RIIO-GD&GT3 cost of equity and debt premium cross-check

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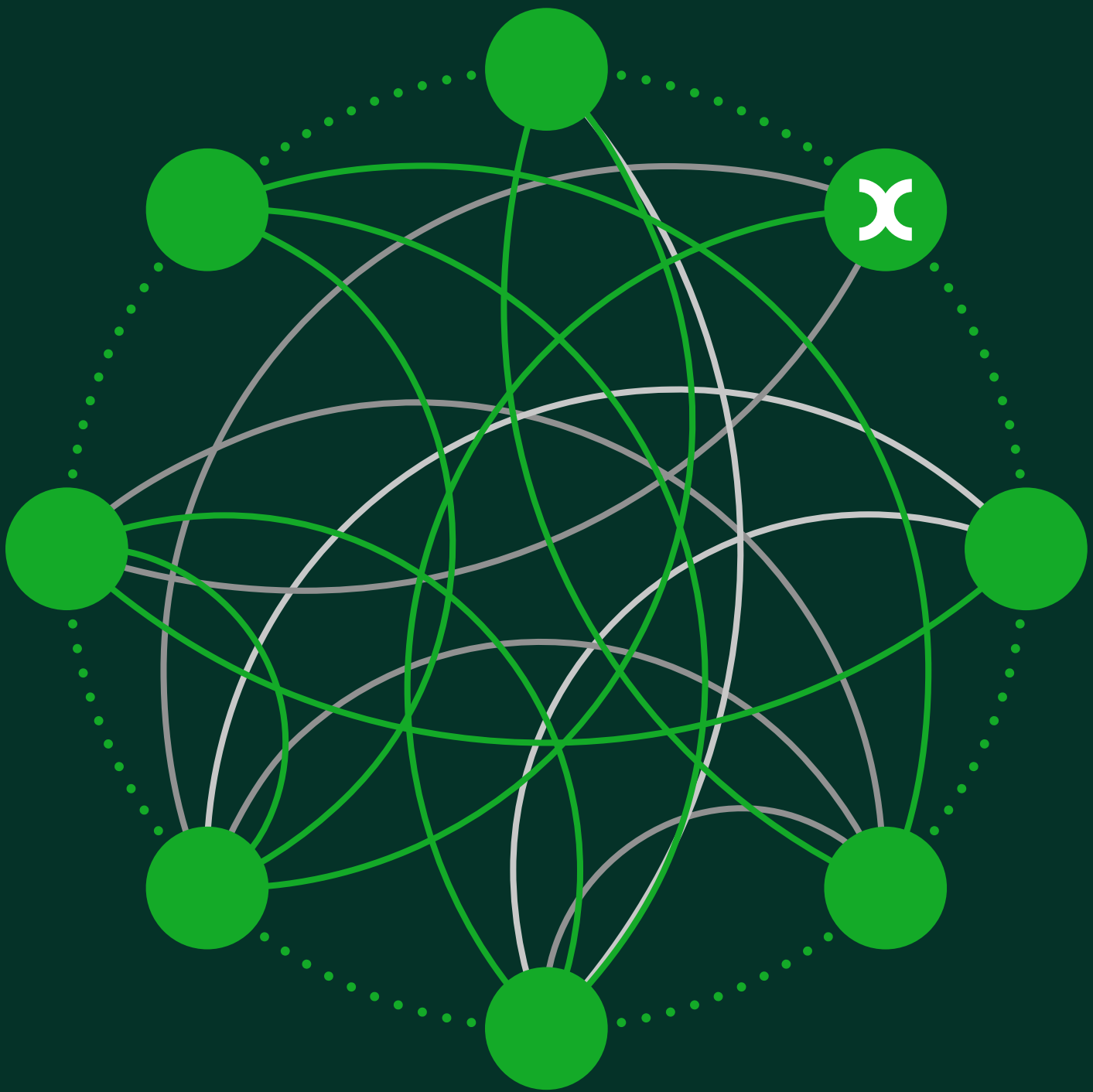

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Executive summary

Following the publication of the Draft Determinations for the RIIO-3 price controls (RIIO-3 DD), Future Energy Networks (FEN) asked Oxera to:

1 review Ofgem's methodological choices in the RIIO-3 DD when estimating the parameters of the capital asset pricing model (CAPM), including the risk-free rate (RFR) and total market return (TMR), and asset beta for gas networks;
2 update Oxera's CAPM-based cost of equity (CoE) estimate previously provided in reports that we wrote for GB gas distribution networks (GDNs) and Energy Networks Association (ENA) responding to Ofgem's Sector Specific Methodology Decision (SSMD; the 'RIIO-3 SSMD Oxera reports'), based on, or in response to, further considerations and evidence presented by Ofgem in the RIIO-3 DD, and updated market data where relevant;[1]
3 assess Ofgem's and Oxera's CoE ranges against the debt premia cross-check (previously referred to as the ARP–DRP[2]).

In recent years the wider economy has gone through a step change in capital market and macroeconomic contexts compared with those in which the RIIO-2 price controls were determined. In addition, gas networks face an increased and significant level of uncertainty about the future of gas, while having to maintain the current operational resilience of the networks. These aspects stress the critical role played by the regulatory allowance in enabling companies not only to retain existing capital but also to attract new capital. This was, and remains, a key premise in our RIIO-3 reports. We note that, in line with the RIIO-3 SSMD, in the RIIO-3 DD Ofgem continues to recognise the importance of ensuring the investability of the energy sector.

As part of the RIIO-3 DD, Ofgem proposed to implement a series of changes to its CoE CAPM methodology that are consistent with the methodology set out in the RIIO-3 SSMD Oxera report for ENA. We welcome these changes, which include:

- excluding the Cost of Living Index (COLI)-Consumption Expenditure Deflator (CED) and serial correlation adjustments from the calculation of the ex ante TMR;
- reintroducing Pennon in the sample of UK water companies used to estimate the beta;

[1] Oxera (2024), 'Cost of equity for RIIO-GD3', prepared for GB gas distribution networks, 29 November. Oxera (2024), 'RIIO-3 cost of equity—CAPM parameters', prepared for the Energy Networks Association, 8 November (both accessed 9 July 2024).
[2] Asset risk premium; debt risk premium.

- confirming the inclusion of the European energy networks in the calculation of the beta.

However, we continue to disagree with Ofgem's approach in a number of areas. Specifically, to achieve an investable allowed CoE, we consider that Ofgem should:

- account for the convenience premium embedded in government bonds when estimating the RFR;
- while we welcome the recognition by Ofgem that there is no longer the need to apply a COLI-CED adjustment, and that there is no definitive evidence on serial correlation that would justify adjusting the historical ex ante estimate of TMR, we maintain that Ofgem should inform its TMR range predominantly on the basis of the ex post TMR, instead of positioning its approach as: '[w]e continue to recommend we give equal weight to both ex ante and ex post TMR estimates';[3]
- reflect the change in the interest rate environment in its TMR estimate, consistent with the previous regulatory decisions, as this is likely to be required for investability;
- set the asset beta range based on gas network comparators or in the upper half of the estimated range, to account for (i) forward-looking risks faced by gas networks to reach the government's net zero objectives, which are placing upward pressure on the investability of the sector, and (ii) the 'low beta anomaly'.

In this report, we provide updates to the CoE estimates from the RIIO-3 SSMD Oxera report based on, or in response to, further considerations and evidence presented by Ofgem in the RIIO-3 DD. Our analysis reflect the methodology that is appropriate for RIIO-3 in light of regulatory precedents, developments in capital markets, academic evidence, the operational and political environment of the gas networks, and the UK Regulators Network (UKRN) cost of capital estimation guidance.

The cut-off date for our analysis is 31 March 2025, which is the same date used by Ofgem in the RIIO-3 DD.

Below, we provide an overview of the areas where we consider Ofgem should amend its methodology for estimating the CAPM parameters.

Risk-free rate

[3] We note that while Ofgem positioned its TMR estimate as placing equal weight to both ex ante and ex post approaches, its proposed TMR point estimate (6.9%) sits at the top of its proposed TMR range (6.8–6.9%). See Ofgem (2025), 'RIIO-3 Draft Determinations - Finance Annex', 1 July, para 3.42 and Tables 17 and 18 (accessed 9 July 2025).

In setting the RFR, Ofgem did not accept the evidence submitted by stakeholders and confirmed its decision not to account for the convenience premium embedded in government bonds. As we highlighted in our RIIO-3 SSMD report for ENA, there is extensive evidence supporting the inclusion of the convenience premium, including academic literature and recent regulatory precedents, such as those from the Competition and Markets Authority (CMA), the Civil Aviation Authority (CAA) and the Utility Regulator (UR) (in Northern Ireland).[4]

In section 2.1, we show empirically that a large and positive convenience premium can be observed across the gilts yield curve, including at the 20-year investment horizon. While we recognise that the level of the convenience premium can fluctuate over time, depending on the underlying market conditions, in Figure 2.1 we show that the convenience premium has been present during periods of calm and distressed financial markets. We consider that adjusting gilt yields to reflect the convenience premium is a necessary step in arriving at an accurate estimate of the RFR, and that relying solely on index-linked gilt (ILG) yields would be an error that would underestimate the RFR.

In relation to the inflation wedge assumption, Ofgem continued not to include a wedge between the Consumer Price Index (CPI) and the Consumer Price Index with Housing (CPIH) (the CPI–CPIH wedge). However, Ofgem stated that it would review whether an adjustment to the inflation assumption is warranted to reflect the long term CPI–CPIH forecast wedge estimated by the Office for Budget Responsibility (OBR) in October 2024. In section 2.2, we identify several reasons why the OBR's CPI–CPIH forecast wedge should not be considered. Specifically, we note that (i) the historical evidence does not support the existence of a stable or predictable CPI–CPIH wedge; (ii) the CPI–CPIH forecast wedge estimated by the OBR does not have the track record and evidential basis needed to support regulatory application; and (iii) some of the underlying drivers of CPIH cannot be forecast reliably.

Ofgem's proposed RFR is 2.01% (CPIH-real). Including the convenience premium leads to a RFR of 2.25% (CPIH-real).

Total market return and equity risk premium

In setting the TMR range, Ofgem continued to place equal weight on ex ante and ex post approaches. In section 3.3, we explain why we continue to consider that ex ante approaches are not particularly informative and that they are subject to a degree of subjective judgement about how the future will be different from the past. This also applies to the Dimson, Marsh and Staunton (DMS) decompositional

[4] Oxera (2024), 'RIIO-3 cost of equity—CAPM parameters', prepared for the Energy Networks Association, 8 November (accessed 1 August 2025).

approach considered by Ofgem which, in reality, is closer to an ex post approach than an ex ante one, as it does not actually attempt to predict a forward-looking TMR.

In addition, while the UKRN guidance suggests that 'the TMR should be primarily based on historical ex post and historical ex ante evidence', it does not recommend placing equal weight on ex ante and ex post approaches.

For these reasons, we consider that Ofgem should inform its TMR range predominantly on the basis of the ex post TMR, and place little to no weight on historical ex ante approaches.

Ofgem also confirmed its approach of not reflecting the higher-interest-rate environment in the estimation of the TMR. In section 3.4, we discuss how Ofgem's approach is inconsistent with its decision to reduce the TMR in RIIO-ED1 and RIIO-2, also in recognition of the falling interest rate environment. In line with the RIIO-3 SSMD Oxera report, we maintain that following a 'through-the-cycle' approach[5] and placing no weight on changes in market conditions risks underestimating the TMR for RIIO-3. In turn, this could result in companies not being adequately supported in retaining and attracting capital during RIIO-3.

On this point, we note that the UKRN guidance specifies that regulators should not consider the TMR to be fixed, and that it also notes that 'it is important to recognise that depending on the macroeconomic environment, this largely 'through-the-cycle' approach could either overstate or understate returns required by investors in a specific price determination.'[6]

Ofgem clarified that it plans to continue to use cross-checks to assess whether its bottom-up TMR estimate is 'materially' out of line with what investors require, but has not defined what constitutes a 'materially' out-of-line TMR. Instead, Ofgem has performed a suite of cross-checks at the CoE level to assess whether the overall allowed CoE is properly calibrated, concluding that its cross-checks support its preferred CoE range. Instead, our debt premia cross-check suggests that Ofgem's allowed CoE and the bottom half of its CoE range are too low.

Based on the above, we consider that Ofgem should account for the current interest rate environment when setting the TMR, to ensure that allowed returns are sufficient to safeguard the investability of the energy sector.[7] Ofgem's proposed

[5] Whereby the TMR is not adjusted to reflect prevailing market conditions, under the assumption that positive and negative short-term deviations will offset each other over time.
[6] UKRN (2023), 'UKRN guidance for regulators on the methodology for setting the cost of capital', p. 19 (accessed 24 July 2025).
[7] 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 the desired investment.

TMR range is 6.80–6.90% (CPIH-real). 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. The historical evidence reflects the through-the-cycle estimate, while the current market conditions suggest that, at this point in time, investors would require higher market returns than the through-the-cycle TMR of 7.00%, and we cannot exclude the possibility that values higher than 7.50% would be required.

Considering the upward trend in gilt yields, it is reasonable to expect that investors have revised their expectations upwards. We note that, when gilt yields were last seen at similar levels (prior to the 2008 financial crisis), the TMR allowance was in the 7.50–8.00% range in CPIH-real terms. A TMR above the through-the-cycle estimate is also supported by the analysis of Frontier Economics (Frontier), with its TMR Glider suggesting a TMR range of 7.8–8.0%, which supports a TMR for RIIO-3 towards the top of the 7.00–7.50% range.

We consider this point to be of particular importance in the current context of the gas networks, that are facing challenges in relation to investment intensity and/or transition risk. Setting a return that is too low risks causing a welfare loss by not adequately supporting the energy networks in attracting and retaining the necessary capital to carry out the investments required to support the government's net zero objectives.

Beta

In the RIIO-3 DD, Ofgem confirmed that it does not intend to differentiate betas between sectors. It also indicated that it does not intend to make any further adjustment to its baseline asset beta estimates to account for gas-specific forward-looking risks, in particular asset stranding risk. To address these risks, Ofgem considers that changing the asset beta comparator set to include European energy networks and accelerating the depreciation of new GD assets is sufficient. Ofgem also dismissed our gas-specific asset beta range, in particular the use of US evidence, due to differences in regulation and net zero risks.

On forward-looking risks, we agree with Ofgem that the risks faced by UK energy networks and European comparators in the sample are similar. However, it is not clear to what extent these shared forward-looking risks are captured in the historical beta estimates. Therefore, the inclusion of European comparators does not necessarily ensure that the entirety of GB gas networks' anticipated systematic risks is adequately reflected in the beta estimate.

We continue to consider that US gas network comparators bring informative value for positioning a gas-specific asset beta range. We note that Ofgem has not responded to the evidence showing strong correlation between the betas of US and European listed gas comparators. Further, to the extent that Ofgem has responded to evidence, we consider that it should not dismiss the evidence

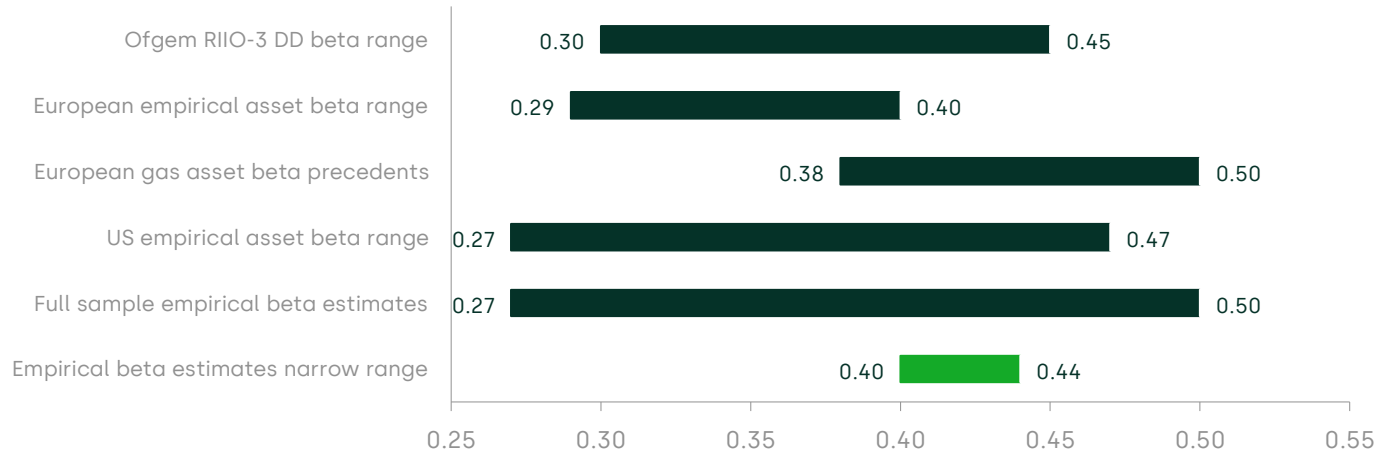
outright, notwithstanding any differences in regulatory regimes and net zero risks between GB and the USA, for the following reasons.

- Differences in regulation and net zero risks between US gas networks and GB—and European—gas networks would generally be expected to indicate a lower risk (all else equal) for US gas networks compared to GB and European gas networks. This reflects the fact that forward-looking net zero risks are, if anything, higher in GB than in the US, given differences in policy outlooks and decarbonisation timelines, notwithstanding restrictions adopted in certain US states. With regard to regulatory risk, we note that the evidence does not consistently indicate higher risk for US regimes; for example, Ofgem's own commissioned review of RIIO-1 noted that adopting more ex post mechanisms, as in the US, could reduce the overall risk/return profile, suggesting that US regulatory risk may, in certain aspects, be lower than in GB.
- The increasing divergence between the gas sector on the one hand and the water and electricity sectors on the other—in particular, in relation to how net zero risks may materialise for each sector—justifies expanding the evidence base to US gas networks, as it allows gas-specific risks to be captured that would otherwise not be captured by a beta comparator sample predominantly composed of non-gas comparators (such as Ofgem's comparator sample).

We have derived a gas-specific asset beta range based on empirical evidence on the gas asset betas of European and US comparators, as well as regulatory evidence on the gas network asset beta allowances from several European jurisdictions (these include Italy and Spain—the jurisdictions where the European networks that Ofgem added to its comparator sample operate).[8] In that regard, we note that, in the RIIO-3 DD. Ofgem has not responded to the regulatory evidence presented in our previous report.[9] We continue to consider this evidence to be relevant, as it informs Ofgem on the views taken by other regulators on the risks faced by the gas networks that operate within their jurisdictions. As illustrated in the figure below, our analysis suggests that a gas-specific asset beta range of **0.40–0.44** is reasonable.

[8] The jurisdictions we reviewed are France, Germany, Italy, the Netherlands, Portugal and Spain.
[9] Oxera (2024), 'Cost of equity for RIIO-GD3', 29 November.

Asset beta ranges



Note: We exclude asset beta precedents for gas storage and regasification. Numbers are rounded.
Source: Oxera analysis based on Bloomberg data and regulatory decisions

- The low end of this range corresponds to the average of the ten-year asset betas of European gas networks—two of which have ten-year asset beta estimates: Snam and Enagás.
- The high end is anchored by the midpoint of the range of gas network asset beta allowances in European regulatory precedents. Selecting an asset beta point estimate within our proposed gas-specific asset beta range would therefore not put Ofgem out of line with other European regulators.

This range is fully underpinned by European evidence, and is corroborated by US evidence, with the high end of this gas-specific asset beta range matching the average between the average ten-year asset beta of US gas networks, on the one hand, and European gas networks, on the other. The positioning of this range compared to the wider set of evidence would make it more likely that an asset beta allowance picked within this range would account for forward-looking gas-specific risks. Finally, we also observe that it is contained in the upper half of the asset beta range proposed by Ofgem in the DD, i.e. 0.30–0.45.

In forming a judgment on the appropriate asset beta allowance for RIIO-GD/GT3, we understand that Ofgem is likely to attribute some weight to the non-gas evidence presented in the RIIO-3 DD. To reflect this, we assume a wider range of **0.375–0.45**, which corresponds to a truncation of the RIIO-3 range put forward by Ofgem in the DD. Indeed, we also observe that Ofgem's proposed asset beta range of 0.30–0.45 does not address the 'low-beta anomaly' (a phenomenon for which there is extensive evidence) that may lead the CoE estimated using the CAPM to underestimate the required returns for regulated utilities. Therefore, picking an asset beta allowance at the low end of this range is likely to underestimate the asset beta of gas networks.

Cost of equity

Ofgem's proposed allowed CoE for RIIO-3 is a range of **5.06–6.96%** at 60% gearing, with a proposed point estimate of **6.04%** (CPIH-real). This compares to the following Oxera CoE estimates (at 60% gearing, CPIH-real), calculated using our values for the CAPM parameters:

- a range of **6.47–7.43%**, with a midpoint of **6.94%** (CPIH-real, at 60% gearing), based on our gas-specific asset beta range of 0.40–0.44;
- a range of **6.17–7.57%**, with a midpoint of **6.84%** (CPIH-real, at 60% gearing), based on our RIIO-GD/GT3 asset beta range of 0.375–0.45.[10]

We observe that the point estimate of Ofgem's RIIO-3 DD CoE range is below the lower bound of both of our CoE ranges.

Debt premia cross-check

In addition to assessing the CAPM-based CoE estimates discussed above, we have cross-checked Ofgem's and Oxera's CoE ranges against the cost of gas network bonds using two specifications of the test:

1 comparing the ARP for Ofgem's allowance with the DRP, where the former must be at least as high as the latter at all times. We estimate the DRP using three averaging periods: one-month, one-year and five-year averages;
2 implying the minimum appropriate ARP (and CoE) from the DRP estimate, by re-levering the DRP estimate to approximate the DRP at 100% gearing, where in theory it equals ARP. We then imply asset beta from the ARP to estimate the minimum CoE.

All specifications serve as a lower bound for the CoE, but some are tighter than others. The test needs to be passed in all its specifications, given that market conditions that affect credit spreads for a given set of assets would also affect the (required return for the) equity risk of those assets, notwithstanding that some volatility in DRP may be temporary.

The table below summarises the outcome of the considered specifications of the debt premia cross-check for Ofgem's and Oxera's CoE ranges for GD and GT networks at 60% gearing.

[10] The midpoints of the Oxera CoE ranges are based on the midpoints of each of the estimated CAPM parameters. This does not equate to the midpoints of the overall CoE ranges due to rounding.

Summary of debt premia cross-check

	Ofgem (RIIO-3 DD)			Oxera (gas-specific)[1]		
	Low	High	Proposed point estimate	Low	High	Midpoint
Positive ARP–DRP	Pass	Pass	Pass	Pass	Pass	Pass
Implied CoE—one-month	Fail	Pass	Pass	Pass	Pass	Pass
Implied CoE—one-year	Fail	Pass	Fail	Fail	Pass	Pass
Implied CoE—five-year	Fail	Pass	Fail	Fail	Pass	Pass

Note: For Ofgem's RIIO-3 DD and Oxera's gas-specific CoE range, we consider the implied minimum CoE estimates derived using Ofgem's RIIO-3 DD and Oxera's RFR and TMR respectively. For an explanation of how the minimum COE estimates have been implied, see section 6. [1] The same conclusions hold when considering Oxera's RIIO-GD/GT3 CoE range of 6.17–7.57% with a midpoint of 6.84%.
Source: Oxera analysis.

The table shows that Ofgem's proposed point estimate of the CoE allowance fails to meet most of the specifications of the debt premia cross-check on the implied CoE discussed in this report. In contrast, the midpoint of Oxera's range passes all of them. Therefore, we conclude that Ofgem's CoE allowance range from the lower bound of 5.06% to midpoint estimate of 6.04% is set lower than required by investors to compensate them for the addition risk of investing in equity compared with debt.

1 Introduction

In July 2025, Ofgem published the RIIO-3 DD for gas distribution and gas and electricity transmission networks (GD, GT and ET).[11] As part of the RIIO-3 DD, Ofgem set out its proposed methodology for setting the CoE allowance in RIIO-3, and provided its proposed CoE range.[12]

The RIIO-3 DD provides an update on the RIIO-3 Sector Specific Methodology Consultation (SSMC) and SSMD published in December 2023 and July 2024, respectively. The RIIO-3 DD reflects Ofgem's further analysis of the CoE parameters and its response to some of the evidence submitted by stakeholders, including some of the evidence in the reports we wrote for GB GDNs and for the ENA in response to the RIIO-3 SSMD (the 'RIIO-3 SSMD Oxera reports'), and for ENA in response to the RIIO-3 SSMC (together, 'the RIIO-3 SSMC and SSMD Oxera reports').[13, 14]

While the methodology proposed by Ofgem in the RIIO-3 DD incorporates some of the suggestions made in the RIIO-3 SSMD Oxera reports and other analysis,[15] it rejects or omits assessment, or response, to other recommendations.[16]

In this report on behalf of FEN, we review Ofgem's RIIO-3 DD methodology for estimating the CAPM parameters and CoE range, and provide evidence supporting the approaches to the estimation of the CoE range that we consider appropriate. We provide estimates of the RFR and TMR, as well as updates to the beta estimation contained within the RIIO-3 SSMC and SSMD Oxera reports, based on, or in response to, further considerations and evidence presented by Ofgem in the RIIO-3 DD.

The report is structured as follows.

- Section 2 presents a review of Ofgem's RIIO-3 DD position on the RFR, and our response to issues such as the convenience premium and the

[11] Ofgem (2025), 'RIIO-3 Draft Determinations for the Electricity Transmission, Gas Distribution and Gas Transmission sectors', 1 July (accessed 9 July 2025).
[12] Ofgem (2025), 'RIIO-3 Draft Determinations - Finance Annex', 1 July, section 3 (accessed 9 July 2025).
[13] Ibid., para. 1.7 (accessed 9 July 2025).
[14] Oxera (2024), 'Cost of equity for RIIO-GD3', prepared for GB gas distribution networks, 29 November; Oxera (2024), 'RIIO-3 cost of equity', prepared for the Energy Networks Association, 23 February; and Oxera (2024), 'RIIO-3 cost of equity—CAPM parameters', prepared for the Energy Networks Association, 8 November.
[15] For example, including European companies in the sample used to estimate the beta and removing the COLI-CED and serial correlation adjustments from the ex ante TMR.
[16] For example, including the convenience premium in the estimation of the RFR, not placing equal weight to the ex ante and ex post TMR estimates, uplifting the TMR to reflect the higher-interest-rate environment, and estimating the asset beta for gas networks based on gas network comparators.

treatment of the inflation wedge. In this section, we also provide our estimate of the RFR.

- Section 3 presents a review of Ofgem's RIIO-3 DD 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 and the weight to place on the 'historical ex ante' method. In this section, we also provide our estimate of the TMR.
- Section 4 presents a review of Ofgem's RIIO-3 DD position on the beta, and our response to setting a gas-specific beta. In this section, we also provide our estimate of beta for gas networks.
- Section 5 presents our estimate of the CoE range.
- Section 6 presents the debt premia cross-check of Ofgem's and Oxera's CoE ranges.
- Section 7 concludes the report.

2 Risk-free rate

The RFR represents the expected return on an asset that is free of risk—that is, a situation where the expected return exactly matches the realised return on the investment, meaning that no risk is involved. In the CAPM framework, this theoretical risk-free asset is also called a 'zero-beta asset' (i.e. an asset with no sensitivity to overall market risk). The CAPM assumes that all investors are able to borrow and lend unlimited amounts at the RFR. In economies with low sovereign default risk, regulators have generally estimated the RFR by referring to the yield to maturity (YTM) on government-issued bonds (referred to as 'gilts' in the UK), either as a baseline to which they add premia, or as one of the instruments that they rely on. These bonds are typically assumed to be free of default and systematic risk.[17]

Recently, however, there has been discussion in the UK and other parts of Europe about whether government bonds are the best proxy for the RFR. It has been noted that private borrowers, even those with minimal credit risk, cannot borrow at the same rate as the government—in other words, the yield on top-rated corporate bonds (those rated AAA) is generally higher than the yield on government bonds of the same maturity.[18] It has also been argued that government bond yields may fall below the return on a zero-beta asset because these bonds possess special features that create a price premium, usually reducing their yields below the true RFR.

In line with our previous reports, we refer to the spread between the government bond yields and the return on a zero-beta asset as a 'convenience premium'—this spread reflects these special properties of the government bonds. As discussed in the RIIO-3 SSMC and SSMD Oxera reports, we consider that it is important to account for the convenience premium when estimating the RFR, and note 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.[19]

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

[17] 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.
[18] For example, see Oxera (2020), 'Are sovereign yields the risk-free rate for the CAPM?', prepared for the Energy Networks Association, 20 May.
[19] Oxera (2024), 'RIIO-3 cost of equity', prepared for the Energy Networks Association, 23 February, section 2.2.1; and Oxera (2024), 'RIIO-3 cost of equity—CAPM parameters', prepared for the Energy Networks Association, 8 November, section 2.1.

Box 2.1 Ofgem's RIIO-3 DD approach for estimating the risk-free rate

Ofgem's proposed RFR estimate is based on the following methodology and set of assumptions.

- **Benchmark yield:** Ofgem confirmed the use of the 20-year ILG as a benchmark for setting the RFR.
- **Averaging period and indexation:** Ofgem confirmed the use of a one-month average of historical 20-year ILG yields. Ofgem also 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').
- **Inflation:** Ofgem continued to estimate the wedge between the Retail Price Index (RPI) and CPIH (RPI–CPIH wedge) using (i) official forecasts of CPI and RPI from the 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 did not include a CPI–CPIH wedge.
- **Convenience premium:** Ofgem confirmed that it does not intend to include a convenience premium in the RFR allowance.
- Based on the above, **Ofgem's proposed RFR** is 2.01%.

Note: [1] The OBR's forecasts of RPI and CPI cover only the first four financial years of RIIO-3 (2027, 2028, 2029 and 2030). For the financial year 2031, Ofgem estimated the value of RPI by taking a weighted average of the OBR's long-term forecast of RPI (2.8%) and CPI (2.0%) to account for the RPI and CPIH convergence.
Source: Oxera (2024), 'RIIO-3 cost of equity—CAPM parameters', prepared for the Energy Networks Association, 8 November, section 2; Ofgem (2025), 'RIIO-3 Draft Determinations - Finance Annex', 1 July, paras 3.6–3.32 (accessed 9 July 2025); Ofgem (2025), 'RIIO GDT3 Allowed Return on Equity Summary File_Draft Determinations_Jun25.xlsx.', 1 July.

We continue to disagree with Ofgem's exclusion of the convenience premium when estimating the RFR in the RIIO-3 DD. In section 2.1, we present further evidence to support the inclusion of the convenience premium. In section 2.2, we discuss the

available evidence on the CPI–CPIH wedge and whether it should be included in the estimation of the RFR. In section 2.3, we present our estimate of the RFR.

2.1 Convenience premium

In the RIIO-3 DD, Ofgem did not accept the evidence submitted by stakeholders and it confirmed its SSMD position of excluding any allowance for a convenience premium in the RFR. Ofgem justified the exclusion of the convenience premium based on various arguments. These are discussed in turn below.

2.1.1 UKRN guidance

In the RIIO-3 DD, Ofgem stated that while the UKRN guidance highlights that recently there has been a debate as to whether real government bonds alone provide a sufficient proxy for the RFR, Ofgem's recommendation remains to estimate the RFR using ILGs.[20] Specifically, as highlighted by Ofgem, the UKRN states that:[21]

> While noting arguments for a convenience yield in gilts, this is not a well-established topic in economic regulation, and the taskforce notes that in academic literature there are no empirical estimates of the convenience yield in index-linked gilts at the 10-20 year CAPM investment horizon used by most regulators. Given divergence in approaches across regulators, this guidance does not therefore propose alignment to a particular stance [...]

This excerpt from its guidance suggests that UKRN does not dismiss the existence of a convenience premium, but it observed a lack of empirical evidence at the ten- and 20-year investment horizons, in deciding to not recommend 'a particular stance' on the inclusion of a convenience premium. In fact, the UKRN guidance also states that:[22]

> However regulators should clearly set out their assessment of the evidence base in making their decisions. Regulators identify this as an area that may benefit from further work to consider the necessity of adjustments to index-linked gilt yields at the 10-20 year horizon.

In section 2.1.5 below, we empirically show that a large and positive convenience premium can be found across the gilts yield curve, including at the ten- and 20-year investment horizons mentioned in the UKRN guidance.

[20] Ofgem (2025), 'RIIO-3 Draft Determinations - Finance Annex', 1 July, para. 3.21 (accessed 9 July 2025).
[21] UKRN (2023), 'UKRN guidance for regulators on the methodology for setting the cost of capital', p. 14 (accessed 24 July 2025).
[22] UKRN (2023), 'UKRN guidance for regulators on the methodology for setting the cost of capital', p. 14 (accessed 24 July 2025).

2.1.2 The RIIO-2 appeals precedent

In the RIIO-3 DD, Ofgem reiterated that, as part of the RIIO-2 appeals, the CMA concluded that Ofgem's decision to rely solely on ILGs when estimating the RFR was 'not wrong'.[23]

As discussed in the RIIO-3 SSMD Oxera report for ENA, we do not consider that the CMA's conclusion in the RIIO-2 appeals implies that using ILGs as the sole proxy for the RFR can be considered a better approach than a combination of ILGs and AAA non-government bonds—the approach the CMA itself used for the PR19 redeterminations.[24]

Furthermore, while considering Ofgem's approach to be 'not wrong', the CMA reiterated that there was evidence that supports the existence of a convenience premium:[25]

> [...] we agree that ILGs are an imperfect proxy for the RFR (a view shared by GEMA [Gas and Electricity Markets Authority]). Specifically, **we noted that there is evidence to support the notion of a convenience yield in government-issued securities**, and we disagreed with the view that the appropriate investor when considering the RFR is a net lender. [Emphasis added]

2.1.3 Alternative calculation of the convenience premium

In the RIIO-3 SSMD Oxera report for ENA, we criticised Ofgem's proposed methodology for estimating the convenience premium based on adjusting AAA non-government bond yields for credit and liquidity risks and comparing the result with gilt yields.[26] In the same report we also highlighted that Ofgem's finding of a negative convenience premium was driven by methodological errors.[27]

In the RIIO-3 DD, Ofgem reiterated that estimating the convenience premium by adjusting the AAA bond data to account for higher liquidity and credit risk was considered by the CMA in its PR19 redeterminations, originally based on suggestions from Oxera's analysis of historical risk premia.[28]

As discussed in the RIIO-3 SSMD Oxera report for ENA, and as acknowledged by Ofgem, the approach based on adjusted AAA non-government bonds has been

[23] Ofgem (2025), 'RIIO-3 Draft Determinations - Finance Annex', 1 July, para. 3.21 (accessed 9 July 2025).
[24] Oxera (2024), 'RIIO-3 cost of equity—CAPM parameters', prepared for the Energy Networks Association, 8 November, p. 13.
[25] Competition and Markets Authority (2021), 'Cadent Gas Limited, National Grid Electricity Transmission plc, National Grid Gas plc, Northern Gas Networks Limited, Scottish Hydro Electric Transmission plc, Southern Gas Networks plc and Scotland Gas Networks plc, SP Transmission plc, Wales & West Utilities Limited Vs the Gas and Electricity Markets Authority—Final determination Volume 2A: Joined Grounds: Cost of equity', 28 October, para. 5.68.
[26] Oxera (2024), 'RIIO-3 cost of equity—CAPM parameters', prepared for the Energy Networks Association, 8 November, pp. 18–22.
[27] Ibid., pp. 19–22.
[28] Ofgem (2025), 'RIIO-3 Draft Determinations - Finance Annex', 1 July, para. 3.27 (accessed 9 July 2025).

superseded by recent regulatory determinations, including the CMA's PR19 redeterminations, in which this approach was discussed and ultimately disregarded in favour of a simpler approach based on the average of gilts and non-government bond yields.[29]

In addition, in the RIIO-3 SSMD Oxera report for ENA we highlighted that the estimation of the credit and liquidity risk premium is characterised by a significant degree of uncertainty. As such, relying on a single point estimate can be problematic, which is also why, in our previous submissions, we identified a wide range for the credit risk premium.[30]

Furthermore, the credit risk should be already reflected in the yield of both government and non-government bonds, according to their respective credit ratings. As presented in Figure 2.1, our estimate of the convenience premium is based on non-government bonds with a AAA credit rating, which is broadly comparable to the sovereign credit rating of the UK.[31] As such, under our approach, there is no need to adjust the convenience premium for any incremental credit risk.

In section 2.1.4 below we discuss the reasons why an adjustment to the convenience premium to account for the liquidity premium is not warranted.

Based on the above, we continue to consider that Ofgem's alternative estimation is not a consistent and robust approach to estimating the convenience premium, even as a cross-check of our convenience premium estimate. Instead, we maintain that Ofgem should rely on a methodology that has built on recent regulatory determinations from the CMA, the CAA and the UR. Specifically, Ofgem should estimate the convenience premium comparing the yield on AAA rated non-government bond indices with the yield on duration-matched zero-coupon nominal gilts.

2.1.4 Alternative interpretation of the convenience premium

In the RIIO-3 DD, Ofgem noted that the inclusion of AAA bond data could confuse the liquidity premium embedded in thinly traded assets with any convenience yield embedded in the yield of gilts.[32]

[29] Oxera (2024), 'RIIO-3 cost of equity—CAPM parameters', prepared for the Energy Networks Association, 8 November, p. 18; and Ofgem (2025), 'RIIO-3 Draft Determinations - Finance Annex', 1 July, para. 3.27 (accessed 9 July 2025).
[30] Oxera (2024), 'RIIO-3 cost of equity—CAPM parameters', prepared for the Energy Networks Association, 8 November, p. 21.
[31] The UK credit rating is AA-/AA/Aa3, according to Fitch, S&P and Moody's respectively. Fitch Ratings (2025), 'Fitch Affirms United Kingdom at 'AA-'; Outlook Stable', 28 February; Moody's Investor Services (2025), 'Government of the United Kingdom – Aa3 stable: Regular update', 27 May; S&P Global (2024), 'Research Update: United Kingdom 'AA/A-1+' Ratings Affirmed; Outlook Stable', 18 October.
[32] Ofgem (2025), 'RIIO-3 Draft Determinations - Finance Annex', 1 July, para. 3.28 (accessed 9 July 2025).

Unlike Ofgem, we find that, overall, the superior liquidity of government bonds is consistent with the explanations of the existence of the convenience premium in the academic literature. For example, Krishnamurthy and Vissing-Jorgensen (2012) explain that the unique 'money-like' properties of government bonds drive the existence of the convenience yield through both extreme liquidity and safety.[33]

The liquidity component of the convenience premium embedded within the pricing of gilts does not contradict the existence of the convenience premium. In fact, if two assets have close to zero default risk (as in the case of gilts and AAA rated non-government bonds), the liquidity premium on the asset that is less liquid (the non-government bond) would drive the convenience premium on the more liquid asset (the government bond).

Indeed, one of the reasons why government bonds attract a convenience premium is their high liquidity and 'money-like' features. Therefore, attempting to adjust the estimate of the convenience premium to reflect the high liquidity of government bonds would result in an underestimation of the convenience premium.

It is also important to note that our estimation methodology does not place full weight on the yields implied by the benchmark indices. Instead, similarly to the methodology used by the CMA in the PR19 redeterminations, we calculate the implied convenience premium by considering the premium implied by the difference in the gilt yields and the average yields of gilts and benchmark indices—further refined to control for the duration of the instruments. This implicitly assumes that the RFR available to investors is at the midpoint of the gilt and AAA non-government bond yields.

2.1.5 Insufficient supporting evidence on the convenience premium

In the RIIO-3 DD, Ofgem discussed how stakeholders had not provided 'compelling' evidence supporting the inclusion of a convenience premium when estimating the RFR. Specifically, Ofgem argues that the literature and empirical estimates presented by stakeholders do not provide evidence of a convenience premium in UK gilts at the 20-year investment horizon, and that some of the evidence presented suggests that during periods of market distress government bonds tend to be the only asset considered to be risk-free.[34]

In this section, we respond to the points raised by Ofgem in relation to the papers we cited in the RIIO-3 SSMD Oxera report for ENA, and we present new evidence supporting the inclusion of a convenience premium when estimating the RFR.

[33] Krishnamurthy, A. and Vissing-Jorgensen, A. (2012), 'The Aggregate Demand for Treasury Debt', *Journal of Political Economy,* **120**:2.
[34] Ofgem (2025), 'RIIO-3 Draft Determinations - Finance Annex', 1 July, paras 3.23–3.32 (accessed 9 July 2025).

Evidence from the academic literature

In relation to the supporting literature that we cited as part of the RIIO-3 SSMC and SSMD Oxera reports, we agree that none of the papers seeks to estimate a convenience premium in long-term UK gilts. However, we do not consider this to be a reason for dismissing the evidence presented in these papers.

In relation to Feldhütter and Lando (2008), in the RIIO-3 SSMD Oxera report for ENA we highlighted how this paper shows that most of the drivers of the convenience premium are not linked to the maturity of the underlying instruments. This implies that, even if a convenience premium cannot be directly estimated for 20-year gilts, its value could be inferred by looking at the evidence from shorter-term instruments.

In addition, Ofgem reiterated that this paper shows that 'a range of assets can be assessed as very low risk during more stable markets, but that when there are periods of market distress government bonds tend to be the only asset considered to be risk-free', suggesting that a convenience premium is visible only in periods of distressed financial markets.[35] As discussed in the RIIO-3 SSMD Oxera report for ENA, we disagree with this suggestion. In the following sub-section, we present further evidence on the stability of the convenience premium over time.

Furthermore, we disagree with Ofgem's suggestion that estimating the convenience premium requires a prediction of what type of market will be faced in the future. The existence of a convenience premium is premised on market participants' knowledge that, in the event of a crisis, a government bond would retain liquidity to a greater extent than other assets. This knowledge creates an excess demand for government bonds that suppresses yields beneath the true RFR. The existence of a convenience premium therefore requires only that market participants' perceived likelihood of a crisis is non-zero. It does not depend on forecasting exactly when that crisis would occur, as Ofgem seems to suggest.

In relation to the Bank of England study cited by Oxera, to which Ofgem also referred in the RIIO-3 DD, the authors examined the preferred-habitat behaviour of investors in the gilts market.[36] Specifically, they examined investors' gilt transactions and their stock of gilt holdings to study whether investors show a preference towards a particular maturity for gilts. As discussed in the RIIO-3 SSMD Oxera report for ENA, the authors found that some investor groups in UK government bonds display the behavioural properties that theory associates with

[35] Ofgem (2025), 'RIIO-3 Draft Determinations - Finance Annex', 1 July, para. 3.24 (accessed 9 July 2025).
[36] Ofgem (2025), 'RIIO-3 Draft Determinations - Finance Annex', 1 July, para. 3.25 (accessed 9 July 2025); 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.

preferred-habitat investors.[37] The paper found that these groups of investors, which comprise institutional investors such as life insurers and pension funds, were 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.

While Acharya and Laarits (2023) find that the convenience premium is likely to increase during periods of distressed financial markets, they do not suggest that a convenience premium can be observed only under these circumstances.[38] Specifically, the authors refer to a widening of the convenience premium at times when the aggregate stock–bond covariance is large and negative, suggesting that a convenience premium is also observable during periods of stable financial markets.

In keeping with this evidence, Diamond and Van Tassel (2025) find a persistent and positive convenience premium in UK government bonds across the 2005–20 period. Specifically, the authors measure the convenience yield as the spread between government bond yields and the 'box rate'—a RFR implied by options prices.[39] While the authors focus on short-term instruments, as discussed in relation to Feldhütter and Lando (2008), the convenience premium estimated for short-term instruments could still be informative of the convenience premium embedded in longer-term instruments.

Finally, we note that the authors find a broadly similar level of convenience premium between the USA and UK, suggesting that the evidence from the USA could still be informative of the convenience premium embedded in the gilts.

We also note that the inclusion of a convenience premium when estimating the RFR is supported by the findings of Brennan (1971), which suggests that the appropriate RFR should take account of the difference between an investor's borrowing and saving rates. This issue is also discussed by Berk and DeMarzo (2013) in a section on 'Determining the risk-free rate':[40]

The risk-free interest rate in the CAPM model corresponds to the risk-free rate at which investors can both borrow and save. We generally determine the risk-free saving rate using the yields on U.S. Treasury securities. Most **investors, however, must pay a substantially higher rate to borrow funds**. In mid-2012, for example,

[37] Giese et al. (2021), op. cit.
[38] Acharya, V.V. and Laartis, T. (2023), 'When do treasuries earn the convenience yield? – A hedging perspective', BER Working Paper No. 31863, November.
[39] Diamond, W. and Van Tassel, P. (2025), 'Risk-Free Rates and Convenience Yields Around the World'.
[40] Berk, J. and DeMarzo, P. (2013), *Corporate Finance*, third edition, Pearson, p. 404.

even the highest credit quality borrowers had to pay almost 0.30% over U.S. Treasury rates on short-term loans. Even if a loan is essentially risk-free, this premium compensates lenders for the difference in liquidity compared with an investment in Treasuries. [Emphasis added]

We note that the above is in line with what we discuss in relation to attempting to adjust the convenience premium for the liquidity premium (see section 2.1.4). As highlighted also by Berk and DeMarzo (2013), the high liquidity of the government bonds is one of the drivers of the convenience premium.

In addition, Berk and DeMarzo highlight that, because of the observed difference between an investor's borrowing and saving rates, 'practitioners sometimes use rates from the highest quality corporate bonds in place of Treasury rates'.[41]

This point was considered extensively by the CMA as part of the PR19 redeterminations. Specifically, the CMA concluded that:[42]

We consider it unlikely that the yield on ILGs is a perfect representation of a theoretical RFR (or the average market participant rate in the Brennan approach). We consider that, on balance, **it is likely that the RFR appropriate for a range of relevant investors sits above the return available from ILGs, but below the level suggested by the return on AAA bonds**. [Emphasis added]

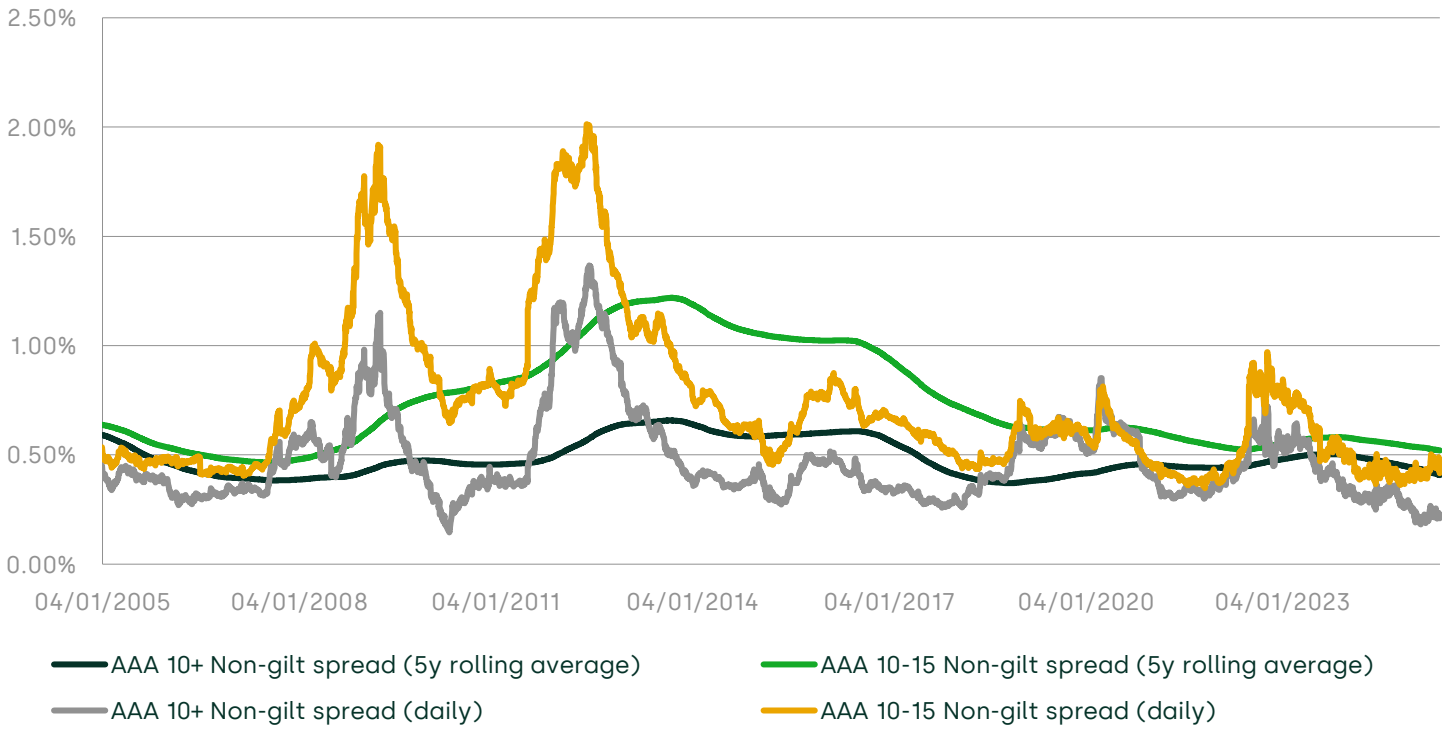
Stability of the convenience premium

As discussed above, we do not agree with Ofgem's suggestion that a convenience premium is visible only in periods of distressed financial markets. While it is true that the convenience properties of government bonds will fluctuate according to market conditions and the perceived level of safety relative to riskier instruments, we find no evidence of the convenience premium disappearing during periods of stable markets.

In Figure 2.1, we present an updated version of the figure we presented in the RIIO-3 SSMD Oxera report for ENA, which shows a large and positive spread throughout the entire period. While the spread between AAA rated bond indices and gilts increased during periods of financial distress (e.g. during the 2008 financial crisis), Figure 2.1 shows that a large spread can be observed even during calm financial markets. This evidence contradicts Ofgem's argument that the spread should be approaching zero in periods of calm financial markets.

[41] Ibid.
[42] Competition and 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. 9.264 (accessed 22 July 2025).

Figure 2.1 Nominal spreads of AAA rated bond indices relative to benchmark government bonds, 2005—23



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 HIS Markit data.

Empirical evidence that 20-year UK gilts have a convenience premium

In relation to our estimate of the convenience premium—based on matching AAA non-government bond indices and UK gilts with respect to the duration of the AAA non-government bond indices—Ofgem suggested that we should match 20-year gilts with AAA rated non-government bonds with a 20-year duration, instead of matching the duration of available AAA rated indices with corresponding gilts.[43]

On this point, we note that the available data on GBP-denominated AAA non-government bonds does not allow us to construct a portfolio with a stable duration of 20 years across the five-year period considered in our analysis in a meaningful and robust way.

In any case, we consider that our estimate of the convenience premium, based on duration-matching, provides sufficient justification for the inclusion of the

[43] Ofgem (2025), 'RIIO-3 Draft Determinations - Finance Annex', 1 July, para. 3.29 (accessed 9 July 2025).

convenience premium, even if it is not based on exactly 20-year gilts. This is because we find it reasonable to assume that the convenience premium does not vary significantly across the gilts yield curve, such that the convenience premium on 20-year gilts can be inferred from the convenience premium observed on shorter-term gilts through our duration-matching approach.

To test our hypothesis, we estimate the convenience premium across the gilts yield curve using the full set of available AAA rated non-government bonds indices. For each index, we calculate the average Macaulay duration over a five-year period and use this to identify a duration-matching gilt benchmark in order to estimate the corresponding convenience premium.[44]

In line with the approach outlined in the RIIO-3 SSMD Oxera report for ENA, we rely on the gilts yield curve estimated by the Bank of England, which reflects the yield on zero-coupon bonds. As a result, the duration on these zero-coupon bonds will equal their maturity.[45]

Table 2.1 below presents the average duration and the number of constituents of each index.

[44] The Macaulay duration measures the weighted average time (in years) until a bondholder receives the bond's cash flows, including both coupons and the final principal repayment.
For zero-coupon bonds, which make no coupon payments and pay only the face value at maturity, the Macaulay duration is exactly equal to the bond's maturity, because the entire cash flow occurs at a single point in time.
[45] Oxera (2024), 'RIIO-3 cost of equity—CAPM parameters', prepared for the Energy Networks Association, 8 November, p. 19.

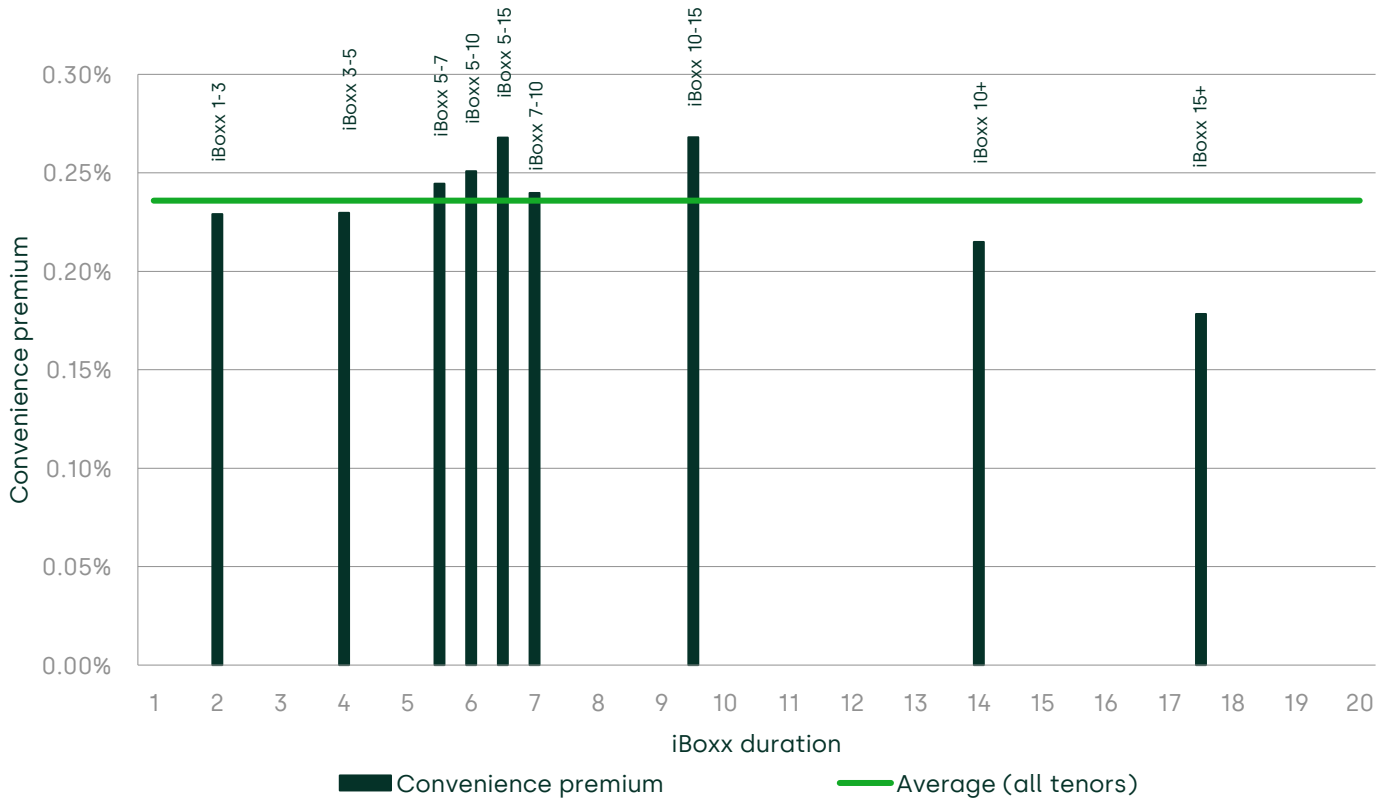
Table 2.1 Characteristics of available AAA rated non-government bonds indices

Index	Average duration	Number of constituents[1]
iBoxx £ Non-gilt AAA 1-3	1.90	68
iBoxx £ Non-gilt AAA 3-5	3.76	50
iBoxx £ Non-gilt AAA 5-7	5.38	16
iBoxx £ Non-gilt AAA 5-10	5.97	23
iBoxx £ Non-gilt AAA 5-15	6.54	28
iBoxx £ Non-gilt AAA 7-10	6.96	7
iBoxx £ Non-gilt AAA 10-15	9.62	5
iBoxx £ Non-gilt AAA 10+	14.20	12
iBoxx £ Non-gilt AAA 15+	17.60	7

Note: [1] As at 31 March 2025.
Source: Oxera analysis using IHS Markit data.

For each index presented in Table 2.1, we estimate the convenience premium by taking half of the five-year average nominal spread between the yield on the AAA rated non-government bond index and the yield on the relative duration-matching gilt. The results of our analysis are presented in Figure 2.2 below.

Figure 2.2 Convenience premium across different AAA rated non-government bond indices (iBoxx £ AAA non-gilt)



Note: The average duration reflects the average Macaulay duration over the last five years. Our analysis relies on the gilts yield curve estimated by the Bank of England, which reflects the yield on zero-coupon bonds. As a result, the duration on these zero-coupon bonds will equal their maturity.
Source: Oxera analysis using IHS Markit, S&P Capital IQ and Bank of England data.

As illustrated in Figure 2.2, our analysis shows that a large and positive convenience premium can be found across the gilts yield curve. Our estimates range between 18bps and 27bps and result in an average convenience premium of 24bps, which is consistent with the value proposed in the RIIO-3 SSMD Oxera report for ENA. This evidence is also in line with the findings of Feldhütter and Lando (2008), which suggest that most of the drivers of the convenience premium are unrelated to the maturity of the underlying instruments.

While none of the available indices had an average duration of 20 years, we note that the 10+ and 15+ indices were fairly close to the 20-year threshold, with an average duration of 14.20 and 17.60 years, respectively. Based on these two indices, we estimate a convenience premium of 21bps and 18bps.

To further test our hypothesis and to directly address Ofgem's concerns in relation to the lack of evidence on the presence of a convenience premium in 20-year gilts, we have examined all available AAA rated non-government bonds indices to identify periods in which some of the indices had a duration of around 20 years.

Between April 2019 and March 2021 the 15+ AAA non-government bond index had an average duration of 20.04 years. Restricting the analysis to the 2019–21 period allowed us to estimate the convenience premium on a duration-matching 20-year gilt, as proposed by Ofgem. The results of this analysis are shown in Table 2.2.

Table 2.2 Convenience premium estimation based on the 15+ AAA non-government bond index, April 2019–March 2021

	Formula	Oxera estimates
Two-year average of AAA 15+ index, nominal	[A]	1.45%
Two-year average of 20-year gilt, nominal[1]	[B]	1.04%
Average AAA 15+ index, gilt	[C] = avg ([A], [B])	1.25%
Convenience premium estimate (2Y)	**[D] = [C] - [B]**	**0.20%**

Note: [1] Our analysis relies on the gilts yield curve estimated by the Bank of England, which reflects the yield on zero-coupon bonds. As a result, the duration on these zero-coupon bonds will equal their maturity.
Source: Oxera analysis using IHS Markit and Bank of England data.

As presented in Table 2.2, our analysis also shows a large and positive convenience premium in the case of 20-year gilts. Despite the limitations of this analysis, we note that the resulting convenience premium of 20bps is consistent with our estimate presented in the RIIO-3 SSMD Oxera report for ENA (27bps) and with the evidence presented in Figure 2.2.

2.1.6 Our estimation of the convenience premium

Building on the discussion above, we consider that adjusting gilt yields to reflect the convenience premium is a necessary step in arriving at an accurate estimate of the RFR, and that relying solely on ILG yields would be an error that underestimates the RFR.

In line with the methodology presented in the RIIO-3 SSMC and SSMD Oxera reports, we estimate the convenience premium over a five-year period, consistent with the duration of the RIIO-3 price controls.

We consider the 10+ and 10-15 AAA non-government bond indices to be the most appropriate benchmark from which to calculate the convenience premium. While Ofgem continued to express concerns about relying on AAA bond indices that are

thinly populated with instruments, we note that their use follows the regulatory precedents set by the CAA and the CMA.[46]

While the 15+ AAA non-government bond index would a priori allow us to more closely track the 20-year investment horizon (than the 10+ and 10-15 indices), we note that a significant proportion of its constituents have very long tenors that deviate from the 20-year investment horizon.[47] For this reason, we consider that the evidence from the 15+ AAA non-government bond index should be considered only as a cross-check of our convenience premium estimate.[48]

Over the last five years, the 10+ and 10-15 AAA non-government bond indices have shown average durations of 14.20 and 9.62 years, respectively. Accordingly, we calculate the convenience premium by matching the AAA non-government bond indices with zero-coupon gilts with a maturity of 14.0 and 9.5 years.

On this basis, we estimate the convenience premium to be 24bps. The results are shown in Table 2.3 below.

[46] Competition and Markets Authority (2021), 'Anglian Water Services Limited, Bristol Water plc, Northumbrian Water Limited and Yorkshire Water Services Limited price determinations, Final report', 17 March; Civil Aviation Authority (2023), 'Economic regulation of Heathrow Airport Limited: H7 Final Decision. Section 3: Financial issues and implementation', March, p. 9.
[47] Over the five-year period under consideration, bonds with more than 30 years to maturity represent over 38% of the 15+ index.
[48] We also note that the 10-15 and 15+ indices are a sub-set of the 10+ index.

Table 2.3 Convenience premium estimation

	Formula	Oxera estimates
Five-year average of AAA 10+ and 10-15 indices, nominal	[A]	3.12%
Five-year average of 9.5- and 14.0-year gilts, nominal[1]	[B]	2.64%
Average of AAA indices, gilts	[C] = avg ([A], [B])	2.88%
Convenience premium estimate (5Y)	**[D] = [C] - [B]**	**0.24%**

Note: The cut-off date for the analysis is 31 March 2025. Discrepancies may be due to rounding. [1] Our analysis relies on the gilts yield curve estimated by the Bank of England, which reflects the yield on zero-coupon bonds. As a result, the duration on these zero-coupon bonds will equal their maturity.
Source: Oxera analysis using IHS Markit and Bank of England data.

In line with the empirical evidence presented in section 2.1.5, Table 2.3 further highlights the importance of accounting for a convenience premium when estimating the RFR to avoid introducing a downward bias in the allowed CoE.

2.2 Inflation

In the RIIO-3 DD, Ofgem estimated the RPI–CPIH wedge based on the same methodology as set out in the RIIO-3 SSMD. Specifically, Ofgem estimated the RPI–CPIH wedge by:[49]

- relying on official forecasts of CPI and RPI from the OBR up to the point of convergence of the RPI and CPIH rates (assumed to be in February 2030);
- assuming a zero wedge for the remaining years until the maturity of the 20-year ILG.

As discussed in the RIIO-3 SSMD Oxera report for ENA, overall we consider this approach to be appropriate.

In the RIIO-3 DD, Ofgem confirmed the RIIO-3 SSMD approach and did not include a CPI–CPIH wedge.[50] However, we note that Ofgem pointed to the OBR's October 2024 Economic and Fiscal Outlook, which assumes a long-run CPI–CPIH wedge of 0.4%.[51] Based on this, Ofgem mentioned that the 2% inflation assumption, based on the Bank of England's CPI target, may understate long-term CPIH expectations. As such, Ofgem mentioned that it would review whether an adjustment to the inflation

[49] Ofgem (2025), 'RIIO-3 Draft Determinations - Finance Annex', 1 July, para. 3.17 (last accessed on accessed 9 July 2025).
[50] Ofgem (2025), 'RIIO-3 Draft Determinations - Finance Annex', 1 July, para. 3.17 (accessed 9 July 2025).
[51] Ofgem (2025), 'RIIO-3 Draft Determinations - Finance Annex', 1 July, para. 3.17 (accessed 9 July 2025); and Office for Budget Responsibility (2024), 'Economic and fiscal outlook', October, pp. 38–39.

assumption and inflation wedge was warranted to reflect the OBR's CPI–CPIH long-run wedge.

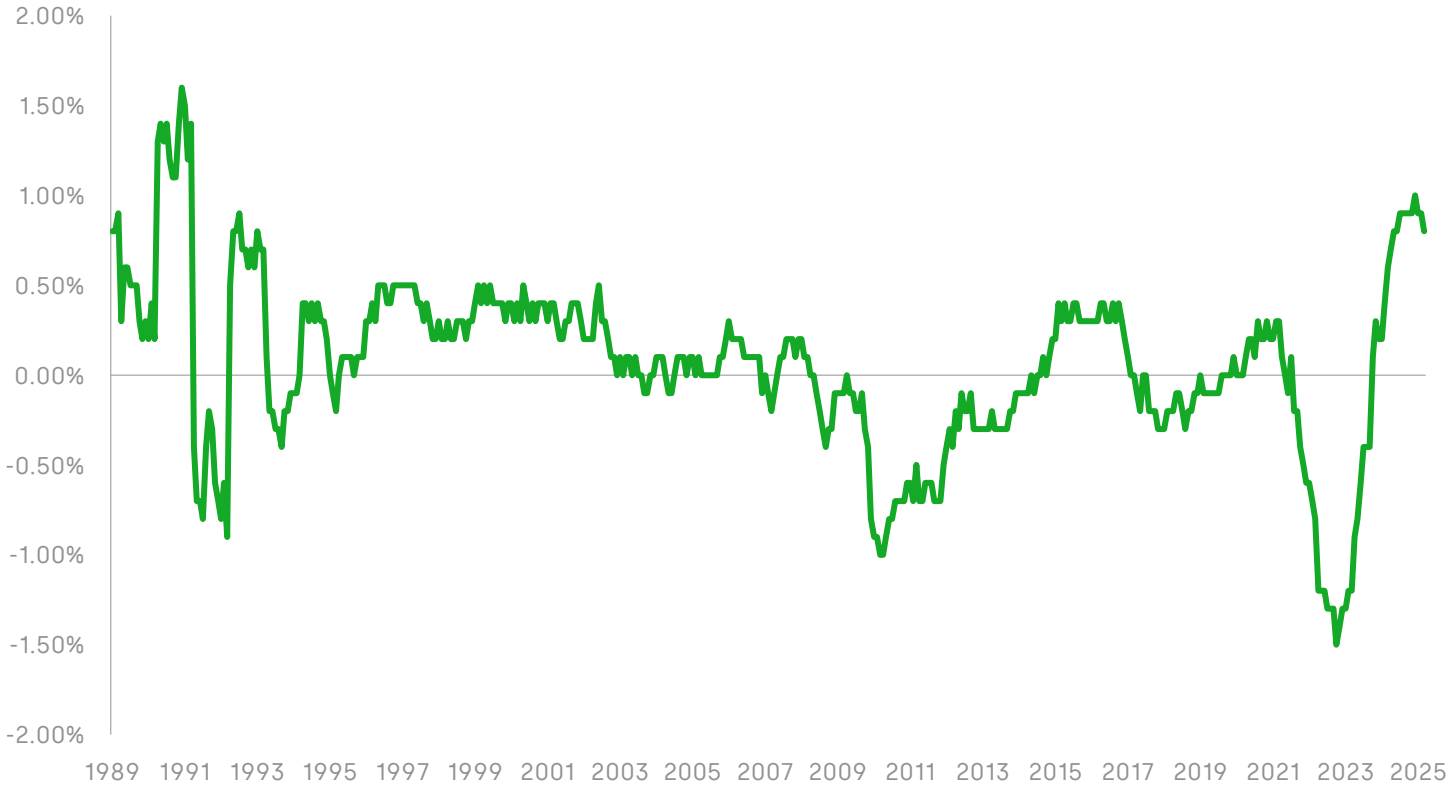
We do not consider it appropriate to include the OBR's CPI–CPIH wedge in the estimation of the RFR. First, historical evidence does not support the existence of a stable or predictable wedge—the observed differential between CPIH and CPI is highly variable over time, with no clear long-term trend.[52] Second, the underlying drivers of estimating the long-term CPIH are conceptually complex and extremely challenging to project reliably. Finally, the OBR has started to publish CPIH forecasts only since its October 2024 report. As a largely untested measure, it lacks the track record and evidential basis needed to support regulatory application. Therefore, introducing a CPI–CPIH wedge into the regulatory framework should not be done without robust and tested evidence of a predictable level of the wedge, at this stage.

2.2.1 Outturn data indicates no persistent or material wedge

As discussed above, the historical evidence does not support the introduction of a wedge between CPI and CPIH in regulatory modelling. As illustrated in Figure 2.3 below, the differential between CPI and CPIH has been highly unstable over time, frequently fluctuating above and below zero, with extended periods in which CPI has exceeded CPIH. This volatility demonstrates that the relationship between the two measures lacks the consistency required to justify the application of a fixed wedge in long-term regulatory assumptions.

[52] Oxera (2024), 'RIIO-3 cost of equity', prepared for the Energy Networks Association, 23 February, p. 33.

Figure 2.3 Historical outturn CPI–CPIH wedge, 1989–2025



Source: Oxera analysis based on Office for National Statistics (ONS) data.

The analysis shows that, over the time horizons typically considered in regulatory decisions, the average wedge is in fact both small and negative. Over the past ten years, the average difference between CPIH and CPI is -0.04%, while over the past 20 years it is -0.12%. These results indicate that CPIH has not exhibited a persistent or material premium over CPI, but rather that the data reflects an unstable relationship between the two indices over time.

The finding above is consistent with Ofgem's own view, as articulated in the RIIO-3 SSMD:[53]

Historical CPI and CPIH rates of inflation have typically been very close on average: between June 2013 and June 2023 (inclusive), average monthly CPIH and CPI inflation varied by only 14bps. This approach has also been adopted by Ofwat and by the CMA. **Although the difference between CPI and CPIH varies in the short term, in making a long-term estimate for RFR commensurate with the use of 20-**

[53] Ofgem (2024), 'RIIO-3 Sector Specific Methodology Decision – Finance Annex', 18 July, para. 3.56 (accessed 23 July 2025).

year ILGs, we consider assuming that CPI is a close proxy for CPIH is appropriate. [Emphasis added]

In this context, the recent suggestion that a CPI–CPIH wedge may now warrant consideration represents a change in Ofgem's position, which is not supported by the evidence of volatility in the estimated wedge.

2.2.2 The underlying parameters are challenging to estimate

The measurement of CPIH differs from CPI by including also (i) owner occupiers' housing (OOH) costs (which represent 16% of the CPIH basket), and (ii) council tax (which represent 3% of the CPIH basket), alongside the same components included in CPI (which account for 81% of the CPIH basket). As council tax is only a small share of the CPIH index, while OOH costs represent a more substantial portion, the assumptions underpinning growth in OOH costs drive the long-term forecast divergence between CPI and CPIH.[54]

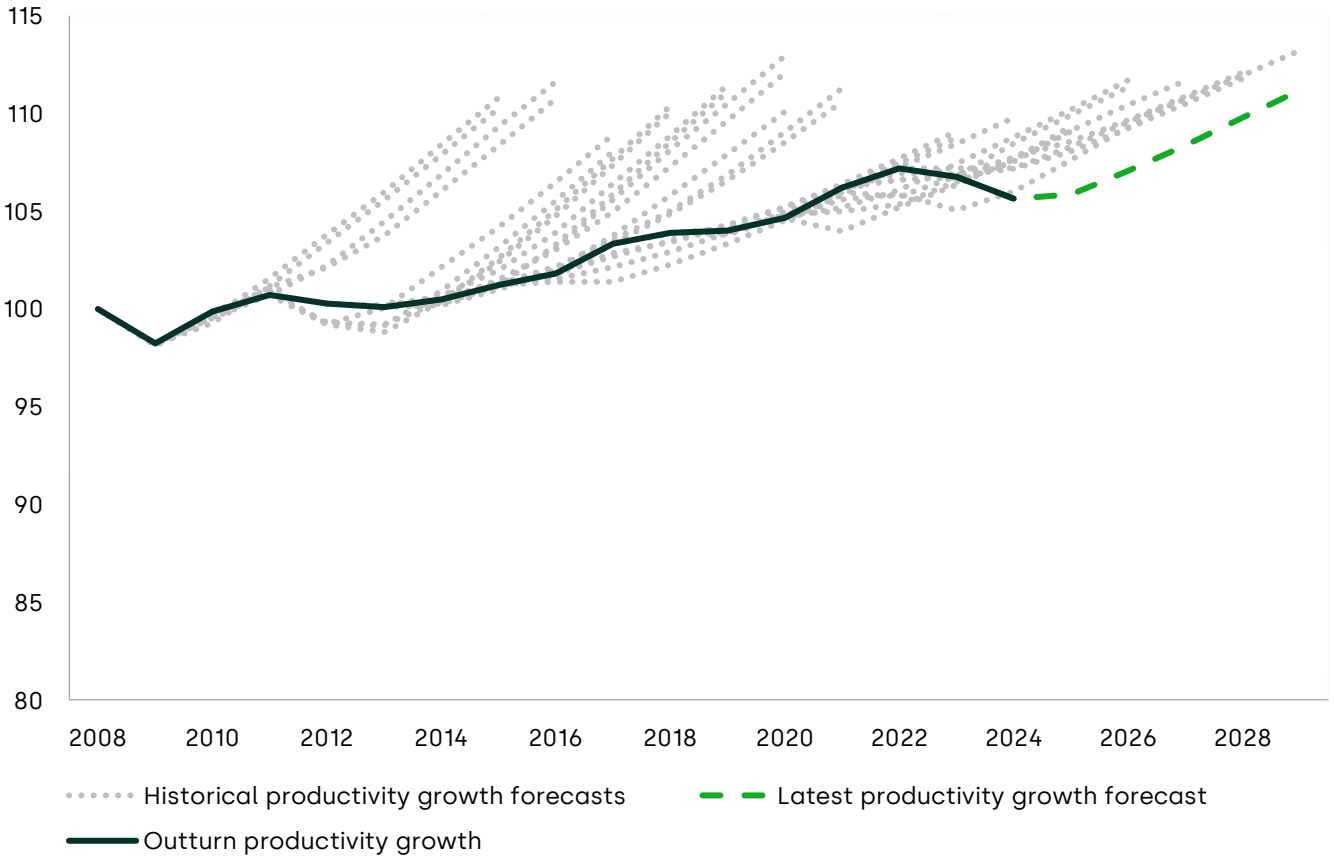
The OBR forecasts long-term OOH costs by growing these in line with CPI actual private rental inflation—which in the long run is assumed to grow in line with average nominal earnings. In turn, the main determinants of average nominal earnings growth, and as such the CPI–CPIH wedge, are assumed to be the GDP deflator and productivity growth, which are assumed to grow at 2.3% and 1.5% respectively.[55]

First, it is unclear why the GDP deflator is a more appropriate index to use when forecasting nominal earnings growth than CPI itself, which is projected to grow at 2%.

Second, it is challenging to forecast productivity growth accurately, with most OBR forecasts of productivity growth materially overshooting outturn growth, as illustrated in Figure 2.4 below.

[54] Office for Budget Responsibility (2024), 'Economic and fiscal outlook', October, pp. 38–39.
[55] Ibid.

Figure 2.4 Productivity growth forecasts and outturn productivity growth (2008=100)



Note: Latest productivity growth forecast is based on the March 2025 OBR Forecast.
Source: Oxera analysis on historical OBR productivity forecasts.

The challenge with forecasting productivity is well documented. For example, Professor David Miles—a member of the Budget Responsibility Committee—has made the following remarks to the Parliamentary Treasury Committee on the gaps between forecasts and outturn results:[56]

Productivity is really difficult to forecast. Fifteen years ago, people thought that the level of GDP in the UK now would be 30% higher than it is. That has been absolutely transformational. It has been catastrophically bad for a long period of time, and I do not think anybody—any economist—really saw that coming. It is a really difficult thing to predict.

A similar debate is present in RIIO-3 in relation to the ongoing efficiency/frontier shift, in which Ofgem proposes to retain an ongoing efficiency target of 1.0% for all

[56] UK Parliament (2024), 'Oral evidence: Economic and fiscal outlook, HC 454', Treasury Committee, 17 April.

companies across RIIO-3,[57] which in itself is higher than productivity growth ranges proposed by the companies in their business plans.[58] The 1.5% long-term annual productivity growth is therefore inconsistent with, and higher than, Ofgem's own assumptions.

More generally, we note that in recent publications the Bank of England highlighted that accurately forecasting inflation has become more challenging in recent years:

Economic forecasters have had a challenging time over the last few years in forecasting the inflation process, given the series of unprecedented and overlapping shocks which have hit the global economy.[59]

The August CPI projection is somewhat higher than the profile in May during the first and second years of the forecast period, and broadly similar in the medium term. There remains considerable uncertainty around the calibration of the Committee's judgement on the path of second-round effects in domestic prices and wages.[60]

Finally, it is worth noting that the OBR has started to publish CPIH forecasts only since its October 2024 economic outlook, explicitly noting that it will 'keep our estimates and forecast methodology under review'.[61] While the OBR published supplementary forecast information in June 2025, these calculations do not address any of the limitations identified in the preceding sections of this report.

Based on the above, we consider that the application of a CPI–CPIH wedge to the long-term CPI forecast is inappropriate at this stage due to the material uncertainty surrounding the forecasting basis and the potential for significant future revisions of the forecast methodology.

2.3 RFR estimate

We estimate the RFR by taking the one-month average 20-year ILG yield using 31 March 2025 as the cut-off date, in line with the approach followed by Ofgem. However, in contrast to Ofgem's RIIO-3 DD approach, we add the convenience premium calculated in Table 2.3. 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 2.4.

[57] Ofgem (2025), 'RIIO-3 Draft Determinations – Electricity Transmission', 1 July, para. 2.10 (accessed 9 July 2025).
[58] For example, in its RIIO-T3 business plan, SP Energy Networks embedded a 0.4% p.a. challenge. SP Energy Networks (2024), 'Cost Assessment and Benchmarking Approach (including RPEs & OE) RIIO-T3 Business Plan SP Energy Networks', 11 December.
[59] Bank of England (2024), 'Outlier or laggard: divergence and convergence in the UK's recent inflation performance – speech by Dave Ramsden', April, p. 2 (accessed 8 August 2025).
[60] Bank of England (2025), 'Monetary Policy Report', August, p. 6 (accessed 8 August 2025).
[61] Office for Budget Responsibility (2024), 'Economic and fiscal outlook', October, pp. 38–39.

Table 2.4 Risk-free rate estimation

	Formula	Ofgem (RIIO-3 DD)	Oxera estimates
20Y ILG yields, RPI-real[1]	[A]	1.91%	1.91%
Convenience premium	[B]	–	0.24%
Benchmark RFR estimate, RPI-real	[C] = [A] + [B]	1.91%	2.15%
RPI–CPIH wedge	[D]	0.10%	0.10%
RFR, CPIH-real	**[G] = (1+[C]) × (1+[D]) - 1**	**2.01%**	**2.25%**

Note: [1] Based on a cut-off date of 31 March 2025. Values may not add up due to rounding.
Source: Oxera analysis and Ofgem (2025), 'RIIO GDT3 Allowed Return on Equity Summary File_Draft Determinations_Jun25.xlsx', 1 July (accessed 9 July 2025).

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 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.[62] Ofgem takes the position that it is inappropriate to change the TMR to reflect prevailing interest rates.[63] However, the TMR is likely to vary over time to some extent, and it is therefore 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 and SSMD Oxera reports, notwithstanding the fact 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 CoE allowance in RIIO-3.[64]

Keeping the regulatory precedent in mind, the TMR can be estimated using a range of methodologies. One method is the historical ex post approach, which is based on the average of observable historical returns. This is the most widely used method. Two other 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.

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

[62] See, for example, UKRN (2023), 'UKRN guidance for regulators on the methodology for setting the cost of capital', p. 16 (accessed 24 July 2025).
[63] Ofgem (2025), 'RIIO-3 Draft Determinations - Finance Annex', 1 July, para. 3.47 (accessed 9 July 2025).
[64] Oxera (2024), 'RIIO-3 cost of equity', prepared for the Energy Networks Association, 23 February 2024, section 2.2.4.

Box 3.1 Ofgem's RIIO-3 DD approach for estimating the total market return

Ofgem's proposed TMR estimate is based on the following methodology and set of assumptions.

- **Approaches:** Ofgem confirmed its approach in the RIIO-3 DD of deriving the TMR by placing equal weight on ex post and ex ante approaches. For the ex post TMR, Ofgem relies on the arithmetic mean of one-year returns. For the ex ante TMR, Ofgem relies on the DMS decompositional approach. We note that, in line with our suggestion in the RIIO-3 SSMD Oxera report for ENA, Ofgem is no longer applying the COLI-CED and serial correlation adjustments when estimating the ex ante TMR.
- **Treatment of inflation:** Ofgem confirmed the use of the following combination of inflation series when estimating the ex post TMR: (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 1989 onwards).
- **Relationship between the TMR and gilt yields:** Ofgem mentioned that it does not believe that it is appropriate to make 'manual adjustments' to the TMR to reflect prevailing interest rates. As such, Ofgem confirmed the RIIO-3 SSMD through-the-cycle approach.
- Based on the above, **Ofgem's proposed TMR range** is 6.80–6.90%.

Source: Oxera (2024), 'RIIO-3 cost of equity—CAPM parameters', prepared for the Energy Networks Association, 8 November, section 3; Ofgem (2025), 'RIIO-3 Draft Determinations - Finance Annex', 1 July, paras 3.33–3.47 (accessed 9 July 2025).

While we note that Ofgem has incorporated some of our suggestions in relation to the ex ante TMR, the approach that it follows to set the TMR remains only partially consistent with the overall methodology outlined in the RIIO-3 SSMD Oxera report for ENA. The main differences are with respect 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:

- the ex post TMR (section 3.1);
- the ex ante TMR (section 3.2);
- the 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 DD, Ofgem confirmed the approach set out in the RIIO-3 SSMD, based on the one-year arithmetic average. As a result, Ofgem proposed to set 6.92% (rounded to 6.90%) as the upper bound of the TMR range.[65]

In line with the RIIO-3 SSMD Oxera report for ENA, we agree with Ofgem's approach of relying solely 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.[66]

While we agree with Ofgem's approach, we have been unable to replicate the value presented in the RIIO-3 DD. As such, in section 3.5, we provide our estimate of the one-year arithmetic average TMR.

We disagree with Ofgem's decision to constrain the top of the TMR range to the historical average, for reasons set out in section 3.4.

3.2 Ex ante total market return

In the RIIO-3 DD, Ofgem confirmed its decision to estimate the ex ante TMR by relying solely on the version of the DMS decompositional approach used by the CMA in the PR19 redeterminations.[67] The ex ante TMR estimated by Ofgem is presented in Table 3.1 below.

[65] Ofgem (2025), 'RIIO-3 Draft Determinations - Finance Annex', 1 July, paras 3.41–3.42 (accessed 9 July 2025).
[66] Dimson, E., Marsh, P. and Staunton, M. (2021), 'Assessment of BNetzA's/Frontier's position on a DMS-based MRP', 21 August, p. 16 (accessed 18 September 2024).
[67] Ofgem (2025), 'RIIO-3 Draft Determinations - Finance Annex', 1 July, paras 3.38–3.40 (accessed 9 July 2025).

Table 3.1 Ofgem ex ante total market return based on the DMS decompositional approach

	Formula	Value
Geometric mean dividend yield	[A]	4.55%
Growth rate of real dividends	[B]	0.64%
Geometric mean ex ante TMR	[C]=[A]+[B]	5.19%
Geometric-to-arithmetic conversion	[D]	1.61%
Raw arithmetic ex ante TMR	[E]=[C]+[D]	6.79%
COLI-CED adjustment	[F]	–
Serial correlation adjustment	[G]	–
Final arithmetic ex ante TMR estimate	**[H]=[E]+[F]+[G]**	**6.79%**

Source: Ofgem (2025), 'RIIO-3 Draft Determinations - Finance Annex', 1 July, Table 15 (accessed 9 July 2025).

As illustrated in Table 3.1, as part of the RIIO-3 DD, Ofgem incorporated our suggestion of excluding the COLI-CED and serial correlation adjustments.[68] Specifically, Ofgem acknowledged that the COLI-CED adjustment was no longer required as DMS now provides the necessary data for calculating the ex ante TMR in nominal terms, which means that the ex ante TMR can be calculated using the same inflation series used for the ex post TMR.[69] In relation to the serial correlation adjustment, Ofgem decided to remove it in recognition of the conflicting views about the presence of a serial correlation in returns.[70] As a result of these changes, the ex ante TMR estimated by Ofgem increased compared with the value estimated in the RIIO-3 SSMD (6.50%).[71]

In line with the RIIO-3 SSMD Oxera report for ENA, we agree with Ofgem's decision to rely solely on the DMS decompositional approach for estimating the ex ante TMR, and we welcome the exclusion of the COLI-CED and serial correlation adjustments from its calculation. However, as discussed in section 3.3, we maintain that Ofgem should not position its approach as: '[w]e continue to recommend we give equal weight to both ex ante and ex post TMR estimates'.

[68] Ofgem previously used the COLI-CED adjustment to account for the difference in the inflation series used by DMS and Ofgem in the 1900–49 period. Ofgem considered that the serial correlation adjustment accounted for potential negative autocorrelation in returns, which could affect the relationship between arithmetic and geometric mean returns.
[69] Ofgem (2025), 'RIIO-3 Draft Determinations - Finance Annex', 1 July, para. 3.39 (accessed 9 July 2025).
[70] Ibid., para. 3.40.
[71] Ibid., Table 15.

Also in the case of the ex ante TMR, we have been unable to replicate the value presented in the RIIO-3 DD. As such, in Table 3.2 we provide our estimate of the ex ante TMR based on the DMS decompositional approach.

Table 3.2 Oxera ex ante total market return based on the 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]	5.19%
Geometric-to-arithmetic conversion	[D]	1.64%
Ex ante TMR	**[E]=[C]+[D]**	**6.84%**

Source: Oxera analysis based on DMS data.

3.3 Weight placed on ex ante total market return

In the RIIO-3 DD, Ofgem acknowledged that, as highlighted in the RIIO-3 SSMD Oxera report for ENA, using the ex ante approach requires subjective adjustments. However, Ofgem did not believe that this detracted from the value of the DMS decompositional approach.[72] As a result, Ofgem confirmed its intention to assign equal weight to the ex ante and ex post estimates when setting the TMR range for RIIO-3.[73]

Ofgem justified its decision to place equal weight on the ex ante and ex post estimates based on UKRN guidance, which proposes that regulators should place weight on historical ex ante evidence.[74] However, while the UKRN guidance suggests that 'the TMR should be primarily based on historical ex post and historical ex ante evidence', it does not recommend assigning equal weight to ex ante and ex post estimates. Given the methodological concerns with the ex ante approach we consider that Ofgem's approach that seeks to place equal weight on ex ante and ex post approaches, when setting the TMR range, remains unjustified.

[72] Ofgem (2025), 'RIIO-3 Draft Determinations - Finance Annex', 1 July, para. 3.44 (accessed 9 July 2025).
[73] Ibid., para. 3.42.
[74] Ofgem agrees with the UKRN that, to the extent that historical returns were not expected ex ante by investors, using achieved returns as a guide to future expectations may be unreliable. Based on the above, Ofgem concluded that an ex ante approach could add balance to an ex post approach. See Ofgem (2025), 'RIIO-3 Draft Determinations - Finance Annex', 1 July, para. 3.44 (accessed 9 July 2025).

Furthermore, as discussed in the RIIO-3 SSMD Oxera report for ENA, we do not consider that the DMS decompositional approach provides the ex ante insight that Ofgem and the UKRN are looking for. This is because the DMS decompositional approach does not actually attempt to predict a forward-looking TMR; rather, it seeks to assess whether the returns that investors were expecting in the past are well approximated by the historical mean.

As illustrated in Table 3.1 above, the ex ante TMR estimated using the DMS decompositional approach is based on historical data on dividend yields and dividend growth rates. Under this formulation, the DMS decompositional approach is more akin to an 'adjusted ex post estimate' than an actual ex ante approach, which would attempt to predict an event before it occurs.

While we welcome the recognition by Ofgem that there is no longer the need to apply a COLI-CED adjustment, and that there is no definitive evidence on serial correlation that would justify adjusting the historical ex ante estimate of TMR, we continue to suggest that Ofgem should inform its TMR range predominantly on the basis of the one-year arithmetic mean approach, and place little to no weight on historical ex ante approaches.

Moreover, we note that while Ofgem argued in favour of placing equal weight to both ex ante and ex post approaches when setting the TMR range, its proposed TMR point estimate reflects the upper bound of the range, which is based only on the ex post approach.[75]

3.4 Total market return determinations and gilt yields

In the RIIO-3 DD, Ofgem clarified that it believes that it is inappropriate to make manual adjustments to the TMR to reflect prevailing interest rates, and that it plans to continue to use cross-checks to assess whether its bottom-up TMR is 'materially' out of line with what investors require.[76] As a result, Ofgem's proposed TMR range reflects only its ex ante (i.e. DMS decompositional approach) and ex post estimates.[77]

In relation to Ofgem's proposed solution to ensure that the TMR is set correctly, we note that Ofgem has not defined what constitutes a 'materially' out-of-line TMR. Instead, Ofgem performed a suite of cross-checks at the CoE level to assess whether the overall allowed CoE is properly calibrated, concluding that its cross-checks support its preferred CoE range.[78] Instead, in section 6, we present the

[75] Ofgem (2025), 'RIIO-3 Draft Determinations - Finance Annex', 1 July, para 3.42 and Tables 17 and 18 (accessed 9 July 2025).
[76] Ofgem (2025), 'RIIO-3 Draft Determinations - Finance Annex', 1 July, para. 3.47 (accessed 9 July 2025).
[77] Ibid, Tables 17 and 18.
[78] Ofgem (2025), 'RIIO-3 Draft Determinations - Finance Annex', 1 July, Table 19 (accessed 9 July 2025).

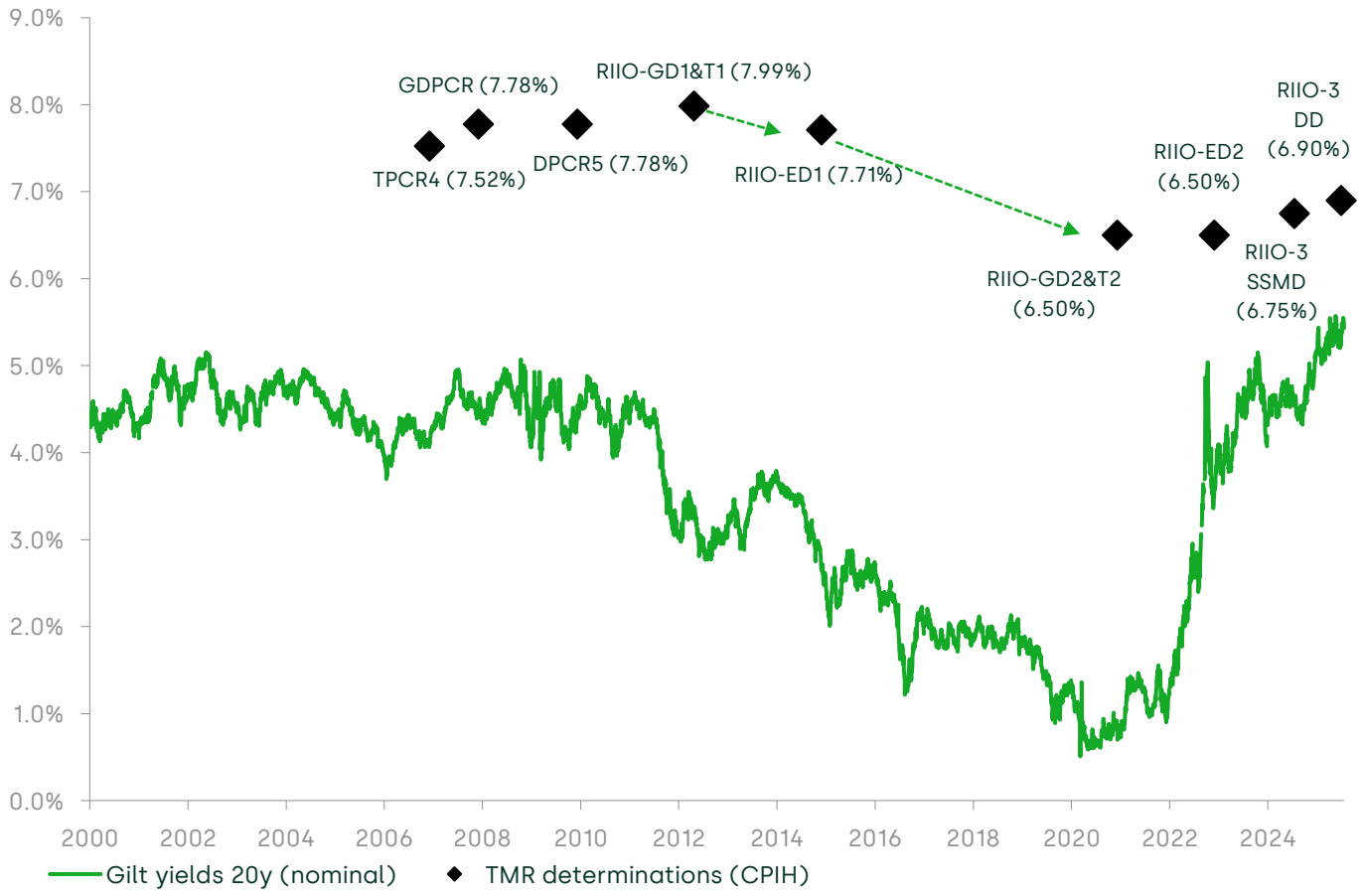
results of our own debt premia cross-check, which show that Ofgem's allowed CoE and the bottom half of its CoE range are too low.

More generally, in the RIIO-3 SSMD Oxera report for ENA, we highlighted that in previous Ofgem decisions the TMR allowance was reduced in an environment of declining gilt yields, and that only a part of these reductions could be explained by the transition from RPI to CPIH.[79] As such, we consider Ofgem's approach in the RIIO-3 DD to be inconsistent with how similar issues were approached in past decisions.

In Figure 3.1 below, we present an update of a figure presented in the RIIO-3 SSMD Oxera report for ENA showing the relationship between Ofgem's allowed TMR and gilt yields.

[79] Oxera (2024), 'RIIO-3 cost of equity—CAPM parameters', prepared for the Energy Networks Association, 8 November, pp. 37 and 40.

Figure 3.1 Historical total market return determinations and underlying gilt yields (CPIH-real)



Note: Historical RPI-real determinations have been converted to CPIH-real using the long-term wedge, as stated by the OBR. We have reflected the changes in the long-term wedges over time. For the years before the Bank of England started targeting CPI, we use the 2.5% RPI target.
Source: Oxera analysis based on Bank of England data and Ofgem determinations: Ofgem (2024), 'RIIO-3 Sector Specific Methodology Decision – Finance Annex', 18 July, Table 5; 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 shown in Figure 3.1, the increase in gilt yields observed in recent years has coincided with only a marginal increase in the allowed TMR. Specifically, between 8 December 2020 and 31 March 2025, gilt yields increased by 4.52% (from -2.58% to 1.93%) on a real basis, while the allowed TMR increased by only 0.4%. In comparison, between 17 December 2012 and 8 December 2020, gilt yields reduced

by 2.56% (from -0.02% to -2.58%) on a real basis, while the allowed TMR decreased by 1.49%.

In keeping with this evidence, in the RIIO-3 SSMD Oxera report for ENA we noted that, in 2024, DMS predicted significantly higher equity returns compared with projections made in 2022. A similar finding can be found in the 2025 yearbook, in which DMS now predicts equity returns that are 240bps higher than projections made in 2022. 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.[80] This further shows how Ofgem's through-the-cycle and fixed TMR risks becoming more and more detached from investors' required returns.

As discussed in the RIIO-3 SSMD Oxera report for ENA, we consider that there is a risk that Ofgem's decision not to adjust the TMR upwards could be interpreted by investors as a signal to expect different treatments in scenarios of increasing and decreasing interest rates. This could undermine investors' confidence and counteract Ofgem's objective of providing a 'stable and predictable' financial framework in a particularly challenging period for the electricity and gas sectors that are facing challenges in relation to investment intensity and/or transition risk.[81]

In our previous reports, we pointed at how the UKRN guidance specifies that regulators should not consider the TMR to be fixed, and also note that 'it is important to recognise that depending on the macroeconomic environment, this largely 'through-the-cycle' approach could either overstate or understate returns required by investors in a specific price determination'.[82] We note that, while Ofgem relies on UKRN guidance to justify the use of both ex ante and ex post TMR approaches, it does not address the concerns about the through-the-cycle approach highlighted in the UKRN guidance.

3.5 Total market return estimate

Based on the discussion above, we consider that the simple arithmetic average based on a one-year holding period is the most appropriate approach to estimate the TMR, with an appropriate adjustment to the through-the-cycle estimate to take into account current market conditions. This is because a TMR based on a very long-run sample could produce results that are no longer representative of the expected market returns at any one point in time.

[80] Dimson, E., Marsh, P. and Staunton, M. (2025), 'UBS Global Investment Returns Yearbook 2025', p. 103.
[81] Ofgem (2025), 'RIIO-3 Draft Determinations - Finance Annex', 1 July, para. 1.4 (accessed 9 July 2025).
[82] See UKRN (2023), 'UKRN guidance for regulators on the methodology for setting the cost of capital', p. 19 (accessed 24 July 2025); and Oxera (2024), 'RIIO-3 cost of equity—CAPM parameters', prepared for the Energy Networks Association, 8 November.

Our analysis points towards a long-run average TMR of 6.95% which, in line with Ofgem's approach, we round up to 7.00%. Similarly 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. When setting our view on the TMR range, we consider that Ofgem should place little to no weight on historical ex ante approaches, as we do not consider the evidence from these approaches to be robust.

Contrary to Ofgem's position, the evidence presented in this section indicates that investors are likely to expect Ofgem to recognise higher required market returns than the central estimate of 7% for the through-the-cycle TMR. Indeed, UKRN guidance cites that 'there is empirical evidence of a positive relationship between real interest rates and real returns on equity, for example, as shown in the DMS Yearbook.'[83]

Given the recent significant and sustained rise in gilt yields, it is reasonable to expect that investors have revised their return expectations upwards. As noted above, adjusting the TMR to reflect the current interest rate environment would align with past regulatory decisions and the UKRN guidance. Historically, when gilt yields were last seen at similar levels (prior to the 2008 financial crisis), the TMR allowance was in the 7.50–8.00% range in CPIH-real terms. Therefore, it is also possible that returns exceeding 7.50% may be necessary.

We consider this point to be of particular importance in the current context of the energy networks. Setting a return that is too low risks causing a welfare loss by not adequately supporting the energy networks in attracting and retaining the necessary capital to carry out the investments required to support the government's net zero objectives.

Frontier's updated analysis on the relationship between TMR and gilts also supports a TMR well above the through-the-cycle value considered by Ofgem.[84] Specifically, Frontier's updated TMR Glider suggests a TMR range of 7.8–8.0% depending on the length of the trailing average.[85] Based on the above, Frontier concludes that the TMR Glider would suggest that the top end of the 7.00–7.50%

[83] UKRN (2023), 'UKRN guidance for regulators on the methodology for setting the cost of capital', p. 20 (accessed 24 July 2025).
[84] Frontier Economics (2025), 'Updated cost of equity cross-check evidence', a report prepared for the Energy Networks Association, August, Section 8.
[85] As discussed by Frontier, 7.8% refers to the value of the TMR Glider based on a two-year moving average, while 8.0% refers to the value of the TMR Glider as at March 2025.

range would be a suitable value of the TMR for RIIO-3, given that cross-check values currently lie beyond the range.

In view of these considerations, it is essential to ensure that the TMR is set at a sufficient level to address the above points. Taking into account the through-the-cycle estimate, as well as gilt yields and the 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**.

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 implies that the movements of a stock are, on average, aligned 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.[86] 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 is the approach that Ofgem intends to follow for RIIO-3.

In Box 4.1 below, we summarise Ofgem's approach in the RIIO-3 DD for estimating the beta.

[86] 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 DD approach to estimating the beta

Ofgem's proposed beta estimate is based on the following methodology and set of assumptions.

- **Timeframe and measurement frequency:** Ofgem confirmed that it would continue to estimate the beta with reference to daily returns over two-, five- and ten-year estimation windows and would not consider rolling averages. In selecting the range, Ofgem placed most weight on the ten-year estimation window.
- **Listed comparator set:** in addition to National Grid and UK water companies (Severn Trent, United Utilities and Pennon), Ofgem confirmed the inclusion of the European utilities (Enagás, Red Eléctrica, Terna and Snam).[1] We note that, in line with our suggestion in the RIIO-3 SSMD Oxera report for ENA, Ofgem reintroduced Pennon in the sample of UK water companies. Ofgem used the same comparator sample for the electricity and gas networks.
- **Index:** Ofgem confirmed the use of local or regional stock markets instead of a global index.
- **Gearing and debt beta:** Ofgem continued to use the enterprise value of gearing as a working definition of gearing and a debt beta of 0.075 in the de-levering of the raw equity beta.[2] The asset beta is re-levered at a notional gearing of 60% for GD and GT.
- **Forward-looking risks:** Ofgem did not make any specific adjustment to its baseline asset beta estimates to separately account for forward-looking risks.
- Based on the above, **Ofgem's proposed asset beta range** is 0.30–0.45 with a point estimate of 0.375. This translates to a re-levered equity beta range of 0.64–1.01 at 60% gearing.

Note: [1] Ofgem ultimately removed Italgas from the sample as it considered the company's beta to be less valuable due to the impossibility of estimating a ten-year beta for it. While Italgas' trading data indeed does not suffice to estimate a ten-year beta, we have checked that its estimated asset beta is 0.39 for the eight-year period for which data is available; this is consistent with our beta range estimate, as set out later in this section. Ofgem also noted that it considered Elia, REN, and Hera but finally excluded them due to limited regulatory comparability, low shares of regulated business, or unexplained low betas. [2] The enterprise value of gearing is computed as net debt divided by market capitalisation plus net debt.
Source: Ofgem (2025), 'RIIO-3 Draft Determinations – Finance Annex', 1 July, paras 3.48–3.67.

We begin this section by reviewing Ofgem's RIIO-3 DD position on the beta estimate for RIIO-GD/GT3 (section 4.1), before updating the empirical evidence presented in our previous report (sections 4.2 and 4.3).[87] We conclude on the appropriate asset beta range in section 4.4.

4.1 Review of Ofgem's RIIO-3 DD position

In the RIIO-3 DD, Ofgem reiterated its SSMD position to use the same asset beta estimate for the electricity and gas sectors.[88] Indeed, it considered that empirical evidence on European asset betas did not allow definitive conclusions to be drawn on the existence of a premium on the asset beta of the gas sector compared to the electricity sector.[89]

Furthermore, Ofgem does not consider the additional risks faced by gas networks in RIIO-3 and beyond to be systematic. In particular, the regulator contends that asset stranding risk—a gas-specific risk in RIIO-3 and beyond—is diversifiable and that it is inappropriate to further adjust the asset beta to address this risk,[90] given that Ofgem considers that changes to the asset beta comparator set and the acceleration of the depreciation of new GD assets are sufficient to address asset stranding risks.[91]

While we agree that the risks faced by UK energy networks and European comparators in the sample are similar, it is not clear to what extent these shared forward-looking risks are captured in the historical beta estimates. Therefore, the inclusion of European comparators does not necessarily ensure that the entirety of GB gas networks' anticipated systematic risks is adequately reflected in the beta estimate. Furthermore, as we discuss in more detail below, it is unclear how a beta

[87] Oxera (2024), 'Cost of equity for RIIO-GD3', 29 November.
[88] Ofgem (2025), 'RIIO-3 Draft Determinations – Finance Annex', 1 July, para. 3.62.
[89] Ibid.
[90] Ibid., para. 3.64.
[91] Ibid., paras 3.118–3.120.

comparator set predominantly composed of non-gas companies accurately reflects gas-specific forward-looking risks.

Furthermore, we have discussed in previous reports that asset stranding risk is an asymmetric risk (i.e. it is exclusively a revenue shortfall risk) that is likely to have a systematic component. To demonstrate this systematic component, we highlighted how decarbonisation policies (and by extension asset stranding risk) may be affected by economic shocks, as exemplified during the 2022 energy crisis that led governments to prioritise affordability and security of supply over decarbonisation efforts.[92]

We further examined empirical evidence showing that (i) debt markets were pricing in a higher risk for gas networks in the long term, and (ii) matched pairs of gas and electricity network betas in Spain and Italy tended to indicate higher gas betas than electricity betas.[93] We note that Ofgem's own DD analysis supports these empirical findings. Indeed, Ofgem is minded to include a 25bps premium in its calculation of the cost of new debt for gas networks.[94] Also, based on Ofgem's asset beta estimates, we note that our conclusion that gas network betas tend to be higher than electricity network betas (based on pairs matched on geography) still stands.[95] We therefore continue to recommend giving due consideration to a gas-specific asset beta range, in order to better account for the systematic component of gas-specific risks.

Notwithstanding this, we also note that the asymmetry of asset stranding risk needs to be compensated. This means that the revenue shortfall risk—i.e. the risk that the current value of the regulatory asset value (RAV) is not returned to the networks through revenue allowances—needs to be compensated. In that regard, Ofgem considers that the acceleration of the depreciation schedule of new GD assets—with the aim to have these assets fully depreciated by 2050, the current net zero date targeted by government—is sufficient (in combination with the use of European energy networks in the beta comparator sample) to mitigate asset stranding risk.[96] With regard to the proposed change in the depreciation schedule of the GD RAV, we consider that it is insufficient to fully address asset stranding risk. Indeed, as the proposed regulatory depreciation policy change affects only new assets, it still leaves GDNs exposed to residual asset stranding risk for the RAV that will not be fully depreciated by 2050—given that the post-2002 additions to the RAV have a regulatory asset life of 45 years.[97] The same holds for the GT assets, which are not affected by a change to the regulatory depreciation

[92] Oxera (2024), 'Risks and investability of the GB gas distribution sector', 1 March, section 2B.
[93] Ibid., sections 2C and 3A.
[94] Ofgem (2025), 'RIIO-3 Draft Determinations – Finance Annex', 1 July, para. 2.20.
[95] Ibid., para. 3.59.
[96] Ibid., paras 3.83 and 3.115.
[97] Ofgem (2025), 'RIIO-3 Draft Determinations – Finance Annex', 1 July, para. 8.9, and Ofgem (2024), 'RIIO-3 Sector Specific Methodology Decision – Finance Annex', 18 July, para. 8.5.

schedule in Ofgem's RIIO-3 DD.[98] In line with what we explained in a previous report, we consider that it is reasonable to use a cost of capital uplift to remunerate networks for any residual asset stranding risk that they bear.[99]

In our previous report, we presented a gas-specific asset beta range of 0.30–0.50, which we narrowed down to 0.40–0.44.[100] In the RIIO-3 DD, Ofgem indicated that it considered this narrowing unjustified.[101] In particular, Ofgem dismissed the higher end of our proposed range, which was partly based on the asset betas of a sample of US gas networks.[102] Indeed, Ofgem explained that it did not consider the asset betas of these comparators 'due to differences in regulation and net zero risks'.[103]

In relation to this comment, we consider that Ofgem has not given due consideration to the following factors.

- Regarding Ofgem's assertion that (forward-looking) net zero risks may be different between GB and the USA, we note that, if anything, such risks are likely to be higher in GB than in the USA, given the different policy outlooks in the two jurisdictions, and in particular the policies followed by the current Trump administration on fossil-fuel use. Nevertheless, we note that, similarly to the UK, State or local authorities in the USA have adopted, or are considering adopting, policies limiting the use of natural gas. This includes policies adopted in jurisdictions where some of our US comparators operate. For example, in its 2024 annual report, Northwest Natural Holdings highlights the legislation implemented by the States of Washington and Oregon (where it operates) outlining targets for a reduction in greenhouse gas emissions.[104] Northwest Natural Holdings goes on to cite measures being considered or implemented to reduce natural gas usage, including, for example, bans on the use of natural gas in new construction.[105] The operator notes that 'such restrictions could adversely impact customer growth or usage and could adversely impact our ability to recover costs and maintain reasonable customer rates.'[106]
- Commenting on the nature of the regulatory differences between the GB and US regimes, Ofgem seems to consider the US regime as more risky than the GB regime. For example, Ofgem notes that 'US utility regulation tends to be on an ex post basis whereas GB regulation is on an ex ante basis, this

[98] Ofgem (2025), 'RIIO-3 Draft Determinations – Finance Annex', 1 July, para. 8.43.
[99] Oxera (2024), 'Risks and investability of the GB gas distribution sector', 1 March, paras 4.8 and 4.73.
[100] Oxera (2024), 'Cost of equity for RIIO-GD3', 29 November, section 2.4.
[101] Ofgem (2025), 'RIIO-3 Draft Determinations – Finance Annex', 1 July, para. 3.66.
[102] Ibid.
[103] Ibid.
[104] Northwest Natural Holdings, 'Form 10-K, Annual Report pursuant to section 13 or 15(d) of the Securities Exchange Act of 1934 for the fiscal year ended December 31, 2024', p. 25.
[105] Northwest Natural Holdings, op. cit., p. 25.
[106] Ibid.

means there is greater risk for US utilities in recovering costs incurred.'[107] It also notes that 'equity investors in GB utilities are protected from inflation due to the indexation of the equity portion of the regulatory asset base whereas US utilities may need to recover unexpected inflationary costs via a supplementary rate case which the regulator may not grant.'[108]

- While a full analysis of the differences in regulatory risk between the US and GB regimes is outside the scope of this report, we note that the *a priori* view that the US regime is riskier than the UK regime is contradicted by other comments on the risk of the US regulatory regime. For example, in a review of the performance of RIIO-1 commissioned by Ofgem, CEPA commented that Ofgem 'could potentially draw on more ex post mechanisms that apply to the entire price control package. These would result in a lower risk/return profile more akin to rate of return regulation in the US'.[109] In any case, if Ofgem's statement on the higher risk of US regimes (due to their ex post nature) were assumed to hold, the use of uncertainty mechanisms in RIIO-3 (as proposed by Ofgem)[110] would then tend to increase the risk of Ofgem's regulatory framework, given the more ex post nature of such mechanisms.

Overall, we acknowledge that there are differences in regulation and net zero risks between US gas networks and GB—and European—gas networks. However, we consider that the differences discussed above, which have been cited by Ofgem, would tend to indicate a lower risk (all else equal) for US gas networks compared to GB and European gas networks. These differences notwithstanding, US gas networks, like GB and European gas networks, face gas-specific risks that may have already been priced into historical betas and that may inform the positioning of a gas-specific asset beta range.

Furthermore, as we highlighted in our previous report, although net zero risks are thematically similar between the gas sector on the one hand and the water sector on the other, we consider that the challenges these sectors face in relation to how net zero risks may materialise are very different, in particular due to divergent investment pathways.[111]

In that regard, we note that, in PR24, Ofwat has adjusted downwards its RCV run-off rates (i.e. how fast it is depreciating the regulated companies' asset base) (implying a longer depreciation period) compared to PR19.[112] This is precisely the opposite to what Ofgem proposed in the RIIO-3 DD for new GD assets, as the

[107] Ofgem (2025), 'RIIO-3 Draft Determinations – Finance Annex', 1 July, para. 3.112.
[108] Ibid.
[109] CEPA (2018), 'Review of the RIIO framework and RIIO-1 performance', March, p. 60.
[110] Ofgem (2025), 'RIIO-3 Draft Determinations Overview Document', 1 July, paras 3.12–3.19.
[111] Oxera (2024), 'Cost of equity for RIIO-GD3', 29 November, paras 2.15–2.17.
[112] Ofwat (2024), 'PR24 final determinations—Aligning risk and return - Appendix', December, p. 57.

regulator is proposing to ensure these assets are fully amortised by 2050,[113] implying shorter depreciation periods.[114] This demonstrates that Ofwat is not foreseeing any asset stranding risk for water assets contrary to what Ofgem is anticipating for gas assets.

A similar remark can be made on the comparison between the gas and electricity sectors—indeed, Ofgem itself highlighted 'structural differences that are likely to emerge' between the sectors to justify the cohort split between ET and the gas sector in the calculation of the cost of debt.[115] Given this divergence between the gas sector and the water and electricity sectors, we continue to consider that expanding the evidence base to US gas networks allows gas-specific risks to be captured that would otherwise not be captured by a beta comparator sample predominantly composed of non-gas comparators, such as Ofgem's proposed beta comparator sample.

We consider that US comparators bring informative value for positioning a gas-specific asset beta range, and that Ofgem should not dismiss the evidence outright, notwithstanding differences in regulatory regimes and net zero risks between GB and the USA. We note that Ofgem has not responded to the evidence presented by Oxera showing strong correlation between US and European betas.

Also, we note that Ofgem has not responded to the evidence on European regulatory precedents that we presented in our previous report. In particular, we showed that European regulatory evidence supported a gas-specific asset beta range of 0.38–0.50, which was only very partially overlapping with Ofgem's proposed SSMD range of 0.30–0.40.[116] In narrowing down our initial gas-specific asset beta range to 0.40–0.44, we gave due consideration to European regulatory evidence.[117] In particular, the high end of our gas-specific asset beta range of 0.40–0.44 was supported by the midpoint of the range of gas network asset beta regulatory allowances.[118] We also note that our analysis of regulatory precedents included decisions by the Italian and Spanish regulators, i.e. countries where the European comparators that Ofgem added to its beta comparator sample operate.

In the rest of the section below, we discuss further the positioning of a gas-specific asset beta range in light of updated empirical and regulatory evidence, which we present in sections 4.2 (European empirical and regulatory evidence) and 4.3 (US empirical evidence).

[113] Ofgem (2025), 'RIIO-3 Draft Determinations – Finance Annex', 1 July, para. 8.9.
[114] Oxera (2024), 'Cost of equity for RIIO-GD3', 29 November, paras 2.15–2.17.
[115] Ofgem (2024), 'RIIO-3 Sector Specific Methodology Decision – Finance Annex', 18 July, para. 2.53.
[116] Oxera (2024), 'Cost of equity for RIIO-GD3', 29 November, section 2.2, paras 2.82 and 2.84.
[117] Ibid., para. 2.82.
[118] Ibid., para. 2.81.

4.2 European gas asset beta evidence

In this section, we start by updating the empirical analysis on the asset betas of European gas networks (section 4.2.1), before discussing European regulatory precedents on gas asset beta allowances (section 4.2.2).

4.2.1 Empirical evidence on European gas asset betas

Below, we present an update of the work undertaken for our previous report for the GB GDNs, estimating the asset betas of the three European gas network operators that we include in our comparator sample: Enagás (Spain), Italgas (Italy), and Snam (Italy).[119] These comparators are also those used by Ofgem in its own beta analysis.

We estimate the asset betas using Ofgem's RIIO-3 DD methodological choices:

- based on daily observations of stock prices and market index returns;
- using the most diversified local index in the relevant currency;
- assuming a debt beta of 0.075;
- estimating gearing based on the book value of net debt and market capitalisation;
- calculating beta estimates over three estimation windows: two, five, and ten years;
- using a cut-off date of 31 March 2025, which is the same as Ofgem's in the DD.

The results of our analysis are presented in Table 4.1. Based on the averages of the betas of the three comparators, we observe an overall asset beta range of 0.29–0.40.

Table 4.1 Asset betas of European networks

Comparators	Two-year	Five-year	Ten-year
Snam	0.29	0.39	0.44
Enagás	0.29	0.29	0.36
Italgas	0.29	0.34	n.a
Average	**0.29**	**0.34**	**0.40**

Note: The cut-off date for the analysis is 31 March 2025.

[119] Ibid., section 2.2.1.

Source: Oxera analysis based on Bloomberg data.

Similarly to Ofgem, we consider that most weight should be given to ten-year betas when positioning the asset beta range.

Also, we note that, in the RIIO-3 DD, Ofgem removed Italgas from the sample of European energy networks[120]—specifically, Ofgem clarified that it considered the evidence from the Italgas beta to be less valuable as it was not possible to estimate a ten-year beta for this company on the cut-off date.[121] While we agree with Ofgem's reasoning, we consider that it will be important to keep monitoring the evolution of Italgas's beta in the coming years.

The analysis of European betas shown above would support a range of 0.36–0.44, overlapping with the upper half of Ofgem's proposed asset beta range (0.30–0.45).

4.2.2 European regulatory precedents

In our previous report, we presented evidence on asset beta allowances in other European jurisdictions, including Spain and Italy—i.e. the countries where the comparators newly added to Ofgem's beta comparator sample operate.[122] We noted that European regulatory precedents on asset beta allowances ranged between 0.38 and 0.50, and used this evidence to support our gas-specific asset beta range of 0.40–0.44, noting in particular that the midpoint of the 0.38–0.50 regulatory evidence range supported the high end of our gas-specific asset beta range.[123]

We note that Ofgem has not responded to this evidence in the DD, even though this evidence could have informed the regulator's judgment on the risks faced by gas networks. Indeed, regulatory evidence allows one to understand the respective views taken by different national regulators on the risks faced by the gas networks that operate within their jurisdictions. This is all the more relevant to consider as Ofgem has added European networks to its beta evidence base on the grounds that net zero risks were similar for GB networks and European networks.[124]

[120] Ofgem (2025), 'RIIO-3 Draft Determinations – Finance Annex', 1 July, para. 3.58.
[121] Italgas was re-listed in November 2016. Therefore, based on a cut-off date of 31 March 2025, it is not possible to estimate a ten-year beta for this company. See 'About Italgas' (accessed 1 August 2025). Nonetheless, while Italgas's trading data indeed does not suffice to estimate a ten-year beta, we have checked that its estimated asset beta is 0.39 for the eight-year period for which data is available; this is consistent with our beta range estimate, as set out later in this section.
[122] Oxera (2024), 'Cost of equity for RIIO-GD3', 29 November, section 2.2.2.
[123] Ibid., paras 2.81–2.84.
[124] Ofgem (2025), 'RIIO-3 Draft Determinations - Finance Annex', 1 July, para 3.58 (accessed 9 July 2025).

Accordingly, we present regulatory precedents on asset beta allowances in other European jurisdictions in order to further inform the positioning of our asset beta range.

Similarly to our previous report, we present these allowances with adjustments to account for different beta calculation methodologies in relation to re-levering and de-levering methodology, and debt beta.[125] As noted in our previous report, we do not consider either of the two adjustments to be superior to the other. Given that one leads to higher asset betas and the other to lower asset betas, we consider that referring to the unadjusted asset beta allowances would not clearly risk under- or overestimating the comparison with Ofgem's range and the positioning of our gas-specific asset beta range.

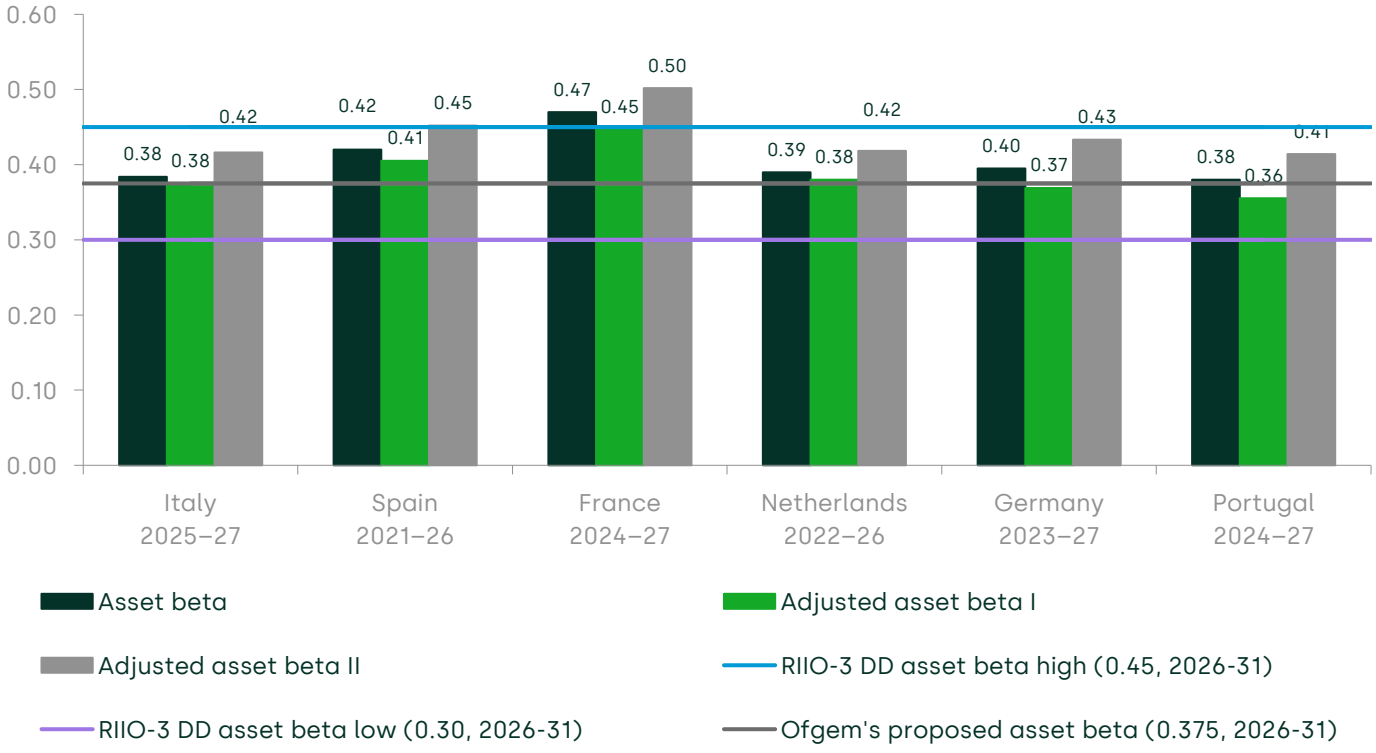
As illustrated in Figure 4.1 and Figure 4.2 below, Ofgem's proposed range of 0.30–0.45 in the RIIO-3 DD is better aligned with the gas asset beta allowances observed in other European jurisdictions, compared with the earlier RIIO-3 SSMD proposed range (0.30–0.40).

Nevertheless, Ofgem's proposed asset beta of 0.375—the midpoint of its proposed DD range—would remain towards the low end of the unadjusted asset beta allowances granted by other European regulators in GT and GD.

- Indeed, unadjusted asset beta allowances for GT range from 0.38 in Portugal and Italy to 0.47 in France, with an average of 0.41 (as shown in Table 4.2) and a midpoint of 0.425. Importantly, Ofgem's proposed asset beta is below this average (and midpoint) and is the lowest allowance in the sample.
- As for the GD estimates, the unadjusted asset betas range from 0.39 in the Netherlands to 0.50 in Spain, for an average allowance of 0.43 and a midpoint of 0.445. Ofgem's proposed asset beta of 0.375 again lies below the sample average (and midpoint) and is again the lowest in the sample.

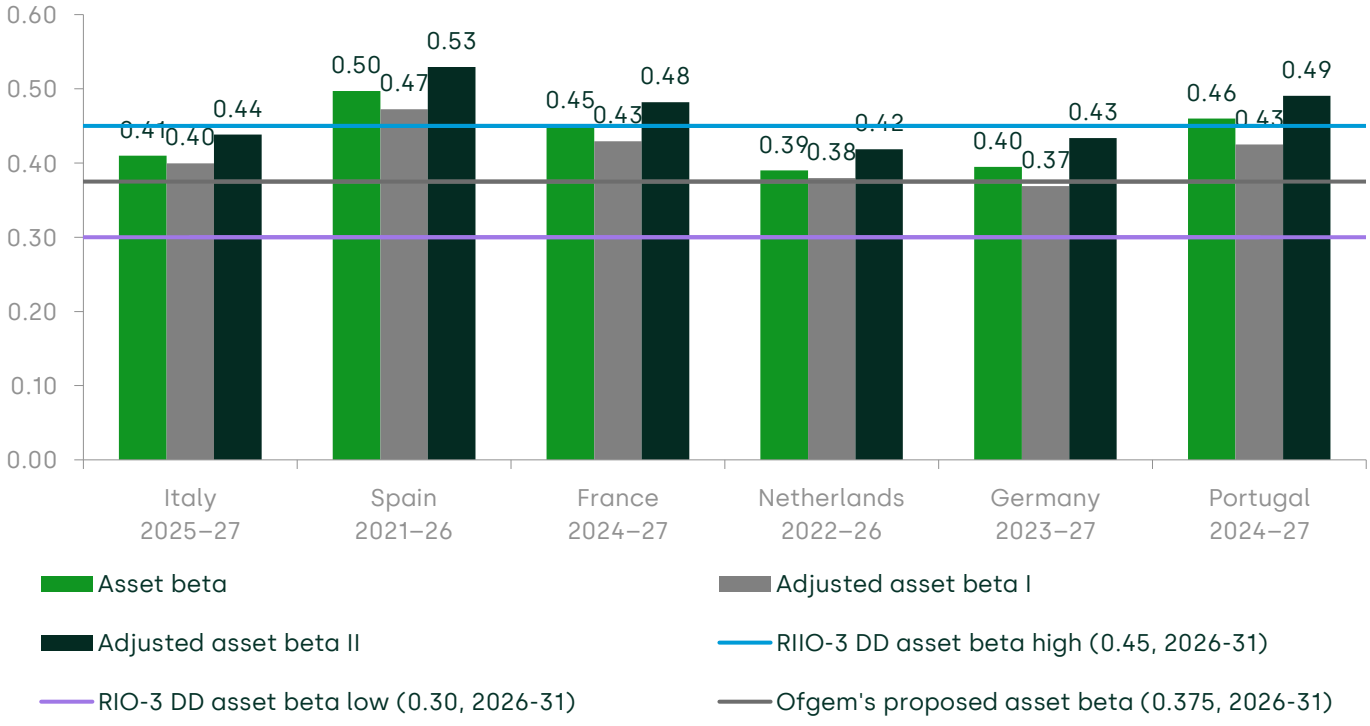
[125] Specifically, the first adjustment de-levers the equity beta allowance in other jurisdictions using Ofgem's de-levering formula (the Harris-Pringle formula), as well as Ofgem's debt beta assumption. The second formula de-levers the equity beta allowance using the de-levering formula used by the relevant regulator (with the Hamada formula being used in all the regulatory decisions we have reviewed), but Ofgem's debt beta assumption. See Oxera (2024), 'Cost of equity for RIIO-GD3', 29 November, paras 2.61–2.64.

Figure 4.1 Comparison of GT asset beta allowances by European regulators



Source: Oxera analysis based on regulatory decisions.

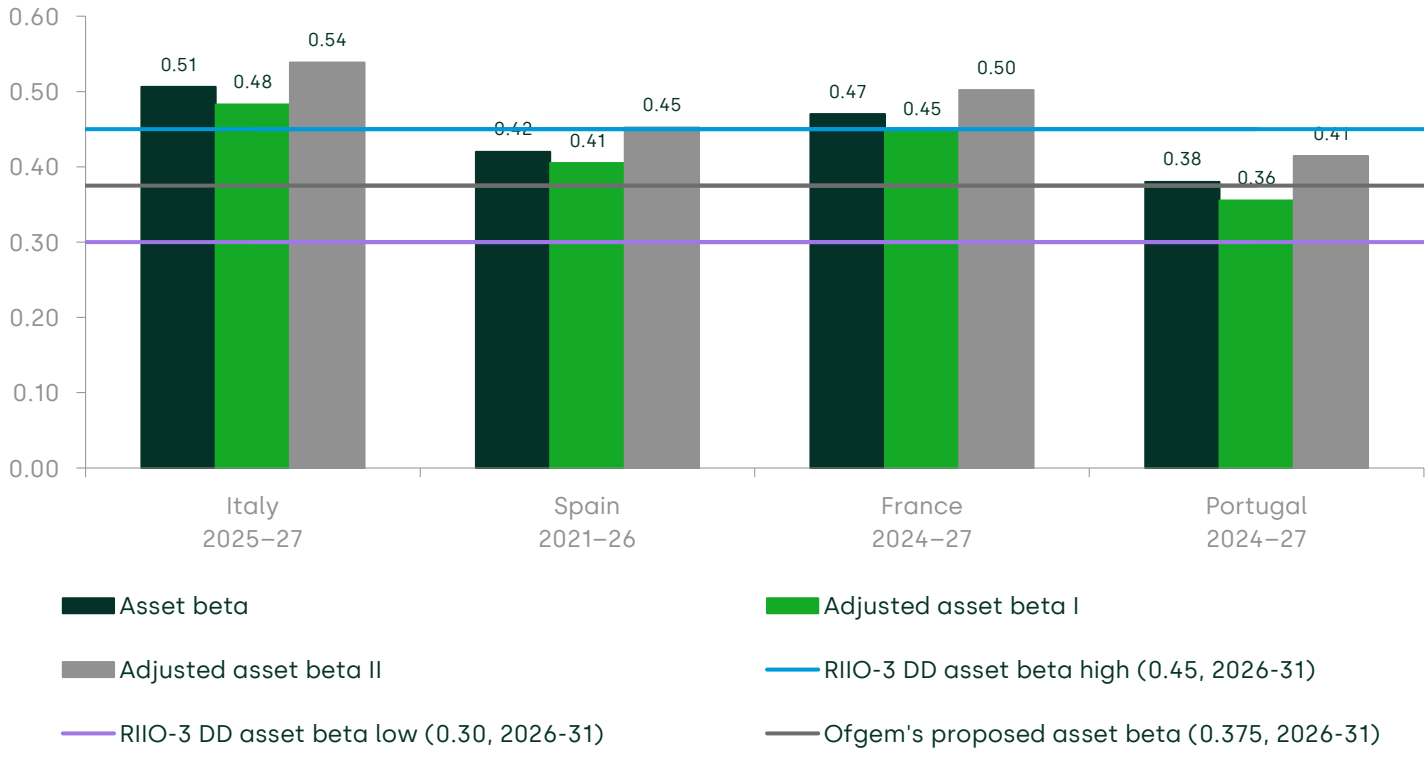
Figure 4.2 Comparison of GD asset beta allowances by European regulators



Note: The regulatory regime of the GD sector in Spain does not require the weighted average cost of capital (WACC) and hence asset beta allowances. However, the Spanish regulator provides an equity beta estimate for GD from which we derive the asset beta.
Source: Oxera analysis based on regulatory decisions.

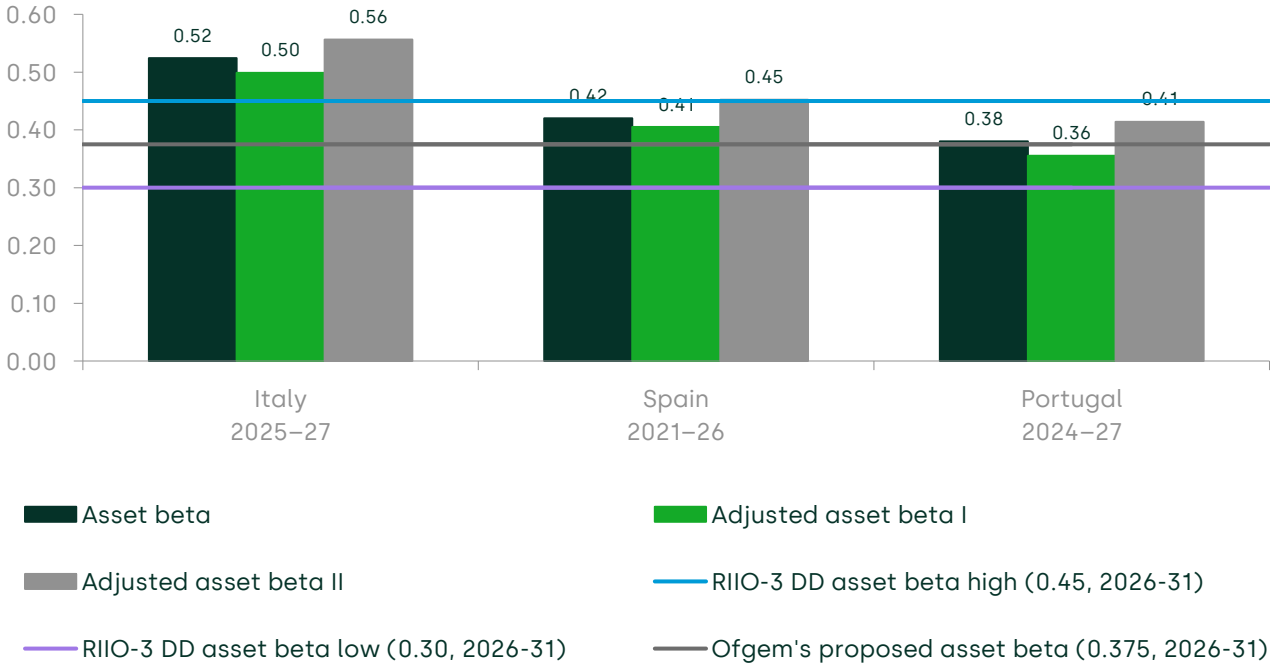
As shown in Figure 4.3 and Figure 4.4 below, asset beta allowances for gas storage and regasification in, for example, France, Italy, and Spain are equal to, or in some cases higher than, those set for transmission and distribution. The unadjusted gas asset beta allowances are above the RIIO-3 DD midpoint of 0.375, and in several instances exceed the high end of Ofgem's range. This suggests that the revised RIIO-3 DD range, while higher than before, is still lower than the beta allowances set in other European jurisdictions considered in this report.

Figure 4.3 Comparison of gas storage asset beta allowances by European regulators



Source: Oxera analysis based on regulatory decisions.

Figure 4.4 Comparison of regasification asset beta allowances by European regulators



Source: Oxera analysis based on regulatory decisions.

Table 4.2 summarises the unadjusted and adjusted asset beta allowances across the four gas sectors that we have considered. While Ofgem's proposed asset beta allowance of 0.375 appears to be more consistent with the overall unadjusted gas asset beta ranges observed in each sector than the proposed point estimate of 0.35 at the SSMD stage, such an allowance would remain lower than the allowances granted by other European regulators.

Table 4.2 Asset beta precedents of different gas sectors

	Gas distribution	Gas transmission	Gas storage	Regasification
Unadjusted asset beta				
Range	0.39–0.50	0.38–0.47	0.38–0.51	0.38–0.52
Average	0.43	0.41	0.44	0.44
Asset beta adjustment I				
Range	0.37–0.47	0.36–0.45	0.36–0.48	0.36–0.50
Average	0.41	0.39	0.42	0.42
Asset beta adjustment II				

Range	0.42–0.53	0.41–0.50	0.41–0.54	0.41–0.56
Average	0.47	0.44	0.48	0.47

Source: Oxera analysis based on Bloomberg data and regulatory decisions.

In conclusion, European regulatory precedents on gas network beta allowances (i.e. disregarding asset beta allowances for gas storage and regasification) range between 0.38 and 0.50, as in our previous report. This supports narrowing a gas-specific asset beta range of 0.36–0.44 (as assessed in section 4.2.1) towards the upper end of that range. We note that any range derived from this narrowing would still be in the lower half of the range derived from regulatory gas network asset beta allowances (i.e. 0.38–0.50), as the midpoint of that range is equal to 0.44.

Furthermore, the evidence suggests that Ofgem's revised RIIO-3 DD asset beta range of 0.30–0.45 improves upon the earlier view in the SSMD by better overlapping with a range of gas asset beta allowances across different European jurisdictions. However, the proposed asset beta point estimate of 0.375 would remain below the average gas asset beta allowance currently applied across European jurisdictions (including, in particular, in Italy and Spain), as well as being at the bottom end of the range for gas transmission and distribution allowed betas—i.e. 0.36 to 0.53, which allows for multiple adjustment methods, to compare precedents between jurisdictions—as summarised in the table above.

4.3 Updated empirical evidence on US gas asset betas

To further inform our assessment of an asset beta for gas networks that would capture gas-specific risks, we maintain a widened sample of international gas network comparators. This broader sample is necessary given the absence of publicly listed pure-play gas networks in GB and the limited number of listed gas networks across Europe. The resulting comparator set includes eight US gas networks (Atmos Energy, Chesapeake Utilities, Kinder Morgan, New Jersey Resources, Northwest Natural Holdings, ONE Gas, Spire Inc, and Southwest Gas Holdings) and three European operators (Enagás, Italgas, and Snam), consistent with the dataset used in the previous report.[126]

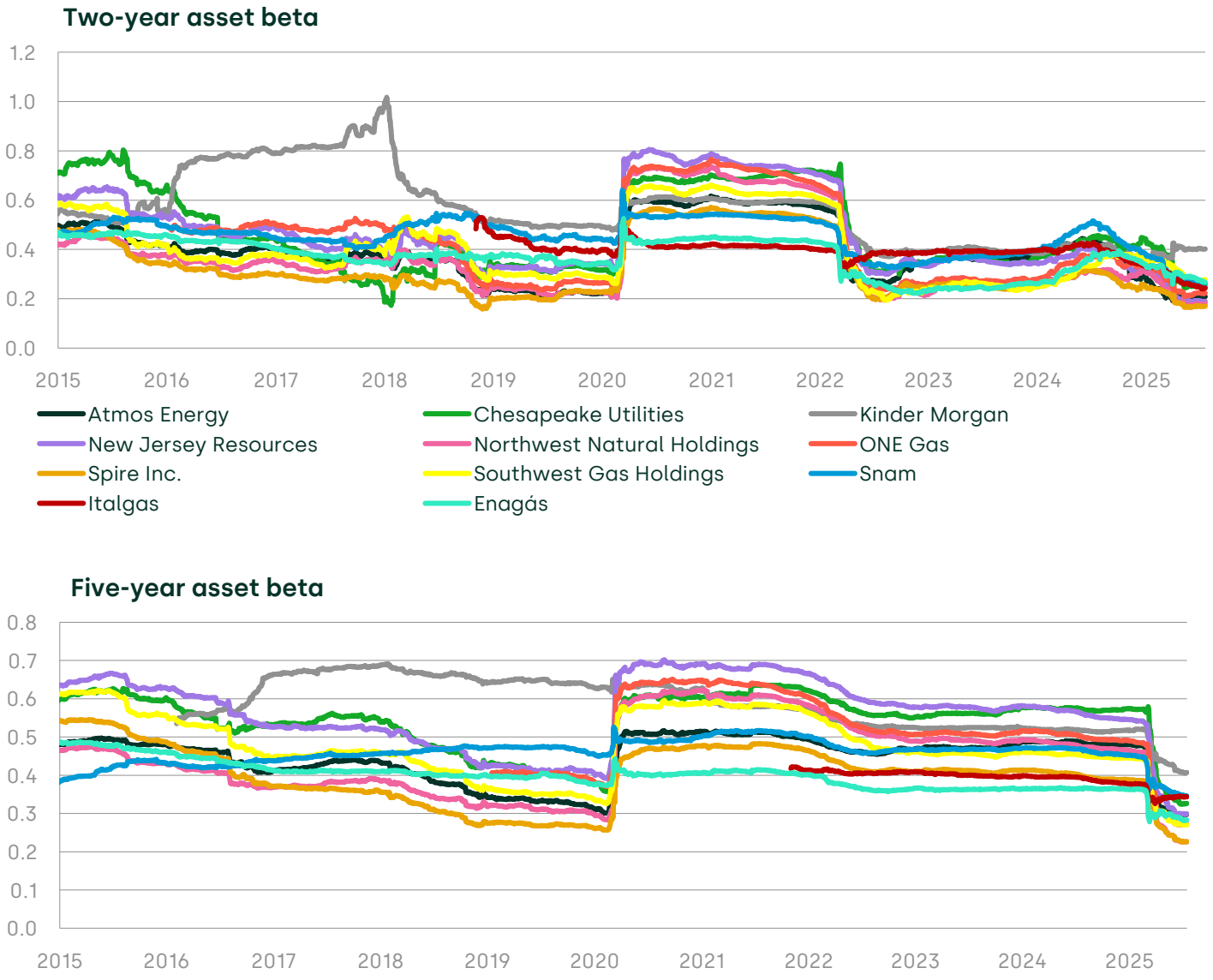
To calculate the asset beta of US networks, we apply the same methodology as that used for the European networks, with the S&P 500 index as the reference market index.

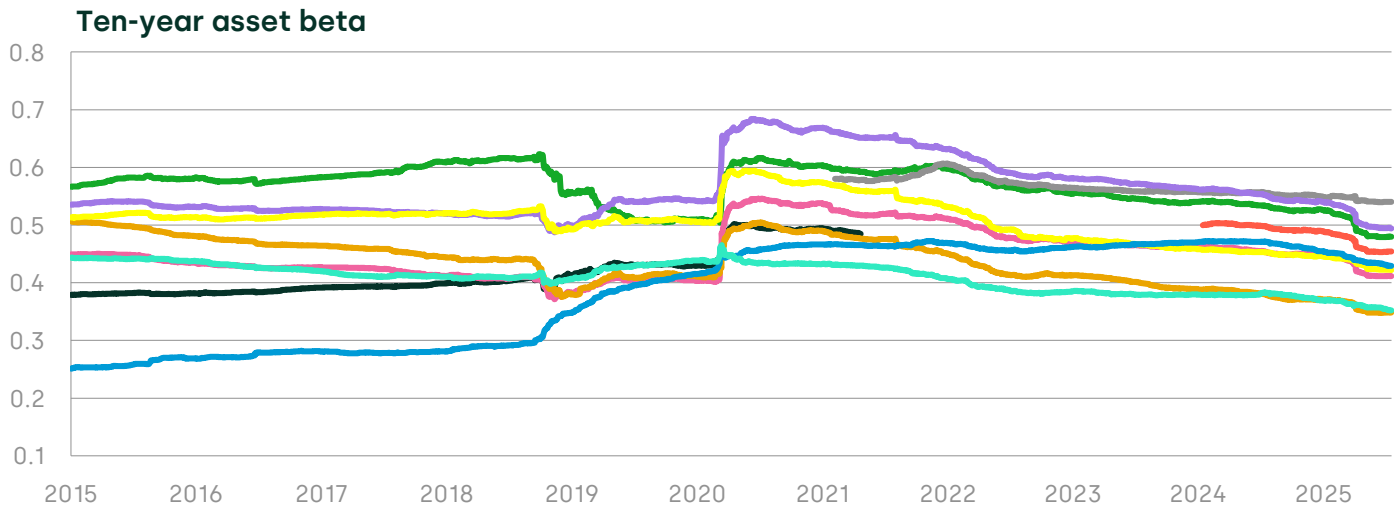
[126] Oxera (2024), 'Cost of equity for RIIO-GD3', 29 November, section 2.3, paras 2.73–2.78. Also, National Fuel Gas is excluded from the analysis due to its asset beta exhibiting weaker co-movement with other firms.

The following figures show the development of asset betas for the individual US and European comparators using two-, five- and ten-year estimation windows, respectively.

It is evident that, while the level of asset betas varies among companies, most asset betas follow a similar trend and pattern over time, and evolve within the same range as each other. This can be observed post-2020, in particular after the economic shock caused by the COVID-19 pandemic. The consistency in the movement of asset betas across the sample provides strong support for the view that these companies are reasonably similar and representative of the gas network sector.

Figure 4.5 Two, five and ten-year asset betas





Note: The cut-off date for the analysis is 31 March 2025. The asset betas are calculated using a 0.075 debt beta assumption, daily data, and gearing estimated with a book value of net debt and market capitalisation. Some companies are not shown in the ten-year beta chart because there is not enough data.
Source: Oxera analysis based on Bloomberg data.

Table 4.3 details the average asset betas of US and European networks. Based on the averages of betas for the USA and Europe, and the simple average of betas of all comparators,[127] we observe an overall asset beta range of 0.27–0.47.

Table 4.3 Average asset betas of US and European networks

Estimation window	Average of betas for the USA	Average of betas for Europe	Average of betas for the USA and Europe	Simple average of betas of all comparators
Two-year	0.27	0.29	0.28	0.28
Five-year	0.38	0.34	0.36	0.37
Ten-year	0.47	0.40	0.43	0.45

Note: The cut-off date for the analysis is 31 March 2025. The asset betas are calculated using a 0.075 debt beta assumption, daily data, and gearing estimated using the book value of net debt and market capitalisation.

[127] Mathematically, the simple average of betas for the USA and Europe (the third column) gives more weight to individual European comparators than the simple average of betas of all comparators (the fourth column). This is because there are more US comparators than European ones.

Source: Oxera analysis based on Bloomberg data.

4.4 Positioning an appropriate asset beta range

In this section, we conclude on an appropriate gas-specific asset beta range (section 4.4.1), and then consider non-gas evidence to derive a RIIO-GD/GT3 asset beta range (section 4.4.2).

4.4.1 Gas-specific asset beta range

The full range of empirical and regulatory evidence on the asset betas of gas networks is wide—from 0.27 to 0.50—and needs to be narrowed down in order to be used to calculate a gas-specific CoE. We narrow down this range based on the following considerations.

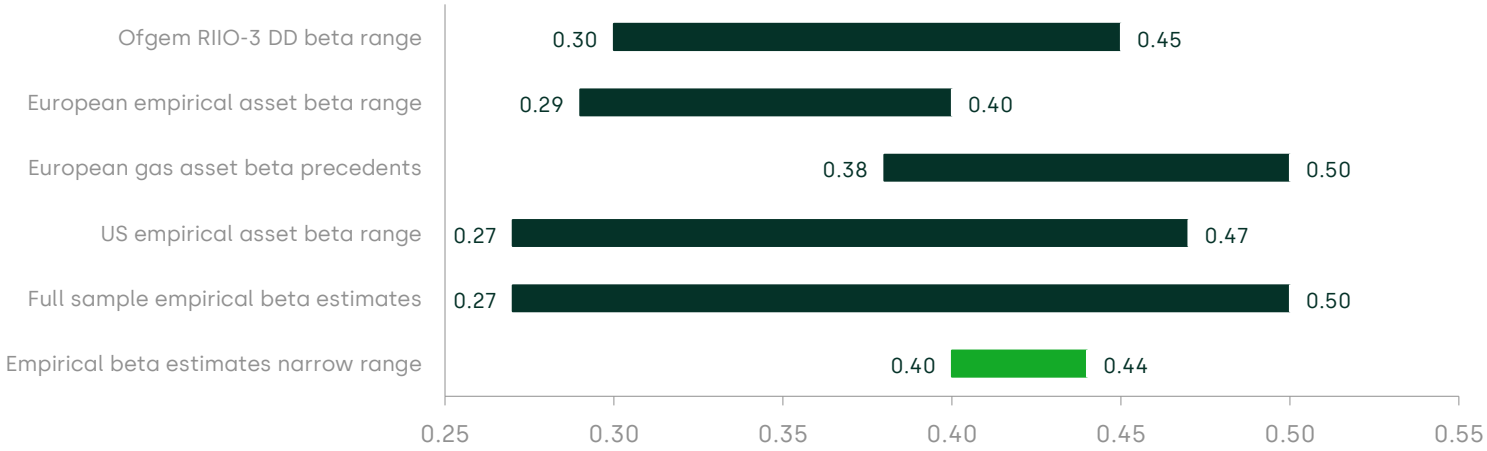
- Consistent with Ofgem's position, we consider that it is appropriate to put more emphasis on ten-year betas in the specific context of RIIO-3.
- Focusing on European evidence, we observe that the ten-year asset beta estimates for Enagás and Snam (i.e. the two comparators for which ten-year estimates are available) are equal to 0.36 and 0.44 respectively, for an average of 0.40.
- European regulatory precedents on unadjusted gas asset betas in GD and GT suggest a range of 0.38–0.50, with a midpoint of 0.44.[128]
- Provisionally, European evidence alone suggests that a gas-specific asset beta range of 0.40–0.44 within a wider range of 0.36–0.50 (based on a combination of the ten-year betas of European gas networks and European gas network asset beta precedents) would be appropriate. Indeed, the low end of this range is anchored by the average of the ten-year asset betas of the European comparators (0.40), while the high end is anchored by the midpoint of the range of unadjusted gas network asset beta allowances in European regulatory precedents. Selecting an asset beta point estimate within our proposed gas-specific asset beta range would therefore not put Ofgem out of line with other European regulators. This anchoring on European regulatory evidence is in line with how we assessed the appropriate gas-specific asset beta range in our previous report, and we note that Ofgem, in the RIIO-3 DD, has not responded to this evidence.
- The addition of US empirical evidence further corroborates this range, especially at the high end. Indeed, 0.44 is in line with the average between the average ten-year asset beta of US gas networks on the one hand and

[128] For reference, European GD and GT asset beta regulatory precedents on an adjusted basis range between 0.36 and 0.47 (with a midpoint of 0.415) for adjustment I, and between 0.41 and 0.53 (midpoint of 0.47) for adjustment II. As discussed in section 4.2.2, we consider that neither adjustment is superior to the other. Given that one leads to higher asset betas than the unadjusted asset beta and the other adjustment leads to lower asset betas, we consider that using the unadjusted asset beta allowance for comparison purposes does not clearly risk under- or overestimation in the comparison and positioning.

European gas networks on the other (i.e. the third column in Table 4.3). We note that this average gives more weight to individual European comparators than to US comparators given that our sample has more US networks than European networks.

Figure 4.6 below shows the full range of asset beta estimates (0.27–0.50), which is composed of: (i) the European empirical asset beta range (0.29–0.40), based on the average asset beta for European comparators); (ii) the European unadjusted asset beta regulatory precedents for the GD and GT sectors (0.38–0.50); and (iii) the US empirical asset beta range (0.27 – 0.47), based on the average asset beta for US comparators). It also shows our narrower gas-specific asset beta range (0.40–0.44). This range partly overlaps with the upper half of Ofgem's DD asset beta range (0.30–0.45).

Figure 4.6 Asset beta ranges



Note: We exclude asset beta precedents for gas storage and regasification. Numbers are rounded.
Source: Oxera analysis based on Bloomberg data and regulatory decisions.

Based on the considerations outlined above, we conclude on a gas-specific asset beta range of **0.40–0.44**. We note that this range is entirely consistent with empirical evidence from European gas networks as well as regulatory precedents on gas network asset beta allowances. We also observe that giving weight to US data further strengthens the evidence base underpinning our range, and, in particular, at its higher end. The positioning of this range compared to the wider set of evidence would make it more likely that an asset beta allowance picked within this range would account for forward-looking gas-specific risks.

We note that this range is embedded in the upper half of Ofgem's own RIIO-3 DD asset beta range. The low end of our range remains significantly higher than the low end of Ofgem's range and indeed higher than its proposed (i.e. point estimate)

asset beta allowance. This is because Ofgem's range gives weight to evidence from different comparator groups compared to the comparators assessed in the present report, i.e. National Grid, UK water companies and European electricity networks.

Being mindful of the fact that Ofgem may give some weight to non-gas evidence in forming a judgment on the RIIO-GD/GT3 allowed asset beta, in the next section we discuss how to position such a range in light of the evidence presented in this report and in Ofgem's RIIO-3 DD.

4.4.2 RIIO-GD/GT3 asset beta range

In section 4.4.1, we explained why we consider that a 0.40–0.44 asset beta range would be appropriate for a gas-specific asset beta. We note that this range is contained in the upper half of the asset beta range proposed by Ofgem in the RIIO-3 DD, i.e. 0.30–0.45.

In our previous report, we explained that the risks faced by GB gas networks are different from those faced by the water and electricity sectors and that, as a result, Ofgem's beta comparator sample may not accurately reflect gas-specific risks, given that it mostly includes non-gas comparators.[129] This, and the comparative lack of European listed gas network comparators, combined with the absence of any UK comparable gas company, motivated the expansion of the evidence base to include US gas comparators to estimate a gas-specific asset beta in our previous report, as well as in this report.

However, Ofgem is likely to attribute some weight to the non-gas evidence presented in the RIIO-3 DD—i.e. to the asset betas of National Grid, UK water companies and European electricity networks. For the purposes of our calculations of the CoE for RIIO-GD/GT3, we therefore consider a RIIO-GD/GT3 asset beta range of **0.375–0.45**, i.e. our gas-specific asset beta range expanded at the lower and higher bounds. The new lower bound corresponds to the point estimate proposed by Ofgem in the RIIO-3 DD. The use of a lower bound that is below the lower bound of our gas-specific asset beta range would reflect the inclusion of non-gas evidence in the determination of a RIIO-GD/GT3 asset beta allowance. The higher bound corresponds to the higher bound of Ofgem's own asset beta range. Ultimately, this range corresponds to a truncation of the RIIO-3 range put forward by Ofgem in the RIIO-3 DD.

Such a truncation would be consistent with the fact that using the lower part of Ofgem's proposed asset beta range of 0.30–0.45 will underestimate the required returns for the gas networks. Indeed, as discussed in our RIIO-3 SSMC report for the

[129] Oxera (2024), 'Cost of equity for RIIO-GD3', 29 November, section 2.1.

ENA,[130] there is extensive academic literature suggesting that the CoE implied by the CAPM for companies characterised by relatively low levels of beta and volatility (such as regulated utilities) understates the actual returns earned by these companies.[131] This phenomenon is known as the low-beta anomaly, and is a well-documented bias of the CAPM framework which results in underestimated returns for low beta stocks. There is empirical evidence that the security market line (the curve depicting the rate of return as a function of systematic risk) is flatter than predicted by the beta implied by the CAPM. Considering that regulated utilities typically have equity betas lower than one, there is a material risk that the CoE estimated using the CAPM may underestimate the required return. This further justifies choosing a point estimate towards the top end of Ofgem's asset beta range.

We also observe that, by construction, compared to our gas-specific asset beta range of 0.40–0.44, the lower bound of the RIIO-GD/GT3 asset beta range of 0.375–0.45 may not appropriately or fully reflect gas-specific risks, in particular forward-looking risks. This is because of the weight it attributes to non-gas evidence at a time when risks are diverging between gas and the other sectors, and because forward-looking risks may not be fully priced in historical betas. Therefore, picking an asset beta allowance at the low end of this range is likely to underestimate the asset beta of gas networks.

In that regard, Ofgem had itself recognised in earlier RIIO-3 consultations that the midpoint of its estimated range may not be the most appropriate point estimate for beta.[132]

We stated that UKRN Guidance recommends that the RFR, TMR and (re-levered) equity beta assumptions should be combined using the CAPM to produce a cost of equity range, and that the mid-point of the range should be used as the point estimate for the CAPM cost of equity. We said we broadly agreed with this. However, we said that this recommendation best applies where CAPM metric ranges are broadly symmetrical. This is likely to apply to the TMR (we do not supply a range for the RFR) **but not to beta**. **We said we retained the ability to weight individual or groups of beta comparators where this will lead to a more accurate estimate. As a result, the most accurate estimate may not be the same as the middle of the identified range**. [Emphasis added]

[130] Oxera (2024), 'RIIO-3 cost of equity', 23 February, pp. 66, 69–70.
[131] For example, see Black, F., Jensen, M. and Scholes, M. (1972), 'The Capital Asset Pricing Model: Some Empirical Tests', studies in the theory of capital markets.
[132] Ofgem (2025), 'RIIO-3 Draft Determinations - Finance Annex', 1 July, para 3.84 (accessed 9 July 2025).

This could justify choosing an asset beta point estimate that is different from the midpoint of its RIIO-3 DD range (i.e. 0.375 within a 0.30–0.45 range) by weighting 'individual or groups of beta comparators' differently.[133]

Considering the higher levels of risk to which gas networks are exposed as a result of the energy transition, we consider that a point estimate towards the top end of the asset beta range proposed by Ofgem in the RIIO-3 DD would be consistent with Ofgem's expectation that 'higher levels of risk exposure to be accompanied by an offsetting increase in expected returns (i.e. a higher cost of equity).'[134] While Ofgem considers that, after performing its step-2 cross-checks, its current proposed cost of equity is sufficient,[135] we note that an asset beta range of 0.375–0.45 for RIIO-GD/GT3 is consistent with Ofgem's statement on picking an asset beta point estimate that is not at the midpoint of its proposed range. We also consider that, by giving a predominant weight to the asset beta of European gas networks and some weight to US betas and European regulatory precedents, a point estimate within our proposed 0.40–0.44 gas-specific asset beta range would be appropriate.

[133] Ibid., para. 3.84.
[134] Ofgem (2025), 'RIIO-3 Draft Determinations - Finance Annex', 1 July, para. 3.113.
[135] Ibid., paras 3.123–3.124.

5 The cost of equity for RIIO-GD/GT3

Based on the discussion in the sections above, we present our estimate of the CoE at 60% gearing (CPIH-real) for gas networks, comparing it to Ofgem's proposal for the allowed CoE for RIIO-3, as presented in the RIIO-3 DD.

In Table 5.1, we present the CoE range resulting from our gas-specific asset beta range of 0.40–0.44. Table 5.2 shows the CoE range resulting from the wider RIIO-GD/GT3 asset beta range of 0.30–0.45.

Table 5.1 Gas-specific cost of equity estimates

	Formula	Ofgem (RIIO-3 DD)			Oxera (gas-specific)		
		Low	High	Proposed point estimate	Low	High	Midpoint
RFR	[A]	2.01%	2.01%	2.01%	2.25%	2.25%	2.25%
TMR	[B]	6.80%	6.90%	6.90%	7.00%	7.50%	7.25%
Asset beta	[C]	0.300	0.450	0.375	0.400	0.440	0.420
Re-levered equity beta at 60% gearing[1]	[D] = {[C] – (gearing*beta debt)}/(1-gearing)	0.64	1.01	0.83	0.89	0.99	0.94
CAPM CoE	**[E] = [A] + [D] * ([B]-[A])**	**5.06%**	**6.96%**	**6.04%**	**6.47%**	**7.43%**	**6.94%**

Note: [1] The debt beta is assumed to be 0.075. Values may not add up due to rounding.
Source: Oxera analysis and Ofgem (2025), 'RIIO-3 Draft Determinations - Finance Annex', 1 July, Table 17.

Ofgem's proposed allowed CoE at 60% gearing for RIIO-3 is a range of **5.06–6.96%** (CPIH-real), using 31 March 2025 as the cut-off date, with a proposed value of 6.04%.

Our proposed gas-specific CoE range is **6.47–7.43%**, with a midpoint of **6.94%** (CPIH-real, at 60% gearing).[136] The point estimate of Ofgem's range is below the

[136] The midpoint of the Oxera CoE range is based on the midpoints of each of the estimated CAPM parameters. This does not equate to the midpoint of the overall CoE range due to rounding.

range proposed by Oxera for a gas-specific CoE, and we note that the midpoint of our range is in fact at the level of the high end of Ofgem's CoE range.

Table 5.2 RIIO-GD/GT3 cost of equity estimates

	Formula	Ofgem (RIIO-3 DD)			Oxera (gas-specific)		
		Low	High	Proposed point estimate	Low	High	Midpoint
RFR	[A]	2.01%	2.01%	2.01%	2.25%	2.25%	2.25%
TMR	[B]	6.80%	6.90%	6.90%	7.00%	7.50%	7.25%
Asset beta	[C]	0.300	0.450	0.375	0.375	0.450	0.413
Re-levered equity beta at 60% gearing[1]	[D] = {[C] – (gearing*beta debt)}/(1-gearing)	0.64	1.01	0.83	0.83	1.01	0.92
CAPM CoE	**[E] = [A] + [D] * ([B]-[A])**	**5.06%**	**6.96%**	**6.04%**	**6.17%**	**7.57%**	**6.84%**

Note: [1] The debt beta is assumed to be 0.075. Values may not add up due to rounding.
Source: Oxera analysis and Ofgem (2025), 'RIIO-3 Draft Determinations - Finance Annex', 1 July, Table 17.

Our proposed RIIO-GD/GT3 CoE range is **6.17–7.57%**, with a midpoint of **6.84%** (CPIH-real, at 60% gearing).[137] Again, the point estimate of the range proposed by Ofgem (6.04%) is below the bottom end of the Oxera CoE range, suggesting that the point estimate of the Ofgem CoE range is too low.

[137] The midpoint of the Oxera CoE range is based on the midpoints of each of the estimated CAPM parameters. This does not equate to the midpoint of the overall CoE range due to rounding.

6 Debt premia cross-check for UK gas networks

In this section, we assess whether Ofgem's RIIO-3 DD CoE allowance and Oxera's gas-specific CoE estimate (as well as Oxera's RIIO-GD/GT3 CoE estimate) satisfy the debt premia cross-check (referred to as the 'ARP–DRP framework' in our previous submissions).[138] More specifically:

- in section 6.1, we compare the ARP for Ofgem's RIIO-3 CoE allowance and Oxera's gas-specific and RIIO-GD/GT3 CoE estimate with the DRP implied by the average yield of a filtered sample of gas bonds;
- in section 6.2, we compare Ofgem's and Oxera's ARP with the minimum ARP implied by the DRP. We then also compare Ofgem's and Oxera's CoE allowance with the implied minimum CoE allowance.

We note that, in the RIIO-3 DD, Ofgem proposed not to consider the debt premia framework for the purposes of cross-checking its CAPM-based CoE.[139] We summarise Ofgem's view in Box 6.1.

[138] For example, see Oxera (2024), 'Cost of equity for RIIO-GD3', prepared for GB gas distribution networks, 29 November, section 4 (accessed 1 August 2025).
[139] Ofgem (2025), 'RIIO-3 Draft Determinations – Finance Annex', 1 July, para. 3.100 (accessed 30 July 2025).

Box 6.1 Ofgem's RIIO-3 DD view on the debt premia cross-check

In the RIIO-3 DD, Ofgem proposed not to use debt-based evidence to cross check the CAPM-based CoE.

- First, Ofgem did not consider that any debt-based cross-check 'can definitely prove or "back-solve" to a required return on equity'.[1] In particular, Ofgem noted that the assumption that 'real equity returns do not respond one-for-one with the RFR is a generally accepted UK regulatory principle'. According to Ofgem this means that 'when interest rates rise, the ARP is likely to fall',[2] and that the relationship is unlikely to be constant.
- Second, Ofgem noted that the CMA 'did not consider the ARP–DRP cross-check to provide superior insight into the correct cost of capital', and that 'the assumed inputs are not universally accepted'.[3]

Note: [1] Ofgem (2025), 'RIIO-3 Draft Determinations – Finance Annex', 1 July, para. 3.100 (accessed 30 July 2025). [2] Ibid. [3] Ibid.
Source: Oxera.

We respond to Ofgem's critique of the debt premia cross-check in section 6.3. In section 6.4, we summarise our findings from the debt premia cross-check.

One of the core inputs into our debt premium cross-checks is the cost of new debt (CoND), which drives the DRP estimate. In this assessment, the CoND is based on the debt spreads of UK gas network bonds. We provide further details on the methodology used to estimate gas spreads in Appendix A1.

6.1 Comparison between Ofgem's ARP and the DRP

Since claims for payments to debt holders have priority over those to equity holders, investors should expect a higher return on their equity investment than on their debt investment in the same company—i.e. the CoE must be above the CoND. This principle applies at any level of gearing, even zero—i.e. even when the CoE is unlevered. Therefore, to check whether the CAPM-implied CoE is set at a sufficient level, the risk premia underlying the unlevered CoE and the CoND could be compared, i.e. the ARP and the DRP. The ARP must be equal to or above the DRP at any level of gearing.

We estimate the premia as follows.

$$ARP = asset\ beta * (TMR - RFR)$$

$$DRP = CoND - duration\text{-}matched\ gilt - expected\ loss$$

The ARP is calculated based on Ofgem's CAPM parameters. In the DRP calculation, the 'expected loss' parameter represents the annualised probability of default multiplied by the losses that a debt investor would suffer if a borrower defaults. For debt rated A and BBB, we have previously estimated this parameter to be equal to 0.30%.[140] Subtracting the expected loss converts the CoND into an expected return on debt. We then estimate the DRP by further subtracting the duration-matched gilt.

To estimate an average DRP for our sample of filtered bonds, we first calculate a daily DRP series for each bond by subtracting a 30bps adjustment for expected loss from the debt spreads (to gilts), as calculated in Appendix A1.

Next, based on the daily DRP series for each of the instruments, we calculate a simple average DRP for each licensee in our sample set. The resulting average DRP estimates for each licensee are presented in Table 6.1. Note that we are estimating a single DRP for all four Cadent networks as Cadent issues bonds as a single entity. In contrast, we are estimating separate DRPs for the two SGN networks, reflecting the fact that SGN issues bonds at the individual network level.

As investors are potentially looking at DRPs over a historical period to understand their requirements for the next control period, we show the results of our debt premia cross-check across different averaging windows.

Table 6.1 Average DRP of the sample set

Parameter	NGT	Cadent	NGN	Scotland	Southern	WWU	Average
One-month average	1.04%	1.11%	1.10%	1.09%	1.09%	0.75%	**1.03%**
One-year average	1.15%	1.19%	1.19%	1.17%	1.17%	0.87%	**1.12%**
Five-year average	1.24%	1.30%	1.33%	1.27%	1.31%	0.98%	**1.24%**

[140] For the full methodology behind the 0.30% point estimate, see Oxera (2019), 'Risk premium on assets relative to debt', 25 March, p. 11 (accessed 30 July 2025). Our expected loss calculation uses annualised default rates based on Feldhütter and Schaefer (2018) that are higher than those reported by Moody's. Using Moody's reported default rates would produce a lower expected loss assumption, i.e. a higher DRP estimate. See Feldhütter, P. and Schaefer, S.M. (2018), 'The myth of the credit spread puzzle', *The Review of Financial Studies*, **31**:8, pp. 2897–942; and Moody's (2025), 'Annual default study: Corporate default rate to fall below its long-term average in 2025', 28 February, Exhibit 36.

Note: The cut-off date for the analysis is 31 March 2025. NGT, National Gas Transmission, NGN, Northern Gas Networks, WWU, Wales & West Utilities.
Source: Oxera analysis based on data from S&P Capital IQ, Bloomberg, and the Bank of England.

The results add support to the sample selection, as we observe that licensees' DRPs are broadly comparable to each other—with the exception of Wales & West Utilities (WWU), which shows a DRP well below those of other licensees. This evidence regarding WWU's DRP is consistent with its stronger credit rating than for the rest of the sample—A3 for WWU versus Baa1 for most of other bonds in the sample.

Table 6.2 compares the ARP, estimated using Ofgem's RIIO-3 DD and Oxera's gas-specific CoE parameters, with the average DRP implied by the sample of filtered bonds based on one-month, one-year, and five-year averages. The test needs to be passed in all its specifications, given that market conditions that affect credit spreads for a given set of assets would also affect the (required return for the) equity risk of those assets, notwithstanding that some volatility in DRP may be temporary.

Table 6.2 ARP based on allowance parameters versus DRP based on one-month, one-year, and five-year averages

Parameter	Formula	Ofgem (RIIO-3 DD)	Oxera (gas-specific)
Asset beta	[A]	0.375	0.420
ERP	[B]	4.89%	5.00%
ARP	[C] = [A] * [B]	1.83%	2.10%
DRP (one-month average)	[D]	1.03%	1.03%
ARP – DRP (one-month average)	**[E] = [C] – [D]**	**0.80%**	**1.07%**
DRP (one-year average)	[F]	1.12%	1.12%
ARP – DRP (one-year average)	**[G] = [C] – [F]**	**0.71%**	**0.98%**
DRP (five-year average)	[H]	1.24%	1.24%
ARP – DRP (five-year average)	**[I] = [C] – [H]**	**0.60%**	**0.86%**

Note: The cut-off date for the analysis is 31 March 2025. DRP estimates are 1.05%, 1.16% and 1.18% for one-month, one-year, and five-year medians.
Source: Oxera analysis based on data from S&P Capital IQ, Bloomberg, the Bank of England, and Ofgem (2025), 'RIIO-3 Draft Determinations – Finance Annex', 1 July.

The table shows that Ofgem's ARP is above the DRP, meaning that this specification of the test does not identify any issues with Ofgem's CoE allowance. The same conclusion holds when considering the ARP based on the midpoint of Oxera's gas-specific CoE range, which also sits well above the DRP across all specifications of the historical averages.[141] However, this is only a necessary but not a sufficient condition to satisfy. In the next section we introduce a tighter benchmark for ARP.

6.2 Comparison between Ofgem's ARP/CoE and the implied minimum ARP/CoE

While the ARP being above the DRP is a necessary condition, it is not a sufficient one. The ARP must always exceed the DRP at levels of gearing below 100%. At 100% gearing, however, the ARP would equal the DRP—this is because, when a company is fully debt-financed, the claim on its assets is equivalent to the claim on its debt. We therefore estimate what the DRP is likely to be at 100% by re-levering it, in order to arrive at a minimum required ARP—i.e. for this test, we assume that the notional company is fully debt-financed.

To estimate the lower bound of the possible DRP at 100% gearing, we extrapolate the DRP on a linear basis from the applicable gearing to 100% gearing. We have shown in a separate report that a linear extrapolation is likely to be an underestimation of the actual risk premium that would be expected for a hypothetically 100% debt-financed company.[142]

Therefore, the ARP estimated in this way is the minimum ARP threshold. Similarly, one could imply the minimum CoE threshold that the CoE allowance must exceed in order to satisfy the test.

To estimate the implied minimum ARP based on the filtered sample of gas bonds, we first linearly extrapolate the DRP estimate for each licensee (summarised in Table 6.1) to 100% gearing based on the annual RAV gearings of each licensee, inferred from the periodic regulatory submissions of the network companies.[143]

The historical annual RAV gearings used for this analysis are outlined in Table 6.3.

[141] The same conclusion holds when considering the ARP for Oxera's RIIO-GD3 CoE midpoint, which is 2.07%.
[142] Oxera (2024), 'Evaluation of the ARP–DRP framework, prepared for Energy Network Association's electricity distribution network operator and transmission owner members', 8 November. The key assumption affecting the effectiveness of a linear extrapolation is the convexity of the DRP curve. Based on volatility estimates for a regulated utility company within a Merton model, the convexity assumption is very likely to hold. Hence, our approximation suggests that a linear extrapolation is likely to underestimate the actual lower bound for DRP at 100% gearing and consequently also the implied minimum ARP.
[143] From 2018/19 to 2021/22, we relied on Ofgem's 'Regulatory financial performance data file – Annex to RIIO-1 – Annual report 2020-21'. From 2022/23 onwards, we referred to each network company's most recent Regulatory Finance Performance Reporting (RFPR): NGT publications, Cadent publications, NGN publications, SGN publications, and WWU publications. All links were accessed on 30 July 2025.

Table 6.3 Annual RAV gearings of the sample set

	NGT	Cadent	NGN	Scotland	Southern	WWU
2018/19	46%	63%	64%	71%	73%	69%
2019/20	54%	63%	64%	71%	72%	68%
2020/21	59%	63%	64%	71%	71%	65%
2021/22	56%	62%	64%	70%	70%	62%
2022/23	51%	60%	63%	66%	67%	60%
2023/24	48%	59%	61%	63%	66%	53%
2024/25	51%	60%	63%	65%	67%	53%
2025/26	56%	62%	65%	67%	68%	59%

Source: Oxera analysis based on Ofgem data and the individual network companies' latest RFPR.

The resulting average implied minimum ARP estimates for each licensee are presented in Table 6.4.

Table 6.4 Implied minimum ARP of the sample set

	NGT	Cadent	NGN	Scotland	Southern	WWU	Average
One-month average	2.15%	1.89%	1.79%	1.67%	1.73%	1.42%	**1.77%**
One-year average	2.38%	2.02%	1.94%	1.78%	1.85%	1.64%	**1.94%**
Five-year average	2.33%	2.13%	2.10%	1.85%	1.93%	1.60%	**1.99%**

Note: The cut-off date for the analysis is 31 March 2025.
Source: Oxera analysis based on data from S&P Capital IQ, Bloomberg, and the Bank of England.

Table 6.5 compares the ARPs for Ofgem's RIIO-3 DD CoE point estimate and Oxera's gas-specific CoE midpoint, with the implied minimum ARP, implied by the DRPs of our sample of filtered bonds.

Table 6.5 ARP versus the implied minimum ARP based on a one-month, one-year, and five-year average

Parameter	Formula	Ofgem (RIIO-3 DD)	Oxera (gas-specific)
ARP (see Table 6.2)	[A]	1.83%	2.10%
Implied minimum ARP (one-month average)	[B]	1.77%	1.77%

Parameter	Formula	Ofgem (RIIO-3 DD)	Oxera (gas-specific)
ARP — implied minimum ARP (one-month average)	**[C] = [A] – [B]**	**0.06%**	**0.33%**
Implied minimum ARP (one-year average)	[D]	1.94%	1.94%
ARP — implied minimum ARP (one-year average)	**[E] = [A] – [D]**	**-0.10%**	**0.16%**
Implied minimum ARP (five-year average)	[F]	1.99%	1.99%
ARP — implied minimum ARP (five-year average)	**[G] = [A] – [F]**	**-0.15%**	**0.11%**

Note: The cut-off date for the analysis is 31 March 2025. Implied minimum ARP estimates are 1.81%, 2.01%, and 2.01% for one-month, one-year, and five-year medians.
Source: Oxera analysis based on data from S&P Capital IQ, Bloomberg, the Bank of England, and Ofgem (2025), 'RIIO-3 Draft Determinations – Finance Annex', 1 July.

The results of our cross-check indicate that Ofgem's CoE allowance is insufficient when considering the one- and five-year average implied minimum ARP. In contrast, the ARP for Oxera's gas-specific CoE range would exceed our implied minimum ARP across all specifications of the historical averages.[144]

Lastly, in Table 6.6 we show the calculations for the CoE implied from the one-month, one-year, and five-year average implied minimum ARPs based on our sample of filtered gas bonds and using Ofgem's RIIO-3 DD RFR and ERP.

Table 6.6 Implied minimum CoE based on the RIIO-3 DD RFR and ERP and different averaging windows (CPIH-real, 60% notional gearing)

Parameter	Formula	One-month average	One-year average	Five-year average
Implied minimum ARP	[A]	1.77%	1.94%	1.99%
Ofgem's RFR	[B]	2.01%	2.01%	2.01%
Ofgem's ERP	[C]	4.89%	4.89%	4.89%
Ofgem's debt beta	[D]	0.075	0.075	0.075
Implied asset beta	[E] = [A] / [C]	0.36	0.40	0.41
Notional gearing	[F]	60%	60%	60%
Implied equity beta	[G] = ([E] – [F]*[D])/(1 – [F])	0.79	0.88	0.90
Implied minimum CoE	**[H] = [B] + [G] * [C]**	**5.89%**	**6.30%**	**6.43%**

Note: The cut-off date for the analysis is 31 March 2025. Implied minimum CoE estimates are 5.97%, 6.47%, and 6.49% for one-month, one-year, and five-year medians.

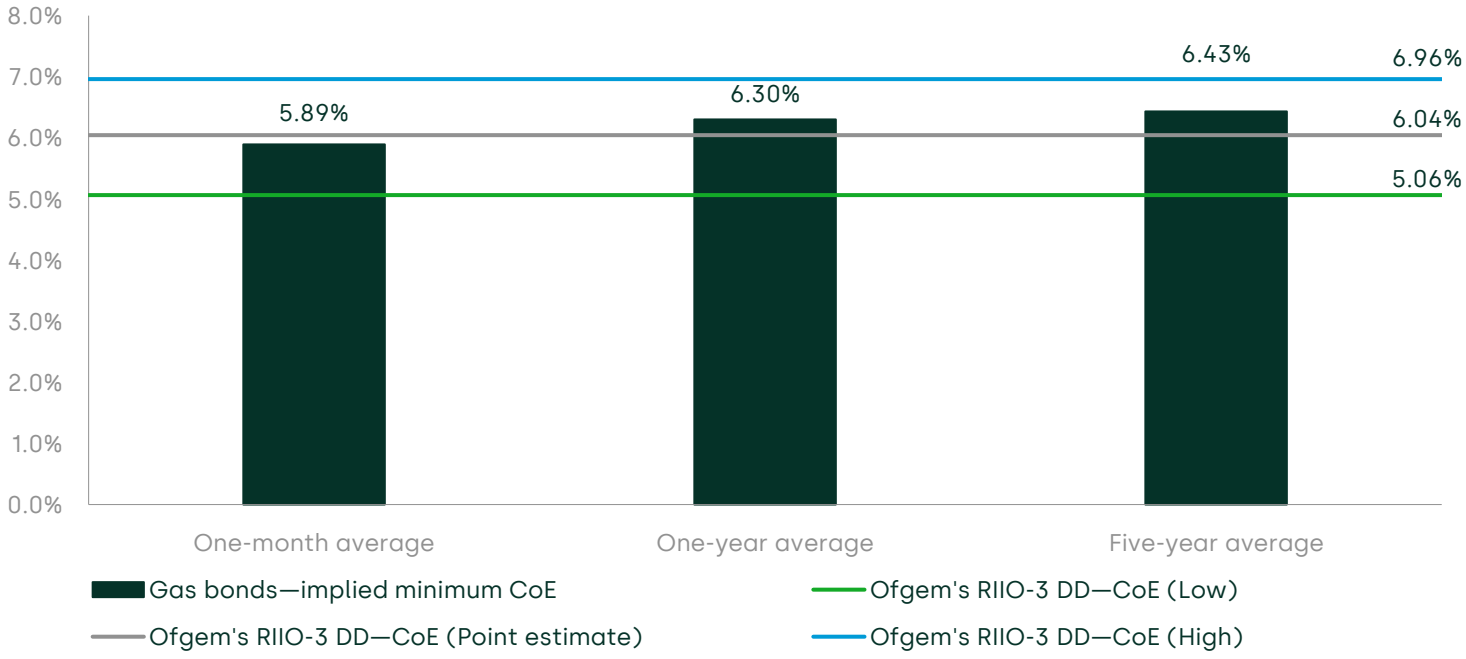
[144] The same conclusion holds when considering the ARP for Oxera's RIIO-GD3 CoE midpoint, which is 2.07%.

Source: Oxera analysis based on data from S&P Capital IQ, Bloomberg, the Bank of England, and Ofgem (2025), 'RIIO-3 Draft Determinations – Finance Annex', 1 July.

The table above indicates that the implied minimum ARP (and CoE), estimated at our cut-off date, increases with a longer averaging period, with the five-year average showing the highest results.

Figure 6.1 below compares the implied minimum CoE calculated based on different averaging periods with the CoE range from Ofgem's RIIO-3 DD.

Figure 6.1 The implied minimum cost of equity versus Ofgem's RIIO-3 DD cost of equity (CPIH-real, 60% gearing)



Note: The cut-off date for the analysis is 31 March 2025.
Source: Oxera analysis based on data from S&P Capital IQ, Bloomberg, the Bank of England, and Ofgem (2025), 'RIIO-3 Draft Determinations – Finance Annex', 1 July.

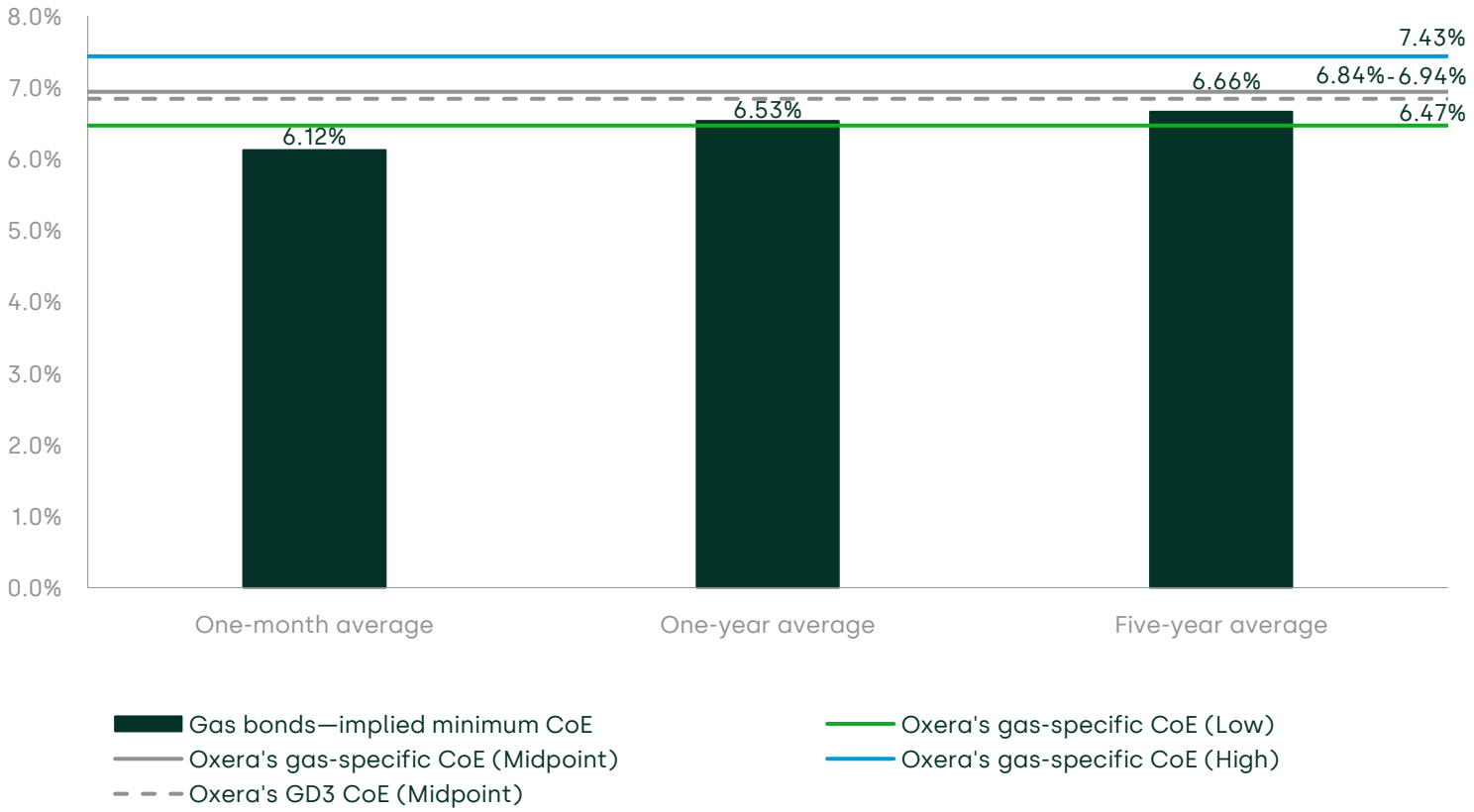
Figure 6.1 shows that Ofgem's RIIO-3 DD point estimate CoE of 6.04% (CPIH-real, 60% gearing) falls below our implied minimum CoE when considering both one-year and five-year averages. Only the high end of Ofgem's CoE range (i.e. 6.96%) satisfies the implied minimum CoE when derived from our debt premia cross-check across all averaging periods.

Based on conversations with representatives of gas network treasury teams, we understand that the perception of the asset stranding risk among debt investors has changed over the last five years, and the risk premia in the first years within

this period are unlikely to be representative of the current and forward-looking risks. Therefore, we have also checked the result for a three-year average DRP (and otherwise following the same methodologies outlined in Table 6.5 and Table 6.6). We find that Ofgem's CoE estimates still do not pass the test.[145]

Figure 6.2 compares the implied minimum CoE, derived using Oxera's RFR and ERP, with Oxera's CoE range. Appendix 7A2 shows the calculations underlying the implied minimum CoE using Oxera's CAPM parameters.

Figure 6.2 The implied minimum cost of equity versus Oxera's cost of equity range (CPIH-real, 60% gearing)



Note: The cut-off date for the analysis is 31 March 2025.
Source: Oxera analysis based on data from S&P Capital IQ, Bloomberg, the Bank of England, and Ofgem (2025), 'RIIO-3 Draft Determinations – Finance Annex', 1 July.

The figure shows that the midpoints of Oxera's gas-specific and RIIO-GD/GT3 CoE ranges presented in Figure 6.2, equal to 6.94% and 6.84% respectively (CPIH-real, 60% gearing), both exceed our implied minimum cost of equity across the

[145] The implied CoE based on a three-year average DRP for benchmarking Ofgem's CoE estimates is 7.30% (CPIH-real).

averaging periods examined. We therefore consider that the midpoint of the Oxera range would be an appropriate CoE level to ensure that gas networks are investable.

Lastly, we note that using the median instead of the mean for historical figures would not affect the results of the debt premia cross-check.

6.3 Response to Ofgem's critique of the debt premia cross-check

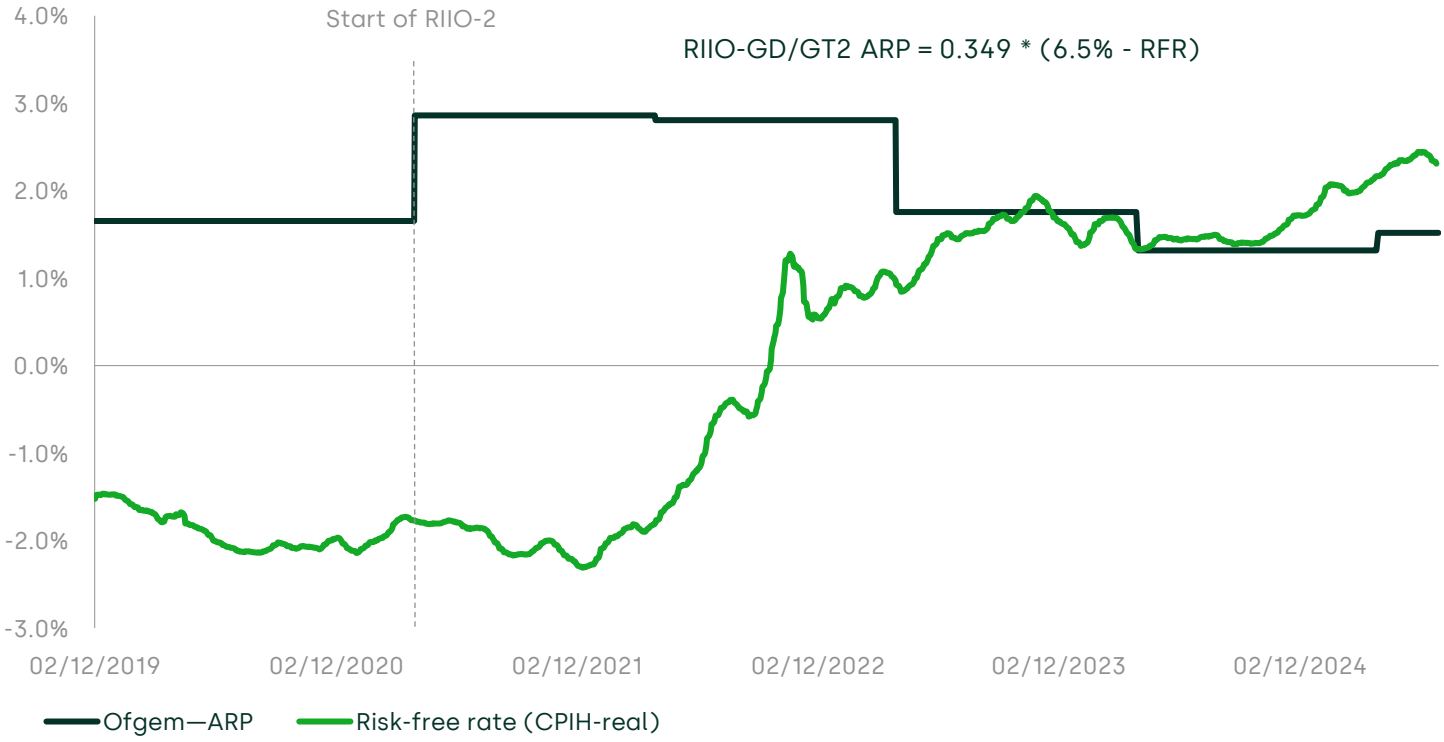
In Box 6.1 above we summarised Ofgem's view on the use of the debt premia framework for the purposes of cross-checking its CAPM-based CoE. We address Ofgem's points below.

6.3.1 Potential correlation between the ARP and the risk-free rate

Figure 6.3 compares the ARP from Ofgem's CoE allowances in RIIO-GD/GT1 and RIIO-GD/GT2 with the time series of the RFR, constructed based on Ofgem's RIIO-3 DD methodology.[146]

[146] For the RFR time series we have not fully replicated the methodology for the RPI–CPIH wedge applied to the estimates specified in the RIIO-3 DD, as the RIIO-3 DD reflect the forecast of the allowance across the five years of the RIIO-3 price control, while the time series reflects the spot data. As a result, there is a mismatch between our RFR estimates and Ofgem's RIIO-3 DD figures. Specifically, our estimates for the RFR in the time series are 15bps higher than the RIIO-3 DD estimates as at 31 March 2025.

Figure 6.3 Ofgem's ARP and risk-free rate based on Ofgem's RIIO-3 DD methodology, 2019–25



Note: Ofgem's historical ARP based on return on equity allowances was derived based on its yearly assumptions for the asset beta, ERP, and RFR, where the RFR was converted into CPIH-real terms for the RIIO-1 period. The daily series of the RFR has been converted to a one-month trailing average series for presentation purposes.
Source: Oxera analysis based on data from Ofgem, the OBR, and the Bank of England.

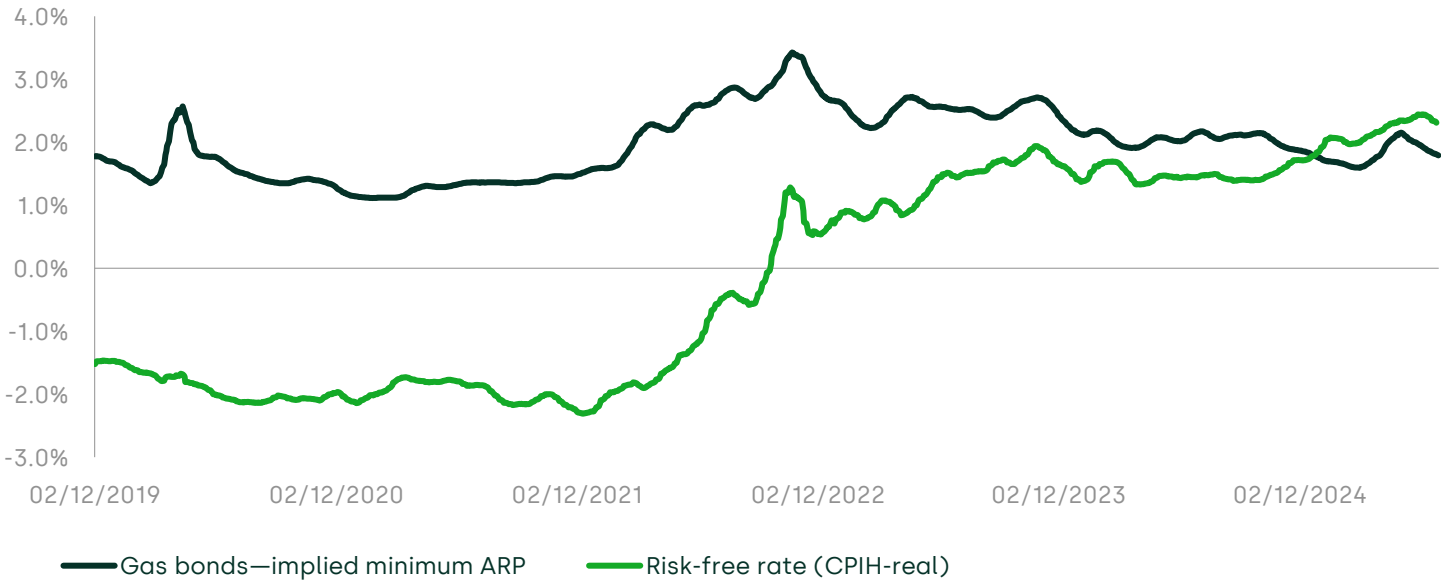
The figure shows that, in line with Ofgem's observation, when interest rates began to rise in early 2022, Ofgem's ARP began to decline in the subsequent financial years, albeit with a time lag. This relationship between interest rates and Ofgem's ARP is driven by Ofgem's decision to use the through-the-cycle assumption for the TMR in RIIO-2. However, it is unclear to us how this observation affects the effectiveness of the cross-check. It is indeed the case that, all else being equal, the lower the ARP, the harder it is to satisfy the cross-check, and as a result, it is likely that it is harder for Ofgem's allowance to pass the ARP–DRP test when interest rates are high. This is consistent with the UKRN's observation that the through-the-cycle approach to the TMR is likely to 'overstate or understate returns required by investors in a specific price determination'.[147] As it is a method that allows the lower bound for the appropriate CoE to be identified, the ARP–DRP cross-check is a way to identify the understated returns—i.e. the cross-check is most likely to be

[147] UKRN (2023), 'UKRN guidance for regulators on the methodology for setting the cost of capital', p. 19 (accessed 24 July 2025).

binding when interest rates are high. In other words, the ARP–DRP test helps to identify whether relying on the through-the-cycle approach in setting the CoE is likely to go against networks' investability in a specific price control period.

Continuing with the empirical evidence for the correlation between the ARP and the RFR, Figure 6.4 shows that, when considering the minimum ARP implied by the DRP, there is no clear evidence of such a correlation. This is because the minimum implied ARP reflects observed changes in debt spreads, which are not necessarily correlated with interest rates. Importantly, unlike Ofgem's ARP—which is derived from the CAPM—the minimum implied ARP is grounded in market data, which offers a more empirical basis for analysis.

Figure 6.4 Implied minimum ARP and risk-free rate, 2019–25



Note: The RFR is based on Ofgem's RIIO-3 DD methodology. The minimum ARP is implied from the sample of gas bonds, as further explained in section 6.2. The daily series of the RFR has been converted to a one-month trailing average series for presentation purposes.
Source: Oxera analysis based on data from Bloomberg, the OBR, and the Bank of England.

Lastly, on the ARP and RFR correlation, Ofgem states that the 'relationship [between the ARP and the RFR] is unlikely to be constant as presented by Oxera'.[148] However, it is unclear what specific analysis or conclusions Ofgem is referring to with regard to Oxera's work. Based on the evidence presented above, the

[148] Ofgem (2025), 'RIIO-3 Draft Determinations – Finance Annex', 1 July, para. 3.100 (accessed 23 July 2025).

correlation between the ARP and the RFR is indeed not constant, as pointed out by Ofgem. This, however, does not detract from the validity of the cross-check.

6.3.2 The CMA's remarks on the ARP–DRP cross-check in the RIIO-2 appeals

Ofgem refers to the CMA's remarks from the RIIO-2 appeals, where the CMA stated that the ARP–DRP cross-check did not offer superior insight into the appropriate cost of capital and that its inputs are not universally accepted.[149]

We note that, in the same decision, the CMA explains that no single cross-check needs to be 'disproportionately effective at identifying the "correct" cost of equity', as, in that case, it would replace the CAPM.[150] However, it is sensible to require a cross-check to offer new (in this sense, 'superior') information about the potential 'true' estimate of the CoE, and the ARP–DRP cross-check does offer that; it offers debt market evidence.

As for the inputs, the CMA explains the following:[151]

> the data [...] suffers from many of the same limitations as the standard CAPM approach. In our view, given that the calibration put to us of the ARP-DRP analysis is based on values from regulators' decisions, it is also reliant on subjective assumptions

First, the CMA suggests that the limitations of the data are the same as (and, importantly, no greater than) those of the CAPM, which is indeed a standard model used, despite its limitations.

Second, the CMA points out that reliance on regulators' decisions is associated with subjective assumptions. We note that, since the ARP–DRP framework was presented to the CMA as part of the RIIO-2 appeals, it has undergone significant developments. As a result, the framework no longer relies on regulators' decisions to calibrate the threshold.[152]

Further methodological developments to the ARP–DRP framework are, in fact, something that the CMA anticipated in 2021. Indeed, the CMA states that 'ARP-DRP might ultimately gain more general acceptance as a relevant cross-check within

[149] Ibid.
[150] Competition and Markets Authority (2021), 'Cadent Gas Limited, National Grid Electricity Transmission plc, National Grid Gas plc, Northern Gas Networks Limited, Scottish Hydro Electric Transmission plc, Southern Gas Networks plc and Scotland Gas Networks plc, SP Transmission plc, Wales & West Utilities Limited vs the Gas and Electricity Markets Authority. Final determination Volume 2A: Joined Grounds: Cost of equity', 28 October, para. 5.720 (a).
[151] Ibid., para. 5.717.
[152] For a description of the framework that used regulatory decisions for calibration, see, for example, Oxera (2019), 'Risk premium on assets relative to debt', Benchmarking CAPM-implied equity returns, 25 March, section 2 (accessed 29 July 2025).

regulatory price control processes.'[153] However, in 2021, according to the CMA, the approach was 'inadequately developed at this stage'—suggesting that the CMA expected that the framework would be developed further.[154] Indeed, the CMA acknowledged that the 'theoretical principles behind ARP-DRP may be valid',[155] and that it provided a 'useful perspective'.[156]

The key development in the ARP–DRP framework since that time has been the introduction of the internal threshold for the ARP (and hence CoE) based on the re-levered DRP, as described in section 6.2. This development means that it is no longer necessary to rely on regulatory precedents to calibrate the framework.

6.4 Conclusions on the debt premia cross-check

Table 6.7 summarises the outcome of the different specifications of the debt premia cross-check for Ofgem's and Oxera's gas-specific CoE ranges for GT and GD networks at 60% gearing. All specifications serve as a lower bound for the CoE, but some are tighter than others. The test needs to be passed in all its specifications, given that market conditions which affect credit spreads for a given set of assets would also affect the (required return for the) equity risk of those assets, notwithstanding that some volatility in DRP may be temporary.

Table 6.7 Summary of debt premia cross-check

	Ofgem (RIIO-3 DD)			Oxera (gas-specific)		
	Low	High	Proposed	Low	High	Mid
Positive ARP–DRP	Pass	Pass	Pass	Pass	Pass	Pass
Implied CoE—one-month	Fail	Pass	Pass	Pass	Pass	Pass
Implied CoE—one-year	Fail	Pass	Fail	Fail	Pass	Pass
Implied CoE—five-year	Fail	Pass	Fail	Fail	Pass	Pass

Note: For Ofgem's RIIO-3 DD and Oxera's gas-specific CoE range, we consider the implied minimum CoE estimates derived using Ofgem's RIIO-3 DD and Oxera's RFR and TMR respectively. The same conclusions hold when considering Oxera's RIIO-GD/GT3 CoE range.
Source: Oxera analysis.

[153] Ibid., para. 5.717.
[154] Ibid., para. 5.717.
[155] Ibid., para. 5.717.
[156] Ibid., para. 5.692 (a).

The table shows that Ofgem's proposed point estimate of the CoE allowance fails to meet most of the specifications of the debt premium cross-check discussed in this section. In contrast, the midpoint of Oxera's range passes all of them.

7 Conclusions

In this report, we have reviewed the methodology for the calculation of the CAPM parameters set out by Ofgem in the RIIO-3 DD and its proposed CoE range. Based on this, we have provided updates to the RIIO-3 SSMD Oxera reports. We have provided a range for the allowed CoE, by applying the methodology that we consider to be appropriate given the developments in regulatory precedents, capital markets and the academic literature. Finally, we have assessed our and Ofgem's CoE ranges using the debt-premia cross-check.

We note that, as part of the RIIO-3 DD, Ofgem implemented some of the methodological changes that we suggested in the RIIO-3 SSMD Oxera report for ENA. Specifically, we welcome (i) the exclusion of the COLI-CED and serial correlation adjustments from the calculation of the ex ante TMR; (ii) the reintroduction of Pennon in the sample of UK water companies used to estimate the beta; and (iii) the confirmation of the inclusion of the European energy networks in the calculation of the beta.

At the same time, we consider that some of Ofgem's methodological choices continue to be in contrast with the empirical evidence, academic literature and regulatory precedents that we presented in the RIIO-3 SSMC and SSMD Oxera reports. In this report, we have focused on these specific topics, reviewing Ofgem's new considerations and evidence presented in the RIIO-3 DD and responding to Ofgem's arguments and revised estimates for these parameters.

First, in the determination of the RFR, Ofgem confirmed its decision to not account for the convenience premium embedded in government bonds. As we highlighted in the RIIO-3 SSMD report, there is extensive evidence supporting the inclusion of the convenience premium, including academic literature and recent regulatory precedents, such as those from the CMA, the CAA and the UR. As discussed in section 2.1, we have empirically shown that a large and positive convenience premium can be observed across the gilts yield curve, including at the 20-year investment horizon. While we recognise that the level of the convenience premium can fluctuate over time, depending on the underlying market conditions, in Figure 2.1 we have shown that the convenience premium has been present during periods of both calm and distressed financial markets. Therefore, we continue to consider that Ofgem's decision to not adjust for the convenience premium when setting the RFR introduces a downward bias to the estimate for a five-year control period.

Second, in the determination of the RFR, Ofgem continued not to include a CPI–CPIH wedge. However, Ofgem mentioned that it will review whether an adjustment to the inflation assumptions is warranted to reflect the long-term CPI–CPIH forecast wedge estimated by the OBR in October 2024. In section 2.2, we have

identified several reasons why the OBR's CPI–CPIH wedge should not be considered. Specifically, we note that (i) the historical evidence does not support the existence of a stable or predictable CPI–CPIH wedge; (ii) the CPI–CPIH forecast wedge estimated by the OBR lacks the track record and evidential basis needed to support regulatory application; and (iii) some of the underlying drivers of CPIH cannot be forecast reliably. Therefore, we consider that introducing a CPI–CPIH wedge into the regulatory framework would introduce unnecessary complexity and risk, and is not supported by robust and tested evidence at this stage.

Third, in the determination of the TMR, Ofgem confirmed its decision to place equal weight on ex ante and ex post approaches. As discussed in section 3.3, we continue to consider ex ante approaches to be not particularly informative and to be subject to a degree of subjective judgement about how the future will be different from the past. This includes the DMS decompositional approach considered by Ofgem, which, in reality, is closer to an ex post approach than to an ex ante one, as it does not actually attempt to predict a forward-looking TMR. Furthermore, while the UKRN guidance suggests that ex ante evidence should be considered by regulators when setting the TMR, it does not recommend placing equal weight on ex ante and ex post approaches. As such, we continue to consider that it is not correct for Ofgem to adopt a position that seeks to place equal weight on historical ex ante and ex post approaches when setting the TMR range. Instead, we consider that Ofgem should inform its TMR range predominantly on the basis of the ex post TMR, and place little to no weight on historical ex ante approaches.

Fourth, Ofgem confirmed its approach of not accounting for the higher-interest-rate environment in the estimation of the TMR. As highlighted in section 3.4, we consider Ofgem's approach to be inconsistent with regulatory precedents. In line with the discussion in the RIIO-3 SSMD Oxera report, we maintain that following a through-the-cycle approach and placing no weight on changes in market conditions risks underestimating the TMR, which is acknowledged in the UKRN guidance, and this would not support companies in retaining and attracting capital during RIIO-3. Therefore, we consider that it is appropriate to reflect this point in the determination of the TMR.

Finally, in the determination of the beta, Ofgem discussed how it does not intend to adjust its baseline asset beta estimates to separately account for gas-specific forward-looking risks. Ofgem proposed using the midpoint of its asset beta range as its point estimate. Instead, we consider that it is appropriate to derive a gas-specific asset beta range that is informed by (i) quantitative estimates of the asset betas of European gas networks, (ii) European regulatory precedents on GD and GT asset beta allowances, and (iii) quantitative estimates of the asset betas of US gas networks. Our analysis of this market and regulatory evidence underpins a truncation of Ofgem's 0.30–0.45 asset beta range as we consider that the lower

part of Ofgem's proposed asset beta range is not appropriate for the RIIO-GD/GT3 context; it neither addresses the low-beta anomaly for regulated utilities nor adequately reflects the challenges that gas networks are expected to face during RIIO-3. We derive a gas-specific asset beta range of 0.40–0.44 that we consider is more likely to adequately reflect gas-specific forward-looking risks in RIIO-3. We assess that a wider asset beta range of 0.375–0.45—giving some weight to UK regulated utilities, which are non-gas comparators—can be used to set the asset beta allowance for GRIIO-GD/GT3.

Based on the above, our analysis leads to a CoE estimate of **6.47–7.43% at 60% gearing, based on our gas-specific asset beta range**, and **6.17–7.57% at 60% gearing, based on our RIIO-3 GD3 asset beta range** (both ranges in CPIH-real terms), with **midpoints of 6.94%** and **6.84%**, respectively.[157] These compare with Ofgem's proposed estimate 5.06–6.96% at 60% gearing (both ranges in CPIH-real terms). The point estimate proposed by Ofgem (6.04%) is below the bottom of the Oxera CoE ranges, which suggests that Ofgem's point estimate is too low.

Having estimated the appropriate range for the CoE, we have cross-checked it alongside Ofgem's RIIO-3 DD CoE range using the debt premia cross-check. We have found that Ofgem's proposed point estimate of the CoE allowance fails to meet most of the specifications of the debt premia cross-check on the implied CoE discussed in this report. In contrast, the midpoint of Oxera's range passes all of them.

Therefore, we conclude that Ofgem's CoE allowance range from the lower bound of 5.06% to midpoint estimate of 6.04% is set lower than required by investors to compensate them for the additional risk of investing into equity compared to debt.

[157] The midpoints of the Oxera CoE ranges are based on the midpoints of each of the estimated CAPM parameters. These do not equate to the midpoints of the overall CoE ranges due to rounding.

A1 Gas debt spreads

In this section, we describe how we screened the sample of bonds for UK GD and GT networks, and estimated the bonds' spreads.

A1.1 Methodology

First, we gather all bonds issued by the five UK GD networks and the UK GT network (National Gas Transmission) outstanding during the period of our analysis, from December 2019 to June 2025. We use S&P Capital IQ to identify the bonds. The UK gas licensees considered for the analysis are listed in Table A1.1.

Table A1.1 UK GD and GT networks considered for our filtered sample of bonds

Licensee	Shorthand term used in this report	Network company	Type of network operations
National Gas Transmission plc	NGT	NGT	Transmission
Cadent Finance Plc	Cadent	Cadent	Distribution
Northern Gas Networks Finance PLC	NGN	NGN	Distribution
Southern Gas Networks Plc	Southern	SGN	Distribution
Scotland Gas Networks Plc	Scotland	SGN	Distribution
Wales & West Utilities Finance plc	WWU	WWU	Distribution

Source: Oxera.

Starting from the set of outstanding bonds issued by gas networks, we filter for debt instruments based on the following criteria:

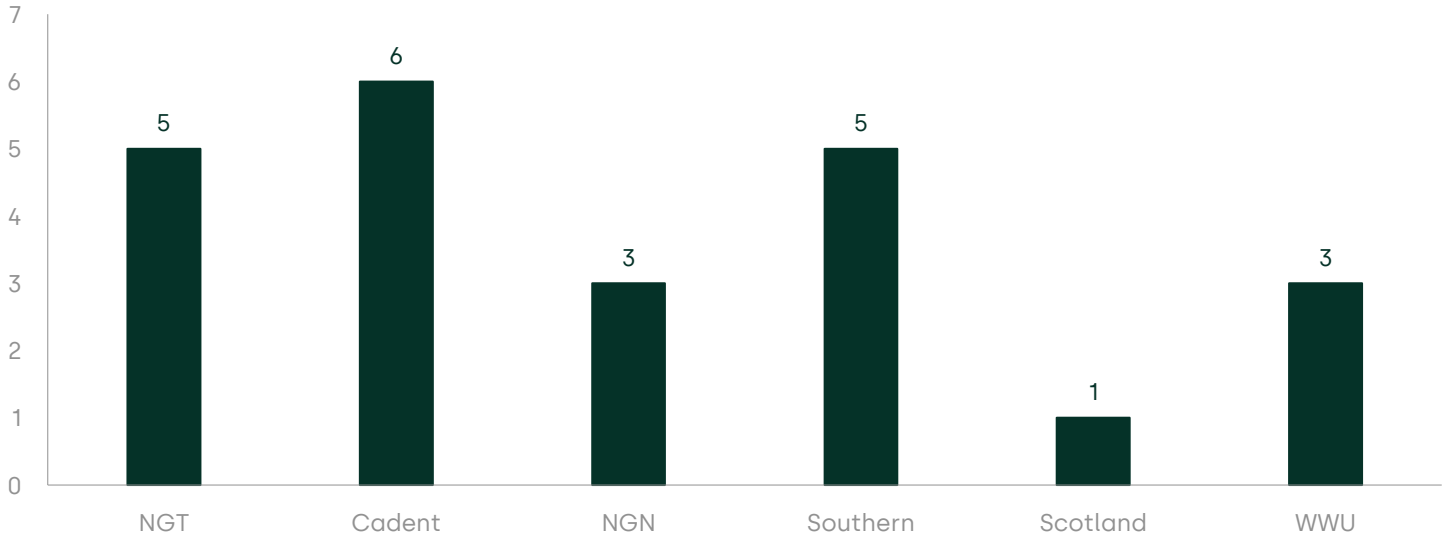
- fixed-interest-rate bonds;[158]
- bullet maturity;
- maturity date after 1 December 2029, i.e. time to maturity from the start of the period of analysis of at least ten years. We apply this filter to limit the analysis to long-term bonds; [159]
- denominated in GBP.

[158] We excluded from our sample four instruments with variable coupons. In addition, we removed 19 inflation-protected instruments, i.e. with principal amounts indexed to inflation.
[159] As our analysis is dynamic, we exclude any bonds from the sample on a rolling basis once their remaining time to maturity becomes less than ten years.

Using these criteria, we identified a sample of 23 bonds.[160]

The total number of debt instruments per network included in the sample is presented in Figure 4.1.

Figure A1.1 Number of debt instruments per licensee included in the sample of filtered bonds

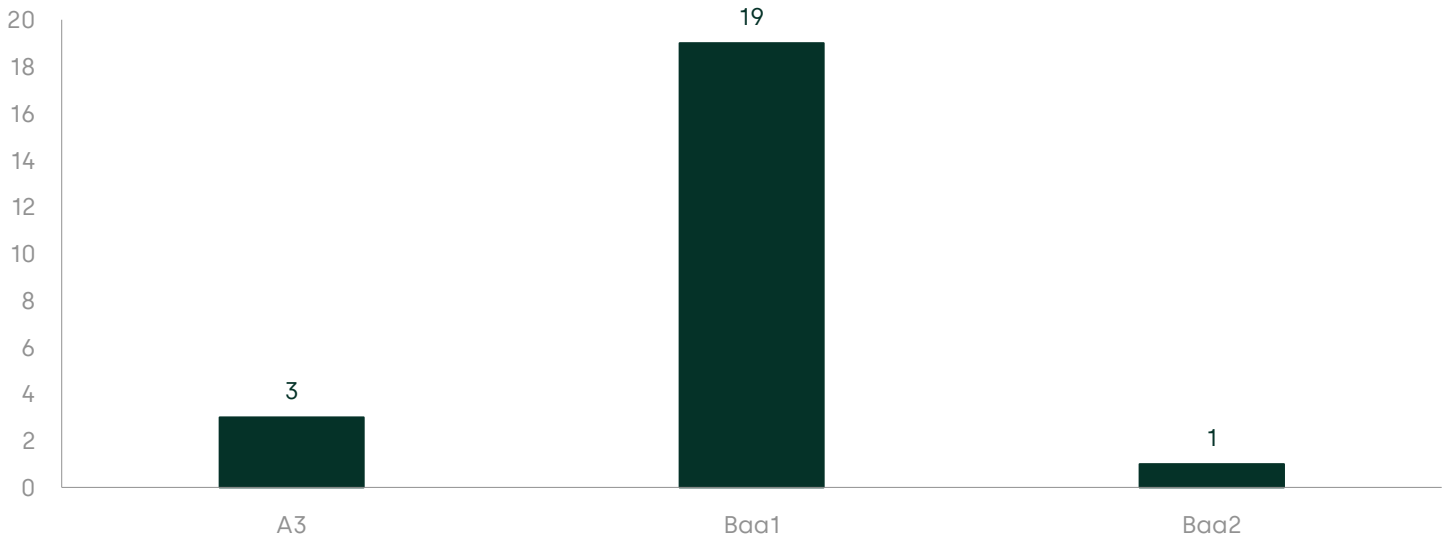


Source: Oxera analysis based on data from S&P Capital IQ.

As shown in Figure A1.2, our gas sample is mostly composed of BBB+/Baa1 rated bonds. The three bonds rated A3/A- pertain to WWU, while the bond rated Baa2/BBB corresponds to Scotland Gas.

[160] In addition to the explicitly stated filtering criteria, we excluded 16 debt instruments due to the absence of historical traded price data, nine of which were private placements. We assessed the liquidity of all bonds in the sample and found that one, issued by NGT on 13 May 2008, exhibited illiquid trading behaviour. This bond was excluded from the sample to prevent any distortion to the analysis. We also excluded one bond with an embedded call option, which could be exercised as early as ten years prior to its maturity date.

Figure A1.2 Credit rating of the sample of bonds issued by gas networks as at 30 June 2025



Note: Whenever a Moody's credit rating was not available for a given bond, we relied on the S&P credit rating, which we then converted to the Moody's rating scale.
Source: Oxera analysis based on data from S&P Capital IQ and Refinitiv Workspace.

We also note that nine out of the 23 included bonds are marked as callable, and therefore for these instruments we considered the yield to convenience (YTC), rather than the YTM.[161] That said, we note that, for all of these bonds, their embedded call options are exercisable three months before the maturity date at the earliest. Therefore, we assume that this has a negligible impact (if any) on the observed spreads for our gas sample.

Next, we calculate a daily series of debt spreads for each bond by:

- taking the mid YTM (or the mid YTC for securities with embedded options) and the Macaulay duration of each instrument;[162]
- matching each instrument with a nominal gilt with time to maturity corresponding to the duration of the bond—with the corresponding gilt being based on the Bank of England nominal zero coupon gilt spot curve;

[161] According to Bloomberg's definition, the YTC represents the market convention yield that corresponds to the mid-price. The yield to convention is typically the yield to worst for bonds with embedded options, meaning the lowest yield resulting from all possible redemption scenarios on callable securities or the highest yield resulting from all possible redemption scenarios on puttable securities. However, Bloomberg highlights that other conventions are possible depending on the structure and state of the security.
[162] For all bonds, including those with embedded options, we have used the maturity date rather than the call date for the duration calculation. We expect the difference in the outcomes of the two approaches to be minor, as the maximum gap between the call and the maturity dates for the bonds in our sample (for the bonds for which the call dates are available) is only three months, while the gilts data is available for the maturities only at wider intervals of six months.

- subtracting the corresponding gilt yield from the yield of the bond.

Lastly, we calculate a simple average of debt spreads to gilts issued by the same gas licensee to estimate the average debt spread for each licensee.

A2 Implied minimum cost of equity based on Oxera's CoE parameters

In the table below, we show the calculations for the minimum CoE implied from the one-month, one-year, and five-year average implied minimum ARPs based on our sample of filtered gas bonds and using Oxera's CAPM parameters.

Table A2.1 Implied minimum ARP and CoE based on Oxera's CoE parameters and different averaging windows (CPIH-real, 60% notional gearing)

Parameter	Formula	One-month average	One-year average	Five-year average
Implied minimum ARP	[A]	1.77%	1.94%	1.99%
Oxera's RFR	[B]	2.25%	2.25%	2.25%
Oxera's ERP	[C]	5.00%	5.00%	5.00%
Debt beta	[D]	0.075	0.075	0.075
Implied asset beta	[E] = [A] / [C]	0.35	0.39	0.40
Notional gearing	[F]	60%	60%	60%
Implied equity beta	[G] = ([E] – [F]*[D])/(1 – [F])	0.77	0.86	0.88
Implied minimum CoE	**[H] = [B] + [G] * [C]**	**6.12%**	**6.53%**	**6.66%**

Note: The cut-off date for the analysis is 31 March 2025. Implied minimum CoE estimates are 6.20%, 6.70%, and 6.72% for one-month, one-year, and five-year medians.
Source: Oxera analysis based on data from S&P Capital IQ, Bloomberg, the Bank of England, and Ofgem (2025), 'RIIO-3 Draft Determinations – Finance Annex', 1 July.

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