NR23 cost of capital: November 2022 update

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Prepared for NATS En Route Plc

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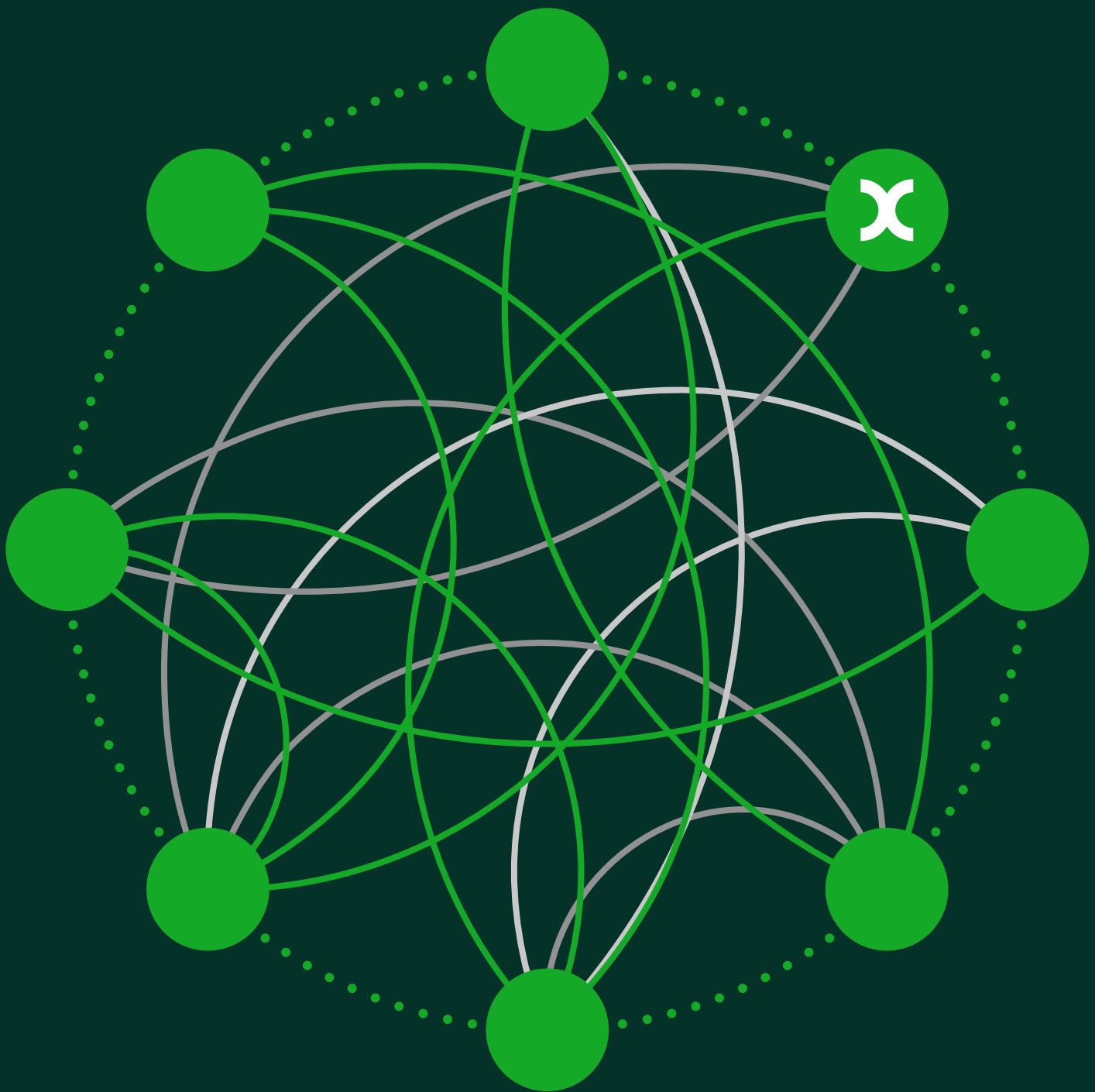

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Executive summary

In October 2022, the Civil Aviation Authority (CAA) published its Initial Proposals for the NR23 price control. In its proposals, the CAA set out its response to evidence from NATS (En Route) Plc (NERL) and other stakeholders on various finance issues, and provided an estimate of the weighted average cost of capital (WACC) for NR23.[1]

In light of the Initial Proposals, NERL has asked Oxera to comment on the CAA's cost of capital methodology and to undertake a revised assessment of the NR23 WACC.

Total market return

In estimating the total market return (TMR), both Oxera and the CAA have considered long-run historical returns using the Dimson, Marsh and Staunton (DMS) dataset. Our range for the TMR of 5.85–6.50% RPI-real is based on our estimate of deflated historical returns, drawing on the findings of the Competition and Markets Authority (CMA) PR19 redetermination and our own analysis.

In deflating returns, the CAA uses a CED/CPI inflation series, which we understand is based on an historical CPI backcast data series. The Office for National Statistics (ONS) has recently published revised CPI and CPIH backcast series, which result in lower long-term rates for these inflation measures. Applying these lower inflation rates to the long-term returns data gives a correspondingly higher long-term real return.

However, the main methodological difference between our approach and the CAA's is the weight placed on 'historical ex ante' evidence. While the CAA includes such evidence in its range, we find that:

- the historical ex ante results are driven by the empirically unproven assumption that past 'good luck' has outweighed 'bad luck' for equity investors;
- the subjective nature of the adjustments made to derive estimates of TMR based on the historical ex ante approach add noise and bias to estimates derived from averaging actual returns.

Therefore, weight should not be placed on estimates derived from the historical ex ante approach and we maintain our proposed TMR range of 5.85–6.50% RPI-real in this report.

Risk-free rate

On the risk-free rate, our methodology and the CAA's are aligned in terms of the tenor of the index-linked gilt (ILG) that is used and the application of a convenience yield. The CAA's convenience yield is based on the spread between ILGs and AAA-rated debt. Our analysis shows that this spread has widened since the CAA's analysis, and now sits above our 50bp assumption.

[1] Civil Aviation Authority (2022), 'Economic regulation of NATS (En Route) plc: Initial Proposals for the next price control review ("NR23")', CAP2394, October.

We diverge from the CAA in applying a forward adjustment to account for the market's expectations of future movements in yields. For price control periods where a single risk-free rate allowance is set on a forward-looking basis, without any adjustments or indexation mechanisms, there is a strong case for adjusting the spot yields observed in the market today for expected rate movements during the price control period, especially in an environment of rising central bank interest rates and the Bank of England's quantitative easing programme.

Our updated range for the risk-free rate—based on the one-month trailing average yield on ten-year ILGs, a convenience premium of 50bp and a forward adjustment—amounts to 0.94–1.31%.

Asset beta

With respect to the estimation of asset betas, we examine the methodology used by the CAA to estimate the impact of the COVID pandemic on NERL's asset beta. The CAA's approach places lower weight on data from the pandemic period, as it seeks to ensure that the impact of the pandemic is not 'over-represented' in its asset beta estimate.

We present a number of critiques of the CAA's approach to re-weighting the pandemic data, which we consider involves a number of arbitrary assumptions and departs from established regulatory practice of estimating betas with reference to observed market data. It is unclear from the CAA's Initial Proposals whether it intends for this approach to be used at future price controls, or whether this is intended to be a one-off for NR23. Even if the pandemic probabilities assumed by the CAA's consultants, Flint Global, were robust, if NERL were to receive the uplift to the pre-pandemic beta for only one control period, it would be remunerated for only a fraction of the pandemic-related beta risk over the 20–50 year period.

We estimate NERL's asset beta based on an approach that relies on the available data without any artificial manipulation of the data.

We have calculated betas for a range of estimation windows based on data available until 11 November 2022. We propose a range with the two-year average estimate across the comparator set (0.61) at the bottom end of the range and the corresponding figure for five-year betas (0.74) at the top end of the range. The five-year betas and the data on ENAV, which we consider to be the closest comparator to NERL, would support a point estimate towards the top end of this range.

ENAV's two- and five-year asset betas have trended upwards since our previous report in October 2021,[2] and are at the top end of our proposed range.

We have also estimated asset betas using the 34-month pandemic period from February 2020, which results in an average of 0.73—this also falls towards the top end of our proposed asset beta range.

[2] Oxera (2021), 'Cost of capital for NR23', prepared for NERL, 28 October.

Gearing

With respect to the gearing, the CAA uses the same methodology to estimate the gearing as it does to estimate the asset betas, as described above. As such, we have concerns that are similar to those relating to the asset beta estimations.

We have considered evidence on gearing from market data of the relevant comparators and NERL's projected actual gearing levels over the course of NR23. This evidence points to a wide potential range for the gearing estimate of 30–50%. We have presented estimates based on the mid-point of this range (40%).

Cost of debt

The CAA estimates the embedded cost of debt through the benchmarking of NERL's issuances to an iBoxx £-denominated A-rated index. Given that the CAA is setting the cost of embedded debt for a single company, with two bond issuances on which market data is readily available, it is not necessary to apply such a proxy. As in previous price reviews, the CAA should start from NERL's actual debt issuances and depart from these values only if there is clear evidence of inefficiency. The application of efficiency cross-checks, through similar benchmarks that the CAA uses, should be sufficient to ensure that NERL retains incentives to raise debt efficiently. These cross-checks suggest that NERL's bond issuances were within a reasonable margin of the benchmark index, regardless of whether the CAA's definition or our definition of the benchmark is used.

On the cost of new debt, the CAA uses the same approach as its approach to estimating the cost of embedded debt. However, we continue to adopt a different methodology in estimating the cost of new debt, assuming that NERL will issue a £250m bullet bond, with a ten-year tenor, in March 2023. We calculate the forward gilt rate in March 2023 and add a debt premium based on the spread between NERL's April 2021 bullet bond and the Treasury benchmark.

Finally, we also adopt a longer-term approach than the CAA for the inflation forecasts used to deflate the nominal cost of debt, in line with NERL's tenor of debt. This results in a long-term RPI inflation forecast of 2.8%.

We estimate the cost of debt to be -0.14% RPI-real.

1 Introduction

The CAA's NR23 price control review will establish the maximum level of air navigation charges that NERL will be able to levy in the period from 2023 to 2027.

In the context of this review, in 2021 NERL commissioned Oxera to provide an independent assessment of the required rate of return for the 2023–27 period.[3] Our estimates were used to inform the cost of capital proposals set out in NERL's business plan.

The CAA recently published its Initial Proposals for the NR23 control.[4] Following the publication of these Initial Proposals, we have been asked to provide a revised assessment of NERL's cost of capital and to present additional evidence on the areas in which our methodology and estimate differ from those of the CAA.

The purpose of this report is therefore to:

- provide the most up-to-date view on the cost of capital parameters, taking account of the latest market data;
- highlight areas where the CAA might reconsider its methodology for the Final Proposals in order to align with best practice.

The remainder of the report considers the main cost of capital parameters in turn:

- section 2 covers evidence on the TMR;
- section 3 discusses the risk-free rate;
- section 4 presents the asset beta;
- section 5 considers gearing;
- section 6 covers the cost of debt;
- section 7 concludes.

[3] Oxera (2021), 'Cost of capital for NR23', prepared for NERL, 28 October.
[4] Civil Aviation Authority (2022), 'Economic regulation of NATS (En Route) plc: Initial Proposals for the next price control review ("NR23")', CAP2394, October.

2 Total market return

In its NR23 Initial Proposals, the CAA proposes an RPI-deflated TMR range of 5.20% to 6.50%, with a mid-point of 5.85%.[5] By comparison, we presented a TMR range of 5.85–6.50% in our initial assessment on behalf of NERL.

In this section we review the methodology used by the CAA to estimate the TMR, outline where it differs from our approach and identify where an alternative methodology would be more robust.

2.1 Comparison of Oxera and CAA approaches

Table 2.1 summarises our approach and the CAA's to estimating the TMR for NR23, as well as the resulting proposed ranges.

Table 2.1 Comparison of Oxera and CAA approaches on TMR

	Oxera October 2021 approach	CAA approach
Approach to averaging historical returns	We deflated historical returns using an adjusted RPI inflation series.	Historical returns are deflated using two inflation series: CED/CPI and CED/RPI.
Weight to place on historical ex ante evidence	We excluded the historical ex ante evidence (which accounted for the 5.20–5.70% portion of the CMA's range) on the basis that it requires subjective adjustments.	Evidence on historical ex ante returns is included in the CAA's range.
Resulting proposed range	5.85–6.50%	5.20–6.50%

Source: Oxera (2021), 'Cost of capital for NR23', October; and Civil Aviation Authority (2022), 'Economic regulation of NATS (En Route) plc: Appendices to initial proposals for the next price control review ("NR23")', October.

In developing our TMR estimate for NR23, we considered that:

- the best source of evidence on the TMR is analysis of long-term equity returns in the UK using the arithmetic average, checked against the average of non-overlapping ten- and 20-year holding periods;
- for an RPI-real estimate, the most appropriate deflator to convert from nominal to real terms is the long-run RPI inflation series produced by the ONS;
- data from dividend growth models can be used as a cross-check of these results.

On this basis, we concluded that the economic evidence pointed to a TMR range of 6.0–6.5% RPI-real for NR23. However, we also recognised the importance of the CMA's role in UK economic regulation and noted that its PR19 redetermination was the most comprehensive regulatory review on this issue. Consequently, we included the CMA's mid-point estimate of 5.85% RPI-real as the lower bound of our range. Importantly, this meant that our estimate excluded the bottom half of

[5] Civil Aviation Authority (2022), 'Economic regulation of NATS (En Route) plc: Appendices to initial proposals for the next price control review ("NR23")', October, para. C139.

the CMA range, which largely relies on historical ex ante evidence that we consider is unreliable for estimating the forward-looking TMR.

The CAA's approach to estimating the TMR also draws on the CMA's Final Determinations on the water PR19 appeals. However, the CAA includes the CMA's full range of 5.20–6.50%, thereby including the historical ex ante evidence.

2.2 Review of CAA methodology

In the Initial Proposals document, the CAA focuses on three main methodological issues for the TMR:

- the approach to deflating nominal historical returns to real terms;
- the weight to place on historical ex ante returns;
- the stability of the TMR over time.

We discuss each of these in turn below.

2.2.1 Deflation of historical market returns

The CAA follows the CMA's approach of deflating nominal historical returns using the CED series (for the period 1900–47) and the CPI backcast for the period 1947–88.

In setting out our evidence on the TMR, we noted our concerns with the use of the ONS backcast CPI series as an input to estimating the real cost of equity allowance, due to issues with the series' robustness. The initial release included ex post estimation of CPI and selective methodological changes, which upon investigation suggested that the resulting estimates were materially upward-biased. The ONS was unable to locate the information used to construct those estimates, and was unable to replicate them.[6]

In May 2022, the ONS published new backcast series for the CPI and the CPIH for the period 1950–88, which addressed the most concerning errors found in the previous release.[7] As a result, we consider that the new CPI backcast should be used instead of the old CPI backcast when estimating historical returns in CPI-real terms.

At the same time, there is still merit in using the historical RPI series because it was compiled and published contemporaneously and it is therefore not subject to the same estimation uncertainty as a backcast series. In discussion with Ofgem (as reported in the RIIO-ED2 finance annex), the ONS has emphasised that there are relative advantages and disadvantages of each of the series, which supports the approach of using both RPI and CPI/CPIH data when estimating the TMR.[8]

> 'The extended historical series essentially relies on a timeseries model to estimate the formula effect over the period and remove it from RPI… this also relies on some strong assumptions

[6] See Oxera (2020), 'The cost of equity for RIIO-2', prepared for the Energy Networks Association, 4 September.
[7] Oxera (2022), 'Assessing the new ONS CPIH back-cast', prepared for the Energy Networks Association, August.
[8] Ofgem (2022), 'RIIO-ED2 Final Determinations Finance Annex', 30 November, p. 39, para. 3.43.

around how RPI categories map to COICOP (classification of individual consumption by purpose), and of course any forecasting model like this can only be indicative.'

'... the historical data are purely indicative, and are provided for analytical purposes. They're much less robust than the current national statistics so that should be factored into any decision on how to use them. There will always be a large degree of uncertainty involved with historical modelling, particularly over such a protracted period of time.'

'RPI has the advantage of having been collected and compiled in real time over the period 1950 to 1988 - the importance of which shouldn't be under-estimated. However, there are also a number of shortcomings of the RPI that make it less robust as a measure of inflation when compared to alternatives like CPIH and CPI.'

Table 2.2 presents the impact of using the new CPI(H) backcast on the CPI(H)-real equity return over the period 1900–2021. Consistent with our previous approach, this analysis is based on UK nominal returns data published by DMS.

Using the new (lower) inflation series published by the ONS leads to a higher estimated average real equity return over the period 1900–2021. As shown in Table 2.2, the average CPI-real equity return over this period is 0.07% higher than the original CPI-real equity return estimate. The difference is greater for the CPIH series (0.24%).

Table 2.2 Impact of new ONS inflation series on real-equity returns

	Old CPI series	New CPI series	New CPIH series
1900–2021 arithmetic average inflation	3.98%	3.91%	3.74%
Difference from old CPI series		-0.07%	-0.24%
1900–2021 arithmetic average real equity returns[1]	6.85–6.94%	6.91–7.01%	7.09–7.18%
Difference from old CPI series		0.07%	0.24%

Note: The update from the ONS affects only the data points between 1950 and 1988. To cover the pre-1950 period, we use Consumption Expenditure Deflator (CED) data published by the Bank of England in its Millennium database. However, we note that this is an imperfect method as the CED is theoretically and empirically a closer proxy for RPI than CPI. For details, see Oxera (2022), 'Assessing the new ONS CPIH back-cast', 15 July.
[1] The range in real equity returns is driven by the range of potential values for the 2021 UK equity returns used by DMS. In particular, we have the yearly breakdown of the data used by DMS for the period 1900–2020, but not for 2021. We infer the estimates in the table from the 1900–2020 and 1900–2021 nominal average returns.
Source: Oxera analysis based on ONS and DMS data.

2.2.2 Use of historical ex ante evidence

In our initial assessment of the NR23 WACC, we argued that historical ex ante evidence should not be given significant weight when estimating the TMR for regulatory purposes. This is because analysis

of historical ex ante returns is more controversial and less robust than analysis of historical ex post returns.[9]

The historical ex ante approach attempts to identify investors' reasonable expectations of returns by adjusting the historical series of returns. The rationale for these adjustments is to seek to correct for one-off periods of good or bad 'luck' in the past that investors might not expect to be repeated in the future.

The question that the ex ante approach attempts to address is therefore whether the returns that investors were expecting in the past are well approximated by the historical mean. A secular decline in the TMR in the past could lead to ex post returns exceeding true ex ante returns. However, there appears to be no way that this question can be resolved definitively and, as a result, there is no consensus on the best approach to take.[10]

The ex ante approach was discussed in the CMA PR19 appeals, where two approaches were used to derive the ex ante TMR, as described below.[11]

- A generalisation of the constant growth model (Fama–French method), which assumes that the market dividend yield (D/P) and/or the earnings yield (E/P) is stationary. Regulators have applied a 'bias adjustment' when using this method, which effectively converts a geometric mean to an arithmetic mean.
- The DMS decomposition method, which involves decomposing the TMR into the mean dividend yield, the growth rate of real dividends, the expansion of the price/dividend ratio, and change in real exchange rate. The adjustment to the estimated TMR then arises from subjective adjustments to the average value of one or more of these components.

The latter approach starts with the same historical returns as in the historical ex post approach, then attempts to decompose the TMR into elements that are likely to be repeatable and those that are not. However, the decomposition of the price return can include many different variables and, therefore, many different forms. Hence, it is a subjective exercise that requires one to choose which elements to include in the decomposition, and which to be classified as 'unlikely to be repeatable'.[12] There is no guarantee that a variable, A, that exhibits 'unrepeatable' behaviour when included in the decomposition with

[9] This view appears to be shared by others. For example, in a report for Ofwat on cost of equity indexation, PwC stated that: 'We adopt this 'historical ex-post' approach as it is arguably the most common and least disputed methodology for estimating TMR, with other approaches tending to produce more varied TMR estimates.' PwC (2021), 'Cost of equity indexation: Evaluating the case for indexation at PR24 and beyond', October.
[10] See, for example, the debate between Welch and Goyal (2008) and Campbell and Shiller (1998) on the prediction of stock market returns. Welch, I. and Goyal, A. (2008), 'A Comprehensive Look at the Empirical Performance of Equity Premium Prediction', *The Review of Financial Studies*, **21**:4, pp. 1455–1508; and Campbell, J.Y. and Shiller, R.J. (1998), 'Valuation Ratios and the Long-Run Stock Market Outlook', *The Journal of Portfolio Management*, **24**:2, pp. 11–26.
[11] Competition and Markets Authority (2021), 'Anglian Water Services Limited, Bristol Water plc, Northumbrian Water Limited and Yorkshire Water Services Limited price determinations', Final report, 17 March, p. 822, para. 9.341.
[12] In the DMS case, the authors assume that the expansion of the price/dividend ratio and change in real exchange rate are 'non-repeatable'.

variable B, would exhibit the same behaviour in conjunction with variable C.

In other words, the decomposition approach does not add any additional information to the ex post approach and instead overlays subjective assumptions about the repeatability of past returns. In the DMS case, this includes assuming that:[13]

- the expected change in the real exchange rate in future will be zero;
- the historical expansion in the price-to-dividend ratio will not be repeated and should be assumed to be zero;
- the historical real growth rate of dividends was partly attributable to good luck.

The DMS approach only excludes 'non-repeatable' factors that relate to perceived good luck over the period studied (1900–2021 in the latest yearbook). It does not adjust for any factors that could be considered as bad luck for investors (which would lead to historical returns being an under-estimate of expected future returns).

The DMS assumptions described above rely on judgement rather than objective, empirical evidence, and are based on the authors' belief that past good luck has outweighed bad luck. It is this inherent subjectivity which makes the results of this approach different from the results of the ex post approach.

While not the same as the DMS decomposition method, the Fama–French approach is similar in that it decomposes total returns into the dividend yield and the capital gain, but then uses a time-series model to estimate the average rate of capital gain as the average growth in dividends or earnings. The shortcomings of the DMS composition approach summarised above also apply to the Fama–French approach.

The subjective nature of the adjustments made to derive estimates of TMR based on the historical ex ante approach add noise and bias to estimates derived from averaging actual returns. Therefore, weight should not be placed on estimates derived from the historical ex ante approach.

2.2.3 Assumption of a constant TMR

The CAA notes that the consensus view among UK regulators when estimating the cost of equity in recent price reviews has been to assume a stable TMR, such that the real TMR does not vary with the risk-free rate or inflation.

However, the CAA argues that the low risk-free rate and high inflation at the cut-off point of its analysis could suggest that a stable TMR estimate might overstate the forward-looking TMR. Hence, it notes

[13] Dimson, E., Marsh, P. and Staunton, M. (2022), 'Credit Suisse Global Investment Returns Yearbook 2022', p. 62.

that there 'might be a prima facie case for assuming a modest level of correlation' between the TMR and risk-free rate (and inflation).[14]

This leads the CAA to suggest that the TMR estimate contained in its Initial Proposals 'can be seen as generous in light of the prevailing macroeconomic circumstances, and the resulting skew in our proposed estimates warrant aiming significantly lower in the range than would otherwise be the case.'[15] It suggests that it will reflect this in its choice of the point estimate for the WACC in its Final Proposals.

In this context, the latest market evidence shows that:

- the risk-free rate has increased significantly since the CAA's cut-off date of 31 March 2022 (as discussed further in section 3);
- while CPI inflation is expected to stand at 7.4% in 2023, the Office for Budget Responsibility (OBR) then forecasts inflation of 0.6%, -0.8%, 0.2% and 1.7% over the remainder of NR23.[16]

As a result, the latest risk-free rate and inflation evidence does not appear to support a reduction in TMR and, based on the CAA's argument, would instead suggest aiming towards the top end of the TMR range.

2.3 Revised Oxera estimate

In light of the above, we consider that there is new data of relevance to the determination of the TMR, as follows.

- The main change since our initial NR23 WACC assessment is the publication of the new CPI backcast by the ONS. The impact of this is 0.24% in CPIH-deflated terms and 0.07% in CPI-deflated terms. Consequently, the impact of this should be an increase in the CAA's TMR estimate. The latest ranges of CPI-real (6.91–7.01%) and CPIH-real (7.09–7.18%) long-run historical returns fall within our range of 5.85–6.50% RPI-real.[17]
- The market evidence on risk-free rate and inflation has changed significantly since the cut-off date of the CAA's Initial Proposals. According to the CAA's own reasoning in the Initial Proposals, the large increase in risk-free rate in recent months would suggest a number towards the top end of the CAA's TMR range.

The main methodological difference between our range and the CAA's range is the weight to place on historical ex ante evidence. The historical ex ante results are driven by the empirically unproven assumption that past good luck has outweighed bad luck for equity investors. Given the subjectivity of the historical ex ante approach, it is inappropriate to place any weight on such evidence. We have provided additional evidence for this in section 2.2.

[14] Civil Aviation Authority (2022), 'Economic regulation of NATS (En Route) plc: Appendices to initial proposals for the next price control review ("NR23")', p. 33, para. C134.
[15] Civil Aviation Authority (2022), 'Economic regulation of NATS (En Route) plc: Appendices to initial proposals for the next price control review ("NR23")', p. 34, para. C138.
[16] Office for Budget Responsibility (2022), 'Economic and fiscal outlook', CP749, November, p. 55.
[17] Assuming an RPI–CPI wedge of up to 100bp.

We therefore continue to adopt a TMR range of **5.85–6.50% RPI-real** in our updated NR23 WACC estimate.

3 Risk-free rate

In this section we review the methodology used by the CAA to estimate the risk-free rate. The CAA proposes a real risk-free rate range of -2.78% to -2.41%, as detailed below.[18]

3.1 Comparison of Oxera and CAA approaches

Overall, there is some alignment between our approach and that adopted by the CAA in terms of the risk-free rate. In particular, we agree that the risk-free rate should be based on the yield on ten-year ILGs, and that a convenience premium should be added to this. However, the CAA has not applied a forward adjustment. Our respective methodologies are summarised in Table 3.1.

Table 3.1 Comparison of Oxera and CAA approaches on risk-free rate

	Oxera October 2021 approach	CAA approach
Basis	Spot yield on the ten-year ILGs.	Trailing one-month average of the spot yield on ten-year ILGs.
Convenience premium	A convenience premium based on academic and empirical evidence was taken into account.	A convenience premium is calculated based on the yield on AAA-rated corporate debt.
Forward adjustment	We made a forward adjustment based on the implied forward yield in the beginning and end of the NR23 period.	The CAA does not make a forward adjustment.

Source: Oxera (2021), 'Cost of capital for NR23', October; and Civil Aviation Authority (2022), 'Economic regulation of NATS (En Route) plc: Appendices to initial proposals for the next price control review ("NR23")', October.

3.2 Review of CAA methodology

There are two main areas of divergence between our approach and the CAA's that may warrant further attention in the CAA's Final Proposals.

1 While the CAA applies a convenience premium, its approach of selecting the mid-point of the range between corporate and government AAA yields may under-estimate this premium.
2 The CAA does not apply a forward adjustment as it does 'not consider that forward rates are good predictors of future spot rates'.[19]

The CAA has adopted a different approach to us in terms of averaging (using a one-month trailing average rather than the spot rate). In the current market circumstances, this balances the objective of focusing on the most relevant data for NR23 against the current elevated level of daily volatility in yields. It is important for the CAA to update the

[18] Civil Aviation Authority (2022), 'Economic regulation of NATS (En Route) plc: Appendices to initial proposals for the next price control review ("NR23")', October, para. C26.
[19] Civil Aviation Authority (2022), 'Economic regulation of NATS (En Route) plc: Appendices to initial proposals for the next price control review ("NR23")', October, para. C23.

analysis for the latest market prior to confirming the WACC allowance for NR23.

We discuss each of these points below.

3.2.1 Reflecting latest market evidence

The CAA uses a cut-off date of more than six months prior to the publication of the Initial Proposals. In its base scenario, the CAA uses a cut-off date of 31 March 2022, which is aligned to the cut off-date of its Heathrow H7 Final Proposals. An 'alternative scenario' has been presented, with data through to August; however, this does not seem to have informed the CAA's initial WACC proposals.

As a result, the CAA's analysis excludes the impact of changed market circumstances that are critical to the NR23 outlook. The CAA acknowledges this and argues that it has adopted this approach due to the current macroeconomic uncertainty.[20]

> 'We have adopted a cut-off date for the analysis of 31 March 2022. We are conscious that this cut-off date does not capture recent developments such as increases in inflation and bond yields over the summer and autumn of 2022. We have adopted this approach because there is significant uncertainty over how the current situation will evolve, which makes it difficult to reach an informed judgement regarding how to interpret recent data. We intend to revisit these issues at Final Proposals, and to take stock of the available information at that point.'

While we acknowledge that there is currently high uncertainty, the CAA's decision to exclude all data post-March leads to a draft position that is out of line with the latest market evidence. Despite being published one month apart, the differential between the CAA's risk-free rate estimate (-2.78% to -2.41%) and Ofgem's RIIO-ED2 risk-free rate (0.53% on an RPI-real basis) is substantial.[21]

This is important since NERL's 2023 unit charges will be based on the Initial Proposals, with an adjustment applied to the 2024 unit rate for any differences that arise in the Final Proposals. In such a process, it is important that the latest market evidence is used to provide the best estimate of the risk-free rate for NR23.

The decision to use a cut-off date of 31 March has the most significant impact in terms of the CAA's risk-free rate estimate. In light of inflationary pressures, the Bank of England has raised the central bank rate from 0.1% to 3.0% (nominal) between December 2021 and November 2022.[22] Its latest guidance suggests that interest rates will peak at 4.75–5.25% in 2023. The Bank is also unwinding its quantitative easing programme through the sale of gilts.

[20] Civil Aviation Authority (2022), 'Economic regulation of NATS (En Route) plc: Appendices to initial proposals for the next price control review ("NR23")', October, p. 13, para. C9.
[21] Ofgem (2022), 'RIIO-ED2 Final Determinations Finance Annex', 30 November, p. 35, Table 11.
[22] Bank of England (2022), 'Monetary Policy Report – November 2022', 3 November.

This has contributed to a significant increase in real yields. As shown in Figure 3.1, the yield on a ten-year ILG has increased from -2.65% on 31 March 2022 to -0.17% on 11 November 2022. During October, the ILG yield reached a peak of just over 1.5%.

Figure 3.1 Real yield on ten-year index-linked gilt (%)

Source: Oxera based on Bank of England data.

The increase in the bank rate means it is highly unlikely that the risk-free rate will return to the levels suggested by the CAA's Initial Proposals (c. -2.5%) and therefore, as envisaged by the CAA, it will be important to revisit this estimate at the Final Proposals stage, taking account of the latest market evidence at that time. Despite the current uncertainty, Ofgem's final determinations for RIIO-ED2 used a cut-off date (31 October 2022) of one month prior to the document's publication (30 November).[23]

3.2.2 Averaging period

Given the unusually high levels of volatility in recent months, the risk-free rate estimate is highly sensitive to the reference day on which the spot yield is calculated. The CAA's approach of using a short-run trailing average, namely one month, in order to smooth some of this volatility, strikes a balance between this volatility and using the data most relevant for NR23. We follow this approach for our revised estimate outlined at the end of this section.

While the one-month average should help to avoid setting the risk-free rate based on a single 'outlier' reference day, this may currently be distorted by political events that occurred in October (see Figure 3.2), which led to the ten-year ILG briefly exceeding 1.5%. At the time of our analysis, there is a 60bp gap between the spot yield (-0.17%) and the trailing one-month average (+0.43%).

[23] Ofgem (2022), 'WACC Allowance Model for RIIO-ED2', November.

This further emphasises the importance of the CAA's analysis taking account of the latest market evidence at the time of its Final Proposals.

Figure 3.2 There has been significant volatility over the last month (spot yield on ten-year ILG, %)

Source: Oxera based on Bank of England data.

3.2.3 Convenience premium

The CAA's Initial Proposals contain an estimate of the convenience yield of 37bp. This estimate is based on the difference between the yield on the iBoxx £ AAA 10-15 Non-Gilts index and nominal gilts of a similar maturity, using a one-month averaging period as of 31 March 2022.[24]

Since our initial report for NERL in October 2021, we have undertaken further analysis of the convenience premium on behalf of water companies in England and Wales. In our response to Ofwat's PR24 consultation,[25] we presented a range of empirical evidence on the size of the premium, as presented below.

- Feldhütter and Lando (2008) find that the magnitude of the convenience premium varies over time and can range from 30bp to 90bp.[26]
- Krishnamurthy and Vissing-Jorgensen (2012) estimate the average of the liquidity component of the convenience premium to be 46bp from 1926 to 2008.[27]
- Van Binsburgen et al. (2020) estimate a convenience premium of around 40bp on US government bonds over 2004–18.[28]
- We conducted analysis based on updating the methodology set out in Longstaff (2004),[29] which compares Treasury bond prices to prices of bonds issued by the Resolution Funding Corporation (REFCORP), a US government agency, which are guaranteed by the

[24] Civil Aviation Authority (2022), 'Economic regulation of NATS (En Route) plc: Appendices to initial proposals for the next price control review ("NR23")', October, pp. 15–16, paras C21–C22.
[25] Oxera (2022), 'RFR methodology for PR24', September, section 3.2.
[26] Feldhütter, P. and Lando, D. (2008), 'Decomposing swap spreads', *Journal of Financial Economics*, **88**:2, pp. 375–405.
[27] Krishnamurthy, A. and Vissing-Jorgensen, A. (2012), 'The Aggregate Demand for Treasury Debt', *Journal of Political Economy*, **120**:2, pp. 233–67.
[28] Van Binsbergen, J.H., Diamond, W.F. and Grotteria, M. (2022), 'Risk-free interest rates' *Journal of Financial Economics*, **143**:1, pp. 1–29.
[29] Longstaff, F.A. (2002), 'The flight-to-liquidity premium in US Treasury bond prices', No. w9312, National Bureau of Economic Research.

US Treasury. Following this methodology, we estimated the long-term convenience premiums implied by the spreads of nine- and 11-year REFCORP bonds from 2010 to July 2022 to be on average 47bp and 50bp respectively.

We have also cross-checked our 50bp estimate with the updated value implied by the CAA's methodology when using our cut-off date of 11 November 2022. Following the same approach as the CAA, but with a cut-off date of 11 November, the one-month average spread between the iBoxx £ AAA 10-15 Non-Gilts index and nominal gilts of similar maturity now amounts to 66bp. With a six-month averaging period, the spread amounts to 53bp, as detailed in the table below. This shows that the spread has widened since the CAA's analysis.

Table 3.2 Summary of convenience premium estimates

Approach	Estimate
CAA six-month average as of 11 November 2022	53bp
CAA one-month average as of 11 November 2022	66bp

Source: Oxera analysis.

On the balance of the above evidence, we continue to apply a convenience premium of 50bp when estimating the risk-free rate based on government bonds. Our approach differs from the CAA's in that we have applied the entire 50bp premium to the trailing average ILG yield. By comparison, the CAA's approach effectively applies half of its 37bp convenience yield to calculate the mid-point estimate of the risk-free rate.

3.2.4 Forward adjustment

As a single risk-free rate allowance is set on a forward-looking basis for the duration of the price control without any adjustments or indexation mechanisms, there is a strong case in principle for adjusting the spot yields observed in the market today for expected rate movements during the price control period. This is particularly important in the current context of:

- rising central bank interest rates—the Bank of England's conditioning assumptions for the November Monetary Policy Committee report show the bank rate increasing from the current level of 3.0% to 5.2% in 2023, 4.7% in 2024 and 4.0% in 2025;
- the unwinding of the Bank of England's quantitative easing programme—the Bank ceased reinvesting the proceeds of maturing government bonds in March 2022 and began to actively sell government bonds in November 2022.[30]

We recognise the CAA's concerns that for much of the last decade forward curves have not been an accurate predictor of future spot rates. However, forward curves do reflect market-implied expectations for future interest rate changes during the price control

[30] Bank of England (2022), 'Monetary policy and central bank asset purchases: Substitutes and complements - speech by Huw Pill', Beesley Lecture, 23 November.

period, and therefore constitute relevant evidence for determining the forward-looking risk-free rate allowance for NR23.

3.3 Revised Oxera estimate

In light of the above, we have updated the risk-free rate estimate by:

- calculating the one-month trailing average yield on ten-year index-linked gilts at the cut-off date of our analysis (11 November 2022);
- adding a convenience premium of 50bp;
- applying a forward adjustment of 0.01–0.38%[31] based on the future yields implied by the forward curve on 11 November 2022.

Based on this approach, our revised risk-free rate range is **0.94% to 1.31%**, as set out in Table 3.3 below.

Table 3.3 Risk-free rate estimate

Parameters	Lower bound	Upper bound
UK government bond yields	0.43%	0.43%
Convenience yield	0.50%	0.50%
Forward adjustment	0.01%	0.38%
Proposed risk-free rate	**0.94%**	**1.31%**

Source: Oxera analysis.

As noted in this section, the one-month trailing average and the forward adjustment are likely to be sensitive to events that have affected market conditions over the months of October and November. Therefore, the exact levels of these estimates are likely to change—potentially by a significant margin—ahead of the NR23 Final Proposals, and it will be important for the CAA to reflect this accordingly in its final allowances.

[31] For our lower bound, we estimate a forward adjustment between our cut-off date of 11 November 2022 and the start of NR23. For the upper bound, we calculate the forward adjustment until the end of NR23.

4 Asset beta

In this section, we review the methodology used by the CAA to estimate the asset beta for NERL based on a set of publicly listed comparators. In its NR23 Initial Proposals, the CAA proposes an asset beta range of 0.54–0.64, as detailed below.[32]

4.1 Comparison of Oxera and CAA approaches

As well as an additional year of market data, there are a number of important differences in approach between our October 2021 estimate and the CAA's Initial Proposals. In particular, these relate to the weight that the CAA places on the airport comparators relative to ENAV, and the approach (adopted by Flint Global) of estimating a long-run beta by combining 'pre-pandemic' betas, 'pandemic' betas and assumptions around the frequency of pandemics.

Table 4.1 Comparison of Oxera and CAA approaches on asset beta

	Oxera October 2021 approach	CAA approach
Comparator set	Comparator set includes four airports (AdP, Aena, Fraport, Zurich) and one air navigation service provider (ANSP) (ENAV).	The CAA uses a similar comparator set, but excludes Zurich.
Estimation window	Our September 2021 report primarily looked at two-year and five-year betas. We also estimated one-year betas with a view to understanding whether there had been any reversion in betas towards pre-COVID-19 levels.	The CAA uses 7.2 years of observations and beta estimations for the airports, and 5.7 years for ENAV.
Weight to place on pre- and post-pandemic betas	We placed greater weight on five-year betas as these were less driven by the COVID-19 data than one-year and two-year betas.	The weight placed on pre- and post-pandemic betas depends on the CAA's assumption on the frequency of pandemics.
Weight to place on individual comparators	We placed most weight on ENAV, as it is the only ANSP within the comparator group.	The CAA places most weight on the airport comparators, as it considers the ENAV beta to be unreliable.

Source: Oxera (2021), 'Cost of capital for NR23', October; and Civil Aviation Authority (2022), 'Economic regulation of NATS (En Route) plc: Appendices to initial proposals for the next price control review ("NR23")', October.

4.2 Review of CAA methodology

In this section, we cover three main concerns with the CAA's methodology:

- the general approach used by the CAA of weighting observations from the pandemic period based on an assessment of the frequency and duration of future pandemic-like events;
- the CAA's decision to place limited weight on ENAV, despite it being the only listed ANSP;
- the CAA's decision to cut off the top end of Flint's range.

[32] Civil Aviation Authority (2022), 'Economic regulation of NATS (En Route) plc: Appendices to initial proposals for the next price control review ("NR23")', October, para. C109.

4.2.1 General approach

The general approach used by the CAA places lower weight on data from the pandemic period, in order to ensure that the impact of the pandemic is not over-represented in the asset beta estimates. Its approach estimates the impact of pandemic-like events on airports' and ENAV's asset betas (i.e. a 'COVID adjustment') by calculating the difference between a pre-pandemic 'baseline beta' and a probability-weighted 'pandemic beta'.

The probability-weighted betas rely on two key assumptions, as detailed below.

- The frequency of pandemics—this assumption determines how much of the stock and index returns data during the pandemic is included in the regression sample. For example, for 7.2 years of observations and beta estimations, which is the window considered by Flint, and assuming a valuation date at 31 March 2022, c. 30% of the data in the sample falls during the COVID period (26 out of 86 months). By assuming that pandemics occur every 20–50 years, Flint divides the 30% by 2.77 (calculated as 20 years ÷ a 7.2-year estimation period) and by 6.94 (calculated as 50 years ÷ 7.2), and decides that the COVID period should make up c. 4% to c. 11% of the sample.
- The duration of pandemics—this assumption functions similarly to the frequency of pandemics. Using the example above, the duration of pandemics determines how many of the 86 months are during the COVID period. While 26 months represents the lower bound of the duration of the pandemic (since the COVID pandemic was assumed by Flint to be 26 months old at the time of Flint's analysis), Flint assumes that the impact of COVID and similar future events could last up to 2.5 years (or 39 months), which forms the upper bound of the duration.

In implementing its approach, the CAA classifies, across its comparator set, daily data as COVID-affected and non-COVID-affected data. It then calculates an equity beta for each comparator using a linear regression, with different weights assigned to COVID and non-COVID observations. In effect, the weights can be translated into an equivalent 'frequency' at which a 'COVID-like' event occurs. It then repeats this regression for a series of different weightings of COVID-like events to represent different frequencies.

In our response to the CAA's Final Proposals for the H7 price control,[33] we reviewed and commented on the methodology used by the CAA to estimate Heathrow Airport Limited's asset beta. The CAA uses a similar approach to assess NERL's asset beta and, as such, our comments on the methodology are similar in nature.

First, the CAA's approach implies that the COVID pandemic ended on 31 March 2022. In reality, the effects of the pandemic on the aviation sector were still being felt beyond this time. For example, as at July 2022:[34]

[33] Oxera (2022), 'H7 asset beta and inflation', August.
[34] Oxera (2022), 'H7 asset beta and inflation', August, pp. 11–18.

1 the number of reported infections was still rising, with a strong resurgence in cases in the EU, and lockdowns were still in place, particularly in China, which put a strain on the global supply chain;
2 the stock prices of airports and airlines were still depressed compared to the relevant stock indices;
3 the implied volatilities of relevant airports were high relative to that of the index, which implies that airports were still facing relatively more uncertainty than the rest of the market;
4 the recovery in the corporate travel sector was slow and might reflect a permanent shift in business travel expenditure.

Second, by design, the CAA's approach allocates a lower weight to the pandemic data. However, our analysis on behalf of Heathrow showed that:[35]

1 the impact of COVID on the stock market, in terms of the magnitude of losses, had not been exceptional by historical standards when compared to other historical key events, such as the EU sovereign crisis in 2011 and 2012, and the dot-com bubble burst and September 11 attacks that took place in 2001;
2 outliers should not be excluded from beta analysis because they contain important information about tail risk.

The result of the CAA's approach is that years of 'benign' market conditions receive more weight than years in which there is a shock.

Third, linked to the above, the assessment of the duration and frequency of future pandemic-like events is highly subjective and not substantiated with evidence.

Finally, it is unclear from the CAA's Initial Proposals whether it intends for this approach to be used at future price controls, or whether this is intended to be a one-off for NR23. Even if Flint's assumed pandemic probabilities were robust, if NERL were to receive the uplift to the pre-pandemic beta for only one control period, it would be remunerated for only a fraction of the pandemic-related beta risk over the 20–50-year period.

In light of the above, the CAA's choice to reduce the weight on pandemic data in its analysis risks understating the 'true' beta for NR23.

4.2.2 ENAV as the best comparator

The question of the appropriate comparator set for estimating NERL's betas was considered by the CMA in its RP3 redetermination. The CMA considered that, in line with the views expressed by both NERL and the CAA at that time, ENAV was a relevant comparator.[36]

> 'ENAV has been publicly traded since 2016, following privatisation of 42.5% of its share capital. ENAV therefore was a useful comparator for NERL. Both Parties accepted that ENAV

[35] Oxera (2022), 'H7 asset beta and inflation', August, pp. 18–20.
[36] Competition and Markets Authority (2021), 'NATS (En Route) Plc/CAA Regulatory Appeal' Final report, 23 July, pp. 182–183, paras 13.56 and 13.63.

> was a relevant comparator to NERL and assumed that ENAV would have a lower beta than NERL...
>
> ...we agreed with both CAA and NERL that ENAV represented a relevant comparator.'

In our October 2021 report, we set out a number of reasons why we considered ENAV to be the best comparator for NERL, and therefore placed the most weight on ENAV when estimating the NR23 asset beta.[37] This included the nature of NERL's activities (i.e. air navigation services), high volume risk subject to regulatory projections, high operational leverage, low capital intensity, short asset lives (relative to other infrastructure networks), and high sensitivity of profits to changes in revenues or costs.

By contrast, the CAA has chosen to place limited weight on ENAV's beta, citing:

1 instability of ENAV's beta over time prior to the pandemic relative to the airport comparators;
2 sensitivity of Flint's estimate of the pandemic impact of ENAV's beta to the inclusion or exclusion of recent data.

In terms of the first of these reasons, the CMA considered pre-pandemic evidence on the betas of ENAV and the airport comparators as part of the RP3 redetermination and did not reach the same conclusion as Flint. In the section of its determination illustrating the betas of the comparators over time, the CMA introduced the charts by stating that: 'whilst all the betas of the firms had been subject to some volatility over time, the overall scale of the betas had been broadly consistent, with least stability in the two-year weekly betas.'[38] It made no mention of ENAV exhibiting higher volatility than the other comparators, and such a conclusion does not appear to be borne out by the charts presented by the CMA.

The second reason provided by Flint—that its estimate of the pandemic impact of the beta is sensitive to recent data—highlights the issues with Flint's approach to estimating the NR23 beta, rather than an ENAV issue. The fact that ENAV's beta is continuing to rise, while the airport betas are falling, even after the period that Flint defines as the 'pandemic period' has ended, calls into question the assumption that betas will return to pre-pandemic levels outside of the defined pandemic window. This assumption is central to Flint's methodology and analysis.[39]

[37] Oxera (2021), 'Cost of capital for NR23', October, pp. 28–29.
[38] Competition and Markets Authority (2021), 'NATS (En Route) Plc/CAA Regulatory Appeal', Final report, 23 July, p. 193, para. 13.97.
[39] In the CAA's words, the approach relies on the assumption 'that comparator companies will exhibit equity beta dynamics similar to that observed prior to the pandemic during future "benign" (that is, non-pandemic) periods.' Civil Aviation Authority (2022), 'Economic regulation of NATS (En Route) plc: Appendices to initial proposals for the next price control review ("NR23")', October, p. 25, para. C78.

Indeed, Flint appears to exclude ENAV on the basis that it is unable to explain why ENAV's beta has increased while the airport betas have reduced in recent months:[40]

> 'we note that ENAV's beta has risen relative to the airports', and is now higher than any of the CMA's main three airport comparators. Furthermore, in the latter months of the pandemic, while betas for airports have fallen towards their pre-COVID level, ENAV's beta has remained higher than its pre-COVID value.
>
> The explanation for this pattern in relative betas is not obvious. We have not identified any notable company-specific news or developments which would explain why ENAV's beta has increased in recent months and remained high, while airport betas appear to have largely reverted to the pre-pandemic level.
>
> …[we] are able to observe betas for multiple airports and draw greater confidence from the fact that the pattern across the airport comparator set is similar. We are unable to do this for ENAV.'

In contrast to Flint, we do not interpret the fact that ENAV's beta has moved in a different way to the airport comparators to be evidence that it should be excluded from the dataset. Rather, this reinforces our view that most weight should be placed on the ENAV beta, as there is clear evidence that the movements in the ENAV beta differ from those of the airport group.

In this context, we agree with Flint's statement that:[41]

> 'The airport data and ENAV's data may point towards different levels of beta for NERL in the future, both at benign times, and in response to a major demand shock with characteristics like those experienced during COVID-19.'

As a result, we continue to consider that ENAV is the best comparator for NERL.

4.2.3 The CAA arbitrarily cuts off the top end of Flint's range

In addition to our concerns around the CAA's methodology for estimating the beta range, the CAA then arbitrarily cuts off the top end of Flint's range because it does 'not consider that the top half of this range is commensurate with NERL's risk profile due to NERL's regulatory protections'[42] compared to the airport comparators on which the asset beta range is based.

The CAA provides no evidence or analysis to support the size of its adjustment to the top end of the range. It also applies this in a one-sided way (i.e. it reduces the upper bound of the range but seemingly

[40] Flint Global (2022), 'Support to the Civil Aviation Authority: Estimating NERL's beta at NR23', May, pp. 18–19.
[41] Flint Global (2022), 'Support to the Civil Aviation Authority: Estimating NERL's beta at NR23', May, pp. 3–4.
[42] Civil Aviation Authority (2022), 'Economic regulation of NATS (En Route) plc: Appendices to initial proposals for the next price control review ("NR23")', October, para. C109.

does not give any consideration as to whether there are reasons why the lower bound of the range should be increased for differences in relative risk).

While acknowledging the regulatory protections that NERL has in place, we noted in our October 2021 report that NERL, and ANSPs more generally, have a lower operating margin when compared to the airport comparators, which means that their profitability is more sensitive to changes in costs and revenues. Indeed, it would take a much smaller cost or revenue shock to significantly reduce the equity return of NERL than any of the airport comparators.

Consequently, we stated in our October 2021 report that there are contrasting effects that make it difficult to assess the relative risk of airports and ANSPs.[43]

Similarly, Flint recognised the ANSPs' cost inflexibility and greater challenge in reducing costs in response to demand shocks compared to airports in its report, while noting that there could be other factors which could lead ANSPs to face lower systematic risks as well. This is consistent with the position we set out in our October 2021 report and is also consistent with the CMA's RP3 redetermination.

The CAA's decision to cut off the top of the range appears to contradict the CMA's finding that:[44]

> 'We concluded that airports were a relevant comparator for NERL, and that while they faced different risks to NERL, there was no consistent evidence that these risks were greater or smaller.
>
> ..there was inconclusive evidence that airports were either more or less risky than NERL, and therefore we used the value of the betas of the airport comparators as a direct comparator for NERL's beta.'

We agree with the CMA that there are contrasting effects when assessing the relative risks of ANSPs and airports. As noted above, it is both true that NERL benefits from certain regulatory protections and also that the impact of a given change in revenue or cost on profitability will be significantly greater for the ANSPs and NERL due to their lower operating margins. This suggests that the CAA's arbitrary cut-off of the top end of Flint's range is unjustified.

Moreover, the fact that ENAV's beta currently sits above the top end of the CAA's range (for one-, two- and five-year estimates), and above the level of the airports, shows that such beta levels are not unrealistic for an ANSP even with traffic-risk sharing.

4.3 Revised Oxera estimate

In light of the previous section, we propose to estimate the asset betas based on an approach that relies simply on the available data. Such an approach is in line with well-established regulatory practice.

[43] Oxera (2021), 'Cost of capital for NR23', October, p. 29.
[44] Competition and Markets Authority (2021), 'NATS (En Route) Plc/CAA Regulatory Appeal' Final report, 23 July, p. 189, paras 13.82–13.83.

As such, we maintain an approach of estimating two- and five-year daily asset betas for the comparators. We also continue to estimate the one-year daily asset betas for reference, and have supplemented this with a beta calculated from February 2020 onwards. We have updated the asset beta estimates using the same comparator set as for our initial work.

Table 4.2 below shows the asset beta estimates at our previous cut-off date of 30 September 2021, and at our current cut-off date of 11 November 2022.

Table 4.2 One-year, two-year and five-year asset betas of comparators

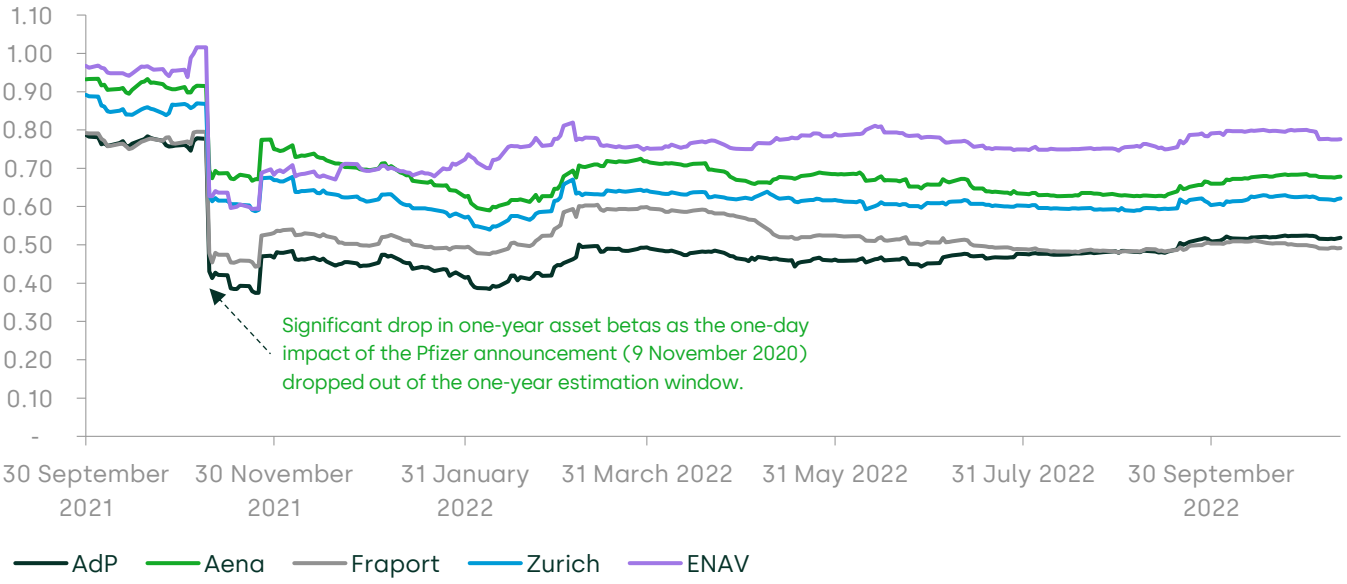
	30 September 2021			11 November 2022			
Comparator	One-year	Two-year	Five-year	One-year	Two-year	Five-year	Feb. 2020 to 11 Nov. 2022
AdP	0.78	0.85	0.86	0.52	0.49	0.76	0.75
Aena	0.93	0.91	0.82	0.68	0.68	0.80	0.85
Fraport	0.78	0.64	0.72	0.49	0.51	0.66	0.57
Zurich	0.89	0.81	0.85	0.62	0.62	0.79	0.76
ENAV	0.97	0.72	0.64	0.78	0.75	0.70	0.74
Average	**0.87**	**0.79**	**0.78**	**0.62**	**0.61**	**0.74**	**0.73**

Source: Oxera analysis based on data from Bloomberg.

Table 4.2 shows that the one-, two- and five-year asset betas have fallen, on average, since our initial assessment. The decrease in one- and two-year betas is more marked as these now exclude the large one-day impact from 9 November 2020, when Pfizer announced its successful COVID-19 vaccine trials,[45] which resulted in the spike of airports and ANSPs stock prices. This decrease is evident in Figure 4.1 and Figure 4.2. We consider that these are valid data points that should be given equal weight when estimating the five-year beta—i.e. we have not carried out any reweighting to reduce the impact of these data points.

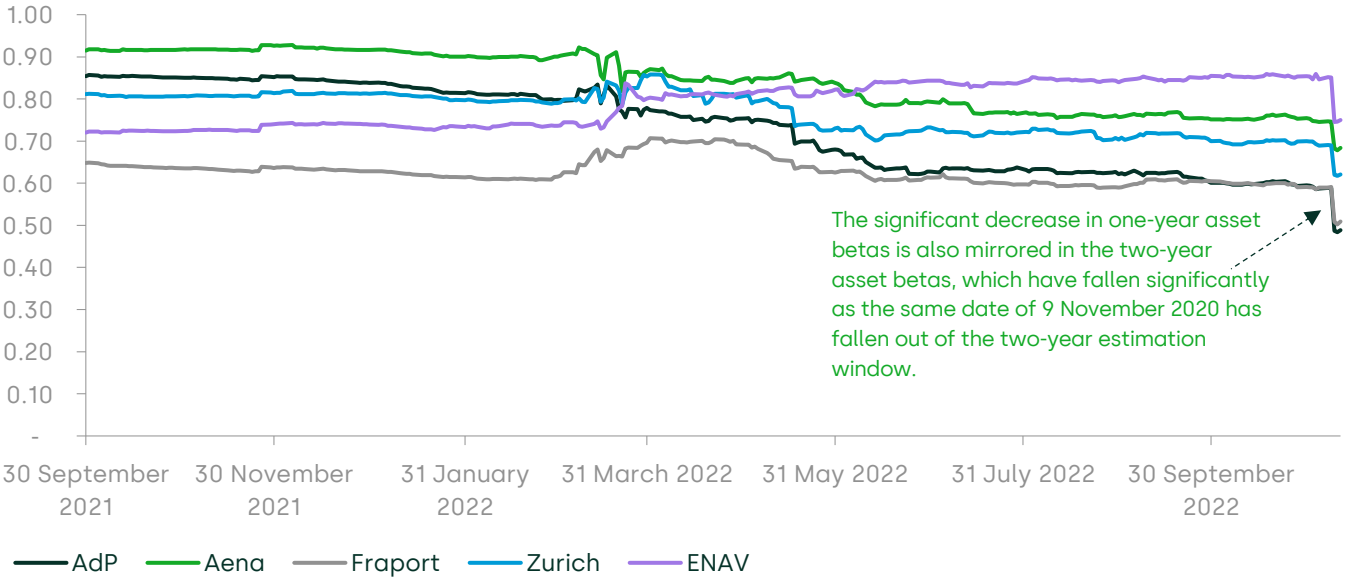
[45] Pfizer (2020), 'Pfizer and BioNTech Announce Vaccine Candidate Against COVID-19 Achieved Success in First Interim Analysis from Phase 3 Study', November, available at https://www.pfizer.com/news/press-release/press-release-detail/pfizer-and-biontech-announce-vaccine-candidate-against, last accessed on 23 November 2022.

Figure 4.1 One-year daily asset betas



Source: Oxera analysis based on data from Bloomberg.

Figure 4.2 Two-year daily asset betas



Source: Oxera analysis based on data from Bloomberg.

Based on the updated market evidence, the average of the betas across all comparators is 0.61 for the two-year asset beta and 0.74 for the five-year asset beta, while the during-pandemic asset beta averages to 0.73.

We propose a range with the two-year average estimate across the comparator set at the bottom end of the range and the corresponding figure for five-year betas at the top end of the range. This results in a range of 0.61–0.74.

The five-year betas and the data on ENAV, which we consider to be the closest comparator to NERL, would support a point estimate towards the top end of this range.

The two- and five-year asset betas of ENAV have trended upwards since our October 2021 report and are at the top end of our proposed range.

5 Gearing

In this section, we review the methodology used by the CAA to estimate the gearing level of NERL. In its NR23 Initial Proposals, the CAA proposes a gearing level of c. 30%, as detailed below.[46]

5.1 Comparison of Oxera and CAA approaches

Similar to the asset beta, the CAA's approach to estimating the gearing consists of estimating a long-run gearing by combining 'pre-pandemic' gearing, 'pandemic' gearing and assumptions around the frequency of pandemics.

By contrast, our approach was based more directly on the available market data, as well as evidence on the forecast gearing (net debt/RAB) for NERL over NR23 based on its financial modelling.

The two approaches are summarised in Table 5.1.

Table 5.1 Comparison of Oxera and CAA approaches on gearing

	Oxera October 2021 approach	CAA approach
Comparator set	Comparator set included four airports (AdP, Aena, Fraport, Zurich) and one ANSP (ENAV). We also considered NERL's forecast gearing.	Aena, Fraport and ADP
Approach to gearing	We compared the average spot gearing of NERL and its comparators to the CMA's gearing allowance of 30%.	The CAA uses a similar approach to estimate the gearing as it does to estimate asset betas, i.e. reweighting of pre- and post-pandemic gearings using assumptions on the occurrence and the duration of a pandemic-like event.
Arrival at estimate	We had uplifted the CMA's gearing allowance of 30% by 20bp in order to reflect the increased gearing of NERL and the comparators as a result of the pandemic.	The CAA has estimated a pre-pandemic gearing of 29.4%, to which it has added a 0.6–1.3% COVID adjustment, to arrive at a gearing level of c. 30%.

Source: Oxera (2021), 'Cost of capital for NR23', October; and Civil Aviation Authority (2022), 'Economic regulation of NATS (En Route) plc: Appendices to initial proposals for the next price control review ("NR23")', October.

5.2 Review of CAA methodology

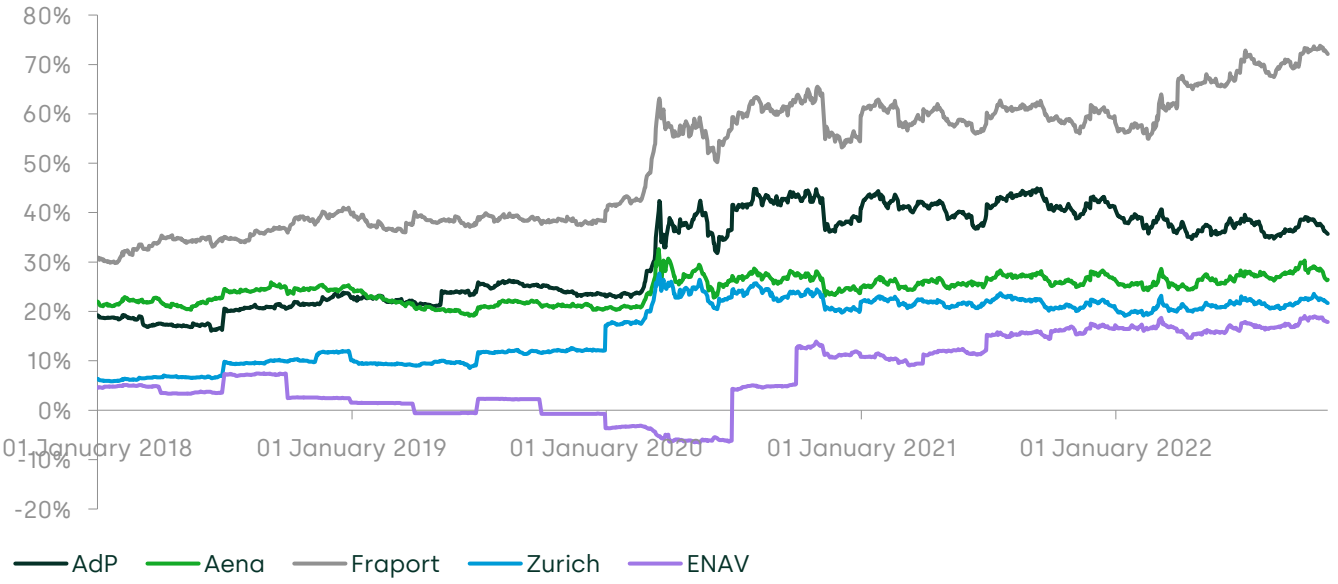
Given that the CAA uses the same methodology to estimate the gearing as it does to estimate the asset betas, we have similar concerns as presented in section 4.2.

5.3 Revised Oxera estimate

We have updated the market value of gearing for the appropriate comparators, using our latest cut-off date of 11 November 2022. As shown in Figure 5.1, the higher gearing levels that stemmed from the pandemic have largely been sustained since March 2020.

[46] Civil Aviation Authority (2022), 'Economic regulation of NATS (En Route) plc: Appendices to initial proposals for the next price control review ("NR23")', October, para. C40.

Figure 5.1 Spot market value of gearing



Source: Oxera analysis based on data from Bloomberg.

The average gearing across the comparators has increased slightly since our previous assessment, as shown in Table 5.2. As of 11 November 2022, the average gearing across all five of our beta comparators (of 34%) is not significantly different from the CAA's estimate (of 30%). However, the average market gearing of the CAA's smaller comparator set (i.e. AdP, Aena and Fraport) is around 43%.

Table 5.2 Market value of gearing

	30 September 2021	11 November 2022
Comparator		
AdP	42%	34%
Aena	25%	26%
Fraport	59%	70%
Zurich	21%	21%
ENAV	14%	18%
Average across all comparators	**32%**	**34%**
Average across the CAA's comparators	**42%**	**43%**

Source: Oxera analysis based on data from Bloomberg.

In coming to a view on the appropriate gearing assumption for NR23, we have balanced the following evidence.

- The CMA used a 30% gearing estimate based on the comparator gearing at that time.
- The market evidence shows that comparator gearing levels have increased following the pandemic. These higher gearing levels have continued.

- The average gearing level across all five of our comparators is currently 34%. This is higher than the average gearing level for these comparators at the time of our October 2021 report (which had a cut-off date of 30 September 2021).
- The average gearing level across the CAA's three comparators is 43% (though Fraport's gearing is significantly above that of AdP and Aena).
- NERL is projecting actual gearing levels of closer to 50% over the course of NR23. However, its forecasts are now for slightly lower gearing than was anticipated at the time of our October 2021 report.

This evidence points to a wide potential range for the gearing estimate of 30–50%.

At the same time, the previously observed relationship between gearing and the WACC estimate (in which the WACC estimate increased with the level of gearing) appears to have reversed with the updated risk-free rate and cost of debt estimates. This was the primary source of the concerns raised by the CMA (and subsequently the CAA) around having a notional gearing level that differed significantly from that of the comparator group.

Given this evidence, we have presented a WACC estimate using a 40% gearing assumption, which lies at that the mid-point of the range identified above.

6 Cost of debt

In this section, we review the methodology used by the CAA to estimate the cost of debt. In its NR23 Initial Proposals, the CAA proposes an RPI-real cost of debt of -0.89%, as detailed below.[47]

6.1 Comparison of Oxera and CAA approaches

Our approach differs from the CAA's approach in that:

- the CAA calculates the cost of embedded debt directly from a benchmark index (iBoxx £-denominated A-rated index). By comparison, we used evidence on the actual cost of NERL's debt issuances, with the benchmark index used as a cross-check of the efficiency of NERL's bond issuances;
- the CAA uses the same index-based approach for both embedded and new debt. We estimate the cost of new debt as the sum of the forward gilt rate and a debt premium based on the spread on NERL's bonds (over the gilt benchmark).
- the CAA has adjusted the weight placed on each of the bonds to take account of the amortising nature of one of the issues.

These differences are summarised in Table 6.1.

Table 6.1 Comparison of Oxera and CAA approaches on cost of debt

	Oxera October 2021 approach	CAA approach
Cost of embedded debt	Based on the actual cost of NERL's bond issuance (calculated on the basis of the yield at issuance). As an efficiency cross-check, we compared the yield at issuance to a benchmark bond index.	Benchmarked to the appropriate iBoxx £-denominated A-rated index.
Cost of new debt	Calculated as the sum of the forward gilt rate and a debt premium (based on the spread of the April 2021 bullet bond above the gilt benchmark).	Benchmarked to the appropriate iBoxx £-denominated A-rated index.
Arrival at estimate	Weighted by the value of principal at the time of the issuance of the bonds.	Weighted by the value of principal outstanding in each year of NR23.
Issuance and liquidity costs	13bp	13bp

Source: Oxera (2021), 'Cost of capital for NR23', October; and Civil Aviation Authority (2022), 'Economic regulation of NATS (En Route) plc: Appendices to initial proposals for the next price control review ("NR23")', October.

6.2 Review of CAA methodology

6.2.1 Cost of embedded debt

The approach used by the CAA to estimate the cost of embedded debt is to benchmark that cost to an iBoxx £-denominated A-rated index, and to weight the cost of each instrument by the value of the principal outstanding in each year of NR23. The CAA has estimated the cost of embedded debt for the existing amortising bond and the bullet bond

[47] Civil Aviation Authority (2022), 'Economic regulation of NATS (En Route) plc: Appendices to initial proposals for the next price control review ("NR23")', October, para. C158.

to be 1.34% and 1.88% nominal respectively. The CAA has also included in the cost of embedded debt a benchmark cost for the bond that was expected to be issued in 2022 in order to replace the two-year bridge loan facility. It estimates the cost of this bond to be 2.88% nominal using a similar benchmark index approach (as at 31 March 2022).[48] The CAA deflates these using an inflation assumption of 3.16% per annum, to arrive at a real cost of embedded debt of -0.89% RPI-real.

The CAA's analysis of the cost of embedded debt results in similar values to our approach for NERL's two existing bonds. However, its methodology is different in that it seeks to set the cost of embedded debt with direct reference to a benchmark index, rather than considering the actual cost of NERL's issuances.

The effect of the CAA's approach is therefore to substitute real market information (i.e. NERL's actual issuances) by a proxy index. While such an approach has been used in other regulated sectors (e.g. energy and water), this has generally been because i) there are multiple companies and the regulator is seeking to set an industry-wide cost of embedded debt, and/or ii) companies have utilised more diverse debt instruments meaning that a 'balance sheet' approach is difficult.

It is not clear why such an approach is necessary in the case of NERL, which is the sole provider of en route air traffic services and has a simple debt portfolio (consisting of two bonds issued on the open market).[49] Under these circumstances, we consider that it is more appropriate to start from NERL's actual debt issuances and only depart from these values if there is clear evidence of inefficiency. The application of efficiency cross-checks should be sufficient to ensure that NERL retains incentives to raise debt efficiently.

In this context, the CAA has historically set NERL's cost of embedded debt allowance with reference to the yield at issuance for its existing bond (5.40% nominal at the time of previous price reviews) and that the CMA upheld this approach in its RP3 redetermination, noting that: 'the cost of embedded debt was unambiguous – in line with the Parties' views we used the 5.40% initial yield to maturity of NATS existing bond'.[50]

Our analysis found that NERL's two bond issuances were efficient relative to the benchmark, such that no such 'efficiency adjustment' is required. The CAA uses slightly different bond indices as its benchmarks, but its own analysis shows that the gap between the NERL bond issues and its chosen benchmarks is small, with one bond 'outperforming' by 10bp and the other 'underperforming' by 10bp.[51]

[48] In line with the expectation set out by Moody's in its latest rating for NATS, we assume that this bond will be issued in March 2023 ahead of the financial year end, and as such will be treated as a new debt for NR23.
[49] The CMA seemingly recognised the difference between precedent for setting the cost of embedded debt allowance for a single company versus industry-level allowances in the PR19 redetermination. 'We have not given particular weight to recent CMA and CC precedent, as those recent redeterminations were based on a single company, rather than broader industry-level allowances, and also the approach needs to reflect the way the cost of debt has changed in recent years.'
[50] Competition and Markets Authority (2021), ''NATS (En Route) Plc/CAA Regulatory Appeal' Final report, 23 July, p. 212, para. 13.161.
[51] Civil Aviation Authority (2022), 'Economic regulation of NATS (En Route) plc:

Consequently, both bonds appear to be within a reasonable margin of the benchmark index, regardless of whether the CAA's definition or our definition of the benchmark is used.[52]

We therefore continue to use the same approach as in our October 2021 report.

6.2.2 Cost of new debt

As mentioned above, the CAA has included in the cost of embedded debt the cost of the bond that was expected to be issued in 2022 in order to replace the two-year bridge loan facility. This bond is now expected to be issued within the NR23 period and, as such, we treat it as new debt in this report.

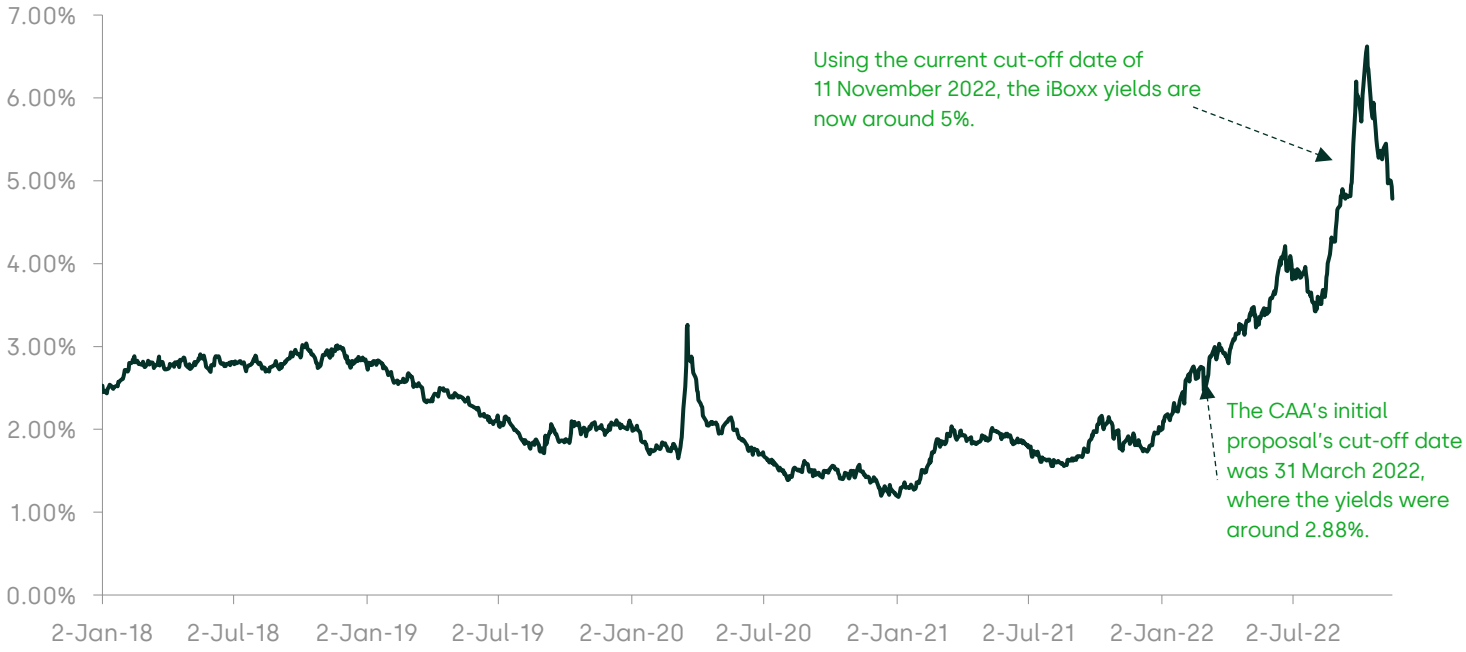
The CAA details its approach for estimating the cost of new debt should NERL have new debt issuance in NR23, which is now expected to be the case. For the cost of new debt, the approach of the CAA is similar to its approach for the estimation of the cost of embedded debt, in the sense that it has benchmarked the cost of the bond that was expected to be issued in 2022 to the appropriate 10-15 iBoxx £-denominated A-rated index. The CAA has estimated the cost of new debt to be 2.88% nominal as at 31 March 2022, which is the CAA's cut-off date.

The yields on the 10-15 iBoxx £-denominated A-rated index have significantly increased since the CAA's cut-off date analysis at 31 March 2022, as shown in Figure 6.1. The yield as at 11 November 2022 now stands at 5.01%, which represents the updated cost of new debt when using the CAA's approach.

Appendices to initial proposals for the next price control review ("NR23")', October, pp. 35–36, paras C149–C150.

[52] This explains why the CAA's approach results in a similar overall estimate to our approach.

Figure 6.1 Yields on iBoxx £ Non-Financials A 10-15y



Source: Oxera analysis based on data from iBoxx.

We continue to adopt a different methodology in estimating the cost of new debt, as follows.

- We assume that NERL will issue a £250m bullet bond, with a ten-year tenor, in March 2023.
- We then calculate the forward gilt rate in March 2023 and add a debt premium, which is based on the spread of the April 2021 bullet bond above the gilt benchmark. We continue to use the forward risk-free rate, for the same reasons discussed in section 3.2.

6.2.3 Weighting

In determining the weights to place on the different debt instruments, the CAA takes account of the amortisation of one of NERL's bonds. We did not originally account for this in our analysis but have done so in producing our revised estimates below.

6.2.4 Inflation

The CAA has presented an alternative scenario, which takes account of more recent market evidence that is relevant for the estimation of the risk-free rate and cost of debt. Under this scenario, the CAA deflates its nominal cost of debt estimates using a forecast of RPI inflation for each year of the NR23 period. The CAA's forecast for the period of 4.11% differs significantly from the 3.16% it uses in the base scenario (which more closely relates to long-run RPI of 3%).

In the time following the CAA's publication, the OBR has produced new independent forecasts for key macroeconomic variables, including RPI inflation. The OBR's latest forecasts show high RPI inflation of 10.7% in 2023 but project that RPI will then fall to below 1.5% for three years. The OBR's forecasts are considerably lower than the previous (OBR and Morgan Stanley) forecasts used by the CAA for each year from

2024 to 2027, and result in an NR23 average of 3.0% (compared to the CAA's average of 4.11%).

Table 6.2 Inflation forecasts

	2023	2024	2025	2026	2027	Average
CAA (alternative scenario)	6.89%	4.48%	3.45%	2.86%	2.86%	4.11%
Office for Budget Responsibility	10.7%	1.5%	-0.4%	1.0%	2.6%	3.0%

Source: Office for Budget Responsibility (2022), 'Economic and fiscal outlook', November, p. 55.

Furthermore, the CAA approach is inconsistent with the pricing of debt based on average inflation forecast over the period to maturity. As such, it is more appropriate to deflate the cost of debt using a long-term inflation forecast that aligns to the tenor of debt, which in the case of NERL is around ten years.

The CAA approach also contradicts extensive regulatory precedent for using long-term inflation forecasts to deflate the cost of debt allowance. A clear recent example is provided by the PR19 water redeterminations, in which the CMA explicitly rejected a request by Yorkshire Water to increase the real cost of debt allowance on the basis that inflation during AMP7 (2020–25) was forecast to be lower than the long-term target.[53]

We therefore estimate the long-term RPI inflation rate to be 2.8% based on:

- applying the latest OBR forecasts for 2023–27;
- using an RPI estimate of 3% for 2028–30;
- assuming that post-2030 RPI will equal the Bank of England's inflation target of 2% (given that the UK government and UKSA have announced that RPI will be aligned to CPIH in 2030).[54]

6.3 Revised Oxera estimate

Following the methodology outlined above:

- we calculate the interest rates on NERL's two existing bonds to be 1.44% and 1.79% on the amortising and bullet bond respectively;
- we have estimated the implied forward risk-free rate to be 3.48%, and the spread of the April 2021 bullet bond above the Treasury benchmark to be 1.47%,[55] both as at 11 November 2022. As such our estimate for the cost of new debt on a nominal basis amounts to **4.95%**, which is very close to the CAA's updated estimate of 5.01%;
- we deflate using a long-term RPI inflation assumption of 2.80%;
- we apply liquidity and issuance costs of 0.13%.

[53] Competition and Markets Authority (2021), 'Anglian Water Services Limited, Bristol Water plc, Northumbrian Water Limited and Yorkshire Water Services Limited price determinations – Final report', para. 9.33.
[54] HM Treasury and UK Statistics Authority (2020), 'A Response to the Consultation on the Reform to Retail Prices Index (RPI) Methodology', 25 November.
[55] Based on Refinitiv data.

Table 6.3 summarises our estimate of the real weighted average cost of debt of **-0.14%**.

Table 6.3 Weighted average cost of debt

Parameters	Average outstanding principal over NR23	Interest rate
Amortising bond	£360m	1.44%
Bullet bond	£300m	1.79%
March 2023 bond	£250m	4.95%
Weighted average cost of debt		**2.52%**
RPI forecast		2.80%
Issuance costs		0.08%
Liquidity costs		0.05%
Cost of debt, real		**-0.14%**

Note: Note: We convert the weighted average cost of debt in nominal terms to RPI-real using the Fisher equation: (1 + nominal rate) = (1 + real rate) x (1 + inflation). We then add issuance and liquidity costs to the RPI-real estimate, in line with the approach adopted by the CMA for RP3. We also now weight the cost of debt by the value of principal outstanding in each year of NR23.
Source: Oxera analysis based on data from Bloomberg and iBoxx, and based on information provided by NERL.

7 NR23 WACC estimate

Table 7.1 summarises our NR23 WACC range estimates for NERL. We present WACC estimates for a 40% gearing assumption, which lies in the middle of the gearing range identified based on the evidence described above.

For the purposes of comparison, we also present the estimates from our October 2021 report, as well as the CAA's Initial Proposals.

The table shows our range for the RPI-real, vanilla WACC of **3.41–4.48% at 40% gearing**.

Table 7.1 Oxera proposed RPI-real WACC range for NR23

	Revised Oxera estimate (40% gearing)		Oxera October 2021 report		CAA Initial Proposals	
Parameter	Low	High	Low	High	Low	High
Asset beta	0.61	0.74	0.60	0.70	0.54	0.64
Debt beta	0.05	0.05	0.05	0.05	0.05	0.05
Gearing	40%	40%	50%	50%	30%	30%
Equity beta	0.98	1.21	1.15	1.35	0.75	0.89
TMR	5.85%	6.50%	5.85%	6.50%	5.20%	6.50%
Risk-free rate	0.94%	1.31%	-2.08%	-1.53%	-2.41%	-2.78%
ERP	4.91%	5.19%	7.93%	8.03%	7.61%	9.28%
Cost of equity, post-tax	5.77%	7.57%	7.04%	9.31%	3.30%	5.51%
Cost of debt, pre-tax	-0.14%	-0.14%	-1.11%	-1.11%	-0.89%	-0.89%
WACC vanilla	**3.41%**	**4.48%**	**2.97%**	**4.10%**	**2.04%**	**3.59%**

Source: Oxera analysis.

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