversion	[D]	1.65%
Ex ante TMR	**[E]=[C]+[D]**	**6.85%**

Source: Oxera analysis based on DMS data.

In Appendix A2, we provide further details on our estimation of the CPIH-real DMS decompositional approach.

[46] See Competition & Markets Authority (2021), 'Anglian Water Services Limited, Bristol Water plc, Northumbrian Water Limited and Yorkshire Water Services Limited price determinations, Final report', 17 March, Footnote 2474 (last accessed on 4 September 2024).
[47] Competition & Markets Authority (2021), 'Anglian Water Services Limited, Bristol Water plc, Northumbrian Water Limited and Yorkshire Water Services Limited price determinations, Final report', 17 March, para. 9.358 (last accessed on 4 September 2024).

3.2.2 Serial correlation adjustment in DMS decompositional approach

As discussed above, when estimating the ex ante TMR using the DMS decompositional approach, Ofgem includes a downward adjustment to account for serial correlation.

Ofgem's approach is similar to the PR19 redeterminations, in which the CMA applied a downward adjustment, to compensate for the alleged serial correlation in returns, based on the difference between the one-year, ten-year and 20-year holding period returns. Following this approach, Ofgem calculated a difference between the one-year and ten-year overlapping average returns of 0.16%, and a difference between the one-year and 20-year overlapping average returns of 0.04%. Ofgem's serial correlation adjustment reported in Table 3.2 above is based on the average between these two figures.[48]

Overall, we consider that Ofgem's rationale for, and approach to, adjusting for serial correlation are not robust.

First, it is not clear what conclusions can be drawn about serial correlation based on comparing average returns over different holding periods. It is particularly unclear what can be concluded from the reduction in the average return when moving from annual to ten-year holding periods, followed by an increase in the average return when extending from a ten- to 20-year holding period.

Second, the standard deviation of equity returns is high, and the standard error of averages calculated from equity returns will also be high. Ofgem has not reported the standard errors but they are likely to be much higher than the 0.04% and 0.16% differences reported. The differences found by Ofgem are unlikely to be statistically significant.

We test our hypothesis by conducting serial correlation tests on both nominal and real return series. We apply the Ljung–Box test to the DMS series, assuming different holding periods. For holding periods exceeding one year, we run the test on non-overlapping samples. The results, summarised in Table 3.4 below, show that for each holding period (i.e. one, five, ten and 20 years), there is no evidence of statistically significant serial correlation in the returns.

[48] Ofgem (2024), 'RIIO-3 Sector Specific Methodology Decision – Finance Annex', 18 July, para. 3.136 (last accessed on 4 September 2024).

Table 3.4 Ljung–Box serial correlation test

Holding period	Returns	P-value	Significant
1Y	Nominal	0.3032	No
	CPIH-real	0.3785	No
5Y (non-overlapping)	Nominal	0.1658	No
	CPIH-real	0.6066	No
10Y (non-overlapping)	Nominal	0.0802	No
	CPIH-real	0.6186	No
20Y (non-overlapping)	Nominal	0.8526	No
	CPIH-real	0.4266	No

Note: The significance test is performed at a 5% significance level. The null hypothesis associated with the Ljung–Box test is H_0: the residuals are independently distributed.
Source: Ljung, G.M. and Box, G.E.P. (1978), 'On a measure of a lack of fit in time series models', *Biometrika*, **65**:2, pp. 297–303.
Source: Oxera analysis based on Bloomberg data.

In addition to the lack of statistical significance, we note that in presenting the results of the decompositional approach, DMS do not apply any serial correlation adjustment, further supporting the exclusion of the downward adjustment considered by Ofgem.[49]

Based on the above, there is no basis for including a downward adjustment for serial correlation in the ex ante TMR calculated using the DMS decompositional approach.

3.2.3 Our assessment of the ex ante TMR

Based on the evidence presented in relation to the COLI-CED and serial correlation adjustments, we consider that the appropriate estimate of the ex ante TMR should be 6.85%. We note that this value is significantly higher than the value estimated by Ofgem (6.50%) and more in line with Ofgem's estimate of the ex post TMR (6.97%).

[49] Dimson, E., Marsh, P. and Staunton, M. (2024), 'UBS Global Investment Returns Yearbook 2024', p. 78.

3.3 Weight placed on ex ante total market return

As discussed above, in the RIIO-3 SSMD, Ofgem confirmed its intention to assign equal weight to the ex ante and ex post estimates when setting the TMR range for RIIO-3.

Ofgem highlighted how, in the PR19 redeterminations, the CMA noted that many academic studies have concluded that the ex post approach is likely to overestimate required returns.[50] Ofgem also pointed at the UKRN guidance, noting that DMS argue that, taking into account luck and repricing results from changes in the underlying risk premium, the forward-looking ERP is liable to be much lower than historical estimates based on long-run averages.[51]

As discussed in the RIIO-3 SSMC Oxera report, we do not consider ex ante approaches, including the DMS decompositional approach considered by Ofgem, to be informative. In fact, these approaches do not actually attempt to predict a forward-looking TMR, but rather estimate an adjusted historical TMR, replacing actual returns with assumptions about the components of future returns.[52]

In relation to the decompositional approach, DMS argue that the ERP can be divided into the following four components:[53]

- geometric mean dividend yield;
- annualised growth rate of real dividends;
- annualised expansion over time in the price-to-dividend ratio;
- annualised change in the real exchange rate.

Of these components, DMS mention that the mean dividend yield has been the dominant factor, as long-run returns heavily depend on reinvested dividends. In Table 3.5 below, we report the value of these components estimated by DMS for the UK over the 1900–2023 period.

[50] Ofgem (2024), 'RIIO-3 Sector Specific Methodology Decision – Finance Annex', 18 July, para. 3.131 (last accessed on 4 September 2024).
[51] Ofgem (2024), 'RIIO-3 Sector Specific Methodology Decision – Finance Annex', 18 July, para. 3.131 (last accessed on 4 September 2024).
[52] Oxera (2024), 'RIIO-3 cost of equity', prepared for the Energy Networks Association, 23 February, section 2.2.3.
[53] Dimson, E., Marsh, P. and Staunton, M. (2024), 'UBS Global Investment Returns Yearbook 2024', p. 78.

Table 3.5 DMS decomposition of historical returns (1900–2023, UK)

Component	Value (%)
Geometric mean dividend yield	4.55
Growth rate of real dividends	0.75
Expansion in the price-to-dividend ratio	0.03
Change in real exchange rate	-0.46

Source: Dimson, E., Marsh, P. and Staunton, M. (2024), 'UBS Global Investment Returns Yearbook 2024', Table 12.

When looking at these components in the context of the world index, DMS consider that the expansion in the price-to-dividend ratio and the change in real exchange rate can be considered as non-persistent and, therefore, they assume a value of zero for these components when assessing the forward-looking ERP. Furthermore, DMS also point to the yield at the end of 2023 on the world index being substantially lower compared with the long-run historical average, suggesting that a part of the growth in dividends was attributable to 'good luck'. On this basis, DMS further reduce the ERP to exclude the impact of 'good luck'.[54] For illustrative purposes, the ERP estimated by DMS for the world index is presented in Table 3.6 below.

Table 3.6 DMS decomposition of historical returns (1900–2023, world)

Component	Formula	Value (%)
Geometric mean dividend yield	[A]	3.97
Growth rate of real dividends	[B]	0.55
Expansion in the price-to-dividend ratio	[C]	-
Change in real exchange rate	[D]	-
US real interest rate	[E]	0.46
Part attributable to past good fortune	[F]	0.56
Prospective ERP (world)	**[G]=[A]+[B]+[C]+[D]-[E]-[F]**	**3.50**

[54] Dimson, E., Marsh, P. and Staunton, M. (2024), 'UBS Global Investment Returns Yearbook 2024', p. 78.

Source: Dimson, E., Marsh, P. and Staunton, M. (2024), 'UBS Global Investment Returns Yearbook 2024', Table 12, and p. 78.

While we note that Ofgem has not included any adjustments for good or bad luck, the discussion above highlights how decomposing equity returns in its various components requires a degree of subjective judgement about how the future will be different from the past.

Furthermore, we note that ignoring the 'part attributable to past good fortune', the ex ante TMR implied in the DMS decompositional approach is very similar to the ex post TMR implied in their long-run average of equity return. In fact, the ex ante TMR implied in the decompositional approach is equal to 5.3% (given by the sum of the first two components of Table 3.5 above) while the long-run average of UK equity returns is 5.4%.[55] These values are both calculated on the basis of geometric means and the same inflation series.

The point above suggests that for the UK there has been a convergence between ex ante and ex post estimates, in part driven by the reduction in the expansion in the price-to-dividend ratio element of the DMS decomposition which reduced from 0.21 to 0.03 in recent years.[56] Therefore, the difference of 50bps between ex ante and ex post TMR assumed by Ofgem is too large to be consistent with the underlying evidence.

Based on the above, we consider that it is not correct to place 50% weight on historical ex ante approaches. Instead, we suggest that Ofgem should inform its TMR allowance predominantly on the basis of the one-year arithmetic mean approach. However, to the extent that Ofgem decides to place any weight on historical ex ante approaches, the evidence presented in relation to the COLI-CED (section 3.2.1) and serial correlation (section 3.2.2) adjustments supports an ex ante TMR of 6.85% which is significantly higher than Ofgem's estimate of 6.50%. A higher ex ante TMR would also be aligned with the recent convergence between ex ante and ex post TMR discussed above.

[55] Dimson, E., Marsh, P. and Staunton, M. (2024), 'UBS Global Investment Returns Yearbook 2024', Table 80.
[56] 0.21 refers to the value published by DMS in 2021, while 0.03 is the value published by DMS in 2024. See Dimson, E., Marsh, P. and Staunton, M. (2021), 'Credit Suisse Global Investment Returns Yearbook 2021', Table 11; and Dimson, E., Marsh, P. and Staunton, M. (2024), 'UBS Global Investment Returns Yearbook 2024', Table 12.

3.4 Total market return determinations and gilt yields

We note that while in the RIIO-3 SSMD Ofgem presented evidence on long-term 'through the cycle' equity market returns, it also recognised that considering returns on a 'through the cycle' basis may cause issues if there is a disconnect with current market conditions:[57]

'Key to our use of cross checks is ensuring that we treat both consumers and investors fairly when setting allowed returns. This is a particularly difficult challenge in RIIO-3, as any new investors into the sector will require current returns to match the market cost of equity. While we normally consider likely returns on a 'through cycle' basis, this may cause issues if there is a disconnect with our 'through cycle' estimate and current market required rates of return. Using a balanced suite of cross-checks will help us to ensure that our estimated cost of equity is broadly in-line with current market requirements.'

In our previous submission, we highlighted how in previous Ofgem decisions the TMR allowance was reduced, reflecting a decline in gilt yields. For example, in RIIO-ED1 Ofgem specifically pointed at changes in market conditions to explain a reduction in the TMR and allowed CoE:[58]

'[…] we are changing our methodology to give greater weight to the influence of current market conditions in relation to the equity market return, […]'

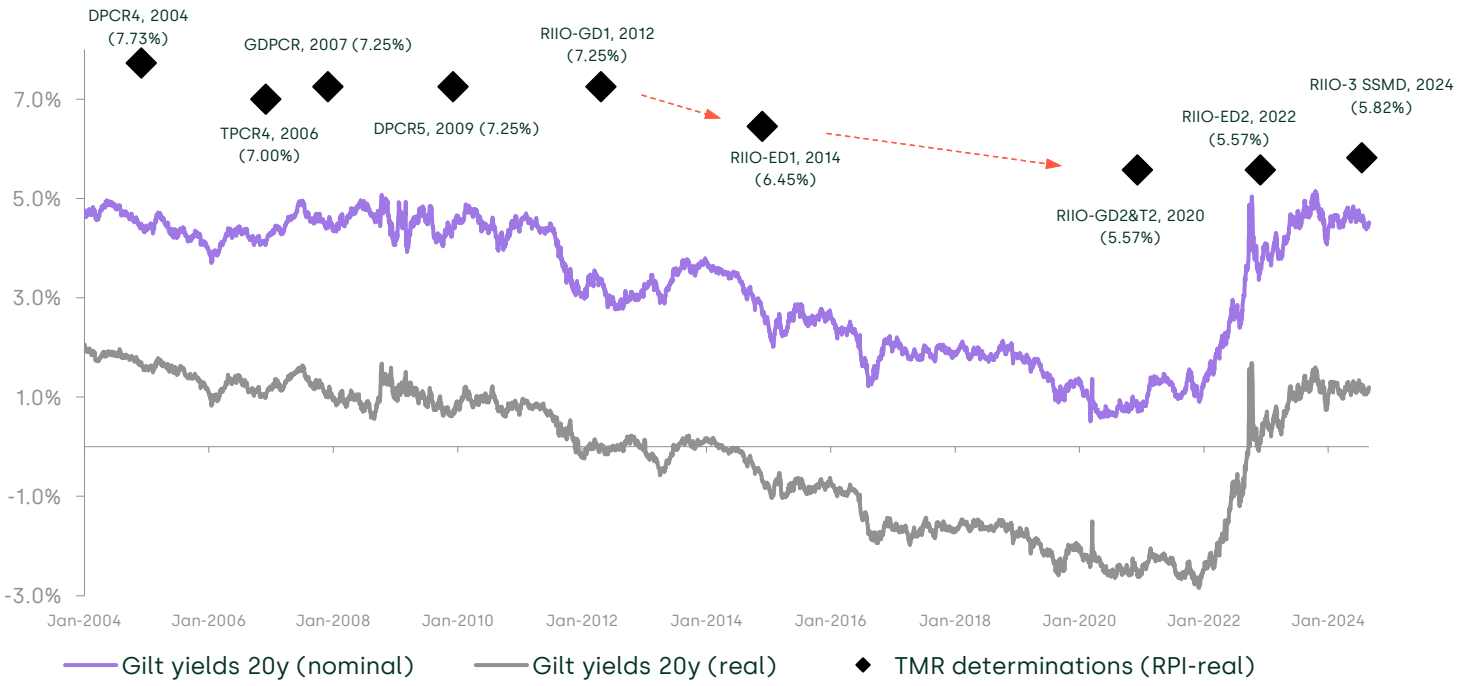
In addition, in the RIIO-2 SSMC, Ofgem pointed at the lower contemporaneous forecasts from asset managers and financial organisations to further support a reduction in the TMR:[59]

'We note that each of these forecasts is significantly lower than the 8-9% nominal TMR range we derive from inflating the UKRN Study by forecast CPI. These are in line with lower forward-looking measures and further reinforce the recommendation to reduce the long-term TMR range […]'

In Figure 3.1 below, we show the relationship between Ofgem's allowed TMR and gilt yields.

[57] Ofgem (2024), 'RIIO-3 Sector Specific Methodology Decision – Finance Annex', 18 July, para. 3.265 (last accessed on 4 September 2024).
[58] Ofgem (2014), 'Decision on our methodology for assessing the equity market return for the purpose of setting RIIO-ED1 price controls', p. 4 (last accessed on 3 October 2024).
[59] Ofgem (2018), 'RIIO-2 Sector Specific Methodology Annex: Finance – Consultation', 18 December, para 3.78.

Figure 3.1 Total market return determinations and gilt yields (RPI-real)



Note: Where a TMR allowance is not specified in the determinations, it is based on the sum of RFR and ERP allowances. We convert the RIIO-2 determinations that are originally in CPIH-real terms to RPI-real terms with a stylised RPI–CPIH wedge of 1%.
Source: Oxera analysis based on BoE data and Ofgem determinations: Ofgem (2024), 'RIIO-3 Sector Specific Methodology Decision – Finance Annex', 18 July, table 6; Ofgem (2022), 'RIIO-ED2 Final Determinations Finance Annex', 30 November, pp. 38 and 48; Ofgem (2021), RIIO-2 Final Determinations – Finance Annex, 3 February, p. 49; Ofgem (2014), 'Final determinations for the slow-track electricity distribution companies Overview', 28 November, p. 40; Ofgem (2013), 'Strategy decision for the RIIO-ED1 electricity distribution price control Financial issues', 4 March, p. 15; Ofgem (2012), 'RIIO-GD1: Final Proposals Finance and uncertainty supporting document', 17 December, p. 22; Ofgem (2011), 'Decision on strategy for the next transmission and gas distribution price controls - RIIO-T1 and GD1 Financial issues', 31 March, p. 35; Ofgem (2006), 'Transmission Price Control Review: Final Proposals', 4 December, p. 55; Ofgem (2006), 'Transmission Price Control Review: Initial Proposals', 26 June, p. 42.

As we discussed in the RIIO-3 SSMC Oxera report, a similar level of gilt yields was last seen in the 2005–11 period, when the TMR allowance was between 7.0% and 7.25% (RPI-real), equivalent to 8.07% and 8.32% in CPIH-real terms.[60] As the TMR allowance was subsequently reduced to reflect the reduction in the gilt yields, a consistent regulatory approach would imply an increase in the TMR allowance for RIIO-3 to incorporate the sharp increase in the gilt yields observed since 2022.

[60] We convert these numbers in CPIH-real terms using a stylised RPI–CPIH wedge of 1%.

We also note that in the 2024 yearbook, DMS predict equity returns which are 200bps higher compared with projections made only two years earlier. According to DMS this rapid change is the result of the sharp increase in real interest rates and the 'very poor' returns experienced in 2022.[61] This further justifies an increase in the TMR allowance to reflect the current higher interest rate environment.

Ofgem's decision to not adjust the TMR upwards was based on several arguments, which are discussed, in turn, below.

3.4.1 Changes in best practice

In relation to the evidence presented in Figure 3.1, Ofgem argued that the TMR allowance for RIIO-2 drew heavily on the work of the 2018 UKRN paper, which did not explicitly look to tailor the TMR estimate to prevailing market conditions. Instead, the reduction was due to returns now being measured on a CPI basis, which resulted in a lower TMR in RPI terms.[62, 63]

On this point, we note that in the RIIO-2 SSMC Ofgem sought to reconcile the lower bound of the TMR range proposed in the 2018 UKRN paper (6.00% CPI-real) with the lower bound of the TMR range previously considered by Ofgem and based on the 2003 paper from Wright, Mason and Miles (6.50% RPI-real). According to Ofgem, the 50bps difference could be explained by: (i) a 40bps reduction due to the combination of lower long-term DMS returns (which reduced the TMR) and DMS inflation (which increased the TMR); (ii) a 10bps reduction resulting from the combination of the methodological changes introduced in the 2018 UKRN paper. In addition to this 50bps difference, Ofgem highlighted a further 100bps reduction linked to the TMR now being expressed in CPI terms instead of RPI.[64] This shows that while the transition from RPI to CPI undoubtedly had an impact on the RIIO-2 TMR, a significant part of the overall reduction was also due to market movements.

In the RIIO-3 SSMD Ofgem also made a general point that best practice in relation to calculating real TMRs has developed over time (e.g.

[61] Dimson, E., Marsh, P. and Staunton, M. (2024), 'UBS Global Investment Returns Yearbook 2024', pp. 85–86.
[62] Ofgem (2024), 'RIIO-3 Sector Specific Methodology Decision – Finance Annex', 18 July, para. 3.95 (last accessed on 4 September 2024).
[63] The 2018 UKRN paper relied on CPI inflation in the absence of long-term CPIH indices. See UKRN (2018), 'Estimating the cost of capital for implementation of price controls by UK Regulators', June, p. D-109 (last accessed on 15 October 2024).
[64] Ofgem (2018), 'Consultation, RIIO-2 Sector Specific Methodology Annex: Finance', 18 December, Appendix 2 (last accessed on 3 October 2024).

superior inflation data for the 1949–88 period, and the shift to CPI/CPIH-real returns), such that it is not possible to draw a parallel with the TMR allowance set in the past when gilt yields were at similar levels as today.[65]

While we recognise that best practice in the estimation of the TMR has evolved since the introduction of the 2018 UKRN paper, we do not consider this to be a sufficient reason to ignore the implications of past regulatory decisions. Specifically, as part of RIIO-GD2 and RIIO-T2, companies passed on 70.3% of the reduction in gilt yields observed since RIIO-GD1 and RIIO-T1 to their customers through a lower TMR allowance, which positively affected the consumers through a lower WACC, and hence, lower energy bills.[66] Conversely, Ofgem's RIIO-3 SSMD position suggests that companies should now bear the effect of the higher interest rates environment.

Furthermore, regardless of the underlying methodology and best practice followed, the TMR values set prior to the publication of the 2018 UKRN paper are still relevant benchmarks today, as these values informed investors' past decisions. On this point, there is the risk that Ofgem's decision of not adjusting the TMR upwards could be interpreted by investors as a signal to expect a different treatment in scenarios of increasing and decreasing interest rates. This could undermine investors' confidence as well as regulatory stability and predictability in a particularly challenging period for the electricity and gas sectors, as also recognised by Ofgem.[67]

Finally, the UKRN guidance specifies that while regulators have generally assumed greater stability in the TMR, this does not imply that the TMR should be considered to be fixed:[68]

'[…] in recent determinations UK regulators assume greater stability in the TMR and therefore estimate it directly from historical equity returns data. In the interests of maintaining consistency across sectors and also across time, continuing with this approach remains preferable. **This approach does not imply that regulators should simply pick the same**

[65] Ofgem (2024), 'RIIO-3 Sector Specific Methodology Decision – Finance Annex', 18 July, para. 3.97 (last accessed on 4 September 2024).
[66] We calculate the percentage passed on to customers as the change in the allowed TMR (expressed consistently on RPI-real terms), as a percentage of the change in the one-month average of 20-year ILG yield between the relevant final determinations over RIIO-1 and RIIO-2.
[67] Ofgem (2024), 'RIIO-3 Sector Specific Methodology Decision – Finance Annex', 18 July, paras 1.2 and 1.6–1.7 (last accessed on 4 September 2024).
[68] UKRN (2023), 'UKRN guidance for regulators on the methodology for setting the cost of capital', 23 March, pp. 19–20 (last accessed on 4 September 2024).

fixed value for the TMR in each decision for all time, but that the TMR would be relatively less variable than the underlying RFR. [Emphasis added]'

Furthermore, UKRN considered that this 'through-the-cycle' approach could produce upwardly biased estimates of the TMR in the event that prevailing interest rates were lower compared with long-run historical averages.

'The potential for this methodology to produce upwardly-biased estimates of the TMR is recognised by regulators, the CMA and the authors of the 2018 UKRN Report. This bias is likely to persist for as long as interest rates remain low compared to long-run historical averages.'

It follows that the opposite should also be true in the current macroeconomic context, i.e. that a downward bias on the TMR is likely to persist as long as interest rates remain high compared with long-run historical averages.[69] Following a 'through the cycle' approach that gives no weight to changes in market conditions risks underestimating the TMR and not supporting companies in retaining and attracting investment in RIIO-3, due to reducing investability.

3.4.2 Financeability

In addition to changes in best practice, Ofgem justified the decision of not reflecting the higher gilt yields in the TMR allowance on the basis that the stable TMR approach followed by Ofgem has brought broader stability to the allowed returns on equity. According to Ofgem, companies are generally protected from excessively low returns on equity (relative to debt costs) through Ofgem's financeability assessment. Whereas, consumers receive no such protection if returns on equity sit higher than required to satisfy the financeability test.[70]

On this point, we note that there is no evidence that in previous determinations regulators, including Ofgem, had to increase the TMR allowance compared with the value initially set because of financeability concerns. For example, as part of the PR19 redeterminations, the CMA considered evidence from historical ex post, historical ex ante, forward-looking approaches and international evidence when setting the TMR. The CMA has not taken financeability into account in any of its TMR considerations. We also note that none of

[69] UKRN (2023), 'UKRN guidance for regulators on the methodology for setting the cost of capital', 23 March, pp. 19–20 (last accessed on 4 September 2024).
[70] Ofgem (2024), 'RIIO-3 Sector Specific Methodology Decision – Finance Annex', 18 July, para. 3.98 (last accessed on 4 September 2024).

respondents to the CMA's provisional findings, including Ofgem, mentioned the need to account for financeability when setting the TMR.

Furthermore, we note that in the RIIO-2 determinations, Ofgem clearly stated that it does not believe that the financeability assessment is a reliable cross-check on the allowed return:[71]

'We do not agree with the view that the financeability assessment is a reliable cross check on the allowed return. It is an assessment of the price control package and cashflows as a whole including whether these are sufficient to allow the notional efficient operator to access finance on reasonable terms. We do not consider it a reliable check on whether the allowed return (or components of it) is reasonable. The cross checks employed for the cost of capital parameters themselves serve to provide comfort that the allowed return is set at the level indicated by market evidence of the requirements of investors.'

More generally, we note that in light of the challenges that the energy networks will face during RIIO-3, the concept of financeability is evolving towards the idea of investability, with the latter more explicitly focused on also ensuring the adequacy of equity returns, instead of just satisfying credit metric thresholds. The key role that investability will play during RIIO-3 has been also recognised by Ofgem.[72]

'Investability is an important issue and we are alive to the new challenges that companies may face when raising equity to fund investments in the coming periods. We will continue to work with stakeholders before DDs and FDs to ensure that the RIIO-3 package is sufficiently attractive to investors while maintaining low costs to consumers.'

Based on the above, we consider that there is no evidence that financeability assessments by Ofgem protect companies against erroneous determinations of TMR that result in return on equity that is below the cost of equity when interest rates are low. This cannot therefore be a reason not to reflect the higher-interest-rate environment when setting the TMR allowance.

[71] Ofgem (2021), 'RIIO-2 Final Determinations – Finance Annex (REVISED)', 3 February, para. 5.12 (last accessed on 1 October 2024);
[72] Ofgem (2024), 'RIIO-3 Sector Specific Methodology Decision – Finance Annex', 18 July, para. 3.285 (last accessed on 4 September 2024).

3.5 Total market return estimate

Based on the discussion above, we consider the simple arithmetic average based on a one-year holding period to be the most appropriate approach to estimate the TMR, with an appropriate adjustment to 'through the cycle' estimates to take into account current market conditions.

Our analysis points towards a long-run average TMR of 6.96% which, in line with Ofgem, we round up to 7.00%.[73] Similar to Ofgem's methodology, our estimate reflects the arithmetic average of real equity returns assuming a one-year holding period and using CPIH backcast inflation series.

As discussed above, we consider that it is not correct to place 50% weight on historical ex ante approaches. However, to the extent that Ofgem decides to place any weight on historical ex ante approaches, the COLI-CED downward adjustment is no longer necessary, provided that the CPIH historical inflation series used by Ofgem is applied to the nominal data provided by DMS. In addition, there is no basis for a downward adjustment for serial correlation, which we estimated to be not statistically significantly different from zero. Based on these adjustments we estimate a historical ex ante TMR of 6.85% which is significantly higher than Ofgem's estimate of 6.50%. In any case, in setting our view on the TMR range, we do not consider the evidence from historical ex ante approaches.

Evidence suggests that at this point in time, investors would require higher market returns than the central estimate of 7% for the 'through the cycle' TMR, and we cannot exclude the possibility that values higher than 7.50% would be required.

In fact, it is highly likely that the recent increase in gilt yields will not have been entirely offset by a reduction in the equity risk premium and therefore will have led to upward revisions of investors' expectations of market returns. We note that when a similar level of gilt yields was last seen, the TMR allowance was above 8.00% in CPIH-real terms. As discussed above, adjusting the TMR to reflect the current interest rate environment would be consistent with previous regulatory determinations and also with UKRN guidance.

[73] The difference compared with Ofgem's estimate of 6.97% is driven by the different cut-off date used for the analysis.

In keeping with this evidence, Frontier's further analysis on the relationship between TMR and gilts is also supportive of a TMR well above 7.00%.[74] Specifically, Frontier deployed a Dividend Growth Model (DGM) to estimate a market-based measure of nominal TMR. Frontier's DGM-based TMR cross-checks combine DGM outputs with long-term historical average TMR and a TMR glider, i.e. an assessment of what market evidence tells about the appropriate level of TMR implied by market movements given the observable level of gilt yields. Frontier shows that the latest readings from the DGM and the TMR glider are 7.79% and 7.83%, respectively. Based on the above, Frontier concludes that the prevailing market conditions in the past two years would strongly suggest a RIIO-3 TMR range of 7.00–7.50%, with a point estimate towards the top of the range.

All of these aspects point towards the need to ensure that the TMR is set at a sufficient level to address the points above. Taking into account the 'through the cycle' estimate, as well as gilt yields and the greater welfare loss of setting a return that is too low, we consider that it would be appropriate to set a **TMR range of 7.00–7.50% for RIIO-3.**

[74] Frontier Economics (2024), 'Updated cost of equity cross-check evidence', a paper for the Energy Networks Association, November, Section 9.

4 Beta

The equity beta in the CAPM is a measure of how risky an equity investment is compared with the average market portfolio. An equity beta of one means that the stock return on average moves in line with the average market return. An equity beta between zero and one means that it tends to move in the same direction as the market return, but to a lesser magnitude (or greater magnitude, for a beta above one).

The beta is a measure of systematic risk in the CAPM. Although it is a forward-looking concept, in practice its estimation requires the interpretation of historical market data. This may lead to betas not capturing some risks that companies expect to face in the future and that may not yet have started affecting share prices, even for those estimates based on the shortest regression windows.

For a company listed on the stock market, estimating the equity beta using regression analysis is fairly straightforward because market data is publicly available.[75] For companies that are not listed, listed comparator companies that can be used as a proxy need to be identified. Observable equity betas for these comparators need to be adjusted to the level of gearing for which the CoE is being estimated, in order for them to be comparable (i.e. de-levering and re-levering needs to be undertaken consistently with reference to the target capital structure). This is how the beta allowance has been calculated in Ofgem's past determinations, and the approach that Ofgem intends to follow for RIIO-3.

In Box 4.1 below, we summarise the approach for estimating the beta followed by Ofgem in the RIIO-3 SSMD.

[75] Since the market portfolio is unobservable, it is standard practice to proxy it using an equity index such as the FTSE All-Share.

Box 4.1 Ofgem's RIIO-3 SSMD approach for estimating the beta

Ofgem's 'early view' on the equity beta is based on the following methodology and set of assumptions.

- **Timeframe and measurement frequency:** in the RIIO-3 SSMD, Ofgem estimated the beta with reference to daily returns over two-, five- and ten-year estimation windows. Ofgem did not consider rolling averages. For the draft and final determinations, Ofgem is expecting to place most weight on longer-term estimation windows. As discussed in the RIIO-3 SSMC Oxera report, we consider this to be an appropriate approach.
- **Listed comparator set:** in the RIIO-3 SSMD, Ofgem placed weight on National Grid, GB water companies (Severn Trent and United Utilities), and European utilities (Enagás, Red Eléctrica, Terna, Snam and Italgas). Ofgem excluded Pennon and SSE from the sample of comparable companies due to their historical non-regulated businesses. While we agree with the inclusion of the European utilities, we do not consider it appropriate to exclude Pennon from the sample. On this point, we note that including Pennon would be in line with the UKRN guidance and Ofgem's approach at RIIO-2.
- **Index:** in the RIIO-3 SSMD, Ofgem used the most diversified local index in the relevant currency when estimating betas, in line with UKRN guidance. Ofgem dismissed Citizens Advice's argument of using betas regressed against a world equity index. We consider this to be an appropriate approach.
- **Gearing and debt beta:** in the RIIO-3 SSMD, Ofgem used the enterprise value of gearing as the working definition of gearing for de-levering raw betas,[1] using the Harris–Pringle formula. Ofgem is minded to maintain the same value of debt beta used in RIIO-2 (0.075). In the absence of further evidence on the debt beta, we consider this to be an appropriate approach.
- **'Early view' on the beta:** based on the above and reflecting the potential range of future market conditions, Ofgem decided to set a wide asset beta

range of 0.30–0.40, which translates to an equity beta range of 0.64–0.89. We agree with Ofgem's observation that focusing on ten-year betas and adding European companies to the sample would result in an estimate in the upper-half of the 0.30–0.40 asset beta range presented in the RIIO-3 SSMD.

Note: [1] The enterprise value of gearing is computed as net debt divided by market capitalisation plus net debt.
Source: Ofgem (2024), 'RIIO-3 Sector Specific Methodology Decision – Finance Annex', 18 July, paras 3.150–3.226 (last accessed on 4 September 2024).

As shown in Box 4.1, the approach followed by Ofgem to estimate the beta is broadly consistent with the methodology outlined in the RIIO-3 SSMC Oxera report, with the exception of the exclusion of Pennon from the list of comparable companies.

In the RIIO-3 SSMC Oxera report, we also discussed how academics have found evidence of low-beta stocks, such as regulated utilities, consistently outperforming CAPM-estimated market returns (a phenomenon known as the 'low-beta anomaly'). To address this issue, we suggested using betas towards the upper end of the proposed range.[76]

In the next sub-sections, we discuss in more detail Ofgem's methodological choices in relation to:

- timeframe and measurement frequency (section 4.1);
- choice of comparators (section 4.2);
- 'early view' on the beta (section 4.3).

4.1 Timeframe and measurement frequency

In forming the 'early view' of the allowed cost of capital, Ofgem relied on a wide range of estimates considering data across two-, five- and ten-year timeframes. However, Ofgem specified that it expects to rely

[76] Oxera (2024), 'European beta comparators', prepared for the Energy Networks Association, September, p. 66.

most heavily on longer-term timeframes, i.e. ten years, when picking a point estimate for asset beta in the draft and final determinations.[77]

As previously discussed in the RIIO-3 SSMC Oxera report, putting more weight on longer-term timeframes comes with disadvantages and advantages. The main disadvantage is due to the inclusion of old data points that may not be as representative of current business activities, and hence type of risk exposure, of the companies. At the same time, relying on longer-term timeframes provides the following advantages.[78]

- Assigning equal weight to all timeframes (two, five and ten years) would place unequal weight on the short-term data that would be included across all three time periods. Therefore, putting more weight on ten-year betas has the advantage of counterbalancing the unequal weight placed on the short-term data.
- Using longer-term timeframes can reduce the estimation noise and improve the stability of the estimates between price controls.
- A longer estimation window could be particularly beneficial in the context of RIIO-3 as National Grid's beta would still capture gas distribution and transmission activities over part of the measurement period, and hence better represent both gas and electricity asset risk.

In relation to frequency, Ofgem confirmed that it will follow the same approach used in RIIO-2 and focus on daily observations, which is also in line with UKRN guidance.[79] We consider this to be an appropriate approach for setting the beta for RIIO-3.

Finally, Ofgem clarified that it does not intend to use rolling averages when estimating betas, as this approach can overweight certain parts of the data, inappropriately skewing the resulting estimate.[80] We consider Ofgem's approach to be appropriate.

[77] Ofgem (2024), 'RIIO-3 Sector Specific Methodology Decision – Finance Annex', 18 July, para. 3.172 (last accessed on 4 September 2024).
[78] Oxera (2024), 'RIIO-3 cost of equity', prepared for the Energy Networks Association, 23 February, p. 68.
[79] Ofgem (2024), 'RIIO-3 Sector Specific Methodology Decision – Finance Annex', 18 July, para. 3.177 (last accessed on 4 September 2024).
[80] Ofgem (2024), 'RIIO-3 Sector Specific Methodology Decision – Finance Annex', 18 July, para. 3.178 (last accessed on 4 September 2024).

4.2 Choice of comparators

In relation to the set of comparators, Ofgem clarified that it is minded to include relevant European utilities, UK water companies and National Grid plc. Ofgem dismissed the suggestion of including construction companies—to reflect the expected increase in construction activity of the transmission operators—due to the large differences in business models and systematic risk exposure.[81] In Table 4.1 below, we report the sample of companies considered by Ofgem in RIIO-3 SSMD.

Table 4.1 Ofgem comparators sample

Company	Sector	Country
National Grid	Electricity transmission	Great Britain
United Utilities	Water	Great Britain
Severn Trent	Water	Great Britain
Enagás	Gas transmission	Spain
Red Eléctrica	Electricity transmission	Spain
Terna	Electricity transmission	Italy
Snam	Gas transmission	Italy
Italgas	Gas distribution	Italy

Source: Ofgem (2024), 'RIIO-3 Sector Specific Methodology Decision – Finance Annex', 18 July, Table 7 (last accessed on 4 September 2024).

Ofgem's choice of including European utilities is driven by the fact that National Grid and GB water companies are not directly comparable to a GB-only regulated energy network, and also the lack of gas-based evidence in shorter-term estimation windows of beta (due to the divestment of Cadent by National Grid).[82]

The addition of the five European utilities is in line with our suggested approach in the RIIO-3 SSMC Oxera report. As previously discussed, it is not clear why the asset risk between UK and other European energy

[81] Ofgem (2024), 'RIIO-3 Sector Specific Methodology Decision – Finance Annex', 18 July, paras 3.190 and 3.201 (last accessed on 4 September 2024).
[82] Ofgem (2024), 'RIIO-3 Sector Specific Methodology Decision – Finance Annex', 18 July, para 3.191 (last accessed on 4 September 2024).

networks would be seen as less relevant than the risk of two different industries in the same country, such as UK water and energy networks. Furthermore, our previous analysis shows that the sample of European utilities considered by Ofgem includes companies with sufficient shares of regulated activities, good data availability and level of liquidity.[83]

At the same time, Ofgem clarified that the inclusion of the five European utilities is not a final decision, and that it will have to consider this further prior to the draft determinations to ensure that the regulatory regimes and business mixes are suitably similar.[84] To support Ofgem's review, we have prepared a separate report in which we discuss the regulatory regimes of the European utilities considered in the sample.[85]

Despite being previously included as part of RIIO-2,[86] Ofgem decided to exclude Pennon from the set of comparable companies due to the significant weight of historical non-water business, affecting Pennon's beta.[87] In the RIIO-3 SSMD, Ofgem did not provide further information or evidence to explain why it decided to change its approach. In particular, Ofgem did not explain why it had done so considering that, following the disposal of Viridor in 2020 and the acquisition of Bristol Water in 2021, by the time of the RIIO-3 final determinations there would be more years of water-only Pennon data which would make including Pennon even more relevant than it was during RIIO-2. As such, Ofgem's decision to exclude Pennon appears to be unjustified.

We also note that including Pennon in the set of comparable companies would be aligned with the UKRN guidance, which states:[88]

'Currently, the suite of UK companies which are likely to be most relevant in the markets of interest are Severn Trent, United Utilities, National Grid, BT Group and, going forward, Pennon.'

In Appendix A1, we present our previous analysis on the impact of including Pennon in the sample of companies used to estimate the beta

[83] Oxera (2024), 'RIIO-3 cost of equity', prepared for the Energy Networks Association, 23 February, p. 62.
[84] Ofgem (2024), 'RIIO-3 Sector Specific Methodology Decision – Finance Annex', 18 July, para. 3.199 (last accessed on 4 September 2024).
[85] Oxera (2024), 'Review of the regulatory regimes and business mixes for relevant European comparators to strengthen the use of European beta data', prepared for the Energy Networks Association, November.
[86] Ofgem (2021), 'RIIO-2 Final Determinations – Finance Annex (REVISED)', 3 February, Table 10 (last accessed on 4 September 2024).
[87] Ofgem (2024), 'RIIO-3 Sector Specific Methodology Decision – Finance Annex', 18 July, para. 3.202 (last accessed on 4 September 2024).
[88] UKRN (2023), 'UKRN guidance for regulators on the methodology for setting the cost of capital', 23 March, pp. 22–23 (last accessed on 4 September 2024).

for the UK water sector.[89] Our analysis showed that the inclusion of Pennon had the same impact on re-levered equity betas across two-, five- and ten-year estimation windows.[90] If Ofwat's (and now Ofgem's) concerns in relation to Pennon's historical non-water business were correct, then we would expect to see a larger impact of including Pennon under longer-term estimation windows.

Based on the above, it is therefore appropriate to include Pennon in the sample of comparable companies used to estimate the beta. As discussed above, Pennon was included in the sample as part of the RIIO-2 determinations and Ofgem's change of position appears to be unjustified, especially when considering the UKRN guidance supporting the inclusion of Pennon going forward.

4.3 'Early view' on the beta

Ofgem decided to include a wide range for the 'early view' on the beta. Specifically, Ofgem's 'early view' on the asset beta is a range of 0.30–0.40, which translates to an equity beta range of 0.64–0.89, at 60% notional gearing, and assuming a debt beta of 0.075.[91]

At the same time, we note that in the RIIO-3 SSMD Ofgem recognised that its preferred approach for setting the beta (including comparable European utilities and using longer-term estimation windows) supports a point estimate towards the upper bound of the proposed range:[92]

'[…] if we were to take a RIIO-2-style approach of basing that estimate on National Grid plc and Water company betas, with most weight placed on National Grid plc, this would currently suggest a central asset beta estimate of approximately 0.35 - itself in line with the figure used in RIIO-2. If, for example, we decide that it is appropriate to combine National Grid data with both Water and European utilities data, this would suggest a figure in the upper half of the 0.30 - 0.40 range.'

In addition, as discussed in the RIIO-3 SSMC Oxera report, there is no reason to expect that the risk of energy networks will have decreased in RIIO-3. Instead, it is more reasonable to expect that risks will have increased. Indeed, they are expected to increase further on a forward-looking basis: for electricity networks this is largely due to their

[89] Oxera (2023),'Cost of capital for PR24, final report for South West Water', 25 August, p. 19.
[90] We observed that for all of the estimation windows the effect of including Pennon in the sample was of increasing the re-levered equity betas by 0.03.
[91] Ofgem (2024), 'RIIO-3 Sector Specific Methodology Decision – Finance Annex', 18 July, para. 3.216 (last accessed on 4 September 2024).
[92] Ofgem (2024), 'RIIO-3 Sector Specific Methodology Decision – Finance Annex', 18 July, para. 3.224 (last accessed on 4 September 2024).

expected expansion; while for gas networks this is due to the uncertainty on the future of gas and the asset-stranding risk.[93] We note that in the RIIO-3 SSMD, Ofgem recognised the need to reflect these risks when setting the beta, and for this reason it is expecting the final value of the beta to be higher than the value set as part of RIIO-2:[94]

'[…] improving our assessment of forward-looking risk exposure by including European utility comparators, would likely increase our estimate of beta into the upper half of the 0.30 - 0.40 range, and to a level in excess of the beta used in RIIO-2. This change explicitly addresses the potential for a different risk profile in RIIO-3 relative to RIIO-2.'

We agree with Ofgem's observation that focusing on ten-year betas and adding European companies to the sample would result in an estimate in the upper-half of the 0.30–0.40 asset beta range presented in the RIIO-3 SSMD. At the same time, current evidence suggests that there are many factors putting an upward pressure on the energy networks' beta, pointing towards a narrower range of 0.35–0.40 or higher.

First, as discussed above, both electricity and gas sectors are expecting to face significant challenges throughout RIIO-3 which are not reflected in the comparator data.

Second, energy networks' ability to retain and attract new capital is challenged by attractive alternative investment opportunities. Therefore, equity returns will need to be set at a level that ensures the investability of the energy sector, not least because of the asymmetric consumer welfare loss in case of under-investment. The choice of beta will be a significant determinant of investability.

Taking all of this into account, we consider a narrower beta range of 0.35–0.40 to better reflect the challenges that energy networks will face during RIIO-3 and this is consistent with Ofgem's signalled position for RIIO-3. This range differs from the range of 0.323–0.373 previously presented in the RIIO-3 SSMC Oxera report as we take into account Ofgem's further thinking and evidence presented in the RIIO-3 SSMD, and the findings of our water sector investability report.[95]

[93] Oxera (2024), 'RIIO-3 cost of equity', prepared for the Energy Networks Association, 23 February, pp. 66–67.
[94] Ofgem (2024), 'RIIO-3 Sector Specific Methodology Decision – Finance Annex', 18 July, para. 3.305 (last accessed on 4 September 2024).
[95] Oxera (2024), 'Investability at PR24 – Final report for Water UK', 27 August.

5 Our estimate of the cost of equity range

Based on the discussion in the sections above, we present our estimate of the CoE and compare it against Ofgem's 'early view' on the allowed CoE for RIIO-3 (based on 1 July 2024 as cut-off date) in Table 5.1 below. The CoE ranges presented do not account for sector-specific forward-looking risks.

Table 5.1 Cost of equity estimates

	Formula	Ofgem (RIIO-3 SSMD)			Oxera		
		Low	High	Midpoint	Low	High	Midpoint
RFR[1]	[A]	1.27%	1.27%	1.27%	1.54%	1.54%	1.54%
TMR	[B]	6.50%	7.00%	6.75%	7.00%	7.50%	7.25%
Asset beta	[C]	0.30	0.40	0.35	0.35	0.40	0.38
Re-levered equity beta at 60% gearing[2]	[D] = {[C] – (gearing*beta debt)} / (1-gearing)	0.64	0.89	0.76	0.76	0.89	0.83
CAPM CoE	**[E] = [A] + [D] × ([B] – [A])**	**4.60%**	**6.36%**	**5.45%**	**5.70%**	**6.83%**	**6.25%**

Note: [1] The value of Ofgem's RFR differs from the value reported in the RIIO-3 SSMD, as the value in the table reflects Ofgem's latest estimate of the RFR included in the latest WACC Allowance Model for RIIO-3. [2] The debt beta is assumed to be 0.075. Values may not add up due to rounding.
Source: Oxera analysis; Ofgem (2024), 'RIIO-3 Sector Specific Methodology Decision – Finance Annex', 18 July, table 13 (last accessed on 4 September 2024); Ofgem (2024), 'RIIO-3_WACC_Rates_Model_aligning_to_v7_20240926'.

Ofgem's 'early view' on the allowed CoE for RIIO-3 is a range of **4.60–6.36%**, using 1 July 2024 as the cut-off date, with a midpoint of 5.45%. Restating the Ofgem CoE range for the upper end betas results in an Ofgem CoE range of 5.26–6.36%, with a 5.79% midpoint (using 1 July 2024 as cut-off date).

Our proposed adjustments to the RFR, TMR and beta result in an Oxera CoE range of **5.70–6.83%** (CPIH-real, at 60% gearing). The 5.45% midpoint of the range calculated using the Ofgem SSMD methodology is below the bottom of the Oxera CoE range, suggesting that the midpoint of the Ofgem CoE range is too low.

6 Conclusions

In this report, we have reviewed the methodology for the calculation of the CAPM parameters laid out by Ofgem as part of the RIIO-3 SSMD. Based on this, we have provided updates to the RIIO-3 SSMC Oxera report. In addition, we have estimated a reasonable range for the allowed CoE for RIIO-3, by applying the methodology that we consider to be appropriate in light of developments in regulatory precedents, capital markets and academic literature.

We note that in the RIIO-3 SSMD, Ofgem implemented some of the recommendations we provided in the RIIO-3 SSMC Oxera report. In particular, we welcome (i) the use of the arithmetic mean as the only approach to calculate the ex post TMR; (ii) the use of CED series, new backcast CPIH series, and CPIH estimates from the ONS to deflate nominal historical returns; (iii) the inclusion of European comparators in the calculation of the beta.

Conversely, some of Ofgem's methodological choices are in contrast with the evidence, academic literature and regulatory precedents we presented in the RIIO-3 SSMC Oxera report. In this report, we have focused on these specific points, reflecting Ofgem's new thinking and evidence, providing our responses to Ofgem's arguments and revised estimates for these parameters.

First, in the determination of the RFR, Ofgem does not account for the convenience premium embedded in the gilts. As we have shown, the existence of the convenience premium is well documented in academic literature. Moreover, other regulators, including the CMA, CAA and UR, have adjusted the government bond yield for the convenience premium. Although the value of the convenience premium varies over time, we consider that making no adjustment for the convenience premium when setting the RFR introduces a downward bias to the estimate for a five-year price control period. As discussed in section 2.1, Ofgem's exclusion of the convenience premium is driven by a flawed analysis that produces a negative convenience premium, which is inconsistent with the extensive evidence of a positive convenience premium. Correcting Ofgem's calculations results in a positive convenience premium.

Second, in the calculation of the 'historical ex ante' TMR, Ofgem applies downward adjustments for COLI-CED and serial correlation. In relation to the COLI-CED, this adjustment is no longer necessary as the historical CPIH inflation series used by Ofgem can be applied to the nominal data

provided by DMS. In relation to serial correlation, Ofgem's rationale for, and approach to, adjusting for serial correlation are not robust. We find no evidence of serial correlation in the historical data, at standard levels of statistical significance. As such, there is no basis for this downward adjustment when calculating the ex ante TMR. Correcting Ofgem's estimate for these points, we calculate a historical ex ante TMR of 6.85% which is significantly higher than the value estimated by Ofgem (6.50%).

Third, in the determination of the TMR, Ofgem gives equal weight to the ex post and ex ante approaches. We consider ex ante approaches to be not particularly informative and subject to a degree of subjective judgement about how the future will be different from the past. As such we consider that it is not correct to place 50% weight on historical ex ante approaches. Furthermore, we also note a convergence in the value of the ex ante and ex post TMR implied in the DMS data. Therefore, the 50bps difference between ex ante and ex post TMR estimated by Ofgem is too large and inconsistent with the underlying evidence.

Fourth, Ofgem presents reasons not to reflect the higher interest rate environment in the estimation of the TMR. As discussed in section 3.4, this is inconsistent with past regulatory practice of reducing the TMR as interest rates decreased. Following a 'through the cycle' approach that gives no weight to changes in market conditions risks underestimating the TMR and not supporting companies in retaining and attracting investment in RIIO-3. We consider it appropriate to reflect this point in the determination of the TMR.

Finally, we disagree with Ofgem's decision to exclude Pennon from the sample of beta comparators. Ofgem's concerns in relation to Pennon's historical non-water business are not supported by our analysis. Moreover, Pennon was part of the sample in the calculation of the beta for RIIO-2, and it would be consistent with UKRN guidance to include Pennon. Therefore, we consider it appropriate to include Pennon in the sample.

Based on the above, our analysis leads to a CoE estimate of **5.70–6.83%** (at 60% gearing, CPIH-real), which compares with Ofgem's 'early view' of 4.60–6.36% (at 60% gearing, CPIH-real and using 1 July 2024 as the cut-off date). The 5.45% midpoint of the range calculated using the Ofgem SSMD methodology is below the bottom of the Oxera CoE range, suggesting that the midpoint of the Ofgem CoE range is too low.

In relation to the selection of the point estimate within the range, the evidence presented suggests that the appropriate point estimate needs

to be towards the upper end of the Oxera CoE range to enable companies to offer investors returns that are attractive and provide reliable access to sufficient capital, and to account for asymmetric risks.

A1 Impact of including Pennon in the set of comparable companies

In a previous publication in response to Ofwat's PR24 final methodology, we analysed the impact of including Pennon in the sample of companies used to estimate the beta for the UK water sector.[96] In Table A1.1 below, we summarise the impact of including Pennon across the two-, five- and ten-year betas.

Table A1.1 Impact of including Pennon in the sample of UK water companies

	Raw equity beta	Gearing level	Asset beta	Re-levered beta
Two-year betas				
Average without Pennon	0.47	51%	0.28	0.51
Average with Pennon	0.49	50%	0.30	0.54
Difference			**0.01**	**0.03**
Five-year betas				
Average without Pennon	0.54	53%	0.31	0.56
Average with Pennon	0.53	49%	0.32	0.58
Difference			**0.01**	**0.03**
Ten-year betas				
Average without Pennon	0.60	52%	0.34	0.63
Average with Pennon	0.59	48%	0.35	0.66
Difference			**0.01**	**0.03**

Note: Values may not add up because of rounding. The values reflect a cut-off date of 31 July 2023. The debt beta is assumed to be 0.1 and the notional gearing is assumed to be 55%.
Source: Reproduction of Table 2.8 and Table 2.9 of Oxera (2023), 'Cost of capital for PR24: final report for South West Water', 25 August.

[96] Oxera (2023), 'Cost of capital for PR24, final report for South West Water', 25 August, p. 19.

A2 The CPIH-real DMS decompositional approach

The 2024 DMS dataset includes historical data on UK-specific equity total returns as well as equity capital gains. These series are available both in real and nominal terms.

Our estimate of the CPIH-real DMS decompositional approach reflects the nominal data provided by DMS, deflated by the same composite inflation series used by Ofgem as a proxy for historical CPIH. Specifically, we use the following series:

- CED inflation series (for the period 1900–49);
- the new ONS backcast series for CPIH (for the period 1950–88);[97]
- the CPIH estimates published by the ONS (for the period 1988–2023).

As a first step, we calculate the annual dividend yield starting from the nominal total equity returns and equity capital gains series provided by DMS using the following formula:

$$Dividend\ yield_t = \frac{(Nominal\ equity\ return_t - Nominal\ capital\ gain_t)}{(1 + Nominal\ capital\ gain_t)}$$

We then calculate the geometric mean dividend yield as the first component of the ex ante TMR. We estimate a geometric mean dividend yield of 4.55%, which matches the estimate presented by DMS.

As a second step, we calculate the annual nominal growth rate of dividends as follows:[98]

[97] The ONS has recently published a new CPIH backcast which addresses issues of concern with the old backcast series. ONS (2022), 'Consumer price inflation, historical estimates and recent trends, UK: 1950 to 2022', https://www.ons.gov.uk/economy/inflationandpriceindices/articles/consumerpriceinflationhistoricalestimatesandrecenttrendsuk/1950to2022 (last accessed on 8 November 2024)

[98] Based on the data available, we are unable to exactly replicate the value of the growth rate of real dividends estimated by DMS for UK (0.75% using the DMS inflation series). This is due to the fact that the data available does not include the dividend yield in 1899 which is required to estimate the annual growth rate in 1900. In our analysis, we estimate the growth rate of real dividends starting from 1901. The impact of this is likely to be minor.

$$growth\ rate_t = (\frac{divdend\ yield_t}{dividend\ yield_{t-1}} * (1 + Nominal\ capital\ gain_t)) - 1$$

From the annual nominal growth of dividends, we calculate an index which we then deflate using the composite inflation series described above. From the deflated index we derive the growth rate of real dividends by taking the compound annual growth rate (CAGR) for the period 1901–2023. This results in a growth rate of real dividends of 0.65%, compared with the value of 0.75% estimated by DMS and used by Ofgem.

In Table A2.1 below, we present our estimate of the CPIH-real DMS decompositional approach, which reflects the geometric mean dividend yield and growth rate of real dividends calculated above using the same CPIH inflation series as used by Ofgem in the historical ex post TMR calculation. To the resulting value, we then apply the geometric-to-arithmetic conversion considered by DMS and Ofgem to estimate the ex ante TMR.

Table A2.1 CPIH-real DMS decompositional approach

	Formula	Value
Geometric mean dividend yield	[A]	4.55%
Growth rate of real dividends	[B]	0.65%
Geometric mean 'ex ante' TMR	[C]=[A]+[B]	5.20%
Geometric-to-arithmetic conversion	[D]	1.65%
Ex ante TMR	**[E]=[C]+[D]**	**6.85%**

Source: Oxera analysis based on DMS data.

Contact

Peter Hope
Partner
+44 (0) 20 7776 6621
peter.hope@oxera.com

Sahar Shamsi
Partner
+44 (0) 20 7776 6624
sahar.shamsi@oxera.com

oxera.com