Cost of equity for RIIO-GD3

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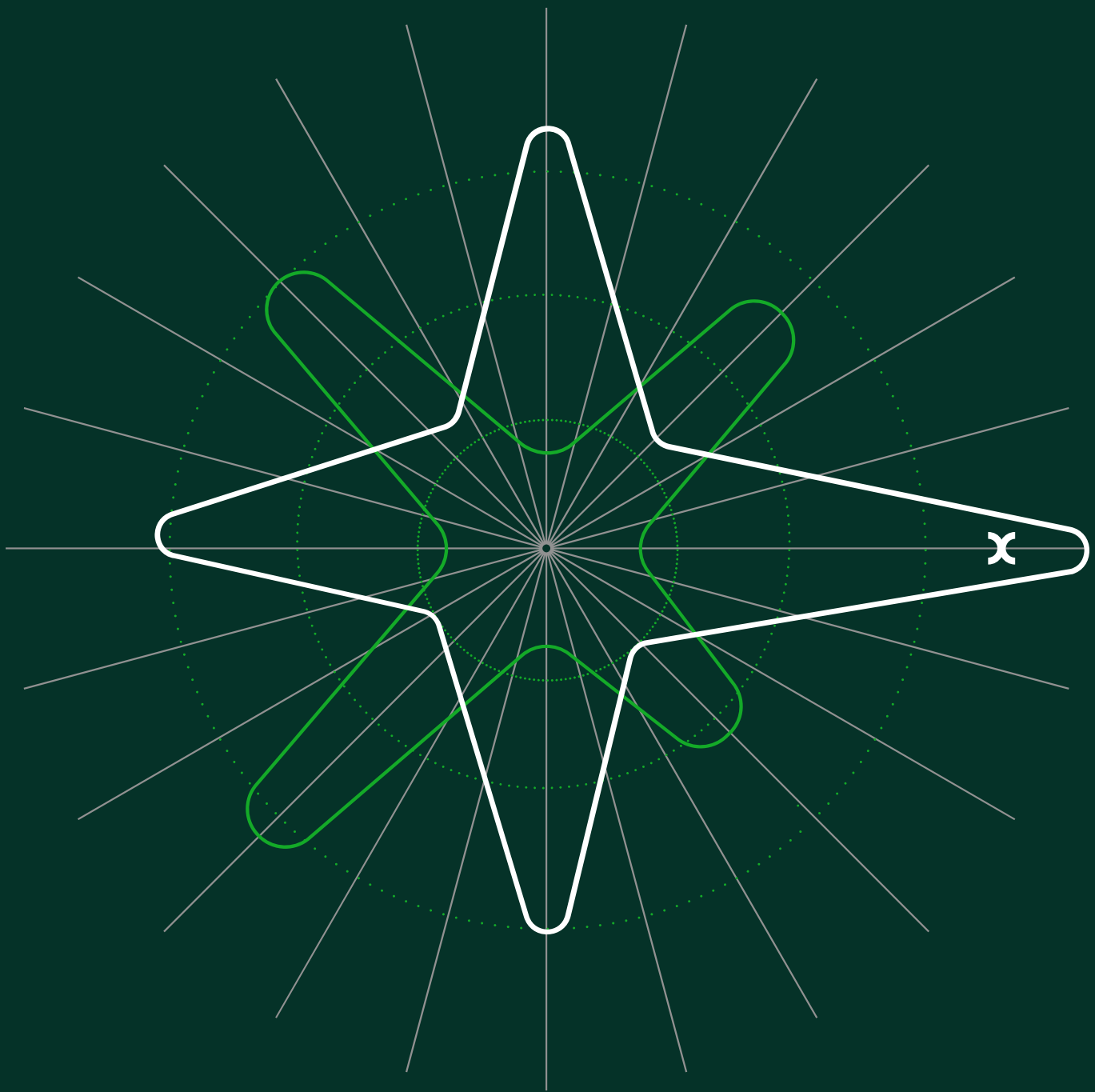
Prepared for GB gas distribution networks

29 November 2024



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Executive summary

In this report, we analyse evidence on an appropriate level of the allowed asset beta for gas distribution networks (GDNs) in the RIIO-GD3 price control by complementing the existing evidence base with gas-specific sector data. We specify the implications for the cost of equity (CoE) range, as well as assess the implications of the debt market evidence for gas networks on the CoE. We also discuss how non-systematic asymmetric risks may need to be accounted for in the CoE allowance separately.

This report is written on behalf of the GB GDNs—i.e. Cadent, Northern Gas Networks (NGN), Scotia Gas Networks (SGN) and Wales & West Utilities (WWU)—following Ofgem's Sector Specific Methodology Decision (SSMD).[1]

Asset beta for GDNs

In its SSMD, Ofgem signalled that it does not currently consider there is sufficient evidence to justify using different beta estimates for the gas and electricity sectors.[2] Separately, the regulator recognised the advantages of including several European energy networks into its beta comparator sample, in addition to National Grid (NG) and UK water networks,[3] and we agree that the inclusion of European energy networks in Ofgem's beta comparator sample would be conducive to improving the accuracy of the regulator's beta estimate. Ofgem will consider at a later stage what weight to attribute to each comparator in the sample in order to derive an accurate asset beta estimate.[4]

In our November 2024 CoE report for the Energy Networks Association (ENA), we reflect Ofgem's SSMD thinking and consider a narrow asset beta range of 0.35–0.40 to estimate the CoE of a baseline UK energy network.[5] However, we also note that this range does not necessarily reflect forward-looking risks, which we can reasonably expect to be

[1] Ofgem (2024), 'RIIO-3 Sector Specific Methodology Decision for the Gas Distribution, Gas Transmission and Electricity Transmission Sectors', https://www.ofgem.gov.uk/decision/riio-3-sector-specific-methodology-decision-gas-distribution-gas-transmission-and-electricity-transmission-sectors (accessed 15 November 2024).
[2] Ofgem (2024), 'RIIO-3 Sector Specific Methodology Decision – Finance Annex', 18 July, para. 3.203.
[3] Ibid., para. 3.199.
[4] Ibid., para. 3.320.
[5] Oxera (2024), 'RIIO-3 cost of equity—CAPM parameters', November, p. 52. This is based on Ofgem's statement that it is 'likely [to] increase its estimate of beta into the upper half of the 0.30 – 0.40 range'. Ofgem (2024), 'RIIO-3 Sector Specific Methodology Decision – Finance Annex', 18 July, para. 3.305.

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increasing in RIIO-3 and beyond, in the context of the energy transition, compared to previous price controls.[6] It does not reflect sector-specific risks either, as Ofgem's SSMD comparator sample includes comparators from several sectors, including, in particular, water as a non-energy sector.

Accordingly, this study supplements the existing evidence base with gas sector-specific data. The purpose of this exercise is to inform the determination of an appropriate asset beta allowance for GDNs. In particular, this provides sector-specific evidence to inform Ofgem's judgement in making a decision on the appropriate level for the asset beta of GDNs. It provides Ofgem with a gas-specific asset beta range that we recommend should be given significant weight (alongside the UK regulated businesses in its sample) in determining a GDN asset beta allowance that is sufficiently reflective of gas-specific risks.[7]

In particular, in weighing the evidence at its disposal to derive its asset beta estimate, Ofgem should account for the fact that the forward-looking risks faced by gas networks are inadequately captured by UK water networks, who face different systematic risks compared to gas networks. Also, we note that gas sector-specific risks are not fully reflected within the beta estimates of NG, who divested gas assets from 2017 to 2023.

Due to the lack of pure-play publicly listed gas networks in Great Britain, we focus our assessment on three listed European gas networks, who face largely similar risks as the GDNs under the regulatory frameworks in which they operate. We also review asset beta allowances by European regulators for gas transmission (GT), gas distribution (GD), gas storage and regasification assets. The latest regulatory allowances for GT and GD networks in France, Germany, Italy, the Netherlands, Portugal, and Spain range from 0.38 to 0.50. The allowances for gas storage and regasification assets increase the upper bound of the range to 0.52, as the latter allowances are higher than the allowances for GT and GD sectors only in Italy.[8]

In order to further inform our analysis of a gas-specific asset beta range, we then widen the sample of comparators to include network

[6] Oxera (2024), 'RIIO-3 cost of equity—CAPM parameters', November, pp. 5 and 52.
[7] We note that it is still not possible to fully capture the forward-looking risks with reference to historical beta estimates.
[8] We have also checked France, Portugal and Spain. In France, although asset betas are identical between GT and gas storage, the overall allowed weighted average cost of capital (WACC) of gas storage is higher than that of GT as a result of the regulator allowing for a premium.

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companies from other countries. As a starting point, we look at the international sample used by the New Zealand Commerce Commission (NZCC) for its beta allowance for energy networks—the NZCC screens for pure-play gas networks across Australia, New Zealand, the UK and the USA.[9] Combined with the European gas network comparators, this results in a comparator sample of nine US gas networks and three European gas networks.[10]

We observe that while the level of asset betas varies among companies, most asset betas in our analysis follow a similar pattern over time. The co-movement of gas network companies' betas in the international sample we have assessed, supports our hypothesis that the risks of these companies are reasonably similar and representative of the gas network sector.

The overall asset beta range based on the described evidence is 0.29–0.50. We have narrowed down this gas-sector range of evidence to **0.40–0.44** based on the following considerations.

- We consider 0.40 to be an appropriate lower bound for our gas-specific asset beta range, in light of European evidence, whether empirical (the evidence on the long-term European gas networks' asset betas suggesting a figure towards the top of Ofgem's own focal SSMD range of 0.35–0.40[11]), or regulatory (precedents on the asset beta allowance for gas networks being in a range of 0.38–0.50). Furthermore, the empirical analysis of the asset betas of our sample across the two considered geographies (i.e. the USA and Europe) shows that most of the estimated asset beta averages are above 0.40, with only the very short-term (i.e. the spot and two-year average of the two-year asset betas) below this mark. Given Ofgem's view that more weight should be placed on long-term betas, we consider that the balance of the evidence supports a lower bound of 0.40.
- As for the upper bound of the narrow range, we consider 0.44 to be appropriate. Indeed, it is the midpoint of the range of European regulatory precedents on asset beta allowances for gas networks (0.38–0.50). It is also consistent with the average

[9] New Zealand Commerce Commission (2023), 'Cost of capital topic paper–Part 4 Input Methodologies Review 2023–Final decision', 13 December, paras 4.229–4.242.
[10] The NZCC also includes companies in Australia and New Zealand in its full sample of energy networks. However, there are no pure-play gas networks in those geographies.
[11] i.e. within the upper half of 0.30–0.40, as suggested by Ofgem in Ofgem (2024), 'RIIO-3 Sector Specific Methodology Decision – Finance Annex', 18 July, para. 3.305.

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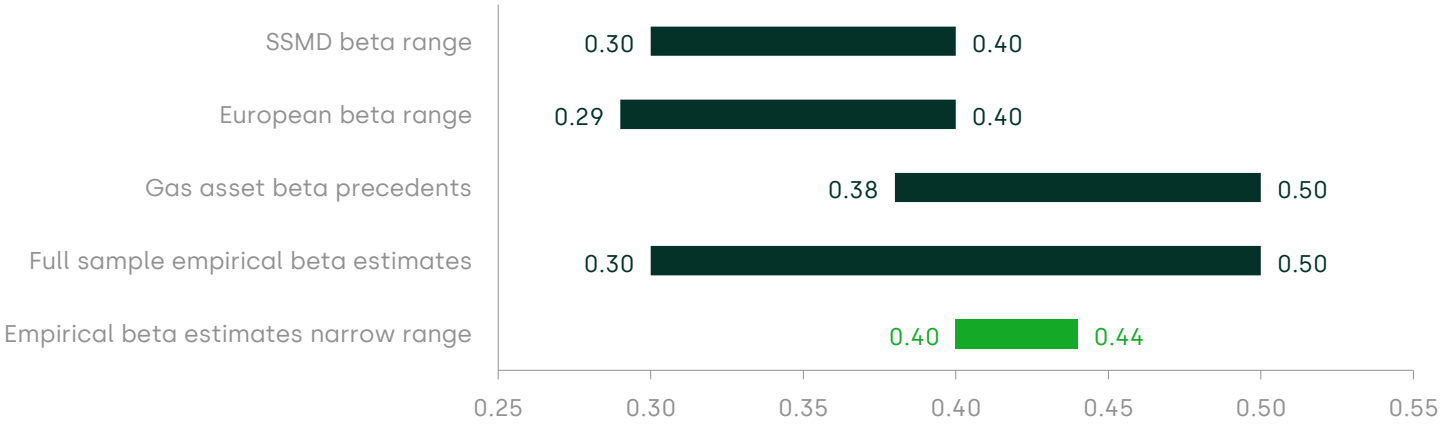
of the long-term betas in the two considered geographies within the sample (i.e. the USA and Europe). We note that in consolidating the upper bound of our narrow range, we retain the simple average of the European and US asset betas, which implicitly gives more weight to European evidence, as there are less European comparators in the extended sample.

Our range is, overall, strongly supported by European evidence (in particular, it overlaps with the bottom half of the range of European regulatory precedents), and consolidated by the inclusion of wider international evidence from the USA in order to ensure gas-specific risks are appropriately captured.

Figure 1 demonstrates the ranges.

Figure 1 Asset beta ranges



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

Accordingly, while a 0.40–0.44 asset beta range robustly reflects the gas-specific evidence analysed in this report, we observe that in forming a judgement on the RIIO-GD3 allowed beta, Ofgem will likely attribute some weight to the non-gas UK evidence as per Ofgem's SSMD sample. In order to reflect this, we assume that a wider range of 0.38–0.44 for RIIO-GD3 is appropriate to cross-check the calculation of the CoE based on the capital asset pricing model (CAPM) (as discussed below). Specifically, the lower bound of this range is equal to the midpoint of

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Ofgem's own focal SSMD range,[12] and it is consistent with the lower bound of the precedents on gas asset beta allowances in Europe as analysed in this report to supplement Ofgem's evidence base.

We combine these asset beta ranges (the gas-specific range and the one weighing in evidence from Ofgem's SSMD comparator sample) with the risk-free rate (RFR) of 1.54% (CPIH-real), updated based on the methodology from our November 2024 CoE report for the ENA,[13] and the total market return (TMR) range of 7.00–7.50% (CPIH-real) from the same report to calculate the implied CAPM-based CoE range.

- The CoE range using the gas-specific asset beta range (of 0.40–0.44) is **6.39–7.43%** (at 60% gearing, CPIH-real), with a midpoint of **6.91%**.
- The CoE range calculated using the asset beta range weighted at the lower end by non-gas evidence from Ofgem's SSMD (of 0.38–0.44) stands at **6.04–7.43%**, with a midpoint of **6.73%**.

Debt market evidence

Our previous report for the GDNs contained evidence of a 'gas premium' in credit spreads of long-term gas network bonds relative to electricity network bonds in recent years.[14] Assuming no difference in financial risk factors, such as gearing, a higher credit spread implies a higher asset risk premium and, by extension, a higher CoE.

In this report, we therefore apply the asset risk premium–debt risk premium (ARP–DRP) framework to cross-check the CAPM-based gas-specific CoE.

The ARP implicit within the CoE range of 6.04–7.43% is 2.05–2.62%.[15]

Using GB gas networks' long-term debt, we estimate a gas-specific DRP. We note that the 'true' ARP for companies with lower risk relative to the economy (such as utilities within a broad stock market index) should be higher than this DRP, extrapolated at 100% gearing (equal to 2.03%). To obtain a CoE estimate for gas networks that is consistent with the debt

[12] i.e. within the upper half of 0.30–0.40. The midpoint of the 0.35–0.40 range is 0.375, and this is rounded to 0.38 in this report for presentation purposes.
[13] Oxera (2024), 'RIIO-3 cost of equity—CAPM parameters', November, p. 7.
[14] Oxera (2024), 'Risks and investability of the GB gas distribution sector. Prepared for GB gas distribution networks', 1 March, section 2C.
[15] The ARP equals the asset beta times the difference of TMR and RFR. For the CoE low scenario this equals 0.38*(7.00% - 1.54%) = 2.05%. For the CoE high scenario this equals 0.44*(7.50% - 1.54%) = 2.62%.

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market evidence, it is therefore necessary to combine a TMR of at least 7.00% at the top end of Ofgem's SSMD range (and in our own TMR range of 7.00–7.50%) with an asset beta that is higher than 0.37 (i.e. 0.38 or above); the whole of the 0.40–0.44 range built on gas-specific evidence as analysed in this report is therefore supported by the cross-check from debt markets. We note that if Ofgem does not allow a TMR of at least 7.00%, the allowed asset beta would face upward pressure within the asset beta range.

We also note that even if Ofgem were to 'aim up' within the upper half of its SSMD beta range (i.e. to 0.38 within the 0.30–0.40 range), while using the midpoint of its TMR range (i.e. 6.75% within the 6.5–7.0% range), the lower bound ARP from the debt market evidence for GDNs would not be satisfied.[16] This shows that the SSMD minded-to position is too low as regards the allowed cost of equity for GDNs, thereby supporting the use of gas-specific evidence (i.e. the gas-specific evidence in this report that shows an asset beta range of 0.40–0.44) to extend the SSMD analysis and inform the RIIO-GD3 decision.

Accounting for gas-specific risks

Ofgem considers that changes to the beta comparator sample (i.e. the inclusion of European energy networks) and to the depreciation profile of the GDNs' regulated asset value (RAV) (i.e. accelerated depreciation) are sufficient to reflect changes in the GDNs' risk profile between RIIO-3 and RIIO-2.[17]

We consider that these changes do not adequately eliminate or compensate the GDNs for gas-specific risks. Indeed, Ofgem's beta comparator sample in the SSMD does not properly reflect gas-specific, forward-looking risks. The evidence in this report demonstrates that this is the case, by supplementing the existing evidence base with gas sector-specific data that supports a range of 0.40–0.44, which is just above the top end of the range assessed by Ofgem in the SSMD (i.e. 0.30–0.40). Also, proposed changes to the depreciation schedule of network assets are not sufficient to fully eliminate the asymmetric stranding asset risks, as uncertainty remains around networks' future ability to recover their costs. Besides, Ofgem's proposed changes to the

[16] For the purpose of this analysis, we have recalculated a DRP extrapolated at 100% gearing that is consistent with Ofgem's RFR assumption.
[17] Ofgem (2024), 'RIIO-3 Sector Specific Methodology Decision – Finance Annex', 18 July, para. 3.305.

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depreciation schedule of the GDNs' RAV might create other risks that would need to be compensated.

While Ofgem indicated in the SSMD that it was considering aiming up within the asset beta range, we note the regulator's intention in doing so is to improve the accuracy of its asset beta estimate (i.e. parametric uncertainty), and not to compensate for asymmetric risks in the context of the price control package. In light of the fact that asymmetric risks such as asset stranding (i.e. the inability for GDNs to (fully) recover their investments into the networks, or even the ongoing costs of operating the networks, in the future) are not fully mitigated by the proposed regulatory package, we view aiming up within the proposed CoE range as an appropriate mechanism for Ofgem to use towards providing a compensation to GDNs for these risks.

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1 Introduction

1.1 The GB gas distribution networks (GDNs)—i.e. Cadent, Northern Gas Networks (NGN), Scotia Gas Networks (SGN) and Wales & West Utilities (WWU)—have asked Oxera to build on the existing evidence base with gas sector-specific data to inform Ofgem's estimate of an appropriate level of the allowed asset beta for GDNs in the RIIO-GD3 price control, assess the implications of the debt market evidence for gas networks and, taking each into account, provide evidence to inform Ofgem's GDN-specific cost of equity (CoE) range.

1.2 This report is written in the context of the ongoing RIIO-GD3 consultation process, as a follow-up to the publication of Ofgem's Sector Specific Methodology Decision (SSMD).[18]

1.3 In the Sector Specific Methodology Consultation (SSMC), Ofgem discussed the upcoming challenges of the gas sector in relation to demand reduction—i.e. that 'demand [is] expected to fall over time as the energy system adapts to support the transition to a carbon-free economy by 2050 to achieve net zero'.[19] As for electricity, Ofgem noted that the sector expects significant growth due to electrification.[20] Given that the challenges of the two sectors diverge, Ofgem considered that their corresponding asset beta allowances could be differentiated if sufficient evidence is presented.[21] Ofgem then invited stakeholders to submit such evidence.[22]

1.4 In the SSMD, Ofgem has not indicated a differential in the allowed asset beta estimate for the gas and electricity sectors, noting its intent to analyse this further: 'At this point, we do not think that there is sufficient data to isolate evidence that there is a structural premium in gas, or justify a set asset beta premium for gas over ET in RIIO-3, but will continue to monitor

[18] Ofgem (2024), 'RIIO-3 Sector Specific Methodology for the Gas Distribution, Gas Transmission and Electricity Transmission Sectors', https://www.ofgem.gov.uk/decision/riio-3-sector-specific-methodology-decision-gas-distribution-gas-transmission-and-electricity-transmission-sectors (accessed 15 November 2024).
[19] Ofgem (2023), 'Consultation – RIIO-3 Sector Specific Methodology Consultation – Finance Annex', para. 1.7.
[20] Ofgem (2024), 'Ofgem's Multiyear Strategy', p. 16.
[21] Ofgem (2023), 'Consultation – RIIO-3 Sector Specific Methodology Consultation – Finance Annex', para. 3.75.
[22] Ibid., FQ9, p. 42.

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this data.'[23] Ofgem has also emphasised the importance of taking account of gas sector risks in its selection of the comparator sample, not least because the only pure-play UK energy network comparator, National Grid (NG), has divested its gas assets over time.[24]

1.5 An appropriate level of the CoE allowance, and by extension beta, is also essential in ensuring 'investability' of the gas sector—a concept referred to by Ofgem in RIIO-3.[25] We discuss this in more detail in our previous report for the GDNs that focuses on their risks and investability.[26]

1.6 In the same report, we also explained that the debt market is informative of asset risks that need to be reflected in the beta and CoE estimates. In particular, we provided evidence for a 'gas premium' based on a widening of credit spreads for long-term gas network bonds in recent years. We also explained that, assuming no difference in financial risk factors such as gearing, a higher credit spread implies a higher asset risk premium and by extension a higher CoE. In this report, we quantitatively translate the market evidence for gas networks into a CoE cross-check.

1.7 The rest of the report is structured as follows.

- In section 2, we start by discussing Ofgem's positions in the SSMD, in particular regarding a differentiated beta between the gas and electricity sectors and the composition of the beta comparator sample. We then look at empirical evidence on the asset betas of European gas networks and assess data on asset beta allowances in gas sectors set by regulators in Europe. We then extend the sample of beta comparators to US networks, before concluding on appropriate gas-specific asset and equity betas.
- In section 3, we derive an overall CoE range for GDNs that would be informed by the gas sector-specific evidence

[23] Ofgem (2024), 'RIIO-3 Sector Specific Methodology Decision – Finance Annex', 18 July, para. 3.200.
[24] Specifically, in the SSMD, Ofgem states that: 'On balance, we provisionally see a net benefit in including European utility companies in our comparator set. […] We see particular value in bringing in direct estimation of gas energy network risk given the questions we face in terms of the perception of asset stranding risk in this sector.' Ofgem (2024), 'RIIO-3 Sector Specific Methodology Decision – Finance Annex', 18 July, paras 3.197–3.198.
[25] Ofgem (2024), 'RIIO-3 Sector Specific Methodology Decision – Finance Annex', 18 July, para. 1.6.
[26] Oxera (2024), 'Risks and investability of the GB gas distribution sector', 1 March.

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analysed in this report, based on the capital asset pricing model (CAPM).

- In section 4, we quantify the implications of the gas networks' debt market evidence for the GDNs' CoE with reference to the asset risk premium–debt risk premium (ARP–DRP) framework.
- In section 5, we assess whether the modifications considered by Ofgem for RIIO-3 are sufficient to adequately address gas-specific (systematic) risks.
- In section 6, we conclude.

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2 Estimating a gas-specific asset beta

2.1 In this section we assess an appropriate gas-specific beta estimate. We assess sector-specific evidence to inform Ofgem's decision, which complements the existing evidence base in the SSMD (i.e. NG, listed water companies and European energy networks). First, we comment on Ofgem's SSMD position on the asset beta (section 2.1). Second, we assess European evidence by carrying out an empirical analysis of the asset beta of European gas networks and reviewing European regulatory precedent on beta allowances for the relevant sectors (section 2.2). We then collect further empirical evidence from an international dataset (section 2.3), before concluding on an appropriate gas-specific asset beta range and the associated equity beta range (sections 2.4 and 2.5).

2.1 Comments on Ofgem's SSMD position

2.2 This subsection discusses Ofgem's SSMD position on the asset beta. In particular, in section 2.1.1 we come back to discussion of Ofgem's current view that a differentiated beta between the gas and electricity sectors is not appropriate. In section 2.1.2 we comment on how the weighting of the evidence would affect the determination of an appropriate asset beta allowance.

2.1.1 Ofgem's position on a differentiated beta between the gas and electricity sectors

2.3 In its SSMC, Ofgem recognised that '[i]f there is also evidence indicating that the gas distribution (GD), gas transmission (GT) and electricity transmission (ET) sectors face different levels of systematic risk on a sectoral basis, it may be appropriate to use different beta estimates for the different network sectors and the allowed return on equity may differ as a result'.[27] It then invited stakeholders' views on the appropriate comparators and timeframes to estimate the beta for energy sectors.[28]

2.4 In response to this consultation, we submitted a report that showed that there is evidence of a 'gas premium' in debt

[27] Ofgem (2023), 'Consultation – RIIO-3 Sector Specific Methodology Consultation – Finance Annex', 13 December, para. 3.75.
[28] Ibid., FQ9, p. 42.

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markets and that this should translate into a higher asset risk premium, i.e. a higher CoE, for gas networks.[29]

2.5 In the SSMD, Ofgem has not indicated a differential in the allowed asset beta estimate for the gas and electricity sectors, noting its intent to analyse this further.[30] Ofgem has also emphasised the importance of taking account of gas sector risks in its selection of the comparator sample, noting: 'On balance, we provisionally see a net benefit in including European utility companies in our comparator set. […] We see particular value in bringing in direct estimation of gas energy network risk given the questions we face in terms of the perception of asset stranding risk in this sector.'[31]

2.6 We also note that Ofgem has examined the evidence that Oxera submitted as regards the gas premium, and noted that there is a 'potentially inconsistent pattern' as regards the observation that Italgas' (Italian GD) five-year asset beta is lower than Terna's (Italian electricity transmission) five-year asset beta.[32]

2.7 In the Oxera report that analysed the gas premium, we presented a range of data from capital markets to highlight that widening credit spreads between gas and electricity bonds were reflective of increasing perceived risk of gas compared with electricity. Evidence on European networks' asset betas also showed that gas asset betas were, on average, higher than electricity asset betas. The conclusion regarding the existence of a gas premium was therefore underpinned by a balanced and robust review of the evidence.

2.8 Specifically, we did not selectively present only evidence that pointed to the existence of the gas premium. It would therefore not be robust to put no weight on a balanced set of evidence on the basis of one observation from a matched pairs analysis (Italgas vs Terna for five-year betas), as Ofgem appears to have done in the SSMD.[33] Indeed, Ofgem appears to acknowledge

[29] Oxera (2024), 'Risks and investability of the GB gas distribution sector', 1 March.
[30] Ofgem states: 'At this point, we do not think that there is sufficient data to isolate evidence that there is a structural premium in gas, or justify a set asset beta premium for gas over ET in RIIO-3, but will continue to monitor this data.' Ofgem (2024), 'RIIO-3 Sector Specific Methodology Decision – Finance Annex', 18 July, para. 3.200.
[31] Ofgem (2024), 'RIIO-3 Sector Specific Methodology Decision – Finance Annex', 18 July, paras 3.197–3.198.
[32] Ibid., para. 3.200.
[33] Ibid.

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that this observation is partial, because it notes that a) betas estimated over different timeframes for Italgas relative to Terna support the observation of a gas premium;[34] and b) matched pairs analysis for other Italian assets (i.e. Snam vs Terna) supports the observation of a gas premium.[35]

2.9 The balance of evidence supports there being a gas premium on the basis of the historical capital markets evidence and regulatory precedent, prior to incorporating forward-looking risks. In this context, this report aims to determine an appropriate gas-specific asset beta range to build on the existing evidence base for the CoE of gas networks over RIIO-3.

2.10 We also note that UKRN guidance states that 'regulators should only deviate from midpoint of the CAPM cost of equity range if there are strong reasons to do so'.[36] This report aims to provide the required evidence base for Ofgem to set an appropriate asset beta for RIIO-GD3, based on empirical evidence, regulatory precedent and the use of appropriate cross-checks (including the ARP–DRP cross-check).

2.1.2 Weighting of the evidence

2.11 There are no pure-play publicly listed gas and electricity networks in Great Britain. The only publicly listed energy networks are NG and SSE.

2.12 In our work for the Energy Networks Association (ENA) in response to the RIIO-3 SSMC, we estimated a CoE for a baseline GB energy network without yet accounting for potential sector-specific and forward-looking risks.[37] In that work, we used a sample of UK and European energy and water networks to estimate the beta. The sample that we use is therefore almost identical to that used by Ofgem in its SSMD.[38]

2.13 In the SSMD, Ofgem signalled its intention to weight evidence from NG, UK water networks and European energy networks to obtain an accurate estimate for the purpose of setting the asset

[34] Ibid.
[35] Ofgem (2024), 'RIIO-3 Sector Specific Methodology Decision – Finance Annex', 18 July, para. 3.200.
[36] UKRN (2023), 'UKRN guidance for regulators on the methodology for setting the cost of capital', 23 March, p. 5.
[37] Oxera (2024), 'RIIO-3 cost of equity', 23 February.
[38] The only difference between our sample and that used by Ofgem in its SSMD is the inclusion of Pennon in our beta comparator sample.

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beta allowance for GB networks.[39] The purpose of this section is to comment on an appropriate weighting for each strand of evidence.

2.14 NG has historically had a mix of gas and electricity (and GB and US) assets. However, the proportion of gas in the mix has declined over time, with the restructuring of NG's portfolio following its strategy to pivot the portfolio towards electricity in order to align with the national agenda of achieving net zero by 2050.[40] SSE has a relatively low proportion of regulated network activities, and has not been included in the sample as part of the Oxera February 2024 ENA CoE report, or by Ofgem in the SSMD analysis. Accordingly, any analysis of historical betas for publicly listed UK energy networks would have limitations in representing the risks that are specific to GDNs.

2.15 With regard to UK water networks, it is helpful to note that, while the regulatory framework is broadly similar,[41] the UK water sector is on a divergent path, relative to the gas sector, with respect to the impact of net zero policies and investment pathways.

2.16 Specifically, in light of the government's net zero target, the gas sector is set to reduce its regulated asset value (RAV) significantly by 2050. For this purpose, Ofgem is currently considering the introduction of accelerated depreciation schemes in the gas sector, the implications of which we discuss in section 5.2. In its SSMD, Ofgem illustrates that it expects the gas distribution RAV to reduce to zero by 2050 under the majority of the accelerated depreciation options.[42] Hence, the gas sector is likely to exhibit a declining RAV in the medium to long term, with decreasing investment needs.

2.17 The opposite trend can be observed when looking at water companies. Ofwat expects RAV growth of 12.7% to 34.5%

[39] Ofgem (2024), 'RIIO-3 Sector Specific Methodology Decision – Finance Annex', 18 July, para. 3.320.
[40] See National Grid (2021), 'Repositioning National Grid's portfolio', 18 March, https://www.nationalgrid.com/repositioning-national-grids-portfolio (accessed 15 November 2024); National Grid (2022), 'Sale of majority interest in NGGT and Metering', 27 March, https://www.nationalgrid.com/gt-announcement (accessed 15 November 2024). The divestiture of Cadent's activities from NG was finalised in 2019, while the ownership of the gas transmission network changed in 2023. Ten-year betas of NG would therefore still include the periods when NG had greater exposure to gas network businesses than it does currently.
[41] Arguably, there are factors of the regulatory regime that are a priori lower risk in water, such as the CMA appeals process for energy vs redeterminations in the water sector.
[42] Ofgem (2024), 'RIIO-3 Sector Specific Methodology Decision – Finance Annex', 18 July, Figure 16.

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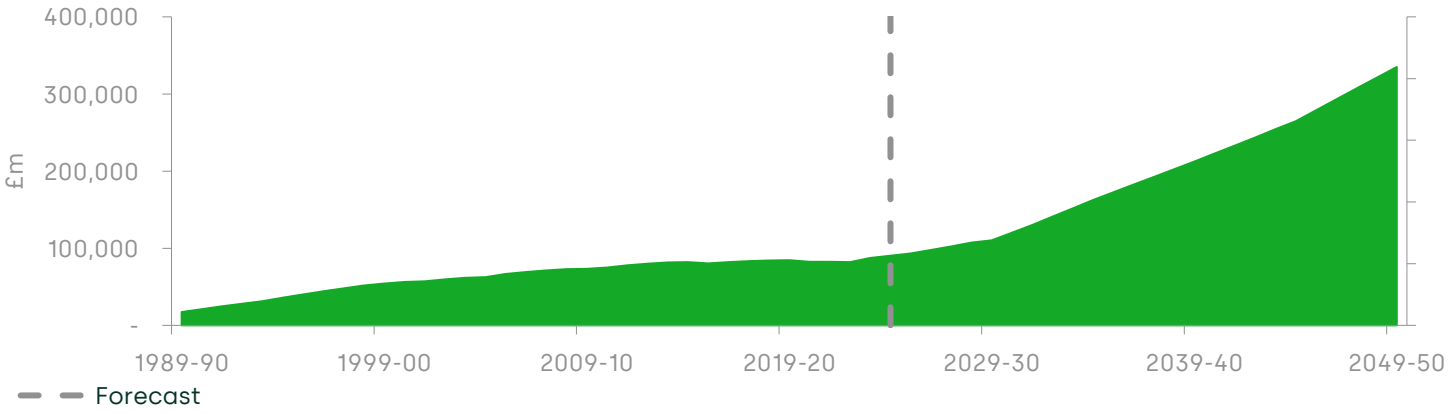
between 2025 and 2030.[43] In Figure 2.1 below we illustrate how the RAV of water companies used to be relatively stable, but is now expected to significantly increase by 2050.[44] Correspondingly, there are substantial investment requirements for water companies in the medium to long term.

Figure 2.1 RAV growth forecast for UK water and sewage companies



Note: RCV growth forecast based on PR24 Draft Determinations for AMP8 and LTDS forecast enhancement CAPEX for the following periods; for AMP9 onwards maintenance CAPEX is assumed to be equal to the RCV run-off rate. Historic data is used up until financial year 2023/24.
Source: Oxera analysis.

2.18 Ofwat, for instance, notes in its Draft Determinations that similar levels of RAV growth are one of the relevant criteria to select appropriate comparators.[45]

2.19 Overall, we consider that Ofgem's statement that 'the Water networks in England and Wales as having [...] thematically similar challenges relating to ensuring resilience, managing investment and adapting to climate change'[46] does not directly apply to the gas sector: if the challenges are indeed thematically similar, the implications of net zero for gas networks are very different to what they are for water companies, in particular in terms of required levels of

[43] Ofwat (2024), 'PR24 draft determinations – Aligning risk and return', July, p. 24.
[44] The figure focuses on water and sewage companies due to limited availability of historic data for water-only companies.
[45] Ofwat (2024), 'PR24 draft determinations – Aligning risk and return – Allowed return appendix', July, p. 48.
[46] Ofgem (2024), 'RIIO-3 Sector Specific Methodology Decision – Finance Annex', 18 July, para. 3.202.

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investment and future utilisation levels. This affects differing levels of asset stranding risk.

2.20 Therefore, giving substantial weight to water comparators would inadequately capture gas-specific risks.

2.21 We also note, for completeness, that Ofgem has changed the water company sample since RIIO-2 by excluding Pennon Group from its comparator sample—if this is driven by the presence of unregulated businesses within Pennon,[47] it is not clear from Ofgem's rationale why Pennon was included in the RIIO-2 sample but not in RIIO-3; Ofgem's methodological change in excluding Pennon has not been discussed extensively nor robustly defended as part of the SSMD narrative.[48] Given that the beta for Pennon Group is higher than those for the other water companies in Ofgem's sample, the change in Ofgem's RIIO-3 water comparator sample would also put downward pressure on its estimated beta.[49]

2.22 The justification for including UK water networks in the beta comparator sample used to be that they face the same regulatory risk as UK energy networks, given the similarities in the regulatory regimes applied by Ofwat and Ofgem.

2.23 However, sectoral systematic risks are different between the water and energy sectors. As we show with reference to wider gas sector-specific evidence in the later sections of this report, assigning a meaningful weight to UK water companies in the sample for RIIO-GD3 would introduce a downward bias in the estimation of the risks faced by gas networks specifically. It appears that the challenges faced by the two sectors are diverging, especially in terms of investment needs and future usage of the network. This is shown by evidence on expected investment trends over RIIO-3 and subsequent periods, as analysed above.

[47] Ofgem (2024), 'RIIO-3 Sector Specific Methodology Decision – Finance Annex', 18 July, para. 3.202.
[48] Ofgem (2024), 'RIIO-3 Sector Specific Methodology Decision – Finance Annex', 18 July, para. 3.202; and Ofgem (2021), 'RIIO-2 Final Determinations – Finance Annex (REVISED)', 3 February, para. 3.71.
[49] Based on Oxera analysis, the asset beta of Pennon Group is 0.04 to 0.05 higher than the average asset beta of United Utilities and Severn Trent as of July 2024 depending on the chosen windows. In its PR24 DD, Ofwat also shows a higher beta for Pennon Group than for other comparators. Ofwat (2024), 'PR24 draft determination – Aligning risk and return – Allowed return Appendix', July, Figure 9.

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2.24 Finally, with regard to European energy networks, we consider that they operate under a regulatory framework that entails a broadly similar level of risk to the one in which UK networks operate. Therefore, including them in the beta comparator sample is likely to improve the accuracy of the beta estimate. We discuss the regulatory frameworks that are applied to some European gas networks (in particular, those under which the gas networks retained in the beta comparator sample operate) further in section 2.2.1,[50] analysing across multiple dimensions the level of risk that each regulatory framework entails, and how these risks compare with those observed for RIIO-2 (i.e. the current price control).

2.25 More generally, we note that the use of European comparators in determining asset betas is not unusual for regulators in the UK. For example, in Ofcom's 2017 Wholesale Local Access Market Review, a sample of European telecoms companies were used when determining the reasonable range for the asset beta of BT's 'Other UK telecoms' activities.[51]

2.26 Additionally, Ofcom considered asset betas from a sample of US telecoms operators. Allowing for differences in regulatory regimes, these were given only limited weight when disaggregating BT group's asset beta.[52] We note that this is consistent with the approach that we have taken in this report of analysing US networks to more fully inform our beta range for sector-specific risks, while allowing for a higher weight to be given to the European comparators in narrowing our estimation.

2.27 Similarly, in the CMA's 2020 assessment of NATS En-route Limited (NERL) and the Civil Aviation Authority's (CAA) regulatory appeal, large European airports were determined to be appropriate direct comparators. The CMA noted that its preference in estimating asset betas was to use a wider range of comparators rather than to apply judgement in interpreting the evidence of the measured asset betas, based on the following two main factors. First, the beta data should be reliable, without any outliers that warrant concerns. Second, the

[50] We discuss the comparability of other regulatory frameworks in more detail in Appendix 6A1.
[51] Ofcom (2018), 'Wholesale Local Access Market Review – Annexes', Statement document, pp. 120–122.
[52] Ibid.

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beta data should be based on businesses and investors that are sufficiently comparable.

2.28 Specifically, the CMA explained that large European airports meet these criteria for four reasons. First, the CMA expected that investors would be guided by expectations around longer-term trends in the relevant sector as a whole. Second, large comparators would have significant equity-free floats and therefore significant liquidity, resulting in reliable beta estimates. Third, while there are differences in regulatory regimes, the differences do not insulate these comparators from sector-specific risks. Finally, while aspects of these comparators' businesses would be of limited relevance to the estimate of the beta allowance, these would represent only a minority of their activities.[53]

2.29 It is interesting to note that the CMA also excluded UK utilities companies, which the CAA used to determine the lower bound for NERL's asset beta, in particular because NERL is more exposed to systematic risks than utilities.[54]

2.30 In addition to regulators in the UK, we note that including comparators in other countries within the same sector when determining appropriate asset betas is also common in other European countries. For example, the Irish communications regulator, ComReg, has used comparators from across the EU, as well as the UK, in its weighted average cost of capital (WACC) update for the Irish mobile, fixed-line and broadcasting sectors since 2021.[55] Their selection follows the European Commission's recommendations.

2.31 Overall, the use of international comparators operating in the same sector as the one that they are overseeing constitutes accepted practice by UK regulators.

2.32 In fact, the arguments raised by the CMA in the context of the NATS appeal appear to be analogous to the RIIO-3 context. In

[53] Competition and Markets Authority (2020), 'NERL / CAA Regulatory Appeal Final Report', 23 July, pp. 179–198.
[54] The CMA noted that, while it accepted the CAA's position, it did not believe that such a lower bound added to the accuracy of the analysis, and the CMA considered the additional risks to which NERL is exposed were likely to imply a materially higher beta. Competition and Markets Authority (2020), 'NERL / CAA Regulatory Appeal Final Report', 23 July, para. 13.53.
[55] ComReg (2024), 'Weighted Average Cost of Capital Annual update – 2024', 20 June; Europe Economics (2024), 'WACC update for the Irish mobile, fixed-line and broadcasting sectors', April.

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particular, the CMA's argument that including sectoral comparators helps to account for investors' long-term trends in the relevant sector supports Ofgem's thinking in the SSMD as regards the inclusion of European networks in its beta comparator sample. Indeed, in order 'to ensure that we are capturing the risk of the sector on a forward-looking basis', Ofgem decided to include European utility companies in its comparator set.[56]

2.33 In its SSMD, Ofgem also noted that the regulatory frameworks under which European networks operate may be different from that under which GB networks operate,[57] and indicated that, although it was minded to include five networks from Spain and Italy in its comparator set, it would 'consider [the addition of these networks to the beta comparator set] further between SSMD and DDs to ensure that the regulatory regimes and business mixes of these European comparators are suitably similar'.[58]

2.34 The position developed by the CMA in the NATS appeal suggests that Ofgem's concerns regarding the comparability of the regulatory regimes should not preclude Ofgem from including those networks in its beta comparator sample, as long as their stock is suitably liquid. To further alleviate these concerns, we discuss the comparability of the GB, Italian and Spanish regulatory frameworks in the gas sector below.

2.35 Also, the CMA's exclusion of utilities in the determination of NERL's beta for reasons related to exposure to systematic risks supports the premise that systematic risks should be fairly similar across the comparators in order to derive an accurate asset beta estimate.

2.36 Overall, it can be inferred from the reasoning advanced by the CMA in that appeal that using European energy networks in the beta comparator sample is appropriate.

2.37 In summary, the evidence in this section and in this report shows that there does not appear to be any robust reason for Ofgem

[56] Ofgem (2024), 'RIIO-3 Sector Specific Methodology Decision – Finance Annex', 18 July, paras 3.194–3.197.
[57] Ibid., para. 3.197.
[58] Ibid., para. 3.199.

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to put less weight on European energy comparators than it does on UK water companies.

2.38 Indeed, in the context of RIIO-3 and beyond, we have shown data on the future divergent investment needs in water relative to gas, which would tend to weaken the comparability of the systematic risks between the two sectors (including in relation to forward-looking risks, which may not be fully captured by historical betas). Moreover, in the context of the sector-specific risks, the European energy comparators need to be weighted alongside NG, to ensure that gas-specific risks are adequately represented within the network beta estimation for RIIO-3. Our focus in this report is, accordingly, to complement the existing evidence base as developed up to SSMD (i.e. water assets, NG and European energy assets) with gas sector-specific data to inform Ofgem's judgement on the appropriate GDN asset beta for RIIO-GD3.

2.39 Specifically, considering that a sample comprising UK water companies, NG and various European energy networks (which also include electricity networks) may not adequately represent gas-specific risks (even if a significant weight is attributed to European gas networks within that sample), the remainder of this section aims to establish a range for a gas-specific asset beta. This is in order to derive a CoE that would adequately remunerate GDNs for the specific risks that they face. The gas-specific asset beta range is derived on the basis of European evidence, but also drawing on data from a wider pool of international comparators exposed to gas-specific risks.

2.2 Review of European evidence

2.40 In this section, we present evidence relating to European gas asset betas. Specifically, we first look at empirical evidence on the asset betas of the three European gas networks that Ofgem is considering for inclusion in its beta comparator sample (i.e. Enagás (Spain), Italgas (Italy), and Snam (Italy)). These comparators were also used in the beta comparator sample of the Oxera February CoE report for the ENA.[59] Then, we review regulatory gas asset beta precedent in the main European jurisdictions.

[59] Oxera (2024), 'RIIO-3 cost of equity', 23 February, Table 2.11.

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2.2.1 Review of the empirical evidence

2.41 We estimate the asset beta of the three European gas networks in line with Ofgem's RIIO-2 methodology:[60]

- based on daily data;
- assuming a debt beta of 0.075;
- using a gearing estimate derived from the book value of net debt and market capitalisation;[61]
- for two-, five- and ten-year estimation windows (i.e. two-year, five-year and ten-year betas) and averaging periods (i.e. rolling averages).[62]

2.42 We use the EURO STOXX Total Market as the reference index.

2.43 We use a cut-off date of 22 April 2024.

2.44 Table 2.1 below details the estimated asset betas for each company and on average, with 22 April 2024 as a cut-off date. Based on the averages of betas for the three comparators (column vi), we observe an overall asset beta range of **0.29–0.40**.

Table 2.1 Average asset betas of European networks

Estimation window	Averaging period	Snam	Italgas	Enagás	Average
i	ii	iii	iv	v	vi = average (iii, iv, v)
Two-year	Spot	0.39	0.35	0.27	0.33
Two year	wo years	0.31	0.33	0.21	0.29
Two-year	Five years	0.40	0.36	0.31	0.36
Two-year	Ten years	0.43	n.a.	0.34	0.39
Five-year	Spot	0.42	0.35	0.33	0.36

[60] Ofgem (2021), 'RIIO-2 Final Determinations – Finance Annex (REVISED)', 3 February, pp. 24–49.
[61] We estimate gearing based on the book value of net debt divided by the sum of market capitalisation and book value of net debt. Ofgem also considered the market value of net debt in addition to the book value of net debt. Ofgem (2020), 'RIIO-2 Draft Determinations – Finance Annex', 9 July, para. 3.40, Table 13.
[62] We do not consider ten-year averages of ten-year betas. We note that Ofgem may be minded to not use rolling averages for the purpose of beta estimation as part of RIIO-3 (Ofgem (2024), 'RIIO-3 Sector Specific Methodology Decision – Finance Annex', 18 July, para. 3.178). This would be a change relative to RIIO-2, as Ofgem then put weight on using 'larger samples of data, such as (…) the 10-year average of the smaller windows'. (Ofgem (2021), 'RIIO-2 Final Determinations – Finance Annex (REVISED)', 3 February, para. 3.74).

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Estimation window	Averaging period	Snam	Italgas	Enagás	Average
Five-year	Two years	0.42	0.36	0.33	0.37
Five-year	Five years	0.45	n.a.	0.36	0.40
Five-year	Ten years	0.43	n.a.	0.38	0.40
Ten-year	Spot	0.44	n.a.	0.34	0.39
Ten-year	Two years	0.43	n.a.	0.35	0.39
Ten-year	Five years	0.42	n.a.	0.38	0.40
Ten-year	Ten years	n.a.	n.a.	n.a.	n.a.

Note: The cut-off date for the analysis is 22 April 2024. The asset betas are calculated using a 0.075 debt beta assumption, daily data, and gearing estimated with the book value of net debt and market capitalisation.
Source: Oxera analysis based on Bloomberg data.

Comments on the adequateness of the European comparators

2.45 As discussed in section 2.1.2, we consider that it would be appropriate for Ofgem to proceed with the inclusion of the European networks in its beta comparator sample. Indeed, we consider that this would improve the accuracy of Ofgem's asset beta estimate by reflecting some of the sector-specific risks that the RIIO-2 comparator sample would not adequately capture.[63]

2.46 In this section, we comment on the fact that the specific European networks that we have added, and that Ofgem has analysed in the SSMD (for inclusion in the beta comparator sample), are very often used by other European regulators when they estimate their own asset beta allowances.

2.47 We also assess how the GB, Italian and Spanish regulatory frameworks compare across several dimensions, in order to determine whether the risk is comparable across regimes. If the risk across the Italian and Spanish regimes is broadly similar to that in the UK, this would support the use of European gas network comparators (i.e. Spanish and Italian listed networks) in the beta estimation for RIIO-GD3.

[63] However, forward-looking risks would not be fully priced within (historical) beta estimates.

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The use of European comparators in European regulation

2.48 A review of comparator samples used by a number of European regulators shows that Enagás and Snam are commonly selected as comparators for the beta estimation. Our findings for each regulator are summarised in Table 2.2 below.

2.49 We note that Arera, the regulator overseeing Italgas, is the only regulator to include Italgas in its sample. The absence of Italgas from the samples of other European regulators is likely to be due to the company's relatively recent history as a publicly listed stock. Since Italgas was relisted at the end of 2016,[64] it is not yet possible to estimate a ten-year beta.

Table 2.2 Overview of European regulators using Enagás, Snam and Italgas as comparators for the beta estimation

Regulator	Country	Sector	Enagás	Snam	Italgas
ARERA	Italy	GT and GD	Yes	Yes	Yes
CRU	Ireland	GT	Yes	Yes	No
BNetzA	Germany	GT and GD	Yes	Yes	No
VREG	Belgium (Flemish region)	GD	Yes	Yes	No
CWaPE	Belgium (Walloon region)	GD	Yes	Yes	No
ACM	Netherlands	GT and GD	Yes	Yes	No
CNMC	Spain	GT and GD	Yes	Yes	No

Note: We have also considered the decisions of the French GD and GT regulator, CRE, and the Belgian federal GT regulator, CREG. However, neither regulator provides details about the sample of comparators that underlies their beta determination.
Source: Arera (2024), 'Documento per la consultazione 342/2024/R/COM, July, Table 2; CEPA (2023), 'PC5 Allowed Return', Appendix A 'Gearing and beta comparators', June; Bundesnetzagentur (2021), BK4-21-056, October, Table 2; VREG (2024), 'Tariefmethodologie reguleringsperiode 2025-2028 Bijlage 2: Kapitaalkostvergoeding', June, Table 3; CWaPE (2023), 'Annexe 1 Décision CD-23e31-CWaPE-0773', May, Table 4; ACM, 'ACM/UIT/56461', p. 19; ACM, 'ACM/UIT/542662', p. 17; CNMC (2019), 'Memoria explicative de la circular de la commission nacional de los mercados y la competencia, por la que se establece la metodologia de calculo de la tasa de retribucion financiera

[64] Italgas (2016), 'Italgas on the Stock Market', November, https://www.italgas.it/en/news/italgas-on-the-stock-market/ (accessed 15 November 2024).

de las actividades de transporte y distribucion de energia electrica, y regasificacion, transporte y distribucion de gas natural', 12 November, p. 70.

Comparison of regulatory frameworks in Great Britain, Italy and Spain

2.50 In the SSMD, Ofgem observed that European and GB energy utilities operating within the same sector are likely to face similar risks. However, Ofgem also emphasised that these companies are governed by different regulatory regimes, which are likely to influence the level of systematic risk that they are exposed to.[65]

2.51 We agree that regulatory frameworks can have impacts on the exposure of regulated companies to systematic risk (including market-wide risk) or to idiosyncratic risk. Although the correlation between total risk and systematic risk is not always equal to one, we can expect a positive correlation between total risk and systematic risk. Therefore, we can conclude that, in the case of regulated networks, the regulatory regime is a driver of systematic risk exposure.

2.52 Therefore, if European utilities are to be used as additional comparators for estimating the systematic risk of GB energy networks, it is helpful to assess how the European regulatory regimes compare with the GB regulatory regime.

2.53 At the outset of this discussion, we note that isolating the effect of a regulatory regime on a network's systematic risk is challenging; a practical approach is to compare the European and GB regulatory regimes across several dimensions that are likely to influence systematic risk.

2.54 In this report, we have conducted a comparative assessment of the systematic risk associated with the Italian GT and GD regimes and the Spanish GT regime against Ofgem's RIIO-2 regime and, where applicable, Ofgem's methodology decisions for RIIO-3 as outlined in the SSMD.

2.55 We begin our assessment by defining a set of regulatory risk factors in order to assess whether they are associated with

[65] Ofgem (2024), 'RIIO-3 Sector Specific Methodology Decision – Finance Annex', 18 July, para. 3.196.

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higher or lower systematic risk. These factors are split into two groups:

- the **regulatory process factors** (including the appeal regime, political interference, regulatory independence, and regulatory consistency);
- the **regulatory regime design factors** (including the profit buffer factor, cost efficiency incentives and demand risk).

2.56 We then evaluate how the Italian, Spanish and GB regulatory regimes perform against these factors. Using this analysis, we then compare the risk associated with the Spanish and Italian regimes with that of RIIO-2 and Ofgem's guidelines for RIIO-3, as outlined in its SSMD.

2.57 Table 2.3 below summarises the findings of our comparative assessment. Appendix A1 provides more details about our approach and our qualitative assessment of each risk factor per regime.

2.58 Based on our findings, we conclude that the Italian and Spanish regulatory regimes as a whole do not differ significantly from RIIO-2 (and Ofgem's SSMD for RIIO-3) in terms of regulatory systematic risk, in spite of minor differences associated with particular risk factors of the Spanish and Italian GT regimes. Besides, these comparators are strongly similar in terms of exposure to industry risks,[66] making them relevant for the purpose of estimating a gas asset beta (as discussed above).

Table 2.3 Summary of regulatory risk comparison by assessment criterion

Risk factor	Italy (GT/GD)	Spain (GT)
Regulatory process		
Appeal regime	Similar	Similar
Political interference	Similar	Similar

[66] We note, in particular, that the risks linked to net zero policies (in particular, asset stranding risk) and uncertainties around the long term future of gas are broadly similar in Italy, Spain and GB. Oxera (2024), 'Risks and investability of the GB gas distribution sector', 1 March, sections 3B and 3C.

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Risk factor	Italy (GT/GD)	Spain (GT)
Current level of regulatory independence	Similar	Similar
Regulatory consistency	Similar	Similar
Regulatory regime design		
Balance of upside opportunity and downside risk (profit buffer)	Similar	Similar
Cost efficiency incentives—OPEX	Similar	Similar
Cost efficiency incentives—CAPEX	Lower	Higher
Cost efficiency incentives—cost of debt	Similar	Similar
Demand risk	Similar	Similar
Overall conclusion	**Similar (slightly towards lower risk)**	**Similar (slightly towards higher risk)**
Motivation	**Frameworks similar to GB energy, but with CAPEX largely passed through**	**Slightly higher risk for GT due to CAPEX incentives being associated with greater regulatory discretion**

Source: Oxera, based on regulatory determinations. Appendix A1 provides more details about our approach and our qualitative assessment of each risk factor per regime.

2.2.2 Review of evidence from European regulatory precedent

2.59 In addition to checking the empirical estimates of gas network companies' betas, as reported in section 2.2.1, we have collected evidence on asset beta allowances by European regulators for GT, GD, gas storage and regasification assets. While there are likely to be differences in the asset risks between gas storage and regasification, and gas transmission and distribution, there are also major a priori similarities such as the long-term demand risk within the gas industry.

2.60 We consider precedent from France, Germany, Italy, the Netherlands, Portugal, and Spain. This analysis serves to

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benchmark Ofgem's RIIO-2 asset beta allowance to GT and GD networks to those of other regulators in comparable regulated sectors.

Methodology to ensure comparability

2.61 When comparing beta allowances in countries that have different beta calculation methodologies, one can consider asset beta allowances directly or adjust the asset betas for certain country-specific methodological elements, such as the level of the assumed debt beta and the beta de-levering and re-levering formula that is used (i.e. how it accounts for the tax shield of debt).

2.62 Therefore, to check the robustness of our comparison across jurisdictions, in addition to collecting asset beta allowances as reported by regulators we derive adjusted asset beta estimates. We test two types of adjustment:

- **the adjustment labelled 'Adjusted asset beta I' in the figures below**, based on the country-specific re-levered equity betas, which we de-lever with the GB methodology for de- and re-levering (i.e. using the Harris–Pringle formula, which assumes a constant leverage policy and therefore does not account for the debt tax shield)[67] and debt beta (0.075);
- **the adjustment labelled 'Adjusted asset beta II' in the figures below**, where we de-lever the country-specific re-levered equity betas using the GB methodology for debt beta (0.075), but use the country-specific de- and re-levering (i.e. the Hamada formula) and country-specific tax shields instead of the GB methodology.

2.63 We do not advance either of the adjustments as superior in this context, because they have different assumptions and interpretations. Instead, they are presented as a robustness check.

[67] We based our calculations on the following Harris–Pringle formula: $\beta(asset) = \beta(equity) * (1 - g) + \beta(debt) * g$, and the following Hamada formula: $\beta(asset) = (\beta(equity) * (1 - g))/(1 - g * t)$, although accounting for debt beta where appropriate.

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2.64 All adjusted asset betas continue to consider country-specific notional gearing.

Comparison of asset beta allowances

2.65 As evident from Figure 2.2 and Figure 2.3 below, Ofgem's RIIO-3 early view asset beta range with a low and high of 0.30 and 0.40 respectively, applied across all energy network sectors,[68] does not consistently cover the asset beta allowances for GT and GD networks of the European sample countries. If Ofgem were to select the midpoint of the range, i.e. 0.35,[69] as the asset beta allowance for RIIO-3, this would be the lowest when compared with the current allowances of the sample countries.

2.66 Indeed, the unadjusted actual asset beta allowances for the GT networks range from 0.38 in Portugal and Italy to 0.47 in France. For GD, they range from 0.39 in the Netherlands to 0.46 in Portugal (with the asset beta derived for Spain's GD sector being even higher at 0.50). However, although the Spanish regulator reports the Spanish asset beta, the regulatory regime of the GD sector in Spain does not require the WACC, and hence asset beta allowances.

2.67 The two adjustments have the opposite effect on beta allowance estimates—one decreases them and the other one increases them. Given that we do not advance either adjustment as superior, we conclude that using unadjusted asset beta regulatory allowances would not clearly under- or overestimate the comparison with Ofgem's allowances (and beta estimates calculated as per Ofgem's methodology). Therefore, we rely on unadjusted regulatory estimates when drawing conclusions (see section 2.4), but show all the evidence below for completeness.

[68] Ofgem (2024), 'RIIO-3 Sector Specific Methodology Decision – Finance Annex', Table 12.
[69] Ofgem indicated that it would not necessarily select an asset beta estimate at the midpoint of the SSMD range. Ofgem (2024), 'RIIO-3 Sector Specific Methodology Decision – Finance Annex', paras 3.224–3.225.

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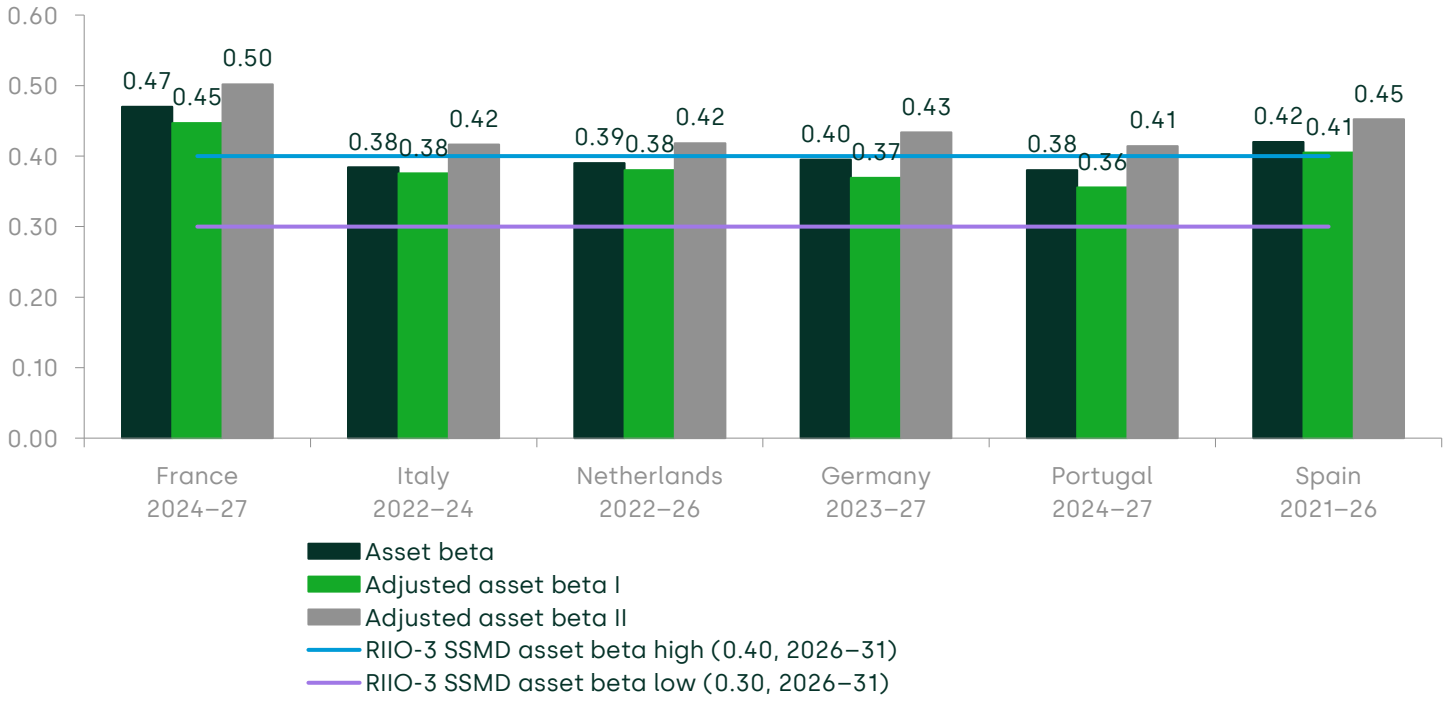
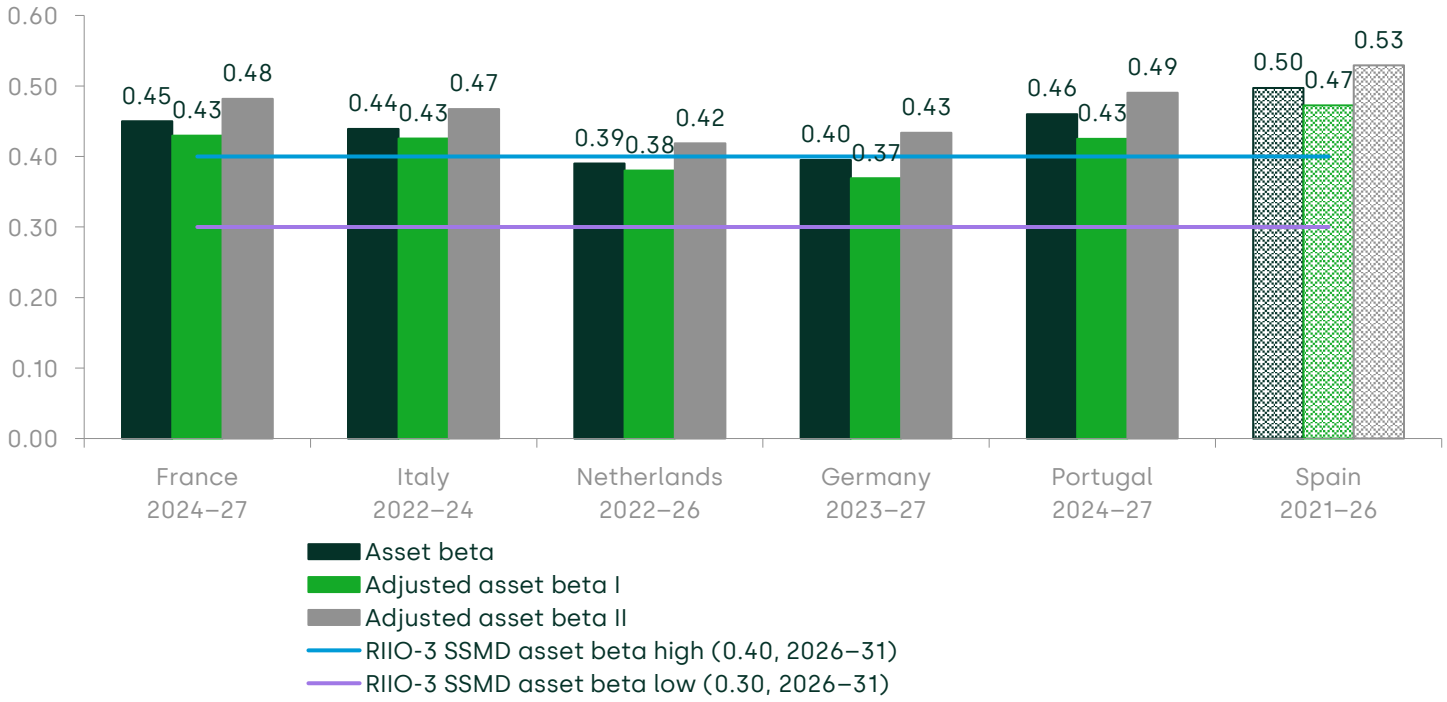
Figure 2.2 International comparison of GT asset beta allowances



Source: Oxera analysis based on regulatory decisions.

Figure 2.3 International comparison of GD asset beta allowances



Note: The regulatory regime of the GD sector in Spain does not require the WACC and hence asset beta allowances. However, the Spanish regulator provides an equity beta estimate for gas distribution from which an asset beta can be derived, which we have

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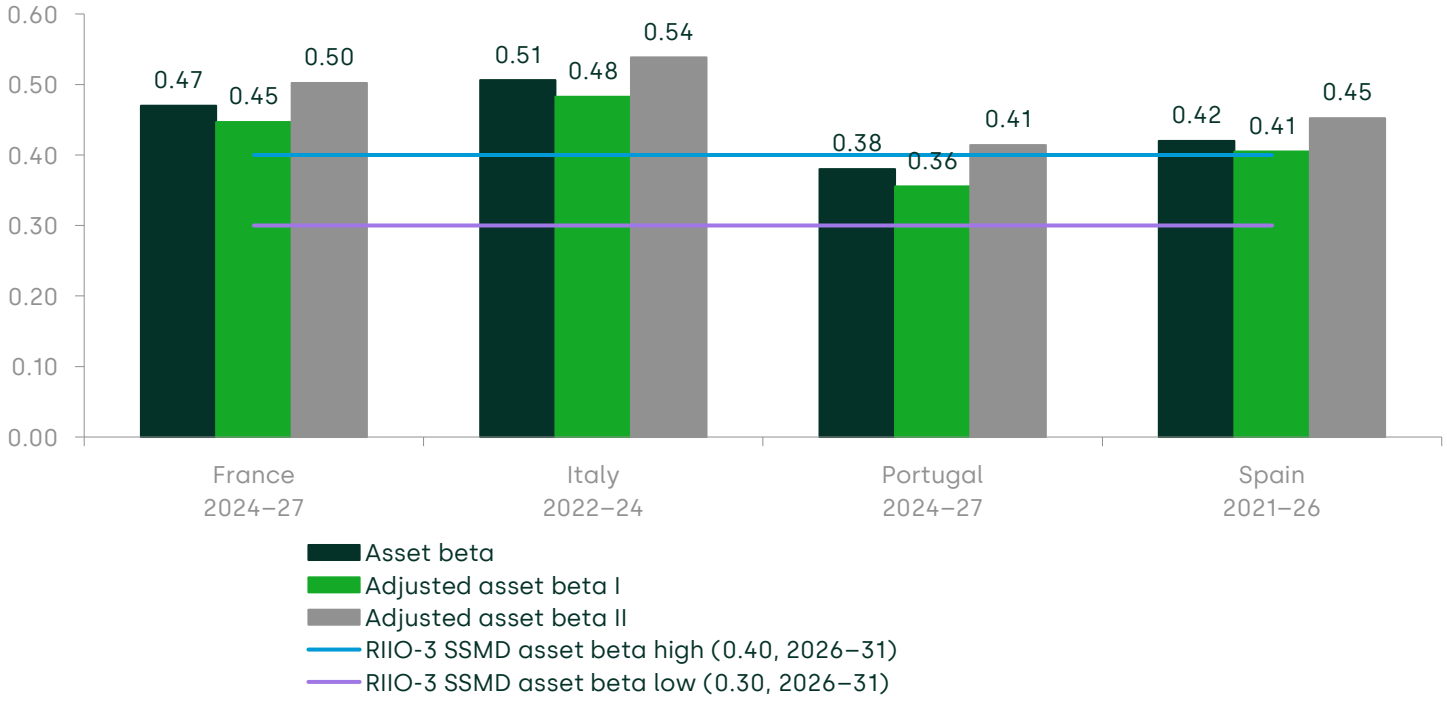
reported in this figure. See Comisión Nacional de la Energía (2019), 'Circular 2/2019', p. 10.
Source: Oxera analysis based on regulatory decisions.

2.68 This result is consistent when considering the allowances for gas storage and regasification, as the asset beta allowances of gas storage and regasification are equal to (France, Portugal and Spain) or higher than (Italy) the asset beta allowances for GT and GD.[70] This is shown in Figure 2.4 and Figure 2.5.

Figure 2.4 International comparison of gas storage asset beta allowances



Source: Oxera analysis based on regulatory decisions.

[70] In France, although asset betas are identical between GT and gas storage, the overall allowed WACC of gas storage is higher than that of GT as a result of the regulator allowing for a premium remunerating the 'economic, technical and geological [risks] of the gas storage operator activity compared to the gas transmission activity'. See CRE (2024), 'Délibération de la Commission de régulation de l'énergie du 30 janvier 2024 portant décision sur le tarif d'utilisation des infrastructures de stockage souterrain de gaz naturel de Storengy, Teréga et Géométhane', 30 January, p. 52.

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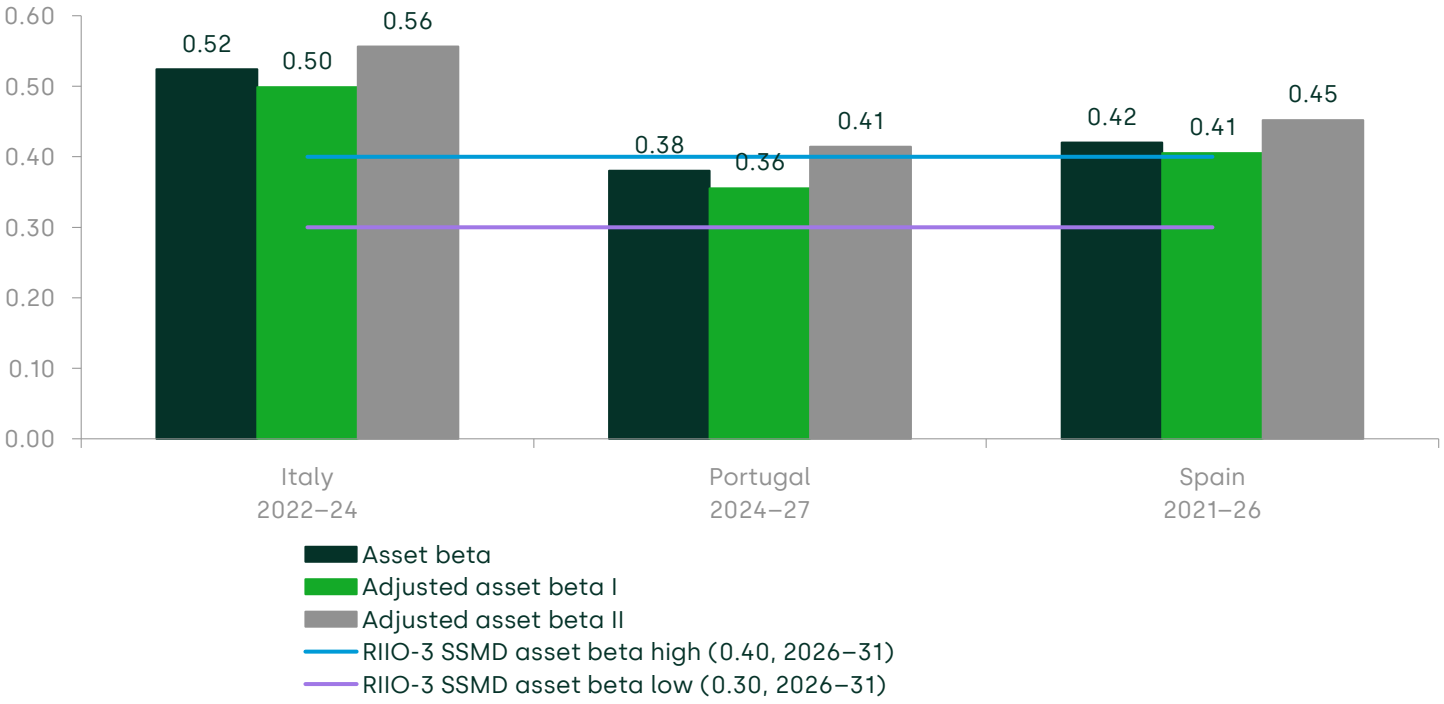
Figure 2.5 International comparison of regasification asset beta allowances



Source: Oxera analysis based on regulatory decisions.

2.69 In Table 2.4, we provide a summary of the unadjusted asset beta allowances and the two specifications of asset beta adjustments across the four considered sectors.

Table 2.4 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	0.44	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	0.42	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

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Average	0.47	0.44	0.48	0.47

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

2.70 The evidence presented shows that the RIIO-3 SSMD early view asset beta allowance range of 0.30–0.40 does not consistently cover the current asset beta allowances of gas sectors in European countries, and, if Ofgem were to select the midpoint 0.35 as the RIIO-GD3 asset beta allowance, this would be consistently below all comparators. The results remain consistent when adjusting the European allowances for differences in the levering formula, taxes and debt beta.

2.3 Extending the comparator sample for further empirical evidence

2.71 In order to further inform our assessment of an asset beta for gas networks that would capture gas-specific risks, we have widened the sample of geographies to screen for comparators relative to our work for the ENA because there are no publicly listed pure-play gas network companies in Great Britain, and only a limited number of publicly listed gas networks in Europe.

2.72 To assess a sample that comprises a broad base of international regulated gas network comparators, we have used, as a starting point, the sample that has been built up by the New Zealand Commerce Commission (NZCC) in its beta analysis for energy networks—the NZCC screens for pure-play gas networks across Australia, New Zealand, the UK and the USA.[71] We use the NZCC sample as a starting point for our analysis, since the New Zealand regulator faces a similar challenge of limited national comparator data availability. We have further refined this sample for liquidity and business activity, excluding three gas networks out of the original 12.[72] We also include the three European networks assessed previously in this analysis.

[71] New Zealand Commerce Commisison (2023), 'Cost of capital topic paper. Part 4 Input Methodologies Review 2023–Final decision', 13 December, paras 4.229–4.242.
[72] Oxera (2023), 'Asset beta and WACC percentile for New Zealand gas distribution businesses', 1 February, section 2. In the referenced report, we assessed a sample used by the NZCC in 2016 and the analysis by the NZCC's consultants from 2022. In its 2023 final decision, the NZCC includes eight additional comparators, of which seven are predominantly electricity and one was acquired and delisted in 2017 (DUET Group, Australia), which we therefore do not include in our gas network sample in this report.

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2.73 This results in a comparator sample including nine publicly listed US gas networks (Atmos Energy, Chesapeake Utilities, Kinder Morgan, National Fuel Gas, New Jersey Resources, Northwest Natural, One Gas, Spire, and Southwest Gas) and three European gas networks (Enagás, Italgas, and Snam).

2.74 Due to the inclusion of US comparators, our sample for listed gas assets is larger than the one considered by Ofgem for the purpose of assessing the asset beta for GB networks. As stated above, our inclusion of US comparators in this empirical analysis aims to increase the number of comparators used in our beta estimation for gas assets so as to expand the evidence base and capture gas-specific risks that Ofgem's SSMD sample would fail to adequately reflect, for the purpose of setting the GDN regulatory asset beta allowance.

2.75 In order to calculate the asset beta of US networks, we use the same methodology as that described in paragraph 2.41. We use the S&P 500 as the reference index.

2.76 The following figures (i.e. Figure 2.6, Figure 2.7 and Figure 2.8) show the development of asset betas of the individual comparators with two-, five- and ten-year estimation windows respectively.

2.77 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 also 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 'through-the-cycle' co-movement of gas network companies' betas strongly supports our hypothesis that the risks of these companies are reasonably similar and representative of the gas network sector.

2.78 The asset beta of National Fuel Gas is the only one where the co-movement with that of other companies is less evident. We therefore exclude it from the analysis that we carry out below. Given that National Fuel Gas' beta is also generally among the highest asset betas within the extended sample, this exclusion is conservative.

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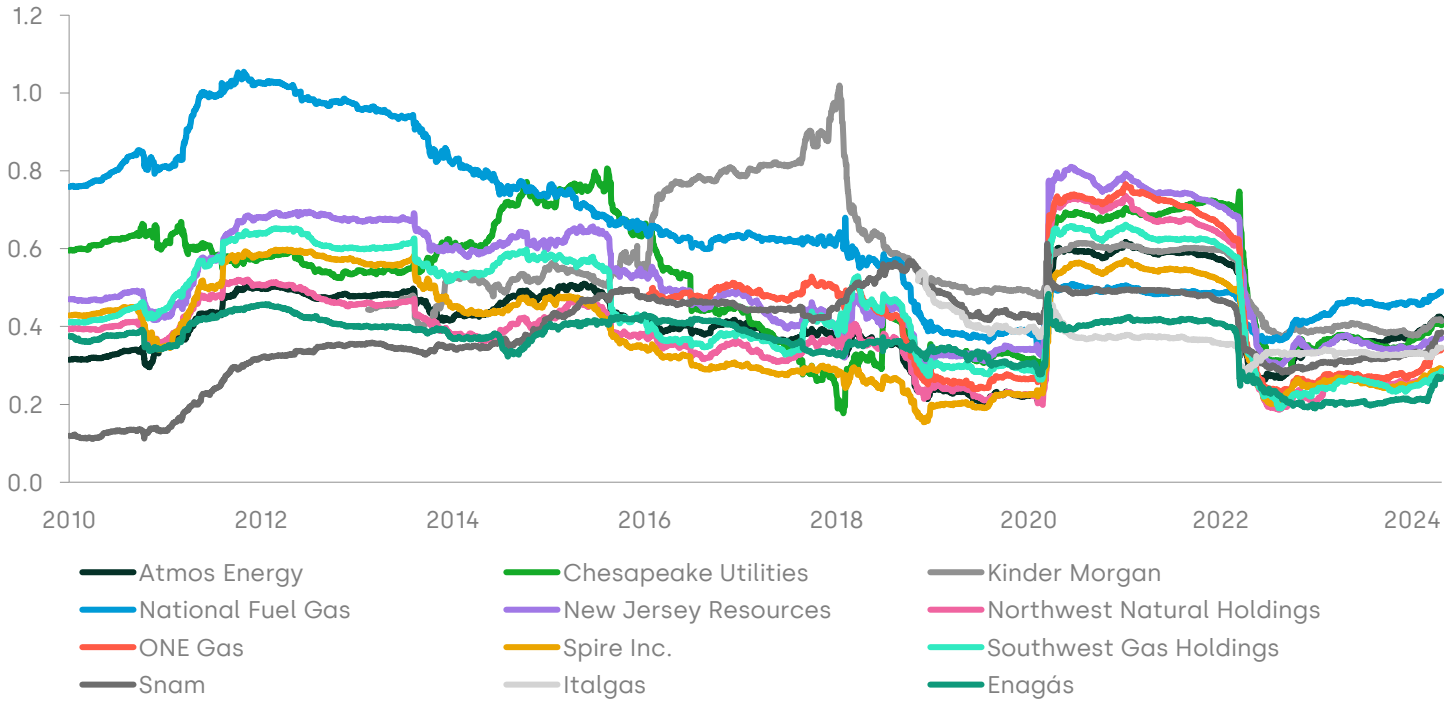
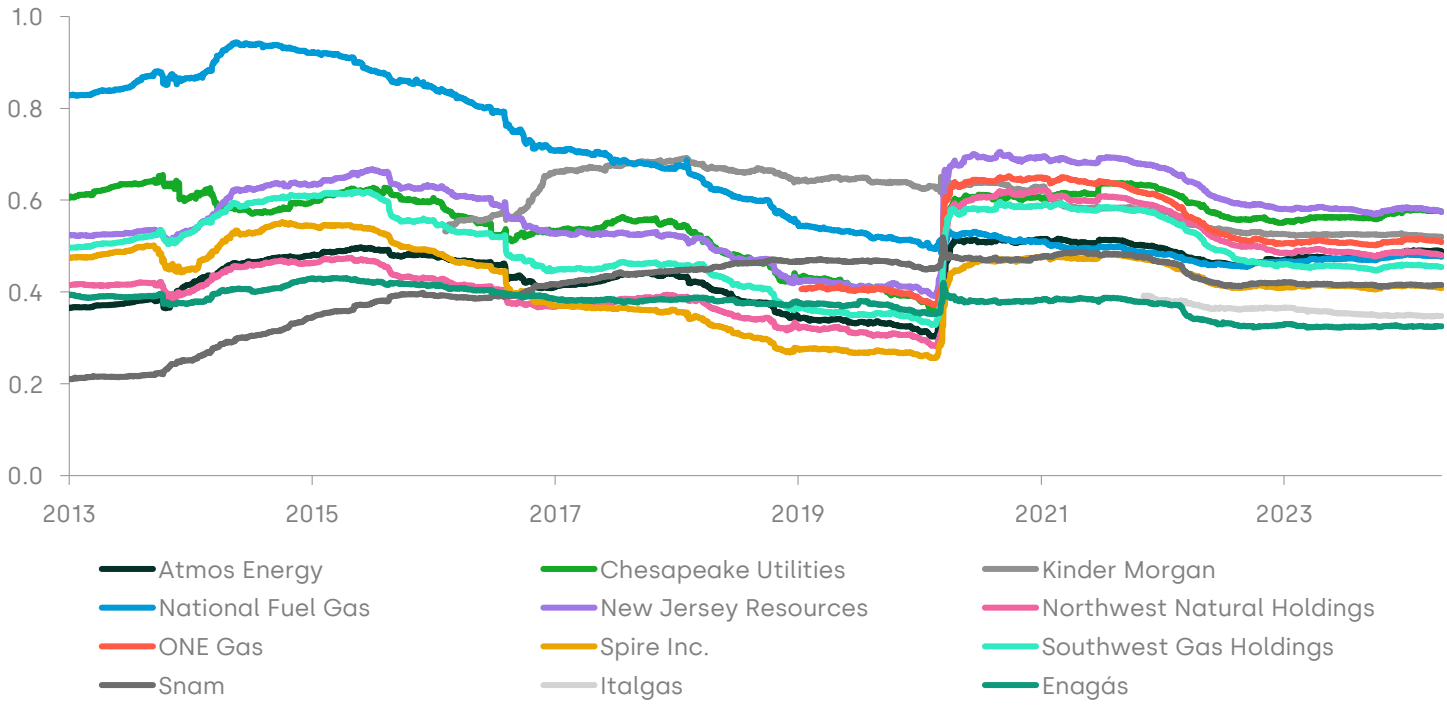
Figure 2.6 Two-year asset betas



Note: The cut-off date for the analysis is 22 April 2024. 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.
Source: Oxera analysis based on Bloomberg data.

Figure 2.7 Five-year asset betas



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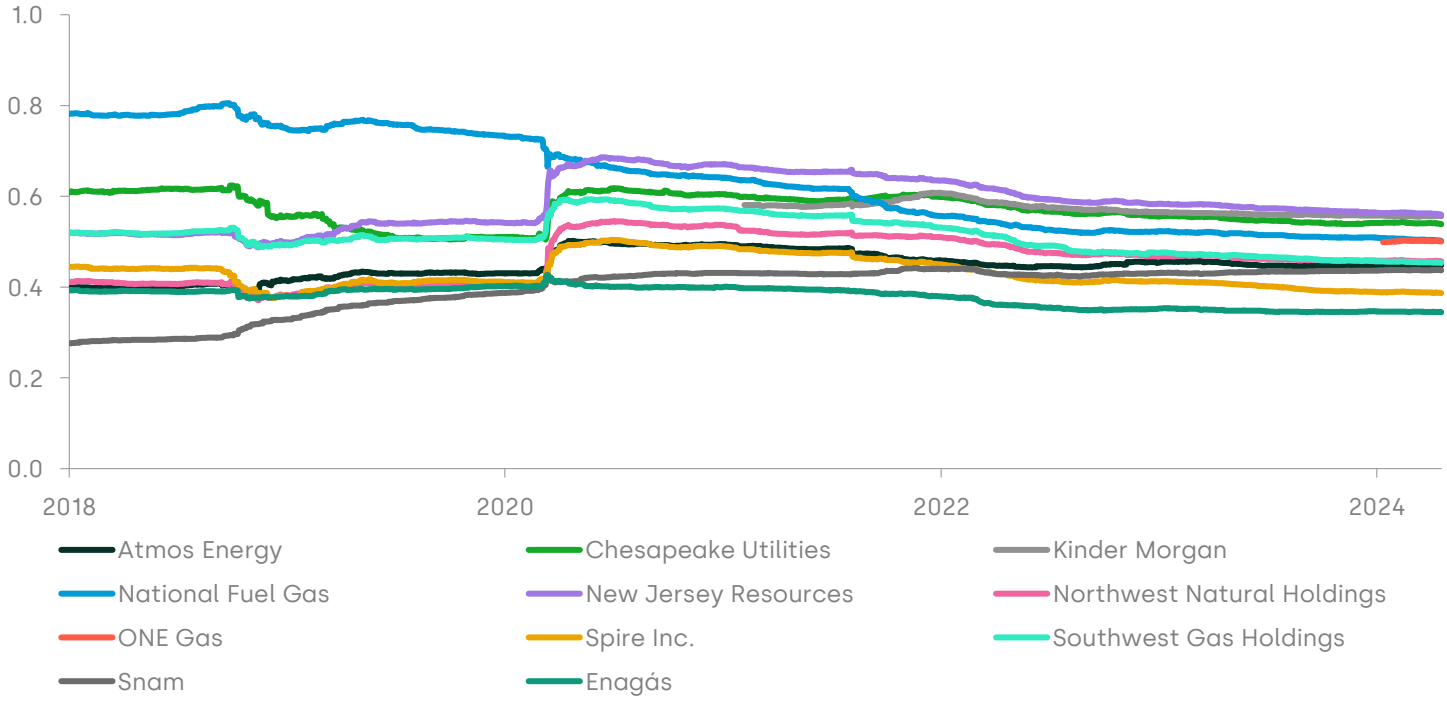
Note: The cut-off date for the analysis is 22 April 2024. The asset betas are calculated using a 0.075 debt beta assumption, daily data, and gearing estimated with a book value of net debt and market capitalisation.
Source: Oxera analysis based on Bloomberg data.

Figure 2.8 Ten-year asset betas



Note: The cut-off date for the analysis is 22 April 2024. 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. We consider only the asset betas of those companies that were continuously listed on the stock exchange for at least ten years. Given that Italgas is publicly listed only from 2016 after its de-listing in 2003, we do not consider its ten-year betas.
Source: Oxera analysis based on Bloomberg data.

2.79 Table 2.5 below details the average asset betas of US and European networks. Based on the averages of betas for the USA and Europe (column v) and the simple average of betas of all comparators (column vi),[73] we observe an overall asset beta range of **0.30–0.49**.

[73] Mathematically, the simple average of betas for the USA and Europe (column v) gives more weight to European comparators than the simple average of betas of all comparators (column vi) because there are more US comparators than European ones.

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Table 2.5 Average asset betas of US and European networks

Estimation window	Averaging period	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
i	ii	iii	iv	v = average (iii, iv)	vi
Two-year	Spot	0.35	0.33	0.34	0.35
Two-year	Two years	0.31	0.29	0.30	0.30
Two-year	Five years	0.45	0.36	0.40	0.42
Two-year	Ten years	0.45	0.39	0.42	0.43
Five-year	Spot	0.50	0.36	0.43	0.46
Five-year	Two years	0.50	0.37	0.44	0.47
Five-year	Five years	0.52	0.40	0.46	0.49
Five-year	Ten years	0.49	0.40	0.45	0.47
Ten-year	Spot	0.49	0.39	0.44	0.47
Ten-year	Two years	0.50	0.39	0.44	0.47
Ten-year	Five years	0.51	0.40	0.45	0.48
Ten-year	Ten years	n.a.	n.a.	n.a.	n.a.

Note: The cut-off date for the analysis is 22 April 2024. The asset betas are calculated using a 0.075 debt beta assumption, daily data, and gearing estimated with book value of net debt and market capitalisation. In the calculations of the average of betas for the USA, we exclude National Fuel Gas from the extended sample.
Source: Oxera analysis based on Bloomberg data.

2.4 Asset beta point estimate

2.80 Having assessed the empirical evidence and regulatory precedent on asset betas for gas networks, in this section we select a point estimate for an asset beta for GB gas networks based on sector-specific evidence to complement the evidence developed up to the SSMD.

2.81 The full range of the empirical and regulatory evidence on gas network asset betas gathered in sections 2.2 and 2.3 is wide—from 0.29 to 0.50—and needs to be narrowed down in order to be used in a regulatory setting. In doing so, we apply the following principles.

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- In our February 2024 ENA CoE report,[74] we elaborate on the GB regulatory precedent by Ofwat, Ofgem and the CMA and the reasoning behind it to support the weighting towards longer-term beta estimates in the specific context of RIIO-3. We also note that Ofgem is minded to '[rely] most heavily on longer-term (10-year) timeframes when picking a point estimate for asset beta', which is consistent with our approach.[75] Therefore, we consider that it is appropriate to attach less weight to the shorter-term beta estimates.
- Focusing on European evidence, we observe that the longer-term asset beta estimates stand at 0.39–0.40, while medium-term evidence stands at around 0.36–0.37. We also note that European regulatory precedents on the asset beta allowance for gas networks are within a range of 0.38 to 0.50. On balance, we consider that using 0.40 as the low end of our range is appropriate, giving more weight to long-term empirical evidence and regulatory precedent. Furthermore, the empirical analysis of the asset betas of our sample across the two considered geographies (the USA and Europe) shows that most of the estimated asset beta averages are above 0.40, with only the very short-term ones (i.e. the spot and two-year average of the two-year asset betas) below this mark.
- As regards the inclusion of US companies in the sample, (which Ofgem has not considered in the SSMD), we note that the wider sample that we have assessed is consistent with the objective of this report—which is to analyse the range of evidence that is currently available for regulated gas assets. Analogous to Ofgem's acknowledgment for European assets, listed US gas assets can provide information about sector-specific decarbonisation risks. As regards this point, we note Ofgem's statement: 'While these [European] companies operate in a different country and under a different regulatory regime, they are likely face (sic) similar challenges relating to meeting net zero targets.'[76]
- As for the upper bound of the narrow range of asset betas, we consider 0.44 to be appropriate. Indeed, 0.44 is the midpoint of the range derived from reviewing European

[74] Oxera (2024), 'RIIO-3 cost of equity', 23 February, section 2.3.
[75] Ofgem (2024), 'RIIO-3 Sector Specific Methodology Decision – Finance Annex', 18 July, para. 3.172.
[76] Ibid., para. 3.197.

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regulatory asset beta allowances. It is also in line with empirical evidence, in particular the long-term average betas between the two considered geographies (Europe and the USA, i.e. column (v) in Table 2.5). This is in contrast to taking a simple average across all comparator companies in the sample, including European and US companies, which would result in higher asset beta estimates (see column (vi) in Table 2.1 above) given that our sample has more US networks, and their asset betas are higher. In other words, having widened our sample to include US listed gas assets to ensure that we are assessing the range of evidence available that can inform the estimate of sector-specific risks, we conservatively apply a lower weight to the US sample than to the European comparators.

2.82 Based on the principles outlined above, we determine a narrower, gas-specific asset beta range of **0.40–0.44**. This range aims to extend the evidence base with sector-specific data to inform Ofgem's determination of an appropriate regulatory asset beta allowance for the GDNs. The gas-specific analysis differs from the analysis in the SSMD as it does not present evidence from the asset beta of NG, water networks or European electricity networks.

2.83 This whole range of gas sector-specific data is supported by the empirical and regulatory precedent evidence base from Europe. The low end is informed by column (vi) in Table 2.1 (also column (iv) in Table 2.5), without accounting for the shortest beta estimates, and is within the range of European regulatory precedent on gas networks asset beta allowances. It is also supported by the evidence from the extended sample, as most of the average betas across the two geographies are above the 0.40 mark. The high end is supported by European regulatory precedent, as well as evidence from the long-term average asset beta between the USA and Europe, as shown in column (v) in Table 2.5.

2.84 Figure 2.9 below shows the full range of average asset betas estimated empirically (0.30–0.50), the narrower asset beta range (0.40–0.44), and the unadjusted asset beta precedents for the GD and GT sectors (0.38–0.50). It is evident that the selected range of 0.40–0.44 is supported by the unadjusted asset beta precedents. This range does not overlap with Ofgem's proposed asset beta range in the SSMD (0.30–0.40).

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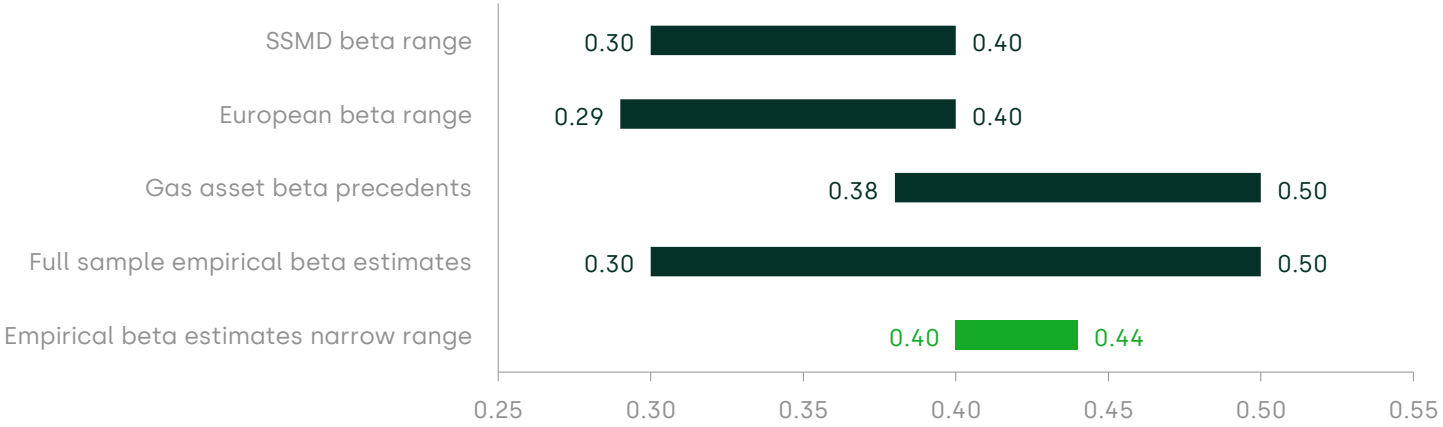
Figure 2.9 Asset beta ranges



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

2.5 Estimating the equity beta

2.85 Starting with the asset beta range of 0.40–0.44, as estimated above, we re-lever it based on a notional level of gearing of 60% and a debt beta of 0.075, using the following Harris–Pringle formula.[77]

$$\beta_{equity\ re-levered} = \frac{\beta_{asset} - \beta_{debt} * g_{notional}}{1 - g_{notional}}$$

2.86 This results in a re-levered equity beta range of **0.89–0.99** with a midpoint of **0.94**.

[77] We use the same level of notional gearing, debt beta assumption and re-levering formula as those used by Ofgem in the RIIO-2 final determinations. Ofgem (2022), 'RIIO-ED2 Draft Determination – Finance Annex', 29 July, Table 12.

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3 Estimating the cost of equity

3.1 The asset beta range derived in section 2 (0.40–0.44) is based exclusively on gas-specific empirical and regulatory evidence. It does not ascribe weight to evidence from the asset beta of NG, water networks or European electricity networks.

3.2 While a 0.40–0.44 asset beta range robustly reflects the gas-specific evidence analysed in this report, we note that in forming a judgement on the RIIO-GD3 allowed beta, Ofgem will likely attribute some weight to the non-gas UK evidence as per its SSMD sample. In order to reflect this, we assume that a wider range of 0.38–0.44 for RIIO-GD3 is appropriate to cross-check in the calculation of the CAPM-based CoE (see next section on debt market evidence). The lower bound of this range is equal to the midpoint of the upper half of Ofgem's SSMD asset beta range (and, therefore, to the midpoint of the asset beta range we use in our November 2024 ENA CoE report[78]). This corresponds to an equity beta range of **0.83–0.99**.

3.3 Table 3.1 below shows the derivation of the CoE range using the range for total market return (TMR) and the risk-free rate (RFR) from our November 2024 ENA CoE report[79] and the range calculated in section 2.5, above, for the re-levered equity beta using gas sector-specific evidence. The CAPM-based CoE range obtained using gas-specific asset beta evidence is **6.39–7.43%** (at 60% gearing, CPIH-real), with a midpoint of **6.91%**. Using the lower bound of 0.38 for the asset beta (i.e. a lower bound that allows for some weight to non-gas evidence as per Ofgem's SSMD sample), the CAPM-based CoE range stands at **6.04–7.43%**, with a midpoint of **6.73%**.

3.4 We have also calculated the CAPM CoE range using Ofgem's RFR and TMR assumptions, as set out in Ofgem's latest WACC allowance model and the SSMD, but using our gas-specific asset beta range of 0.40–0.44. The implied CoE range is **5.91–6.93%**, with a midpoint of **6.42%.**

[78] Oxera (2024), 'RIIO-3 cost of equity—CAPM parameters', November, p. 7.
[79] Ibid.

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Table 3.1 CoE estimation at 60% gearing, CPIH-real, Oxera gas-specific beta evidence and Ofgem range

	Formula	Oxera, gas and non-gas (low)	Oxera, gas-specific (low)	Oxera, gas-specific (high)	Ofgem SSMD (low)	Ofgem SSMD (high)
RFR	[A]	1.54%	1.54%	1.54%	1.27%	1.27%
TMR	[B]	7.00%	7.00%	7.50%	6.50%	7.00%
Oxera's re-levered equity beta at 60% gearing	[C]	0.83	0.89	0.99	0.89	0.99
CAPM CoE	**[Ke]=[A]+[C]*([B]-[A])**	**6.04%**	**6.39%**	**7.43%**	**5.91%**	**6.93%**

Note: the RFR and TMR are taken from the Oxera November 2024 CoE report for the ENA. The cut-off date for the beta analysis is 22 April 2024. The value of Ofgem's RFR differs from the value reported in the RIIO-3 SSMD as the value in the table reflects Ofgem's latest estimate of the RFR included in the latest WACC Allowance Model for RIIO-3.
Source: Oxera analysis based on Oxera (2024), 'RIIO-3 cost of equity—CAPM parameters', November, p. 7; Ofgem (2024), 'RIIO-3 Sector Specific Methodology Decision – Finance Annex', 18 July, Table 13 and Ofgem (2024), 'RIIO-3_WACC_Rates_Model_aligning_to_v7_20240926'.

3.5 Given that the purpose of this report has been to complement the existing evidence base that was developed up to SSMD with gas sector-specific evidence, for the purpose of comparison, we have also calculated the CoE that would result from applying other asset beta ranges:

- that presented by Ofgem in its SSMD (0.30–0.40);[80]
- that presented by Oxera in our November 2024 ENA CoE report (0.35–0.40).[81]

3.6 It should be apparent that unlike the asset beta range presented in section 2.4 of this report, which aims to only represent gas-specific risks to complement the existing evidence, these ranges include the evidence previously considered by Ofgem from UK water networks, NG, and European electricity networks.

[80] Ofgem (2024), 'RIIO-3 Sector Specific Methodology Decision – Finance Annex', para. 3.222.
[81] Oxera (2024), 'RIIO-3 cost of equity—CAPM parameters', November, p. 7.

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3.7 We combine each asset beta range respectively with the RFR and the TMR range from our November 2024 ENA CoE report. We obtain the following CoE ranges:

- 5.02–6.83% when combined with the asset beta range from Ofgem's SSMD (i.e. 0.30–0.40);
- 5.70–6.83% when combined with the asset beta range of our November 2024 ENA CoE report (i.e. 0.35–0.40).

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4 ARP–DRP as a cross-check to the CAPM

4.1 In our RIIO-2 submissions to Ofgem, we explained that the differential between the ARP and DRP can be used as a cross-check to the estimation of the allowed CoE.[82] We outlined the approach in detail and addressed recent methodological concerns by regulators in our CoE work for the ENA prepared in response to Ofgem's RIIO-3 SSMC.[83]

4.2 Based on the ARP–DRP framework, we explained in our recent report for GDNs how the 'gas premium' on long-term debt implies that a premium is also required on the allowed return on equity.[84] Hence, the ARP–DRP framework requires a gas-specific DRP estimate to cross-check the CoE for RIIO-GD3.

4.1 Estimating the ARP–DRP differential

4.3 In order to estimate the ARP–DRP differential, we start by deriving the gas DRP, which includes the 'gas premium', from traded gas network bonds. Next, we calculate the ARP based on our asset beta and CoE ranges (see sections 2.4 and 3).

4.1.1 Estimating the long-term gas DRP

4.4 The relevant formula for calculating the forward-looking long-term gas DRP is as follows.

$$DRP = CoND - RFR - expected\ loss$$

4.5 Where the CoND is the cost of new debt, RFR is the risk-free rate and the 'expected loss' parameter represents the annualised probability of default multiplied by the losses that a debt investor will suffer if a borrower defaults. We describe the methodology for estimating each of the parameters below.

4.6 We estimate the **CoND** using traded yields of bonds issued by gas network companies. In doing so, we calculate a gas-specific DRP. For consistency with the CoE submission by Oxera to Ofgem on behalf of the ENA, we consider all bonds by GB gas

[82] For a summary of the ARP–DRP intuition, see Oxera (2023), 'What does the cost of debt tell us about the cost of equity?', *Agenda*, May, https://www.oxera.com/insights/agenda/articles/what-does-the-cost-of-debt-tell-us-about-the-cost-of-equity/ (accessed 15 November 2024). See also Oxera (2019), 'Risk premium on assets relative to debt', 25 March.
[83] Oxera (2024), 'RIIO-3 cost of equity', 23 February, section 3.
[84] Oxera (2024), 'Risks and investability of the GB gas distribution sector', 1 March, section 2C.

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networks (GD and GT) that are actively traded up to the cut-off date of 31 August 2024.[85] Subsequently, we build a sample of 21 bonds issued by GB gas networks.[86]

4.7 For consistency with nominal yields of gas network bonds, we estimate the **RFR** used in the DRP calculations based on nominal zero-coupon gilt yields maturity-matched to the modified duration of the respective bonds.[87] We adjust the nominal gilt yields for the RFR estimate by adding a convenience premium of 0.27%.[88]

4.8 We have calculated the '**expected loss**' to be equal to 0.30%, consistent with our work for the ENA.[89] The 0.30% estimate of the expected loss corresponds to the product of the annualised default rate for long-term A- and BBB-rated debt, and loss-given-default rate for A- and BBB-rated senior unsecured debt.

4.9 We have looked into estimating a gas-specific expected loss, considering the recovery rates in Moody's reports (one of the components of the expected loss) for oil and gas utilities. However, those recovery rates are based on only three default incidences since 1983.[90] It is unclear how many of these incidences involved a gas utility. Hence, the parameters for oil and gas utilities are likely to be distorted by oil utilities' evidence, or even to be exclusively based on oil rather than gas utilities, and are in all instances based on a limited sample of observations. Therefore, we give no weight to these gas-specific estimates and rely on our estimate of 0.30%, applicable to any senior long-term unsecured debt that is rated A or BBB. This is a conservative approach, as the estimate of the expected loss

[85] Keeping only GBP-denominated, nominal fixed-rate coupon bonds and excluding callable, puttable and sinkable bonds.
[86] See Appendix A2 for the full list of bonds.
[87] We undertake this matching exercise on a daily basis for each bond separately. We round the daily modified duration of the bonds to the closest half-years to match the bonds to the half-yearly zero-coupon nominal yield curve.
[88] We estimate the convenience premium as half the difference between the five-year average yields of iBoxx AAA 10–15 and iBoxx AAA 10+ indices, nominal and the five-year average of duration matched gilts, nominal as of the cut-off date of 31 August 2024.
[89] For the full methodology behind the 0.30% point estimate, see Oxera (2019), 'Risk premium on assets relative to debt', 25 March, p. 11. 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; Moody's (2023), 'Annual default study: Corporate default rate will rise in 2023 and peak in early 2024', 13 March, Exhibit 36.
[90] Moody's (2023), 'Annual default study: Corporate default rate will rise in 2023 and peak in early 2024', 13 March, Exhibit 27.

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based on the oil and gas recovery rates would be 0.16%[91] (i.e. lower than the standard 0.30% estimate) and a lower expected loss leads to a higher estimate of the DRP and higher implied ARP and CoE.

4.10 We calculate the DRP on a daily basis, using a range of estimation windows of the last two, three, and five years from our cut-off date of 31 August 2024. As we have shown in our previous work, the 'gas premium' has substantially increased since 2021; therefore, we focus on the shorter averaging windows in our results.[92]

4.11 We first estimate the DRP for each company by averaging the DRPs of the individual bonds. We then average all the company specific DRP estimates. We follow this two-step approach to avoid the final DRP estimate being affected by the differences in the number of bonds issued by each of the gas networks.

4.12 As the DRP corresponds to the CoND, and networks issue primarily long-term debt, we keep only those bond observations that have a remaining time to maturity of more than ten years. This is also consistent with our observation in the previous report for the GDNs that the 'gas premium' is prevalent in long-term rather than short-term debt.[93] In addition, we exclude one bond issued by National Gas Transmission (NGT) exhibiting liquidity concerns. In doing so, 11 out of 21 bonds remain in the sample. Our filtered sample of long-term bonds has an average remaining time to maturity of 16.8 years.[94]

4.13 The target **credit rating** of the notional company in RIIO-2 is BBB+, which applies to gas networks as much as to any other GB energy network.[95] Our sample of gas bonds includes debt from WWU, which is rated A-, while all bonds issued by the other GDNs and by NGT are rated BBB+ by at least one of the credit rating agencies. Therefore, to keep the assessment consistent with the notional company parameters, we could exclude WWU bonds

[91] This is calculated as the average annualised default rate of 0.57% for long-term A and BBB bonds based on Feldhütter and Schaefer (2018) times the expected loss given default of 27.40% for senior unsecured debt of oil and gas utilities reported by Moody's. Moody's does not report long-term default rates for oil and gas utilities.
[92] Oxera (2024), 'Risks and investability of the GB gas distribution sector. Prepared for GB gas distribution networks', 1 March, section 2C.
[93] Ibid.
[94] This is based on an averaging window of three years.
[95] Ofgem (2021), 'RIIO-2 Final Determinations – Finance Annex (REVISED)', 3 February, p. 190.

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from the sample. However, that would further limit the sample, would be less representative of GB gas networks debt, and would be less conservative.[96] Consequenlty, we report our results with and without WWU's debt, and focus on the results with it included.

4.14 Figure 4.1 below presents the results of the DRP estimation by company for different averaging windows. As mentioned above, WWU's debt has a higher credit rating than the debt of the other GDNs and NGT. Hence, WWU is expected to have an outlying low DRP estimate. Nevertheless, for the reasons discussed above, we keep WWU in the sample.

4.15 We also observe that DRP estimates are higher when focusing on more recent data. This is in line with our previous observation that the gas risk premium is a recent development in the market.[97] In order to balance between shorter estimates, which reflect more recent data and market developments, and longer estimates, which are less volatile, we focus on the three-year average.

4.16 As a result, we estimate that the DRP is **1.23%**, based on the three-year averaging window and including WWU.

[96] WWU bond yields are on average lower than those by other gas networks, implying that we would increase the estimate of the DRP, and hence implied ARP and CoE, by excluding WWU from the sample.
[97] Oxera (2024), 'Risks and investability of the GB gas distribution sector. Prepared for GB gas distribution networks', 1 March, section 2C.

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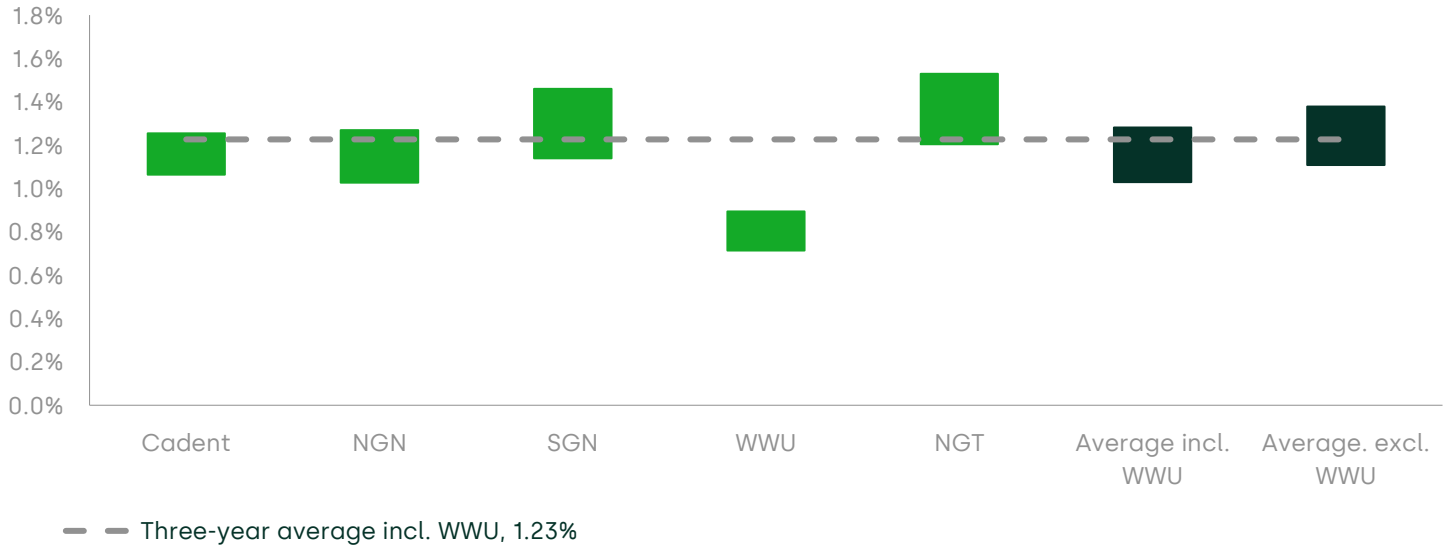
Figure 4.1 DRP range by network



Note: The ranges shown in the chart pertain to the ranges of DRP estimates for each network, and the averages including and excluding WWU across averaging windows of two, three and five years. The upper bound of the range for each company is informed by the two-year averaging window, while the lower bound is informed by the five-year averaging window, with the estimates based on the three-year averaging window being in the middle of the range. For individual estimates informing the ranges, see Table A3.1.
Source: Oxera analysis based on Bloomberg data.

4.1.2 Calculating the ARP

4.17 We calculate the ARP based on the following formula.

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

4.18 Based on our extended **asset beta** range of 0.38–0.44 and the CPIH-real **TMR** range of 7.00–7.50%, we consider two scenarios for the ARP–DRP cross-check in line with the CoE estimation in section 3:

- the 'Oxera low' scenario with an asset beta of 0.38 and TMR of 7.00%;
- the 'Oxera high' scenario with an asset beta of 0.44 and TMR of 7.50%.

4.19 Consistent with the CPIH-real TMR, we use the CPIH-real **RFR** of 1.54% in both scenarios.

4.2 The results of the ARP–DRP cross-check

4.20 In Table 4.1 below, we calculate the ARP–DRP differential for the asset beta and TMR scenarios. It shows that both tested

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scenarios satisfy the condition of a positive ARP–DRP differential. This is, however, only a necessary but not sufficient condition to cross-check the calibration of the return on capital.[98]

Table 4.1 ARP–DRP differential

	Formula	CoE low	CoE high
RFR, CPIH-real[1]	[1]	1.54%	1.54%
TMR, CPIH-real	[2]	7.00%	7.50%
Asset beta	[3]	0.38	0.44
CoE	[4]	6.04%	7.43%
ARP	[5]=[3]*([2]-[1])	2.05%	2.62%
DRP[2]	[6]	1.23%	1.23%
ARP–DRP	**[7]=[5]-[6]**	**0.82%**	**1.40%**

Note: Differences may exist due to rounding. [1] The CPIH-real RFR includes the convenience premium. [2] The DRP is estimated as the CoND (nominal) minus the gilt yield (nominal), minus the convenience premium, minus the expected loss over a three-year averaging window. Values may not sum due to rounding.
Source: Oxera analysis based on BoE and IHS Markit data; Ofgem (2024), 'RIIO-3 Sector Specific Methodology Decision – Finance Annex', 18 July, Table 13.

4.21 Therefore, we estimate the prediction of the ARP based on extrapolating the DRP to the 100% gearing level, i.e. the lower bound for the ARP. We calculate this as a DRP (of an individual gas network company) divided by the actual regulatory gearing of that company.[99] Figure 4.2 below presents the results by company and averaging window.

[98] For more discussion on this point, see Oxera (2024), 'RIIO-3 cost of equity', February, p. 83.
[99] We derive the actual regulatory gearing from the regulatory performance data published by Ofgem. See Ofgem (2022), 'Regulatory financial performance data file - Annex to RIIO-1 Annual Reports - 2020-21', 4 July, https://www.ofgem.gov.uk/publications/regulatory-financial-performance-annex-riio-1-annual-reports-2020-21 (accessed 15 November 2024); Ofgem (2024), 'RIIO-2 Regulatory Performance Data File 2022-23', 25 March, https://www.ofgem.gov.uk/publications/riio-2-regulatory-performance-data-file-2022-23 (accessed 15 November 2024).

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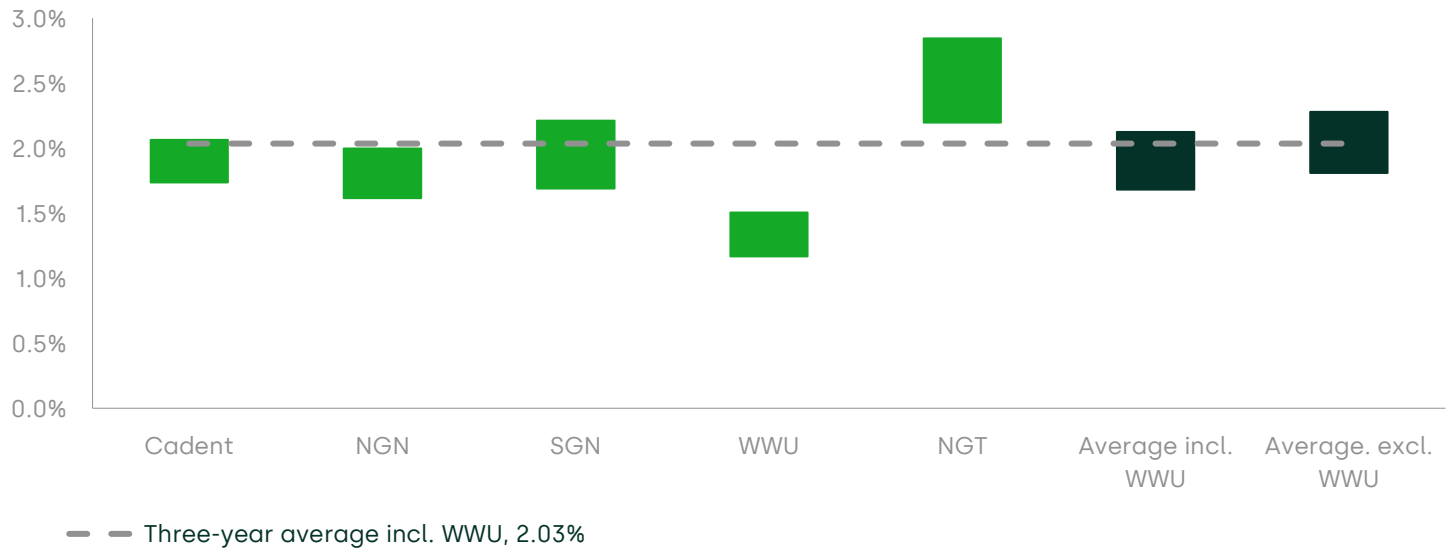
Figure 4.2 DRP extrapolated at 100% gearing range by network



Note: The ranges shown in the chart pertain to the ranges of DRP extrapolated at 100% gearing for each network, and the averages including and excluding WWU across averaging windows of two, three and five years. The upper bound of the range for each company is informed by the two-year averaging window for DRP, while the lower bound is informed by the five-year averaging window, with the estimates based on the three-year averaging window being in the middle of the range. For individual estimates informing the ranges, see Table A3.2.
Source: Oxera analysis based on Bloomberg data.

4.22 Once again, we focus on the midpoint estimate based on the three-year average DRP extrapolated at 100% gearing, including WWU. According to this estimate, the theoretical relationship between the risk premia on debt and assets suggests that the DRP extrapolated at 100% gearing should be around **2.03%**.[100]

4.23 Figure 4.3 below compares the lower bound of 2.03% set by the DRP extrapolated at 100% gearing against the ARP implied by the GDNs' CoE range, as estimated in section 3. The figure shows that our CoE range, calibrated with the 0.38–0.44 betas, is supported by the ARP–DRP cross-check when anchored on gas sector-specific debt data, suggesting that the allowed CoE should be set within the range that we propose.

4.24 To obtain a CoE estimate for gas networks that is consistent with the debt market evidence, it is therefore necessary to

[100] Excluding WWU debt rated A- would lead to a substantially higher estimate of 2.18%. The estimates for individual companies are available in Table A3.2 in Appendix A3.

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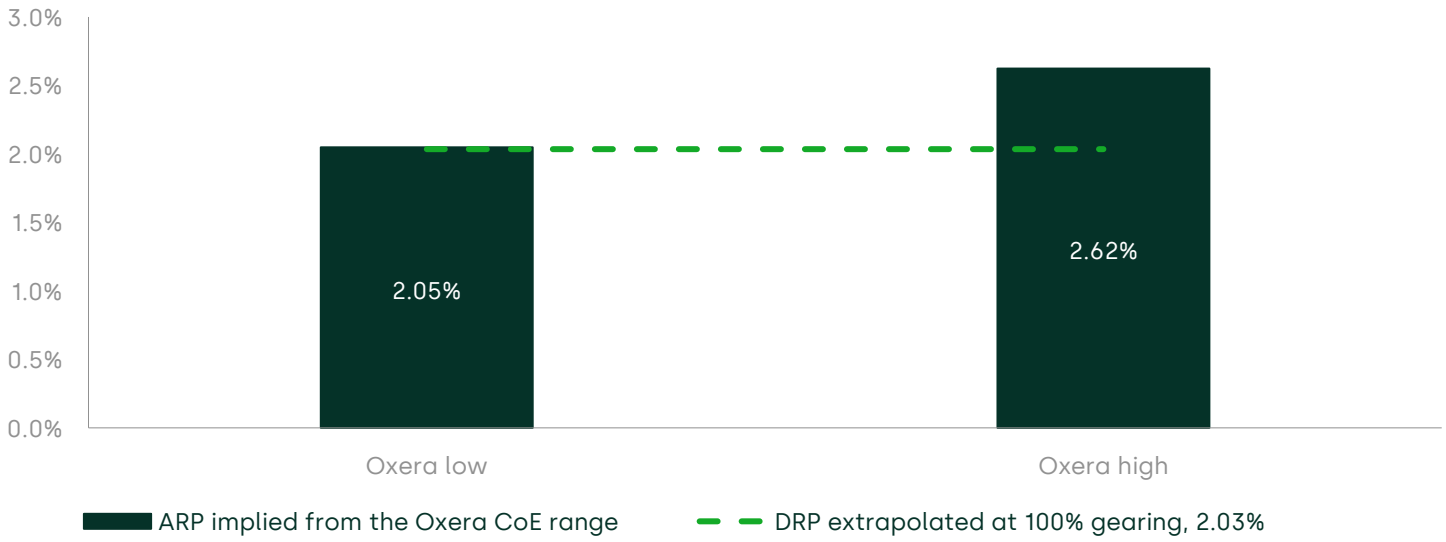
combine a TMR of at least 7.00% at the top end of Ofgem's SSMD range—which is consistent with our TMR range of 7.00–7.50%—with an asset beta that is higher than 0.37 (i.e. 0.38 or above). Therefore, the cross-check supports the whole of the 0.40–0.44 asset beta range for gas-specific evidence.

4.25 More generally, we note that if Ofgem were to set a TMR below the top end of its 6.50–7.00% SSMD range, this will put upward pressure on the allowed asset beta for the ARP–DRP cross-check to be satisfied.

Figure 4.3 The DRP extrapolated at 100% gearing compared with the ARP implicit within the CoE lower and upper bounds of the range



Note: The DRP extrapolated at 100% gearing is based on a three-year average including WWU. The ARP implicit within the CoE range is calculated as presented in Table 4.1.
Source: Oxera analysis.

4.26 In order to check whether Ofgem's SSMD range satisfies the ARP-DRP cross-check when anchored on gas-specific debt data, we also calculated the DRP extrapolated at 100% gearing without our convenience premium assumption (following the methodology outlined in section 4.1.1), in order to ensure consistency with Ofgem's own analysis (which does not include a convenience premium in the calculation of the RFR).

4.27 Figure 4.4 below compares that DRP extrapolated at 100% gearing to the ARP implied by Ofgem's working assumption for

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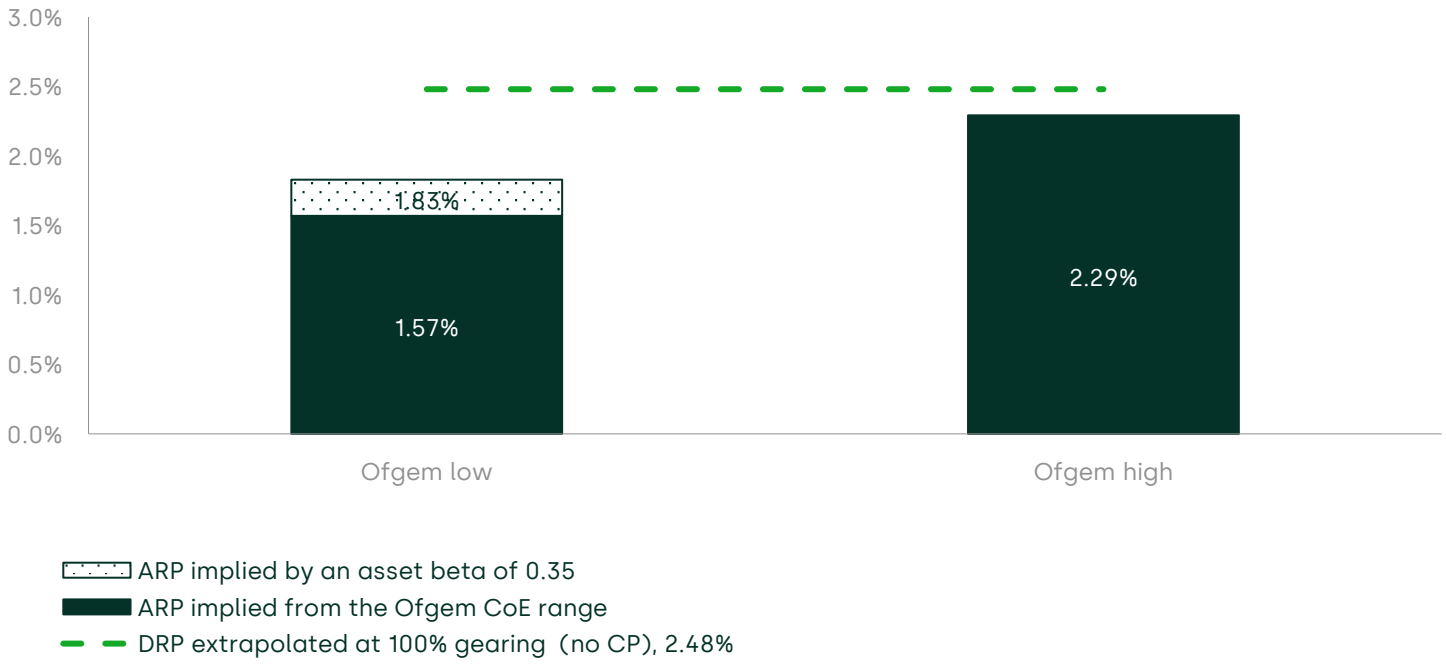
the CoE range, as estimated in section 3. In addition, it shows the implied ARP if Ofgem revised its lower bound for the asset beta upwards from 0.30 as the lower bound in the SSMD to 0.35. The figure demonstrates that Ofgem's SSMD range fails to meet the ARP–DRP cross-check when the DRP is estimated using gas-specific debt data.

Figure 4.4 The DRP extrapolated at 100% gearing compared with the ARP implicit within the Ofgem CoE lower and upper bounds of the range



Note: The DRP extrapolated at 100% gearing is based on a three-year average including WWU. The ARP implicit within the CoE range is calculated as presented in Table 4.1 using Ofgem's assumptions, i.e. 1.27% RFR, 6.50–7.00% TMR and 0.30–0.40 asset beta. The dotted column shows the ARP, if the lower bound of the asset beta range is set to 0.35 with all else equal. In line with Ofgem's approach, we calculate the DRP shown in this figure based on a RFR which does not account for the convenience premium.
Source: Oxera analysis; Ofgem (2024), 'RIIO-3 Sector Specific Methodology Decision – Finance Annex', 18 July, Table 13 and Ofgem (2024), 'RIIO-3_WACC_Rates_Model_aligning_to_v7_20240926'

4.28 In particular, this shows that even if Ofgem were to 'aim up' within the upper half of its SSMD beta range (i.e. to 0.38 within the 0.30-0.40 range), while using the midpoint of its TMR range (i.e. 6.75% within the 6.5–7.0% range), the lower bound ARP from the debt market evidence for GDNs would not be satisfied. This shows that the SSMD minded-to position is too low as regards

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the allowed cost of equity for GDNs, thereby supporting the use of gas-specific evidence (i.e. asset beta range of 0.40–0.44) to extend the SSMD analysis and inform the RIIO-GD3 decision.

4.3 Conclusion of the ARP–DRP cross-check

4.29 In this section, we have estimated the DRP for gas networks based on publicly traded long-term gas bonds. We use a three-year average and include all GDNs and NGT. This leads to a point estimate of the DRP of **1.23%**. Extrapolating the DRP to the 100% gearing level, we show an estimate lower bound for the gas-specific ARP of **2.03%**.

4.30 Therefore, our CoE range, calibrated with the wider beta range of 0.38–0.44, is supported by the ARP–DRP cross-check when anchored on gas sector-specific debt data, suggesting that the allowed CoE should be set within the range that we propose.

4.31 Our ARP-DRP cross-check anchored on gas-specific debt data also shows that the SSMD minded-to position is too low as regards the allowed cost of equity for GDNs, thereby supporting the use of gas-specific evidence (i.e. asset beta range of 0.4-0.44) to extend the SSMD analysis and inform the RIIO-GD3 decision.

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5 Are risks adequately accounted for by the regulatory package?

5.1 In our previous report for GDNs, we discussed the asset stranding risk GDNs are exposed to.[101] This risk is, by nature, asymmetric in that it implies losses with greater probability than gains. Given that there is no expectation that Ofgem will allow over-recovery of allowed revenues, there is no potential gain from asset stranding. On the other hand, Ofgem is unable to ensure that there will never be under-recovery.

5.2 As with any other asymmetric risk within a regulatory regime, the asset stranding risk implies a downward pressure on the expected returns. Hence, either the risk should be addressed directly within the regulatory regime, or an appropriate uplift should be applied to the allowed return to avoid under-compensation and to maintain a fair and balanced return expectation.

5.3 In its SSMD, Ofgem states that risk asymmetry should be assessed at the level of the overall regulatory package.[102] While we agree with that position, we note that a fair assessment of what residual risks remain after accounting for the regulatory framework is still necessary.

5.4 It is also relevant to consider whether there might be a systematic component to asset stranding risk, and that this systematic component is apparent in capital market evidence (for example, traded debt yields and beta differentials) as a 'gas premium' between gas and electricity networks,[103] prior to accounting for forward-looking risks that cannot be fully priced in current market data, as already highlighted in our previous report for the GDNs.[104]

5.5 In its SSMD, Ofgem considers that changes to the beta comparators and accelerated depreciation sufficiently reflect any changes to the risk profile of RIIO-3 relative to RIIO-2, both

[101] Oxera (2024), 'Risks and investability of the GB gas distribution sector. Prepared for GB gas distribution networks', 1 March, section 2.
[102] Ofgem (2024), 'RIIO-3 Sector Specific Methodology Decision – Finance Annex', para. 3.302.
[103] Oxera (2024), 'Risks and investability of the GB gas distribution sector. Prepared for GB gas distribution networks', 1 March, section 2.
[104] Ibid., section 3C.

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in terms of accounting for the systematic risks of energy networks and accounting for any residual asymmetric risks.[105]

5.6 However, we consider that this is not the case, and that an asymmetry still remains despite Ofgem's proposed changes, and that this asymmetry is not adequately compensated for. In this section, we discuss in turn why modifications to the beta comparator sample and the depreciation schedule of the GDNs' RAV are insufficient to adequately address gas-specific (asymmetric) risks, in particular asset stranding.

5.1 Proposed changes in the beta comparator set

5.7 In the SSMD, Ofgem has signalled its readiness to extend the beta comparator sample to include European energy network comparators.[106] In particular, Ofgem intends to add two electricity networks and three gas networks in its beta comparator sample.[107] Ofgem considers that doing so would more effectively account for the impact of net-zero risks, including asset stranding risk, to the extent they are systematic.[108]

5.8 However, as we have discussed in section 2, Ofgem's sample in the SSMD does not adequately represent the asset stranding risks faced by gas networks. For example, we have shown evidence that the water sector's investment needs and outlook for utilisation are divergent from the gas sector needs in RIIO-3 and beyond.

5.9 In addition, Ofgem has acknowledged that energy networks may face forward-looking risks, which may not be accurately reflected in backward-looking beta samples.[109] Ofgem views changes in the beta sample to be the most effective way to capture the risk of the sector on a forward-looking basis as accurately as possible.[110] However, forward-looking risks cannot be fully priced in historical market data on betas.

5.10 Overall, this suggests that an asset beta allowance giving more weight to non-gas evidence might underestimate gas-specific

[105] Ofgem (2024), 'RIIO-3 Sector Specific Methodology Decision – Finance Annex', para. 3.308.
[106] Ibid., para. 3.190.
[107] Ibid., para. 3.199.
[108] Ibid., para. 3.305.
[109] Ibid., para. 3.179.
[110] Ibid., para. 3.194.

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risks, especially in light of the divergent dynamic that the gas sector is undergoing compared to other sectors.

5.2 Effects of accelerated depreciation schemes

5.11 In addition, Ofgem proposes several options to accelerate the depreciation of gas distribution network assets in its SSMD.[111]

- Option 1—this would consist in using a sum-of-digits depreciation profile with asset lives set such that the RAV is fully depreciated by the government's net zero target date.
- Option 2—this would be option 1 plus the application by Ofgem of an acceleration factor (to be determined at each price control) to the current sum-of-digits depreciation schedule. The acceleration factor is meant to account for current government policies and consumer gas usage forecasts.
- Option 3—this would consist in depreciating the RAV using straight-line depreciation with a variable declining balance adjustment, using the acceleration factor described above. The RAV would be fully returned by the government's net zero target date for GDNs.
- Option 4—this would be a split approach for existing assets and new investments. The depreciation policy for existing assets would be left unchanged. New investments would be subject to a sum-of-digits approach calibrated such that new investments are fully depreciated by 2050. In other words, option 1 would apply to new assets only.

5.12 The four options considered by Ofgem help address asymmetric stranding risk in various ways, but they cannot eliminate it altogether. As we pointed out in our report in response to the SSMC, absent any third party intervention such as a government guarantee, a combination of regulatory measures might be needed to reduce and/or compensate the residual asset stranding risk.[112]

5.13 Ofgem fails to acknowledge that there would still be residual asset stranding risk even if cash flows are accelerated in the period up to 2050, when it notes that 'aligning the repayment of

[111] Ofgem (2024), 'RIIO-3 Sector Specific Methodology Decision – Finance Annex', 18 July, Table 19.
[112] Oxera (2024), 'Risks and investability of the GB gas distribution sector', 1 March, p. 5.

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investment in GD to the government's target net zero date provides the most certainty to investors'.[113]

5.14 Indeed, accelerated depreciation might not be sufficient to eliminate the risk of stranding when the implication of declining gas usage in future price controls is that a decreasing customer base faces increasing bills up to a level where their acceptance by consumers is no longer guaranteed. While accelerated depreciation reduces the tariffs that need to be levied on future customers, the risk of partial stranding remains, especially if dynamically changing factors result in frequent tariff spikes as the regulator adapts the regulatory framework.

5.15 Accelerating the depreciation scheme also creates new uncertainties. Specifically, a diligent calibration of the options is required to avoid the problematic tariff spikes discussed above. However, the extent to which this would be possible is unclear. Indeed, the shorter the remaining time to 2050 is, the faster any new investment would need to be depreciated irrespective of the chosen option, with increasingly significant impacts on tariffs.

5.16 All options have, by design, tariff implications, which will naturally have an impact on usage.

5.17 Hence, the depreciation acceleration options might seem adequate to address stranding risk in a static state of the world. However, given uncertainties about future policy evolutions and changing consumer behaviours, there is no certainty that a regulatory change can address an asymmetric risk that is likely to materialise in the medium to long term.

5.18 Moreover, an accelerated depreciation scheme can create operational risks once all assets are depreciated. According to most of the proposed options, the value of the RAV will be set to zero by 2050. However, some of the assets may still be in use and required. For such assets that are still in use, networks would still have to bear the operational risks, with potentially insufficient allowances (if the RAV is fully depreciated) to

[113] Ofgem (2024), 'RIIO-3 Sector Specific Methodology Decision – Finance Annex', 18 July, para. 8.41.

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remunerate this risk above and beyond operational cost allowances.

5.19 Finally, adjusting the depreciation profile of the RAV does not address the risk that networks are unable, in the future, to recover the ongoing costs of operating the networks in case of a decrease of the user base that would lead to untenable increases in customer bills.

5.20 This suggests that the options currently under consideration by Ofgem would help to address stranding risk, but they would not eliminate it altogether. Networks would still be exposed to early and partial stranding risks, especially as the user base starts to decrease significantly in later years.

5.21 In that regard, we note that Ofgem is likely to need to undertake further analysis of the impact of each option on perceived stranding risk in the future, with a focus on the evolution of the outstanding RAV balance at the point of minimal gas consumers and on forecasting future gas consumer bills.[114] This analysis will inform the residual asymmetric risks that would remain under the various depreciation policy options.

5.3 Aiming up as a way to address various types of risks

5.22 In the SSMD, Ofgem left open the possibility to aim up within the CoE range through applying a beta that is higher than the midpoint of the range currently being considered.[115] Ofgem indicated that it did not consider aiming up for any other purpose.[116] Ofgem also indicated that it did not currently identify asymmetric risks that would necessitate an adjustment in order to equalise expected returns and allowed returns (i.e. aiming up).[117]

5.23 It is important, for the purpose of setting appropriate returns, that aiming up as a way of addressing parameter uncertainty is not conflated with aiming up to address risk asymmetries. The motivation behind these two regulatory judgement calls is different: aiming up to address parameter uncertainty aims to ensure that the allowed CoE is not underestimated due to the uncertainties that are intrinsic to the exercise of estimating CoE

[114] Ofgem (2024), 'RIIO-3 Sector Specific Methodology Decision – Finance Annex', 18 July, para. 8.67.
[115] Ibid., paras 3.224 and 3.305, read in conjunction with para. 3.320.
[116] Ibid., paras 3.322 and 3.350.
[117] Ibid., para. 3.350.

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parameters, whereas aiming up to address residual asymmetric risks aims to ensure that the return on equity that is achieved by the networks is in line with their CoE.

5.24 The CMA drew this distinction during the RIIO-2 appeals, when it considered arguments related to uncertainty around individual CoE parameter estimates, including beta, and the arguments related to risk asymmetry, including risk asymmetry linked to net zero, in separate discussions.[118]

5.25 In its SSMD, Ofgem stated that it considered widening the comparator sample in order to ensure that '[Ofgem is] capturing the risk of the sector on a forward-looking basis as accurately as possible'. This suggests that the inclusion of these comparators primarily aims to improve the certainty of the beta estimate, notwithstanding that it is not possible to fully assess forward-looking risks by using historical capital markets data.

5.26 Ofgem went on to note that the midpoint of its current asset beta range might not be the most accurate estimate and that the different comparators might be weighted differently based on Ofgem's judgement about the weightings that would result in the most accurate estimate of the networks' asset beta.[119]

5.27 In sum, Ofgem's suggestion that it might set a beta that is not in the middle of the SSMD range would consist of aiming up for the purpose of mitigating parameter uncertainty.

5.28 In section 5.1, we explained that the approach taken by Ofgem would nevertheless fail to adequately reflect the gas-specific systematic risks over RIIO-3.

5.29 In addition, and as discussed above, Ofgem does not currently view its regulatory package as containing residual asymmetric risks that would warrant aiming up (by adjusting the allowed returns so that it matches, in expectation, Ofgem's CoE estimate).

[118] 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, paras 5.755 and 5.757–5.890.
[119] Ofgem (2024), 'RIIO-3 Sector Specific Methodology Decision – Finance Annex', 18 July, para. 3.225.

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5.30 However, we consider (as discussed in section 5.2) that the regulatory changes (in particular, to depreciation policy) contemplated by Ofgem would not be sufficient to eliminate all asymmetric risks. As a result, we consider that further aiming up is needed to address the residual risk asymmetries that remain despite the regulatory changes under consideration, in the absence of government intervention.

5.31 Other regulators have recognised that if they are unable to fully address factors such as parameter uncertainty and asymmetric risks at source, aiming up might be necessary as an adequate way to counter the remaining risk. For instance, for PR24, Ofwat has significantly deviated from the midpoint of its CoE range and set its point estimate toward the upper end of the range.[120] Moreover, the CMA has also chosen to aim up when picking a point estimate from its CoE range in the PR19 redetermination.[121]

5.32 Aiming up for the purpose of addressing risk asymmetries would also be consistent with our review of international regulatory precedents, which showed that a combination of regulatory measures might be required to address asymmetric risks and specifically asset stranding risks.[122] In particular, we explained that a cost of capital uplift could support in mitigating stranding risk—and specifically in mitigating residual stranding risk—accounting for changes to the regulatory depreciation policy otherwise being implemented.

5.33 In relation to asset stranding risk in particular, we explained that a cost of capital uplift, partly attributable to sector-specific demand risk, was granted to gas networks in France and New Zealand through a higher asset beta allowance.[123] Similarly, the New Zealand regulator granted a 10bps allowance on the regulated asset base of fibre assets to compensate operators for bearing asset stranding risk.[124] While the latter allowance is

[120] Ofwat (2024), 'PR24 draft determinations – Aligning risk and return – Allowed return appendix', July, pp. 74–75.
[121] Competition and Markets Authority (2021), 'Anglian Water Services Limited, Bristol Water plc, Northumbrian Water Limited and Yorkshire Water Services Limited price determinations', 17 March, para. 86.
[122] Oxera (2024), 'Risks and investability of the GB gas distribution sector. Prepared for GB gas distribution networks', 1 March, section 4.
[123] Ibid., para. 4.72.
[124] Ibid.

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separate from the cost of capital allowance, it is in effect akin to a cost of capital uplift.

5.34 In that regard, aiming up for the purpose of addressing these asymmetric risks can be viewed as akin to a CoE uplift, with precedents in international regulation and UK regulation that make it reasonable and pragmatic regulatory practice.

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6 Concluding remarks

6.1 In this report, we have estimated gas sector-specific evidence to build the existing evidence base on asset betas to inform Ofgem's judgement of an appropriate asset beta allowance and CoE range for GDNs in RIIO-GD3.

6.2 To do so, we determined a gas-specific beta and used gas-specific debt capital markets evidence as a cross-check, while using the RFR methodology and the TMR range from our ENA CoE report.

6.3 To estimate a gas-specific beta, we use a wide sample of US and European gas network companies and cross-check the results with European regulatory allowances in gas sectors. We conclude that a range of **0.40–0.44** is supported by the gas-specific evidence, to build the existing non-gas specific evidence base that has been assessed by Ofgem up to the SSMD. In combination with the RFR of 1.54% and a TMR range of 7.00–7.50%, we conclude that using gas-specific asset beta evidence (i.e. 0.40–0.44) would imply a CAPM-based CoE range of **6.39–7.43%** (at 60% gearing, CPIH-real) with a midpoint of **6.91%**.

6.4 In forming a judgement on the RIIO-GD3 allowed beta, Ofgem will likely attribute some weight to non-gas UK evidence as per Ofgem's SSMD sample. In order to reflect this, we assume that a wider range of **0.38–0.44** (in which the lower bound is equal to the midpoint of the upper half of Ofgem's SSMD asset beta range) for RIIO-GD3 is appropriate to cross-check the calculation of the CAPM-based CoE. Using this asset beta range, we obtain a CoE range of **6.04–7.43%**, with a midpoint of **6.73%**.

6.5 We then perform an ARP–DRP cross-check, based on gas-specific bond evidence. The cross-check supports our CoE range, calibrated with the 0.38–0.44 betas, suggesting that the allowed CoE should be set within the range that we propose.

6.6 We also note that even if Ofgem were to 'aim up' within the upper half of its SSMD beta range (i.e. to 0.38 within the 0.30-0.40 range), while using the midpoint of its TMR range (i.e. 6.75% within the 6.5–7.0% range), the lower bound ARP from the debt

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market evidence for GDNs would not be satisfied.[125] This shows that the SSMD minded-to position is too low as regards the allowed cost of equity for GDNs, thereby supporting the use of gas-specific evidence (i.e. asset beta range of 0.4-0.44) to extend the SSMD analysis and inform the RIIO-GD3 decision.

6.7 In addition, this report discusses how Ofgem's proposed changes are insufficient to address some of the asymmetric risks faced by gas networks over RIIO-3 and beyond, in particular asset stranding risk. While our asset beta range of 0.38–0.44 captures gas-specific risks more accurately than Ofgem's SSMD sample, its lower bound may not appropriately and fully reflect gas-specific forward-looking risks—given the weight it attributes to non-gas evidence at a time when risks are diverging between gas and the other sectors, and given that forward-looking risks may not be fully priced in historical betas. Therefore, picking an asset beta allowance at the low end of the range might entail more risk of underestimating the asset beta of GDNs.

6.8 We continue to view aiming up within the CoE range as an appropriate mechanism for Ofgem to use towards mitigating these risks for GDNs, in the absence of other mechanisms to fully mitigate sector-specific risks, such as government intervention.

[125] For the purpose of this analysis, we have recalculated a DRP extrapolated at 100% gearing that is consistent with Ofgem's RFR assumption.

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A1 Review of the comparability of the Italian and Spanish gas network comparators

A1.1 Comments on the business mix of the gas network comparators

A1.1 In order to ensure the appropriateness of Enagás, Italgas and Snam as comparators to assess the beta of a regulated gas network, we checked what proportion of their revenues is derived from regulated activities.

A1.2 The figure below shows that Enagás derived almost all of their revenues from regulated activities in 2023 (and also in 2019). For Italgas and Snam, the share of revenues derived from regulated activities is lower, but still significant at 84% and 72% respectively.

A1.3 We note that in 2019, both Italgas and Snam also generated almost all of their revenues from regulated activities, and while the proportion of unregulated business increased up to 2023,[126] the regulated business is still a significant majority of the business and it is apparent that their long-term beta (for example, ten-year) is informative in assessing the risks of a regulated gas network.

[126] For Italgas, the progression of unregulated revenues is driven by revenues derived from 'energy efficiency interventions', referring to work carried out to 'improve energy efficiency' (Italgas (2024) 'Integrated annual report 2023', p. 322). For Snam, this progression is related to the growth of its 'energy transition business', which covers Snam's activities in biomethane, hydrogen, carbon capture and storage and energy efficiency (Snam (2024), 'Annual report 2023', pp. 27–29).

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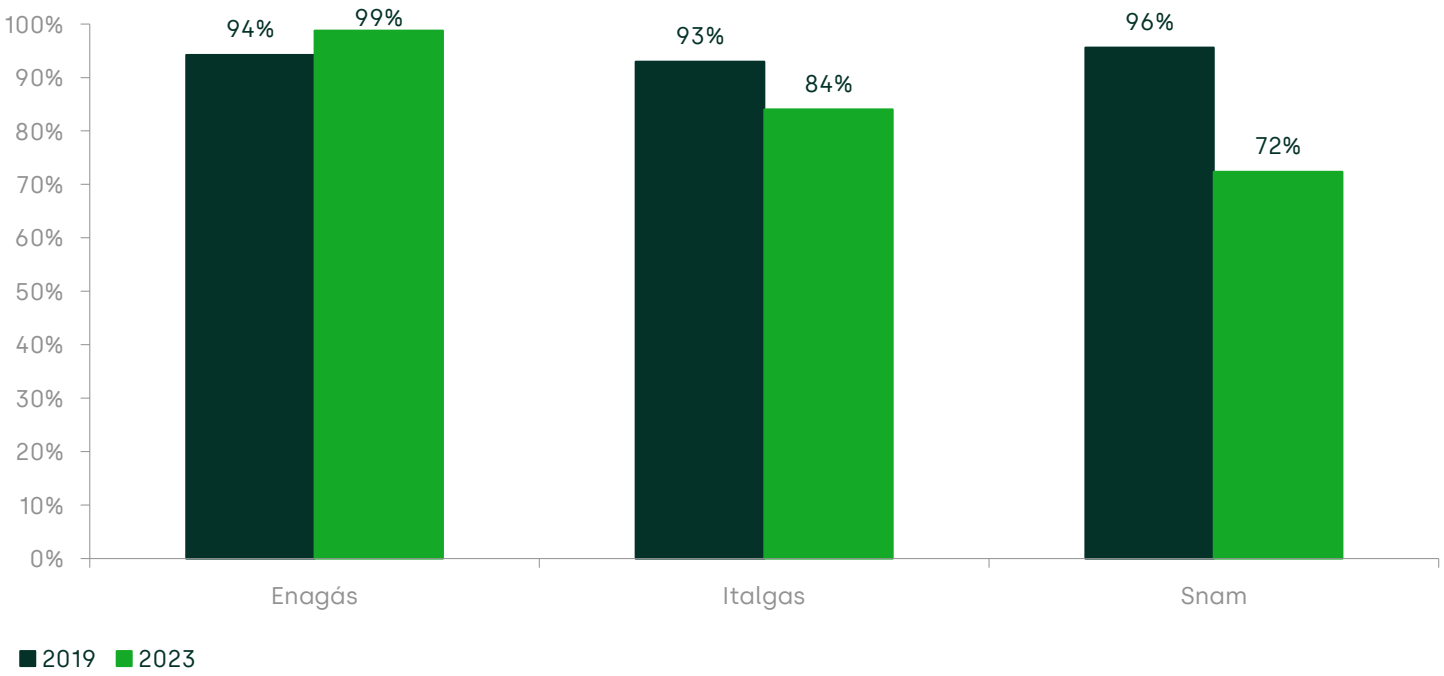
Figure A1.1 Proportion of regulated revenues in 2019 and 2023



Source: Oxera analysis based on companies' annual reports.

A1.4 We also checked the proportion of revenues sourced by each comparator from the regulatory frameworks being assessed in this report (i.e. gas distribution and transmission). This is shown in Figure A1.2 below.

A1.5 This shows that our assessment of the comparability of the regulatory regimes in Italy and Spain covers a significant share (more than 90%) of Enagás' and Italgas' revenues in 2019.[127] For Snam, the figure is lower, but we note that a further 27% of the operator's revenues in 2019 were regulated, being revenues derived from its gas storage and regasification activities (these activities being regulated in Italy), as shown in Figure A1.1 above.

[127] We focus on data from 2019 as this year represents the mid-point of a ten-year period for the beta estimation.

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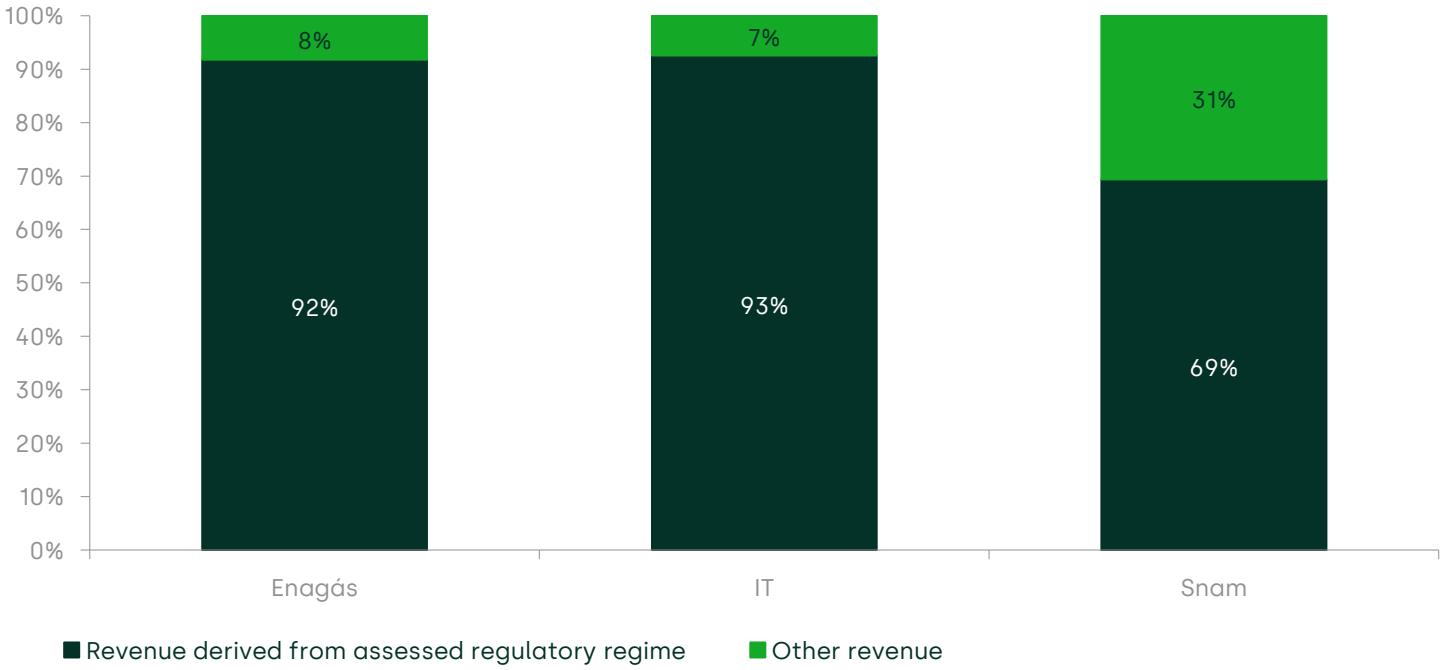
Figure A1.2 Proportion of revenues regulated under the assessed regulatory frameworks in 2019



Note: Revenues from Enagás Transporte del Norte S.L are classified as 'Other revenue' (classified as regulated in Figure 3.1). For Italgas, revenue from infrastructure construction and improvements (IFRIC 12) is included in the revenue derived from the assessed regulatory regime, in addition to gas distribution revenues. Snam's 'Other revenue' includes its revenue from storage, regassification and corporate activities.
Source: Oxera analysis based on companies' annual reports.

A1.6 Overall, this analysis confirms the relevance of using these comparators for the purpose of estimating an asset beta for the GDNs. It also confirms that the analysis of the regulatory regimes in Italy and Spain carried out below covers a significant share of the activity of those comparators.

A1.2 Comparability of the regulatory regimes in GB, Italy and Spain

A1.7 In this section, we provide an analysis of the comparability of the GB, Italian and Spanish regulatory regimes. The purpose of this exercise is to determine whether the systematic risks associated with regulatory frameworks and faced by the GDNs and the three European gas networks considered by Ofgem for inclusion in the beta comparator sample are similar.

A1.8 As the analysis presented in section 2 focuses on gas networks, this commentary focuses on the three European gas networks under consideration (Enagás, Snam and Italgas).

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A1.9 If the risks are indeed similar, including these companies in the beta comparator sample would improve the accuracy of the beta estimation. It would also be appropriate to attribute a significant weight to these comparators.

A1.10 This section provides a detailed explanation of our approach and the results of our regulatory framework comparison. Section 6A1.2.1 offers a brief overview of the factors that influence a company's level of systematic risk and how regulatory risk can modify or add to the existing risk faced by regulated network companies. Section A1.2.2 details our analysis of the regulatory frameworks along several regulatory risk dimensions (described in more detail in sections A1.2.3 and A1.2.4). Finally, section A1.2.5 presents the results of our assessment of the various regulatory frameworks.

A1.2.1 The impact of regulatory risk on systematic risk

A1.11 When using European gas comparators to estimate the asset beta for GB gas network companies, it is helpful to assess the level of systematic risk faced by both groups. While GB gas companies and their European counterparts operate within the same sector, this does not necessarily imply that they experience comparable levels of systematic risk

A1.12 For unregulated companies, systematic risk is typically affected by the following factors.

- Industry factors, such as demand elasticity, competition dynamics, asset stranding risk, etc.
- Operational risk factors, such as the scale of investment programs, and the level of capital intensity (for example, measured by the ratio of capital employed or assets to revenue).

A1.13 While regulation may alter existing systematic risks, for instance by making profits less sensitive to short-term upside or downside deviations in demand, the degree to which these risks are mitigated may vary across regimes.

A1.14 Regulatory regimes may also introduce risks that are unrelated to the company's core business and would not exist in an unregulated environment. These risks are often linked to the regulator's level of discretion and the consistency of the regulatory framework. For example, a regulator may exercise considerable judgement in determining the CoE allowance,

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creating a risk that this allowance could change significantly due to factors unrelated to market conditions.

A1.2.2 Principles of regulatory framework comparison

A1.15 The key risk factors we consider in our assessment of the Spanish and Italian regulatory regimes are split into two groups.

- The **regulatory process factors** (including the appeal regime, political interference, regulatory independence, and regulatory consistency).
- The **regulatory regime design factors** (including the profit buffer factor, cost efficiency incentives and demand risk).

A1.16 Each factor is described in more detail below.

A1.17 We then compare these regimes with RIIO-2 and guidelines from Ofgem's SSMD for RIIO-3 to determine whether they give rise to higher or lower systematic risk. Our review mainly focuses on historical decisions for Spain and Italy and attaches little weight to ongoing or forthcoming regulatory reforms (such as the transition towards the ROSS-integrale methodology in Italy). This is because our interest lies in understanding how regulatory frameworks have historically impacted investor expectations and stock returns during the periods for which betas are estimated.

A1.2.3 Risk factors relating to the regulatory process

A1.18 We start with the risk factors relating to the regulatory process.

- **Appeal regime:** An appeal regime imposes constraints on regulatory discretion. The broader the scope of the appeal body's review, the greater the constraint on regulatory discretion, leading to lower systematic risk from regulatory decisions. However, the rule should be applied carefully, as it is the degree of regulatory discretion after the constraint of the appeals process that matters. If a regulator exercises less discretion (for example, because its methodology is constrained by law), then even if the appeal regime does not impose an additional limit on regulatory discretion, the overall risk will still be lower. With regards to the appeal regime itself, we draw a distinction between redeterminations, where the appeal body is required to redetermine the price control (as is the case in England & Wales water networks), and court procedures, where the appeal body is restricted to finding whether the

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regulator was wrong on any of the specific grounds (as is the case for GB energy networks).

- **Political interference:** Cases of political interventions show greater dependence of regulated returns on the political and social environment, and therefore indicate greater systematic risk.
- **Regulatory independence:** In addition to examples of political interference, we checked for any major reasons to consider that the regulators are likely to be less independent of their governments than Ofgem. For example, in 2019 the European Commission referred a number of member states to the European Court of Justice for not providing their regulator with sufficient independence.[128] We assess this factor in combination with the examples of political interference.
- **Regulatory consistency**: Any regulatory decision, especially one that requires substantial consideration and economic analysis, is associated with a degree of regulatory discretion and therefore potential systematic risk. We follow the principle of greater regulatory consistency over time being associated with lower systematic risk.

A1.2.4 Risk factors relating to the design of the regulatory regime

A1.19 Here, we describe the risk factors relating to the design of the regulatory regime.

- **Balance of upside opportunity and downside risk (profit buffer)**: If a company has an opportunity to earn revenue over and above the core building blocks (using RIIO-2 as a benchmark) without a symmetric risk of being penalised, it has the potential to create a **profit buffer**. Such a buffer may be argued to reduce systematic risk. The potential for a profit buffer would exist even if, in theory, the rewards and penalties are symmetrical. This is because, in practice, the target required to get the reward might be easy for the company to meet. The opposite would also apply—i.e. when revenue-earning opportunities are more negatively skewed than in RIIO-2, we consider this to increase systematic risk.

[128] European Commission (2019), 'Assessing the independence and effectiveness of National Regulatory Authorities in the field of energy', Publications Office of the European Union.

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- **Cost efficiency incentives**: We consider the cost efficiency incentives in the context of CAPEX, OPEX and cost of debt in relation to the following sub-factors.
    - **Intensity of incentives**: first, we check how high-powered the cost-efficiency incentives are. High-powered cost-efficiency incentives expose networks to greater deviations of actual costs from allowances and therefore to greater underlying cost risk, including any regulatory judgement applied in setting those allowances, while pass-through clauses protect companies from this. Where allowances are set ex ante, the proportion of out- and underperformance shared with customers show how high-powered the incentives are.[129]
    - **Regulatory approach to cost allowances**: we consider how the regulator establishes cost allowances. If ex ante allowances are set for each company individually, mechanically reflecting its past performance, they account for the company's individual circumstances, and regulatory discretion is limited. If ex ante allowances are based on the cost data of other companies as well—i.e. the costs are benchmarked and assessed for efficiency—the company may find it more challenging to meet the targets, and there is more scope for regulatory judgement.
    - **Ex post assessment of cost efficiency**: we assess whether the regulator evaluates cost efficiency after the costs have been incurred. In particular, such mechanisms expose companies to asymmetric risk, because it is easier to identify areas of inefficiency and disallow these costs than it is to identify areas of efficiency and allow additional revenue to be earned.
- **Demand risk**: We differentiate fixed allowed revenue (with short-term protection from demand risk) from price cap (exposure to demand risk) regimes. For this exercise, we did not differentiate between regimes by the timing of

[129] We distinguish between incentive rate and sharing rate. The Incentive rate represents the percentage of out- (or under-)performance that the company is able to retain (or required to bear). The sharing rate represents the percentage of out- (or under-)performance that can has to be shared (or can be shared) with consumers. As such, the sharing rate can be computed as one minus the incentive rate.

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demand-related under-recoveries (for example, during versus after the price control) or by the underlying demand risk, assuming that fixed allowed revenue regimes neutralise this risk.

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A1.2.5 Regulatory framework comparison

Table A1.1 Description of the RIIO-2 regime and proposed changes for RIIO-3

Factor	RIIO-2 Description	RIIO-3 proposed methodology
Appeal regime	Regulatory decisions can be challenged before the CMA. The CMA does not conduct a full redetermination. We consider this to be comparable to court procedures where expert evidence is considered.	The appeal regime is not expected to undergo any changes prior to or during the RIIO-3 price control period.
Examples of political interference	We are not aware of explicit examples of political interference affecting GB networks.	
Regulatory independence	Ofgem is an independent regulator which sets tariffs independently from the government.	Not subject to change under RIIO-3.
Regulatory consistency	Although Ofgem does not change regulatory principles at every price control review, it reconsiders its framework, methodologies to set parameters and parameters estimates. Sophisticated methodologies and regulatory judgement are applied in the review process, introducing regulatory risk. Examples of changes between RIIO-1 and RIIO-2 price controls are as follows.	The introduction of specific mechanisms in the RIIO-3 price control is aimed to provide confidence to network companies and investors by mitigating perceived asset stranding risks. Other than that, the regulation of GT and GD is not expected to be disrupted during RIIO-3. Ofgem aims to address the longer-term risk of gas network asset stranding if gas demand falls significantly (or even disappears) before the assets are fully depreciated. Ofgem is explicit about seeking to address risk 'at source' without the

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Factor	RIIO-2 Description	RIIO-3 proposed methodology
	• Set of incentives—removed the information quality incentive (IQI), introduced the business plan incentive (BPI), and revisited the set of output delivery incentives (ODIs). • Cost efficiency incentives—the mechanism did not change; sharing rates, ex ante allowances and the efficiency factor were revised. • Output targets—output targets were revised; new outputs were added to the outputs framework for RIIO-2, including Price Control Deliverables (PCDs). • RFR methodology (as an example within the CoE allowance methodology)—moved from a combination of evidence points to spot yields on government bonds, and indexation was also introduced. • Other methodological changes in relation to the CoE allowance included changes in the allowed equity beta, the allowed debt beta, and the TMR (which is now expressed in CPIH-real terms and materially lower in nominal terms than in RIIO-1). • Returns adjustments—introduced an ex ante reduction to returns based on the expected outperformance (although this was overturned on	introduction of decommissioning liabilities through baseline allowances. The set of envisaged policy changes includes, among others, the following. • Set of incentives—in RIIO-3, Ofgem is going to maintain the BPI, albeit a revised version. There will no longer be a distinction based on high-/low-confidence cost categories. The overall value of the BPI will also be capped at ±60bps of RoRE, which Ofgem expects to be a strengthening of the incentive relative to the 2% TOTEX BPI incentive in RIIO-2. While the maximum reward/penalty is symmetric, it is going to differ across three stages that will set the share of comparability and information quality for the assessed costs. • Output targets—the general output framework will stay in place for RIIO-3. In contrast to RIIO-2, Ofgem intends to calculate financial ODIs on a RoRE basis. • Accelerated asset depreciation—introduced to aim to address the asset stranding risk at source in order to protect current and future consumers. This will lead to increased charges during RIIO-3, but is considered necessary by Ofgem in order to help mitigate the risk of unsustainable increases in future depreciation charges, as the consumer base decreases. • Changes in payback date of additional RAV spend—there might be differences regarding the payback date of additional RAV spend

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Factor	RIIO-2 Description	RIIO-3 proposed methodology
	appeal); threshold levels for returns were introduced. Returns above or below thresholders are adjusted downwards or upwards respectively, using an adjustment rate. • RPEs indexation—As compared to RIIO-1, a significant proportion of forecast TOTEX allowances is now indexed for outturn RPEs relative to CPIH to improve the recovery of nominal costs. • Regulatory pressure—Ofgem urged networks to make voluntary contributions due to their outperformance in the RIIO-1 price control, with most companies obtaining (real) double-digit returns. The voluntary contributions have yielded over £650m in savings to customers.	for GD and GT. For GD, Ofgem is targeting a payback date in line with the statutory net zero target date of 2050, but has not yet decided whether this date should apply to the entire RAV or only to new additions made under RIIO-3. For GT, Ofgem is still considering whether it should set the same target date as for GD. • RFR methodology—Ofgem has updated its estimates of the RPI–CPIH wedge, to reflect the RPI–CPI convergence in 2030. • Cost of debt methodology—for GD no major changes have been proposed.
Balance of upside opportunity and downside risk (profit buffer)	There are ODIs and a BPI, which are associated with both rewards and penalties, and therefore, do not create a profit buffer on average.	ODIs and BPI will stay in place for RIIO-3 with some minor changes to streamline and simplify them.
Cost efficiency incentives—OPEX	There is an ex ante TOTEX allowance. 50–67% of exposure is shared with customers. The costs of all companies in the sector are assessed in order to set the TOTEX allowances.	Ofgem intends to maintain the TOTEX incentive mechanism (TIM), advising companies that 'using a sharing factor in the range of 20–50% is plausible for the purpose of business planning and financeability analysis'. This compares with a 33–50% range in RIIO-2. The sharing rate for the TIM will

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Factor	RIIO-2 Description	RIIO-3 proposed methodology
	In addition, RIIO-2 involves ex post assessment of costs and outputs. For example, PCDs allow consumers to be refunded if an output is not delivered (or not to a specified standard). In particular, while for mechanistic PCDs the adjustments to allowances are largely automatic and typically proportional to volumes, for evaluative PCDs the adjustments depend on Ofgem's ex post assessment, thus entailing greater regulatory discretion and higher risk. Evaluative PCDs account for a substantial share of allowed TOTEX.	not be mechanically derived from a cost confidence assessment, but instead determined using a qualitative and quantitative assessment of relevant factors. For PCDs, a materiality threshold of £15m is being introduced and, where PCDs result in (efficient) overspend due to changes in scope and generate benefits for consumers, the allowance can be adjusted upwards.
Cost efficiency incentives—CAPEX	As per OPEX.	As per OPEX.
Cost efficiency incentives—cost of debt	The cost of debt allowance is based on the iBoxx GBP Utilities 10+ years trailing average, set to match the sector average actual cost of debt. Companies face the risk that this does not correspond to their actual cost of debt.	The methodology to set the cost of debt allowance is not expected to undergo any other changes than the differential treatment of the fixed-interest and index-linked debt in the RAV.
Demand risk	A fixed allowed revenue is in place.	Not subject to change under RIIO-3.

Source: Oxera analysis based on various regulatory documents.

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Table A1.2 Italian GT and GD regulatory framework and comparison to RIIO-2 and RIIO-3

Factor	Risk compared to RIIO-2 and RIIO-3	Description
Appeal regime	Similar risk	There is no redetermination by a competition authority; rather, legal proceedings are used to investigate the administrative procedures. This is similar to the CMA only intervening if an error is found in Ofgem's determination, rather than carrying out a redetermination.
Examples of political interference	Similar risk	We are not aware of explicit examples of political interference affecting networks. We find no reason to conclude that ARERA's decisions are more or less affected by political agendas than Ofgem's.
Regulatory independence	Similar risk	ARERA is an independent administrative authority, but it has to take into account the general policy guidelines introduced by the government and Parliament. Italy was not referred by the European Commission to the ECJ for failing to comply with the EU energy market rules in relation to regulatory independence.
Regulatory consistency	Similar risk	As in GB energy, potential changes to the framework, methodologies to set parameters and parameter estimates are considered at every price control review. In 2021, ARERA started a reform process to transition towards a TOTEX regime called ROSS ('Regolazione per Obiettivi di Spesa e di Servizio'). This new regime will include business planning, more detailed cost assessments and a stronger focus on output-based incentives. The process is ongoing and will take place in a gradual way, with different timescales depending on the sectors. GT has already transitioned to the 'ROSS-base'[1] model at the

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Factor	Risk compared to RIIO-2 and RIIO-3	Description
		start of 2024, while GD is expected to be subject to the new ROSS regime starting from 2026 (when the current period expires).[2] While the move towards a TOTEX regime is currently ongoing, it is worth noting that ARERA has adopted a phased approach to ensure a smooth and gradual transition to the new model. At a high level, the ROSS-base regime currently applied to GT shares some of the features of the 'hybrid' regime (RAB-WACC model with a rate-of-return remuneration system for CAPEX, combined with a price-cap mechanism for OPEX) previously in place in Italy and currently applied for GD.[3] Set of incentives—new incentives were introduced (for example, for dual-fuel compression stations for GT, or in relation to smart meters, more careful management of the delta in-out[4] and metering more generally for GD). Moreover, in 2023, ARERA introduced a new incentive mechanism for GT networks to maintain fully depreciated assets in operation, where it is safe to do so, thereby creating additional opportunities for rewards and lower risk.[5] Cost efficiency incentives—for GD, the mechanism is largely unchanged compared to the previous regulatory period. A different cost sharing mechanism has been introduced for GT as part of the ROSS-base regime. This combines a TIM for savings attributed to CAPEX (currently not 'directly' applied, as CAPEX is largely passed through) and a rolling incentive mechanism for savings attributed to OPEX.

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Factor	Risk compared to RIIO-2 and RIIO-3	Description
		Output targets—some outputs and/or specifics of the design of certain incentive mechanisms were revised relative to the previous price control (for example, some mechanisms related to quality for GD). Rate of return methodology—at a high level, some aspects of the methodology for setting the WACC have remained unchanged from the previous WACC period. The allowance is set for a period of six years, with a mid-period update. The methodology for the following WACC period is split into two semi-periods, with most of the parameters undergoing redetermination at the start of the second sub-period. However, the regulator introduced several changes in order to refine the methodology to compute some of the parameters and protect investors from variations in macroeconomic conditions. These include the below. • A trigger mechanism (with a pre-defined threshold) has been introduced to update the WACC if market parameters undergo significant variations intra-period. This mechanism was introduced for the first semi-period of the current WACC period (2022–24).[6] • RFR methodology—the RFR is estimated with reference to AAA and AA rate EUR-denominated government bonds (while previously, it was estimated with reference to the yield on Italian government bonds). In 2015, an RFR floor of 0.5% was introduced, but has now been removed. Furthermore, the new methodology considers three premia in the RFR calculation—namely, the convenience premium, the uncertainty premium, and the forward premium.

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Factor	Risk compared to RIIO-2 and RIIO-3	Description
		• Cost of debt methodology—before 2015, the cost of debt was estimated as the sum of the RFR, a country risk premium, and a debt risk premium. Under the current methodology, ARERA estimates the cost of debt as the average between the cost of existing debt and the cost of new debt using market indices. A mechanism ensures a gradual transition from the old to the new methodology through the inclusion of a fixed term in the WACC calculation (the weight of which decreases over time).
Balance of upside opportunity and downside risk (profit buffer)	Similar risk	There are positive and negative effects of different elements, resulting in a broadly balanced position. Therefore, we conclude that the risk is similar to RIIO-2. For both GT and GD, work-in-progress CAPEX is treated differently from assets that have entered in operation (specifically, it receives an allowed return but is not depreciated until the assets enter in operation). For GT, work-in-progress CAPEX is remunerated at a lower rate than the allowed rate of return and for a maximum of four years (as a general rule). This term can be extended for a maximum of two years for certain projects with (i) costs above €1bn, and (ii) an expected build time of more than four years. This is associated with slightly higher risk than in RIIO-2, where investments are recognised when they are undertaken, and work-in-progress CAPEX is not treated differently from the rest of TOTEX. For GD, work-in-progress CAPEX is remunerated at the WACC, without time limits. A more favourable treatment (which is comparable to that under RIIO-2) therefore applies for GD.

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Factor	Risk compared to RIIO-2 and RIIO-3	Description
		In GT, a premium of 1.5% on top of the allowed WACC is recognised for a period of ten years on new investments entered into operation between 2020 and 2022 with a benefit-to-cost ratio higher than 1.5. This premium is on top of the standard building blocks of RIIO-2. This mechanism has since been phased out (i.e. has not been renewed in more recent price controls), but its application period has not yet expired.[7] In GT, ARERA introduced a new incentive mechanism (where safe to do so) to maintain fully depreciated assets in operation, thereby creating additional opportunities for rewards.[8]
Cost efficiency incentives—OPEX	Similar risk	For GD, there is full exposure to out- and underperformance of costs over the course of the regulatory period in which these are incurred. In addition, the targets are set in a way that strengthens the incentive—the target OPEX in the first year of the regulatory period is set on the basis of actual OPEX in the base year + 50% of out- or underperformance in the base year, instead of being linked to the actual OPEX in the base year. The incentive is more high-powered than in RIIO-2 and therefore would imply higher risk. Moreover, ex ante allowances are set on the basis of regulatory accounting data (for the whole sector/cluster), thus potentially resulting in allowed OPEX being higher or lower than actual OPEX. Conversely, OPEX allowances are set according to specific formulas, thereby providing fewer opportunities for regulatory discretion, and thus implying lower risk. Furthermore, under specific circumstances, there is a possibility for ex post recovery of cost overruns if these are fully justified (such as costs resulting from unforeseeable and exceptional events or from changes in the

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Factor	Risk compared to RIIO-2 and RIIO-3	Description
		policy framework). This is comparable to RIIO-2 uncertainty mechanisms. On balance, we consider the risk associated with OPEX allowances to be similar to RIIO-2. For GT, the OPEX baseline is set differently under the ROSS-base regime. In particular, the allowed OPEX in the first year of the period is set on the basis of actual costs in the base year (with a company-specific assessment). In the following years, the allowance is updated for: (i) inflation, (ii) an annual efficiency factor (X-factor, set by ARERA at the beginning of the period, that varies depending on the cost sharing option chosen by the network operator),[9] and (iii) two additional factors to account for incremental OPEX resulting from unforeseeable and exceptional events and/or changes in the policy framework (Y-factor), or related to new investments linked to the energy transition (Z-factor). Moreover, a new cost sharing mechanism applies on a yearly basis (with a lag, once outturn data become available) to deal with deviations between the OPEX baseline and outturn costs. Specifically, savings attributed to OPEX are subject to a rolling incentive mechanism, with different incentive rates depending on the 'option' (low- or high-powered option) chosen by the network operator at the beginning of the period.[10] Overall, we consider the risk associated with OPEX allowances for GT to be broadly similar to RIIO-2.
Cost efficiency incentives—CAPEX	Lower risk	For both GT and GD, there are currently no efficiency targets on CAPEX, as allowances are largely set at the level of costs incurred in year T-1, which is similar to a cost-plus basis with a lag. There are also no opportunities for regulatory discretion. We consider this to be lower risk than in RIIO-2.

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Factor	Risk compared to RIIO-2 and RIIO-3	Description
		There is an ex ante downwards adjustment to CAPEX allowances in GT if the benefit-to-cost ratio is below one and the amount of investment meets certain thresholds (the cost-benefit assessment is limited to investments >€25m for the national network or >€5m for the regional network)—in these cases, investments are included into the RAB for a value corresponding to that of the benefits. Although no ex ante downward adjustments are undertaken based on benefit-to-cost ratios in RIIO-2, companies' investment plans are scrutinised, which leads to downward adjustments to ex ante allowances. While more limited in its application, GD also has some unit costs mechanisms (i.e. for smart meters, but these represent a small share of total costs), while a tariff cap (defined in €/PdR)[11] applies for CAPEX allowances in newly methanised areas, where gas supply first started after 2017 (if capital charges are above the cap, actual costs are not recovered in full). However, we do not consider this factor to outweigh a generally lower-powered and lower-risk incentive mechanism.
Cost efficiency incentives—cost of debt	Similar risk	The cost of debt is not company-specific; instead, and similar to RIIO-2, it is set at the same level for all the Italian gas (and electricity) networks. Under the current methodology, the cost of debt is a weighted average of the cost of existing debt and the cost of new debt, both calculated by reference to market data.
Demand risk	Similar risk	In GT, there is volume risk on less than 1% of the allowed revenue, due to the capped risk exposure on the OPEX component.[12] In GD, there is no demand risk exposure as ex post corrections apply.

Note 1: ARERA (2023), 'Delibera 163/2023/R/com', April. ARERA (2023), 'Delibera 497/2023/R/com', October.
Note 2: ARERA (2022), 'Consultazione 317/2022/R/com', July, section 11.

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Note 3: One of the main changes introduced with ROSS-base consists in identifying the costs that are recovered in-year (i.e. the fast-money component) and those logged to the RAB (i.e. the slow-money component) according to a given capitalisation rate set ex ante by the regulator.
Note 4: The delta in-out refers to the difference between the gas volumes injected in the exit points of the GT network interconnected with GD networks (city gate) and the volumes withdrawn by final consumers connected to the distribution network.
Note 5: ARERA (2022), 'Delibera 723/2022/R/gas', December.
Note 6: Based on the latest consultation document ahead of the mid-period review of the WACC methodology, ARERA is minded to confirm the trigger mechanism also for the second semi-period (2025–27). ARERA (2024), 'Consultazione 342/2024/R/com', July.
Note 7: ARERA (2023), 'Delibera 139/2023/R/gas', Attachment A, April, para. 6.2.
Note 8: ARERA (2022), 'Delibera 723/2022/R/gas', December.
Note 9: The network operator can choose between a low-powered incentive (SBP) and a high-potential incentive (SAP). Under the SBP, the incentive rate is 100% in the first year the (in)efficiency is incurred and 50% in the subsequent three years. Under the SAP, the incentive rate is 100% in the first year the (in)efficiency is incurred and 75% in the subsequent three years (but with a 'cap' to penalties in case of structural underperformance). The X-factor is 0% for the SBP and 0.50% for the SAP (annual values). See ARERA (2023), 'Delibera 497/2023/R/com', October and ARERA (2023), 'Delibera 163/2023/R/com', April.
Note 10: Snam chose the low-powered option. See ARERA (2023), 'Delibera 216/2024/R/gas', May.
Note 11: PdR stands for point of re-delivery.
Note 12: See, for example, Snam (2023), '2023 EMTN UPDATE-BASE PROSPECTUS', p. 21.
Source: Oxera, based on regulatory determinations.

Table A1.3 Spanish GT regulatory framework and comparison to RIIO-2 and RIIO-3

Factor	Risk compared to RIIO-2 and RIIO-3	Description
Appeal regime	Similar risk	Regulatory decisions can be challenged before the National High Court (NHC). No redetermination is undertaken by a competition authority; rather, legal proceedings are used to investigate the administrative procedures. This implies a similar risk to RIIO-2.

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Factor	Risk compared to RIIO-2 and RIIO-3	Description
Examples of political interference	Similar risk	We are not aware of explicit examples of political interference into the regulator's regime. We therefore mark this factor as indicating similar risk.
Regulatory independence	Similar risk	Since 2020, an independent regulator, the Comisión Nacional de los Mercados y la Competencia (CNMC) has been provided with more powers and regulatory independence. After its appointment four years ago, the CNMC set the regulatory framework in all energy sectors, partially maintaining continuity with respect to the previous regimes. Overall, regulatory independence has been comparable to that of Ofgem. As our focus is on the most recent price control, we mark this factor as similar risk.
Regulatory consistency	Similar risk	In 2020, when the CNMC was provided with additional powers, the regulatory framework was broadly maintained consistent with the previous regulatory period. As in GB energy, before the start of every regulatory period, methodologies and parameters can be updated. • Set of incentives—a specific component, the REVU (remuneration for useful life extension), has been strengthened, i.e. higher OPEX recognised for fully depreciated assets to incentivise networks to maintain these assets in operation. The remuneration for continuity of supply (RCS) component is being phased out gradually. There is no concept of OPEX directly linked to fully depreciated assets (REVU) or any specific

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Factor	Risk compared to RIIO-2 and RIIO-3	Description
		component directly analogous to the RCS component in RIIO-2—therefore, the impact on risk compared to RIIO-2 is unclear. • Rate of return methodology—a new methodology to set the financial remuneration was established in 2019[1] with no further changes by the CNMC since then. The WACC is now used instead of adding a spread (and an additional RCS component) on top of the average yield on Spanish government bonds.
Balance of upside opportunity and downside risk (profit buffer)	Similar risk	There are positive and negative effects of different elements, resulting in a broadly balanced position. Therefore, we conclude that the risk is similar to RIIO-2. • Grants are generally excluded from the RAB, but in the case of EU funds, only 90% of the amount received will be deducted from the RAB. This implies lower risk. • Assets under construction are not included in the RAB, implying that no depreciation nor return allowance is earned until they are put into service. This implies higher risk. • An RCS component is provided on top of the building blocks. The CNMC has decided to phase out this component gradually, but it has still been maintained for the current regulatory period. It potentially creates opportunities for additional revenues and implies lower risk.

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Factor	Risk compared to RIIO-2 and RIIO-3	Description
		• A financial prudence penalty applies to networks with ratios of indebtedness and economic financial capacity that fall outside recommended values. This is limited to a maximum of 1% of the total revenues and applies from 2024. This is broadly comparable to Ofgem's tax review mechanism and its financial resilience requirements. • The REVU component allows for higher OPEX for fully depreciated assets. There is no concept of OPEX directly linked to fully depreciated assets in RIIO-2—therefore, the impact on risk compared with RIIO-2 is unclear.
Cost efficiency incentives—OPEX	Similar risk	There is full exposure to out- and underperformance of efficiencies over the course of the regulatory period in which these are incurred. The targets are based on reference costs set by the regulator without direct reference to the company's recent actual costs. These factors would imply a higher risk than in RIIO-2. However, no ex post efficiency adjustments are mentioned in the methodology. In addition, there is an asymmetric efficiency incentive—the company can keep 50% of its outperformance in the previous regulatory period. No penalty for underperformance is mentioned in the methodology. Given that these factors imply lower risk than in RIIO-2, we conclude that, on balance, the risk is similar.
Cost efficiency incentives—CAPEX	Higher risk	CAPEX allowances are set based on reference costs. Unit costs are determined based on 'representative average values obtained from investment cost of facilities whose technical design and operating conditions are adapted to the standards

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Factor	Risk compared to RIIO-2 and RIIO-3	Description
		used in the gas system, and according to the evolution of the main cost drivers considered'.[2] A 50% incentive rate is applied to out- and underperformance, which is towards the higher end of the range in RIIO-2 (where companies bear 33–50% of the difference). In addition, ex post efficiency adjustments may be applied to the actual costs (before sharing) in all circumstances, rather than only when the actual costs deviate from the reference costs significantly. Overall, we consider risk to be higher than in RIIO-2.
Cost efficiency incentives—cost of debt	Similar risk	The cost of debt allowance is set using a comparator-based approach and is not company-specific, in line with RIIO-2. We also note that, differently from RIIO-2, the CNMC makes a distinction between GT and ET.
Demand risk	Similar risk	There is a specific component of revenues that varies with demand (RCS). Over the 2021–26 control period, the RCS component represents on average c. 20% of the allowed revenues for GT.[3] However, as the component is being phased out over the current control period and is no longer linked to demand volumes,[4] we can conclude that the demand risk is similar to RIIO-2.

Note 1: Comisión Nacional de los Mercados y la Competencia (2019), 'Decision 2/2019', November.
Note 2: Comisión Nacional de los Mercados y la Competencia (2019), 'Decision 9/2019', December, art. 20.
Note 3: Comisión Nacional de los Mercados y la Competencia (2019), 'Decision 9/2019', December, Explanatory Report, Table 157.
Note 4: Enagás, '2023 Annual Report', p. 307.
Source: Oxera, based on regulatory determinations.

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A2 Sample of GB gas bonds

Table A2.1 GB gas bonds publicly traded as of 31 August 2024

Issuer	Fitch rating	S&P rating	Moody's rating	Issue date	Maturity date	Principal amount	Included in the three-year average window[1]
Cadent	A-	BBB	Baa1	22/09/2016	22/09/2028	£1,112m	No
Cadent	A-	BBB	Baa1	22/09/2016	22/09/2038	£916m	Yes
Cadent	A-	BBB	Baa1	22/09/2016	22/09/2046	£1,047m	Yes
Cadent	A-	BBB	Baa1	21/03/2018	21/03/2040	£422m	Yes
Cadent	A-	BBB	Baa1	10/10/2019	10/10/2035	£372m	Yes
Cadent	A-	BBB	Baa1	14/03/2023	14/03/2034	£365m	Yes
Cadent	A-	BBB	Baa1	11/01/2024	11/01/2036	£401m	Yes
NGN	No rating	BBB+	Baa1	15/11/2005	30/06/2027	£250m	No
NGN	No rating	BBB+	Baa1	15/11/2005	15/11/2035	£255m	Yes
SGN	BBB+	AA	A1	21/10/2005	21/03/2029	£375m	No
SGN	BBB+	BBB	Baa1	15/05/2008	15/05/2040	£225m	Yes
SGN	BBB+	BBB	Baa1	03/02/2015	03/02/2025	£350m	No
WWU	A-	A-	No rating	31/03/2010	29/03/2030	£300m	No
WWU	A-	A-	No rating	04/11/2011	07/03/2028	£150m	No
WWU	A-	A-	No rating	03/08/2018	03/08/2038	£375m	Yes
WWU	A-	A-	No rating	28/02/2020	28/05/2041	£250m	Yes
NGT	A-	No rating	Baa1	08/02/1994	08/02/2044	£200m	Yes
NGT	A-	No rating	Baa1	27/06/1995	27/06/2025	£275m	No
NGT	A-	No rating	Baa1	02/10/1998	02/10/2028	£50m	No
NGT	A-	No rating	Baa1	14/12/1999	16/12/2024	£503m	No
NGT	A-	No rating	Baa1	13/05/2008	13/05/2038	£457m	No[2]

Note: [1] We only include bond-day observations with a remaining time to maturity of more than ten years. [2] We have analysed the liquidity of all bonds in the sample. In doing so, we have found that the bond issued by NGT on 13 May 2008 exhibits an illiquid trading

pattern. Hence, we have excluded it from our analysis to not distort the results.
Source: Bloomberg.

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A3 DRP and DRP at 100% gearing estimates by company and averaging window

Table A3.1 DRP estimates by company and averaging window

Averaging window	Cadent	NGN	SGN	WWU	NGT	Average (incl. WWU)	Average (excl. WWU)
Two years	1.26%	1.27%	1.46%	0.89%	1.53%	1.28%	1.38%
Three years	1.21%	1.23%	1.39%	0.86%	1.44%	1.23%	1.32%
Five years	1.06%	1.03%	1.14%	0.71%	1.20%	1.03%	1.11%

Note: The table shows the average DRP estimated by company and for the averaging windows of two, three and five years. The methodology is described in section 4.1.1.
Source: Oxera analysis based on Bloomberg data.

Table A3.2 DRP extrapolated at 100% gearing

Averaging window	Cadent	NGN	SGN	WWU	NGT	Average (incl. WWU)	Average (excl. WWU)
Two years	2.06%	2.00%	2.21%	1.51%	2.84%	2.12%	2.28%
Three years	1.99%	1.94%	2.10%	1.44%	2.70%	2.03%	2.18%
Five years	1.74%	1.61%	1.69%	1.17%	2.20%	1.68%	1.81%

Note: The table shows the average DRP extrapolated at 100% gearing estimated by company and for the averaging windows of two, three and five years. The DRP extrapolated at 100% gearing is calculated as DRP divided by the actual regulatory gearing of the bond issuer. The methodology is described in section 4.1.
Source: Oxera analysis based on Bloomberg data.

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