NERA
ECONOMIC CONSULTING

Updated Weighted Average Cost of Capital for NATS (En-Route) plc at RP3

A Report for NERL

September 2018

CONFIDENTIALITY

Our clients' industries are extremely competitive, and the maintenance of confidentiality with respect to our clients' plans and data is critical. NERA Economic Consulting rigorously applies internal confidentiality practices to protect the confidentiality of all client information.

Similarly, our industry is very competitive. We view our approaches and insights as proprietary and therefore look to our clients to protect our interests in our proposals, presentations, methodologies and analytical techniques. Under no circumstances should this material be shared with any third party without the prior written consent of NERA Economic Consulting.

Project Team

Richard Hern
James Grayburn
Jim Yin

NERA Economic Consulting
Marble Arch House
66 Seymour Street
London, UK W1H 5BT
+44 207 659 8500
www.nera.com

Contents

List of Tables

List of Figures

Executive Summary

NATS (En Route) plc has engaged NERA Economic Consulting to provide an estimate for the Weighted Average Cost of Capital (WACC) for its RP3 Business Plan. This report sets out our update of NERL's weighted average cost of capital (WACC) at RP3, reflecting the latest empirical evidence and regulatory precedent since our March 2018 cost of capital report which was submitted to the CAA alongside NERL's initial Business Plan in April 2018[1]. We also review the potential impact of the European Commission's proposals on its Single European Sky regulations for RP3, and examine the impact on NERL's cost of capital. We have considered the Civil Aviation Authority (CAA)'s comments on the cost of capital submission in NERL's initial Business Plan, and set out our responses.

We have maintained the same framework and methodology used in our March 2018 report, and estimate a WACC (vanilla, real) range of 4.24 to 4.78 per cent for RP3, compared to our March 2018 estimated range of 4.17 to 4.46 per cent. We calculate a WACC point estimate of 4.51 per cent, at the mid-point of our proposed range, compared to 4.31 per cent in our March report. The higher WACC range mainly reflects the recent increase in empirical asset beta estimates for international airports since our previous report. We summarise the key updates for each of the parameter below.

- We maintain our real TMR of 6.5 to 7.1 per cent (real RPI) based on long-run historical returns, which takes into account the RPI formula effect.
- We recommend a RfR of -1.1 to 1.5 per cent for RP3 based on both long-run and current market evidence. Compared to -1.0 to 1.5 percent in March report, the change in lower bound reflects recent evidence of lower forward rate expectation and higher expected inflation.
- We estimate an asset beta in the range of 0.56 to 0.66, based on a relative risk assessment for NERL compared to international listed airports. This is higher than our range of 0.55 to 0.60 in the March report, reflecting an increase in the average 2Y asset beta for the international airports. Asset betas for UK regulated utilities comparators (excluding SSE) against the FTSE All Share have slightly increased, implying an increase in the lower bound for NERL's beta. We estimate ENAV's asset beta range to be 0.52 to 0.66 based on 1Y and 2Y estimation windows, broadly consistent with NERL's asset beta range based on the international airports comparators.
- We estimate a real cost of debt of 1.08 per cent, taking account of NERL's embedded costs and forecast costs of new debt for RP3. This is slightly lower than our March report estimate of 1.11 per cent, reflecting lower forward interest rate expectations and higher expected inflation.

In our review of the proposed RP3 regulation, we identify three main changes from the RP2 regulatory arrangement that could potentially increase NERL's downside risks, which could in turn increase investors' required rate of return and the cost of capital for NERL. The proposed regulation introduces an asymmetric and higher capacity incentive penalty cap, a higher traffic risk sharing threshold, and mandatory use of STATFOR traffic forecast. We

[1] NERA (20 March 2018): The Weighted Average Cost of Capital for NATS (En-Route) plc at RP3, A Report for NATS.

note that our current estimate assumes that the RP2 regulation will continue, and does not reflect the potential risk premia due to the proposed RP3 regulation.

In response to the CAA's comments, we consider NERL's higher cost of capital in RP3 reflects increased beta risks faced by NERL and the CAA's underestimation of NERL's risks at RP2. NERL's higher asset beta reflects the increase in listed airport asset betas since RP2, and NERL's higher operating leverage than its peer group, which the CAA did not adjust for at RP2. Also, our approach to estimating TMR is consistent with the CMA's approach, and we show that there is no evidence to support a TMR lower than the 6.5 per cent determined in CMA's NIE and Bristol Water determination. Finally, we do not consider there is strong evidence for a reduction in cost of capital for other regulated sectors, and the analysis proposed by the UK regulators' advisors contain several flaws that understate WACC.

1. Introduction

NATS (En Route) plc has engaged NERA Economic Consulting (NERA) to provide an estimate for the Weighted Average Cost of Capital (WACC) for its RP3 Business Plan.

This report summarises NERA's range for NERL's WACC at RP3, taking into account the latest empirical evidence and regulatory precedent since our March 2018 cost of capital report which was submitted to the CAA alongside NERL's initial Business Plan in April 2018[2]. In this report, we have also analysed the potential impact of the European Commission's proposals on its Single European Sky regulations for RP3, and the potential impact on NERL's cost of capital. We have considered the Civil Aviation Authority (CAA)'s comments on the cost of capital submission in NERL's initial business plan, and set out our responses.

This report is structured as follows:

- Section 2 sets out our updated evidence on NERL's cost of capital for RP3;
- Section 3 reviews the potential impact of the European Commission's proposed RP3 Single European Sky regulations on NERL's cost of capital; and
- Section 4 sets out our responses to CAA's comments on the cost of capital submission in NERL's initial business plan.

[2] NERA (20 March 2018): The Weighted Average Cost of Capital for NATS (En-Route) plc at RP3, A Report for NATS.

2. Updated Cost of Capital

In this section, we set out our updated range of cost of capital for NERL at RP3. We maintain the same framework and methodology used in our March 2018 report[3]. We estimate a WACC (vanilla, real) range of 4.24 to 4.78 per cent for RP3, compared to our March 2018 estimated range of 4.17 to 4.46 per cent. The updated WACC range mainly reflects the recent increase in empirical asset beta estimates for international airports since our previous report.

We calculate a WACC point estimate of 4.51 per cent, at the mid-point of our proposed range. Our current point estimate assumes that the current regulatory framework for RP2 continues to apply in RP3. We may revise our view of the appropriate point estimate, once we fully analyse the RP3 regulation to take into account the risks faced by NERL under the new traffic risk sharing mechanism and incentive schemes. Table 2.1 summarises our updated estimate for NERL's cost of capital for RP3.

[3] NERA (20 March 2018): The Weighted Average Cost of Capital for NATS (En-Route) plc at RP3, A Report for NATS.

Table 2.1
NERA WACC Range for RP3

	CAA RP2	NERA Low	NERA High	NERA Method
Gearing	60%	60%	60%	Same as RP2 notional gearing
Total Market Return	6.25%	6.50%	7.10%	LB: 5Y holding period for long-run historical returns adjusted for RPI effect; UB: 1Y holding period for long-run historical returns
Risk-free Rate	0.75%	-1.10%	1.50%	LB: 1-month average of real government bond yields adjusted for forward-looking expectations; UB: Long-run historical average
Equity Risk Premium	5.50%	7.60%	5.60%	Calculation
Asset Beta	0.505	0.56	0.66	LB: 2Y asset beta for ADP; UB: Based on 2Y betas of international listed airports
Debt Beta	0.10	0.05	0.05	PwC assumption for Heathrow at H7, cross-check against academic estimates
Equity Beta	1.11	1.33	1.58	Calculation
Post-tax Cost of Equity	6.87%	8.97%	10.32%	Calculation
Tax Uplift	37%	17%	17%	Holding assumption based on UK statutory corporation tax rate from April 2020. Actual tax uplift might differ from the holding assumption.
Pre-tax Cost of Equity	10.90%	10.81%	12.43%	Calculation
Cost of Embedded Debt	2.50%	2.13%	2.13%	NERL's bond yield at issuance deflated by HMT most recent inflation forecast
Cost of New Debt	1.75%	0.42%	0.42%	NERL 1-month average bond yield plus UK gilt forward curve increase up to RP3, deflated by HMT most recent inflation forecast
Transaction Costs	0.15%	0.15%	0.15%	Same as RP2 allowance, and in line with NERL actual transaction costs
Pre-tax Cost of Debt	2.50%	1.08%	1.08%	Calculation
Vanilla WACC	**4.25%**	**4.24%**	**4.78%**	Calculation
Pre-tax WACC	5.86%	4.97%	5.62%	Calculation
Vanilla WACC point estimate	**4.25%**	**4.51%**		Calculation

Source: NERA analysis based on information date of 10 August 2018

In the following sections, we set out our updated estimates for individual parameters for the cost of capital in more detail.

2.1. Total Market Return and Risk-free Rate

We recommend a real TMR of 6.5 to 7.1 per cent (real RPI) based on long-run historical returns

We maintain the "TMR approach" to estimating the RfR and ERP, which recognises the empirical and academic evidence supporting the inverse relationship between the two components of equity market returns. The use of the "TMR approach" is consistent with UK regulatory precedent including the CMA's approach in its most recent reviews (NIE 2014 and Bristol Water 2015).

We estimate a TMR based on long-run historical returns for the UK market, drawing on different holding periods and averaging techniques as considered by the CMA in its Northern Ireland Electricity (NIE) 2014 determination. Table 2.2 shows the long-run historical average of the UK TMR under a range of different approaches.

Table 2.2: Long-run DMS TMR estimates (real, RPI-deflated)

	Simple	Overlapping	Blume	JKM
1Y holding	7.1	7.1	7.1	7.1
2Y holding	6.6	7.0	7.1	7.1
5Y holding	6.7	6.8	7.0	7.0
10Y holding	6.8	6.7	7.0	6.7
20Y holding	7.1	6.8	6.8	6.2

Source: NERA calculations using DMS (February 2018), Credit Suisse Global Investment Returns Yearbook 2018 (DMS data since 1988 converted to real RPI-deflated figures for consistency with earlier data).[4]

As explained in our March 2018 report, our review of the literature shows that the use of arithmetic mean and short holding periods are consistent with academics and practitioners' approaches. Therefore, the updated long-run historical evidence points to a TMR range of 6.8 to 7.1 per cent.

In our March 2018 report, we considered whether it is appropriate to reflect 2010 changes to the ONS methodology of data collection ("formula effect"), and we applied a downward adjustment of 0 to 30 bps to the historical returns data. We continue to make the same adjustment in our update, which supports a lower bound real TMR (RPI-deflated) of 6.5 per cent, equal to the 6.8 per cent lower bound historical TMR minus 30 bps for the "formula effect". We make no adjustment to our upper-bound estimate of 7.1 per cent to reflect the uncertainty over the other off-setting adjustments for the "formula effect".

[4] DMS (February 2018), Credit Suisse Global Investment Returns Yearbook 2018, p.214-217. We note that the 2018 DMS publication includes real returns for the UK market since 1988 which have been calculated using CPI as opposed to RPI inflation. (See DMS (February 2018), Credit Suisse Global Investment Returns Yearbook 2018, p.210.) As a result, the DMS reported historical real return for the UK market of 7.3 per cent over the period 1900-2017 should not be interpreted as a real RPI-deflated measure. To ensure consistent treatment of inflation, we have re-calculated the real UK historical returns to be based on a RPI deflated basis. This provides an estimate of historical real returns of 7.1 per cent for the UK market over the period 1900-2017.

Overall, we estimate a TMR in the range of 6.5 to 7.1 per cent, where the bottom end of our range is consistent with the TMR determined by the CMA in its 2014 NIE and 2015 Bristol Water determinations. We do not adjust our TMR estimate with the CAA's comments on TMR in respect of UKRN's recommendation, which we discuss in detail in Section 4.2.1 of this report.

We have reviewed the recent TMR determinations and the indicative TMR range proposed in recent price control methodology documents, which we discussed in detail in Appendix A. The recent UK regulatory decisions on TMR ranges from 6.10 per cent (Ofcom WLA, 2018)[5] to 6.75 per cent (Ofwat PR14, 2014)[6], and the CMA's last decision on the TMR (NIE 2014 and Bristol Water 2015) gives 6.5 per cent.[7] In recent methodology documents, the CAA, Ofwat and Ofgem presented their early view on the TMR estimates, most of which are below the CMA's recent determination of 6.5 per cent, and our range of 6.5 to 7.1 per cent. As set out in Appendix A, we consider that the proposed reduction to the TMR range is not justified. Drawing on the established approach to estimating the TMR as employed by the CMA, we have shown that there is no reason to support a TMR lower than the CMA's NIE and Bristol Water decision of 6.5 per cent.

In Appendix A, we also update the different approaches the CMA considered in determining the TMR at the 2014 NIE and 2015 Bristol water determinations using latest available data. The updated TMR range based on different approaches shows a slight increase compared to the evidence presented by the CMA in 2014 NIE and 2015 Bristol water determinations, which supports our conclusion that the TMR for RP3 should be no lower than 6.5 per cent. We note that the Bank of England's independent forward-looking estimates support a range of 7.2 to 8.1 per cent real TMR, higher than the historical estimates presented by CMA at NIE 2014.[8] Therefore, we consider our recommendation of 6.5 to 7.1 per cent TMR for the RP3 period is well supported by the established approach used in recent regulatory decision (the CMA NIE and Bristol Water decisions).

We recommend a RfR of -1.1 to 1.5 per cent for RP3 based on both long-run and current market evidence

We have updated the estimate for RfR under the two general approaches: i) long-run historical averages, and ii) short-run market evidence.

---

5 We note that in its 2018 decision, Ofcom has decided not to lower the real TMR in current low RfR environment, citing there is no clear evidence of TMR changing since previous review in 2016. Source: Ofcom (March 2018): Wholesale Local Access Market Review: Statement, Annexes 17-27, p.105, para A20.110. Also, Ofcom has historically estimated a relatively low real-RPI TMR, partly because Ofcom sets a nominal cost of capital and has used a relatively high inflation assumption compared to the CMA decision.

6 Ofwat (December 2014): Final price control determination notice: policy chapter A7 – risk and reward, p.41.

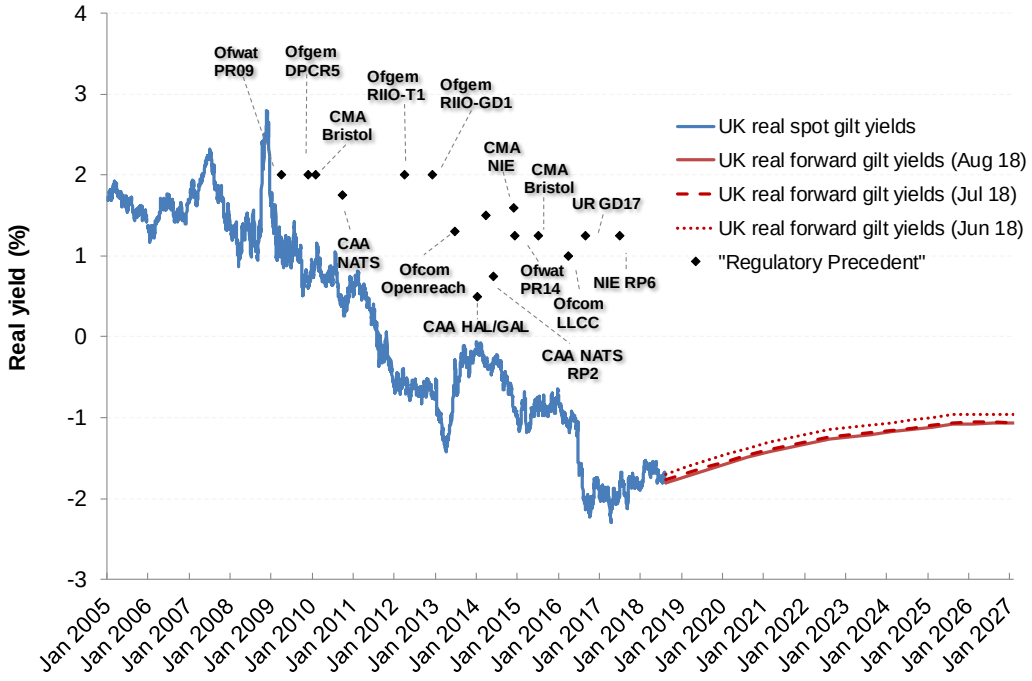
7 CMA (March 2014), NIE Limited price determination, p. 13-39, Table 13.11 and CMA (October 2015), Bristol Water plc, A reference under section 12(3)(a) of the Water Industry Act 1991, Report, p332, para 10.186.

8 We consider forward looking evidence should be treated with caution, given the relative sensitivity of the results to the long-term dividend growth assumption. Therefore, we only use forward-looking estimates as a cross-check. We discuss this evidence in further detail in our November report prepared for National Grid. See link below: http://www.nera.com/content/dam/nera/publications/2017/171103_TMR_report_NERA.PDF.

Long-run estimates of the RfR based on UK government bonds yields as calculated by DMS over the period 1900-2017 suggest a long-run RfR estimate for the UK of 2.4 per cent.[9]

The short-run market evidence shows that the current UK 10Y government yields are around -1.7 per cent in real terms as in August 2018, and forward rates indicate that the market expects these yields to increase to -1.1 per cent up to the mid-point of the RP3 period (shown in Figure 2.1 below). We estimate the short-run risk free rate by taking the 1-month average yield on UK 10-year gilts, adding a forward rate adjustment for the expected increase in yields from today up to the mid-point of RP3, and then deflating by HM Treasury Consensus forecasts of RPI for 2022.[10]

Figure 2.1: Forward rate evidence supports expected increase in gilt rates during RP3



Source: NERA analysis of Bloomberg data, Bank of England data and regulatory precedent, cut-off date 10 August 2018.

Based on the above evidence, our updated RfR range is at -1.1 to 1.5 per cent. Our upper end of the range places greater weight on long-run evidence to avoid setting the allowed rate of return which varies with the business cycle which contributes itself to co-variant risk, as well as regulatory risk.[11] Our upper end of RfR range remains at 1.5 per cent, given there is no update to the regulatory evidence, as shown in Figure 2.1 and our March report.[12] We

9 Calculated based on DMS bond returns data, adjusted post 1988 deflated using RPI inflation. See footnote 2 for details.

10 The 1-month average 10-year UK gilt yield is 1.41% and the increase in yields on the same bond up to the mid-point of RP3 is 63bps. We deflate the sum of these two estimates by the average of HM Treasury consensus forecasts of RPI for 2022 of 3.2%.

11 Our 20 March 2018 report Table 2.3 shows that in recent times, UK regulators have left comfortable margins in their risk-free rate estimates above spot rates.

12 NERA (20 March 2018): The Weighted Average Cost of Capital for NATS (En-Route) plc at RP3, A Report for NATS, p.7.

consider -1.1 per cent a plausible lower bound for the real risk-free rate in the current macro environment, given the current real interest rate lies below zero.

Table 2.3 summarises our recommendations on the TMR and how this should be decomposed between the RfR and ERP components. We set out our response to the CAA's comments on RfR in Section 4.2.2.

Table 2.3
NERA Range on TMR, Risk-free Rate and ERP

	Short-run market evidence	Regulatory precedent on RfR
Risk-free Rate	-1.1%	1.5%
Equity Risk Premium	7.6%	5.6%
Total Market Return	6.5%	7.1%

Source: NERA analysis

2.2. Beta

We estimate an asset beta in the range of 0.56 to 0.66, based on a relative risk assessment for NERL compared to international listed airports

In our March 2018 report, we estimated NERL's asset beta in the range of 0.55-0.60 for RP3 based on a relative risk assessment against listed international airports. We did not consider Heathrow or Gatwick as appropriate benchmarks for NERL, since the asset beta for Heathrow and Gatwick cannot be directly observed and estimating asset beta for NERL based on asset beta for Heathrow and Gatwick will only introduce additional estimation errors. The more appropriate approach is to directly compare NERL to the listed international airports.

We have updated empirical asset beta estimates for UK regulated utilities and international airports.

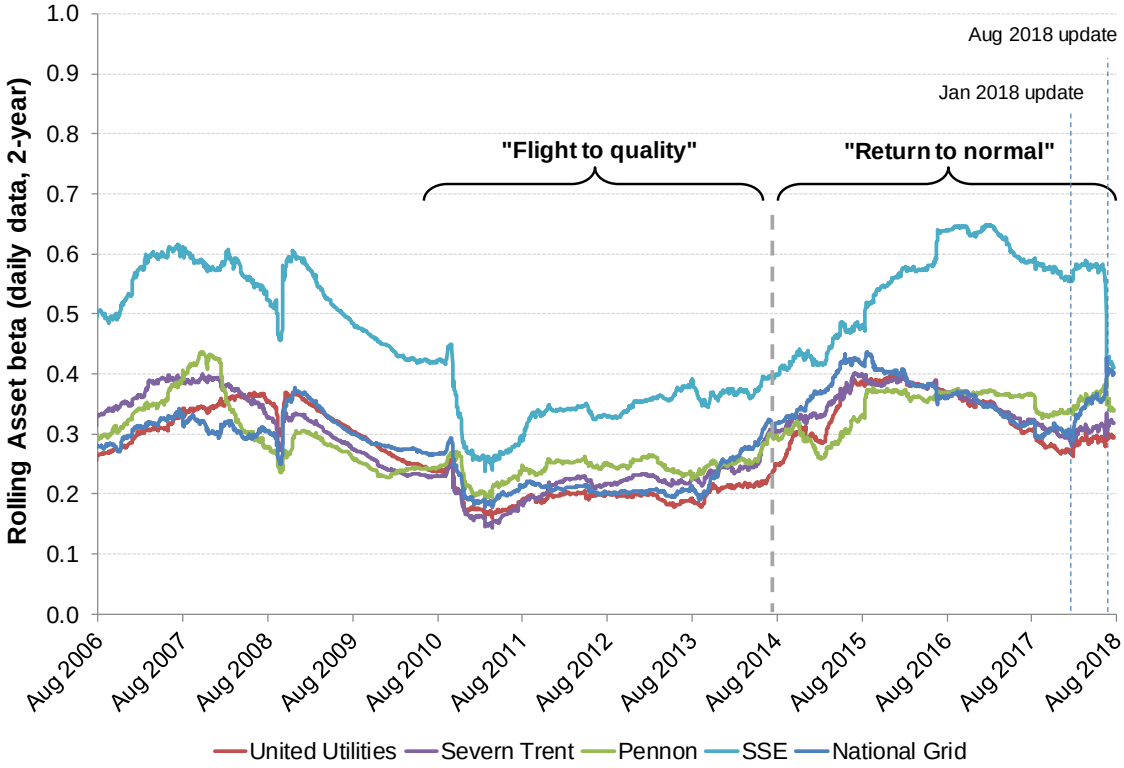
Since our last report, asset betas for UK regulated utilities comparators (excluding SSE) against the FTSE All Share have slightly increased, implying an increase in the lower bound for NERL's beta.

Figure 2.2 shows rolling asset beta estimates for UK utilities. UK utilities asset betas have declined following the financial crisis due to higher market volatility relative to the regulated utilities' volatility, and reduced correlation. Since around 2014, the betas for regulated utilities have been returning to "normal" (pre-global financial crisis) levels as correlation with the market and relative (absolute) risk are trending back to normal levels. Since our last report, the two-year asset betas for UK Utilities comparators (excluding SSE) against the FTSE All Share have slightly increased, reflecting the increased stock volatilities of regulated companies relative to the market index. By contrast, SSE's asset beta shows a steep reduction, which could be attributed to the effect of the dates around Brexit referendum falling out of the sample.[13]

[13] This does not affect NERL's beta, since we do not consider UK utilities to be suitable beta comparators for NERL. We note that this steep reduction of beta following Brexit referendum data falling out of sample is also observed in several

Since betas for regulated companies tend to be correlated, and NERL continues to face more volume risk than UK regulated utilities under its volume risk sharing arrangement, the recent increase in the asset beta for regulated utilities implies an increase in the lower bound for NERL's beta.

Figure 2.2
2Y Rolling Asset Betas for UK Listed Utilities



Source: NERA analysis of Bloomberg data; Note: Estimates based on data up to 10 August 2018.

The average 2Y asset beta for the international airports has increased since our last report, likely due to the increasing stock volatility relative to the market volatility.

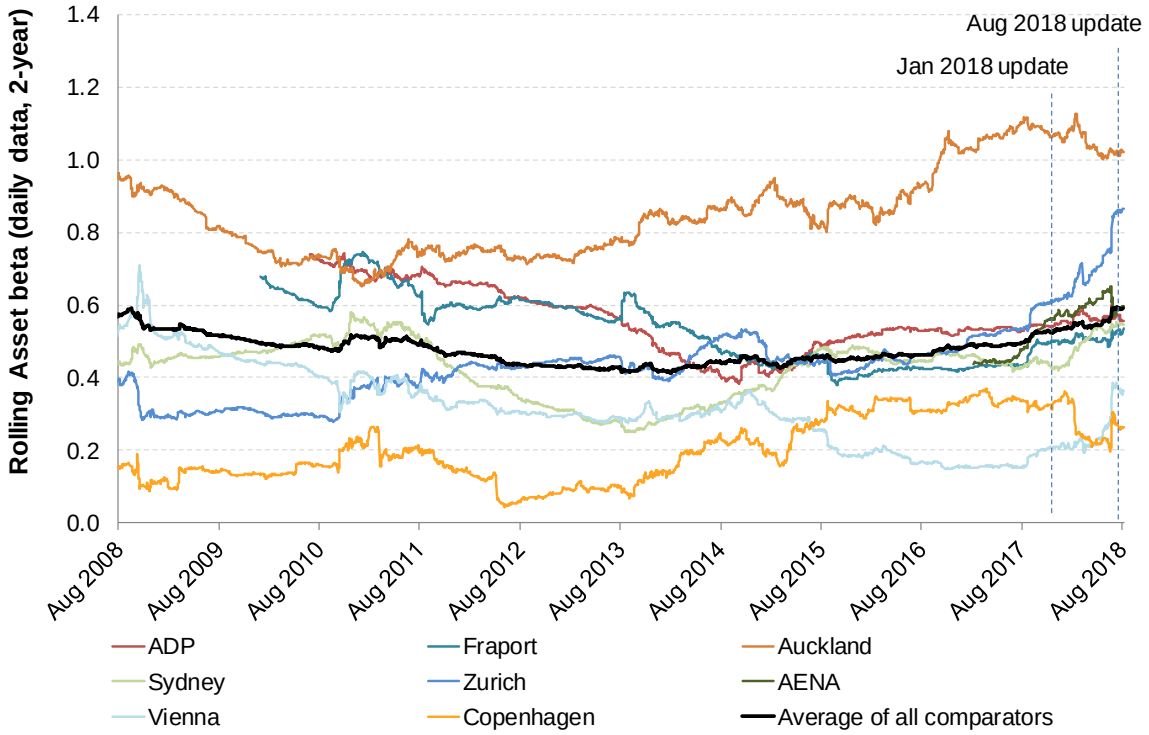
We have updated empirical asset betas for international listed airports using the latest available data up to 10 August 2018. Figure 2.3 shows that the asset beta for international listed airports has also exhibited the post-crisis "flight to quality" and recent "return to normal" trend, suggesting that investors also perceive airports as "defensive stocks" similar to UK regulated utilities.

Table 2.4 presents current asset beta estimates for international airports for different estimation windows. As shown in the table, both 2Y and 5Y average asset beta have increased since our last report in January 2018. The average 2Y asset beta for the

other UK companies. We also note that SSE, unlike traditional utilities, has a large proportion of generation and non-regulated activities, and could be perceived to be relatively riskier compared to regulated utilities during market uncertainties. This could partially explain the difference in asset beta evolution between SSE and the traditional utilities.

international airports is 0.59, reflecting an increase in asset beta for most of international airport comparators, which appears to be attributed to the increasing stock volatility relative to the market volatility.[14]

Figure 2.3
2Y Rolling Asset Betas for International Airports



Source: NERA analysis of Bloomberg data; Note: Estimates based on data up to 10 August 2018.

[14] Compared to our last report, the 2Y asset beta for ADP, Fraport, Zurich, Vienna, Sydney, and AENA have increased, whereas 2Y asset beta for Copenhagen and Auckland have declined. In our decomposition of the equity beta, we find that all the international airport comparators that have higher beta have shown higher stock volatility relative to market volatility.

Table 2.4
Asset Beta Estimates for International Airports

	NERA March 2018 report		NERA August 2018 update	
	2Y asset beta (t-statistic)	5Y asset beta (t-statistic)	2Y asset beta (t-statistic)	5Y asset beta (t-statistic)
ADP (Paris)	**0.55**	**0.51**	**0.56**	**0.52**
	(12.54)	(19.11)	(7.97)	(19.04)
Fraport (Frankfurt)	**0.50**	**0.44**	**0.54**	**0.46**
	(8.92)	(14.42)	(6.66)	(14.57)
Zurich	**0.63**	**0.50**	**0.86**	**0.54**
	(13.67)	(18.51)	(13.59)	(19.84)
Vienna	**0.22**	**0.22**	**0.36**	**0.22**
	(3.11)	(5.96)	(4.19)	(6.01)
Copenhagen	**0.33**	**0.31**	**0.26**	**0.30**
	(4.41)	(7.41)	(2.53)	(7.24)
Sydney	**0.44**	**0.43**	**0.55**	**0.47**
	(6.79)	(12.28)	(6.95)	(12.76)
Auckland	**1.08**	**0.98**	**1.01**	**0.97**
	(0.57)	(17.35)	(12.40)	(17.46)
AENA	**0.57**	**-**	**0.59**	**-**
	(11.68)		(8.61)	
Average	**0.54**	**0.48**	**0.59**	**0.50**

Note: The asset beta for ADP and Fraport are calculated by de-levering their equity betas using their book gearing instead of the gearing published by Bloomberg. The gearing published by Bloomberg does not take account of all cash and cash-type instruments, which we understand makes a particularly significant difference for the beta estimates for Fraport and ADP. Therefore, for these two airports, we have used the net debt from the accounts to de-lever the equity betas. We use a 0.05 debt beta assumption. We note that all beta estimates are statistically significant at the 5% confidence level, as the t-statistics are above 1.96 threshold, assuming returns are normally distributed.

Source: NERA analysis of Bloomberg data up to 10 August 2018; the information date for March 2018 report is 19 January 2018.

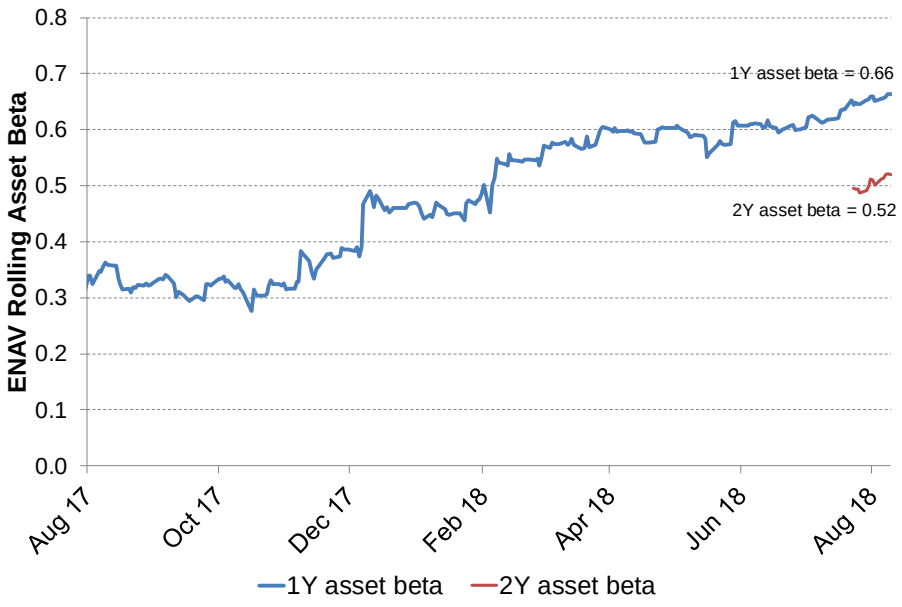
We estimate ENAV's asset beta range to be 0.52 to 0.66 based on 1Y and 2Y estimation windows, broadly consistent with NERL's asset beta range based on the international airports comparators.

We have also considered whether ENAV, the only listed ANSP in the world, could be a useful beta comparator for NERL, since both ENAV and NERL operate under a common regulatory framework. We consider that while ENAV is a useful beta comparator for NERL, ENAV's beta estimate should be treated with caution, and adjusted to take into account the key differences between ENAV and NERL when used as a reference point for NERL's beta. As we explain below, the differences between ENAV and NERL indicate that ENAV's beta may underestimate NERL's beta.

ENAV was listed in July 2016 and now has 2 years of data, which is just enough to calculate 2Y asset beta. As shown in Figure 2.4, ENAV's 2Y asset beta is currently at around 0.52, and ENAV's 1Y asset beta is around 0.66. In addition, ENAV's asset beta has been

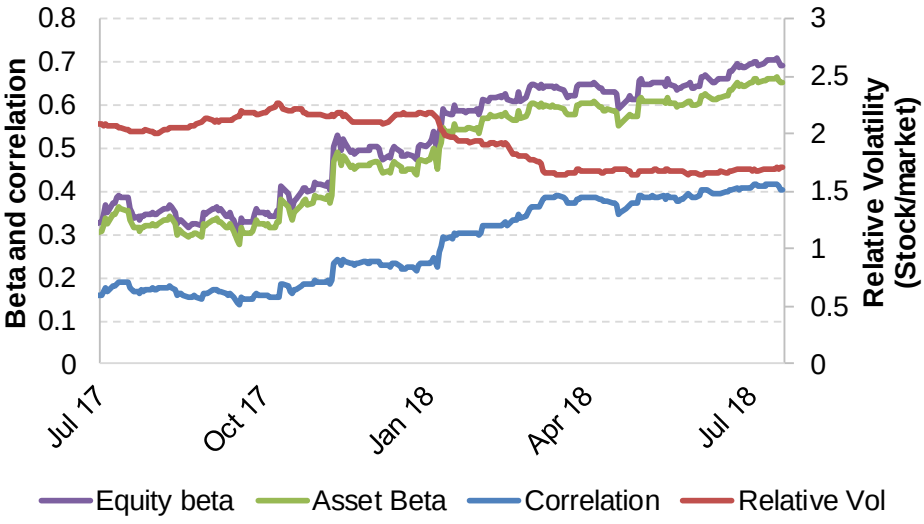
increasing since its initial listing. Figure 2.5 shows the decomposition of ENAV's 1Y asset beta indicates that the ENAV's correlation with the market index has been on a persistent rising trend, which has resulted in its 1Y asset beta increasing from 0.33 to 0.66. If this rising trend continues, ENAV's 2Y asset beta will likely be within our proposed asset beta range. Given the relatively short record of ENAV's 2Y asset beta and its current rising trend in correlation, we estimate ENAV's asset beta range to be 0.52 to 0.66 based on the 1Y and 2Y estimation window, broadly consistent with the 2Y asset beta range estimated for the international airport comparators.

Figure 2.4: ENAV 1-Year and 2-Year Rolling Asset Beta



Source: NERA analysis using Bloomberg data up to 10 August 2018

Figure 2.5: ENAV's beta and correlation have been rising quickly



Source: NERA analysis using Bloomberg data up to 10 August 2018

In our March 2018 beta report[15], we have analysed the differences between ENAV and NERL, which indicates that ENAV's beta may underestimate NERL's beta. We found that ENAV was exposed to more upside traffic risk to NERL, which means investors will demand less of a premium for investing in ENAV relative to a company that is less exposed to asymmetric upside risk like NERL. Also, ENAV's customer mix may be less sensitive to changes in the economy than NERL's customer mix, since it is more dependent on low cost carriers whose demand is less likely to drop when there is a downturn.[16] In addition, there is empirical evidence showing that betas for Italian listed utilities appears to be lower than betas for equivalent utilities in other countries, suggesting there may be certain specific features in the Italian market that suppress the beta estimates. For example, political risks in Italy may suppress betas of Italian companies, which mean their betas are an underestimate of the betas for companies in countries where there is no such political risk.[17]

Drawing on the international airport comparators' estimates, together with the relative risk assessment on NERL's exposure to traffic risk and effect of operating leverage in our March 2018 report, we estimate the following range for the asset beta:

- A lower bound of **0.56**, equal to ADP's 2-year asset beta: ADP's beta estimate represents a suitable lower bound for NATS because it is partially protected from traffic risk under its regulatory regime, similar to the way NERL is. Given NERL's high operational leverage, we would expect NERL's beta to be above ADP's.
- An upper bound of **0.66**, equal to the average 2-year beta for all international listed airports, with less weight on the less similar airport comparators, such as Copenhagen, Fraport and Vienna. [18] Copenhagen and Vienna are exposed to less traffic risk than NERL because these airports negotiate their charges directly with their customers and in this way are able to mitigate traffic risk to a greater extent. Fraport is lower risk because it operates in a regime where it can call a 'rate case' to amend its prices at any time, for example if traffic risk is greater than it expected.

Our final asset beta range is at 0.56 to 0.66[19], higher than our asset beta range in March report of 0.55-0.60, reflecting an increase in international airport comparators' asset beta. This is higher than the CAA's asset beta estimate of 0.505 for RP2, reflecting i) the increase in listed airport asset betas since RP2, ii) NERL's higher operating leverage than its peer group, which the CAA did not adjust for at RP2. As shown in our March 2018 report, NERL's operating cost elasticity does not mitigate the impact of demand shocks under its traffic risk sharing mechanism for realistic levels of demand shocks, and the CAA is likely to underestimate NERL's beta if failing to adjust for NERL's operating leverage. ENAV's asset beta range of 0.52 to 0.66 based on the 1Y and 2Y estimation window also broadly supports our final asset beta range, even before any adjustments for the differences in relative risks.

---

15 NERA (7 March 2018): NERL's Asset Beta for RP3, a Report for NERL.

16 NERA (7 March 2018): NERL's Asset Beta for RP3, a Report for NERL, page 41 - 42.

17 NERA (7 March 2018): NERL's Asset Beta for RP3, a Report for NERL, page 38 - 40.

18 Our upper bound of 0.66 reflects the weighted average 2Y asset beta of international listed airports in Table 2.4, with less weight (25% weight) on the less suitable comparators, namely Fraport, Vienna, and Copenhagen. We discuss our rationale in detail in our March WACC report for NERL, p.12-13, and March asset beta report for NERL, p.19-20.

19 This is based on a 0.05 debt beta assumption.

Finally, we note that our current range of NERL's asset beta assumes that the RP2 regulatory framework will continue in RP3. We will reconsider our estimated range to reflect NERL's risk exposure under the RP3 regulation, as regulatory uncertainty could increase investors' required rate of return, particularly if risks are skewed towards the downside or if investors can benefit from waiting to undertake new investments once the uncertainties resolve.

2.3. Cost of Debt

We estimate a real cost of debt of 1.08 per cent, taking account of NERL's embedded costs and forecast costs of new debt for RP3

We apply a weighted average approach to estimating the cost of debt at RP3, in line with the CAA's approach at RP2.

We estimate a real cost of embedded debt of 2.1 per cent for RP3, slightly lower than our estimate of 2.2% in the March report, reflecting an increase of inflation forecast from 3.15 per cent to 3.2 per cent.[20] This is based on NERL's bond's nominal yield at issuance of 5.4 per cent, which is unchanged since RP2 because NERL has not issued any other bonds since, deflated by a 3.2 per cent inflation forecast[21] using the Fisher formula.

For the cost of new debt, we estimate NERL's nominal cost of new debt based on the 1-month average yield of NERL's bond of 1.73 per cent (nominal)[22], plus forward market evidence that shows yields are expected to increase by 63 bps[23] during RP3 as UK interest rates rise. The updated 1-month average yield of NERL's bond is higher compared to 1.55 per cent (nominal) in our March report, whereas the expected interest rate increased based on forward market evidence is lower compared to 78 bps in our March report.

We also adjust NERL's cost of new debt for the:

- Term premium: We have adjusted the yield upward by 78 bps to reflect the fact that NERL's sinking fund bond effective maturity is currently around five years, and NERL is more likely to issue at a longer maturity in RP3, in line with its original issuance.
- Notice period premium: From March 2021 the CAA could give NERL 10 years' notice to terminate NERL's licence. The possibility that the CAA could issue this notice during RP3 could influence NERL's credit rating during RP3, and result in its cost of debt on new debt issuances increasing. Europe Economics estimated that NERL's termination notice period could result in its cost of debt increasing by 50 bps.[24]

Taking account of the above adjustments, we estimate a nominal cost of new debt of 3.64 per cent, based on the sum of the current yield on NERL's bond of 1.73 per cent, the forward rate

[20] HM Treasury (August 2018): Forecast for the UK economy, a comparison of independent forecasts, p20. HM Treasury (November 2017): Forecast for the UK economy, a comparison of independent forecasts, p18.

[21] HM Treasury (August 2018): Forecast for the UK economy, a comparison of independent forecasts, p20.

[22] The information date for our analysis is 10 August 2018.

[23] The 1-month average 10-year UK gilt yield is 1.41% and the increase in yields on the same bond up to the mid-point of RP3 is 63bps. Information date is 10 August 2018.

[24] Europe Economics (September 2015): "Implications for debt-raising and the cost of debt of changing the minimum termination notice period for NERL's licence".

uplift of 0.63 per cent, the term premium of 0.78 per cent and the notice period premium of 0.50 per cent. This translates into an estimated real cost of new debt of 0.42 per cent, assuming an inflation forecast of 3.2 per cent (HM Treasury's most recent inflation forecast for 2022).

Our overall cost of debt is therefore 1.08 per cent, based on a 70 per cent weight on new debt according to NERL's projections for RP3 and a transaction cost allowance of 15 bps. Our updated cost of debt estimate is slightly lower than our estimate of 1.11 per cent in the March report[25].

[25] NERA (20 March 2018): The Weighted Average Cost of Capital for NATS (En-Route) plc at RP3, A Report for NATS, p.23-24.

3. Impact of changes in RP3 regulation on NERL's cost of capital

In this section, we review the potential impact of the European Commission's ("the Commission") proposals on its Single European Sky regulations for RP3, and examine how the changes in the performance and charging scheme will affect NERL's cost of capital.

In August 2018, the European Commission published a draft proposal[26] to revise its Single European Sky (SES) performance and charging schemes for RP3. The Commission's draft regulation proposes several changes to the existing RP2 regulations No.390/2013[27] and No.391/2013[28], which could lead to higher risks for NERL in RP3. We identify the main changes below:

- The capacity incentive scheme introduces a higher cap for penalties than for bonuses, which could lead to greater downside risk and tail risks for NERL compared to RP2[29];
- The traffic risk sharing threshold is raised from 10 to 15 per cent, which could increase NERL's risk exposure[30]; and
- The traffic forecast is required to be based on Eurocontrol's Statistics and Forecast Service "STATFOR" base forecast, without any provision for alternative forecasts.[31] This could potentially increase risks if NERL's forecast is more accurate and has lower forecasting error than STATFOR's forecast.

Our analysis is based on current information on the European regulatory framework and the performance targets that NERL expects to be incentivised against. It will be necessary to revisit the analysis when the European RP3 regulations and NERL's performance targets are known.

We note that the regulatory uncertainty and the potentially increased downside risks could increase investors' required rate of return, and as a result the cost of capital for NERL. In the following sections, we summarise the proposed regulatory changes and qualitatively assess the potential implications for NERL.

3.1. Proposed changes to the incentive scheme

For the incentive scheme, we find that the proposed RP3 regulation introduces an asymmetric incentive scheme in the key performance area of capacity, with a higher cap on the penalties than bonuses, which could lead to greater downside and tail risks for NERL.

---

26 European Commission (2018): Commission implementing regulation (EU) …/… laying down a performance and charging scheme in the Single European Sky and repealing Implementing Regulations (EU) No 390/2013 and (EU) No 391/2013.

27 European Commission (3 May 2013): Commission implementing regulation (EU) No 390/2013 of 3 May 2013 laying down a performance scheme for air navigation services and network functions.

28 European Commission (3 May 2013): Commission implementing regulation (EU) No 391/2013 of 3 May 2013 laying down a performance scheme for air navigation services and network functions.

29 European Commission (2018) RP3 regulation, Article 11, para 3, page 19.

30 European Commission (2018): RP3 regulation, Article 27, para 2-4, page 33-34.

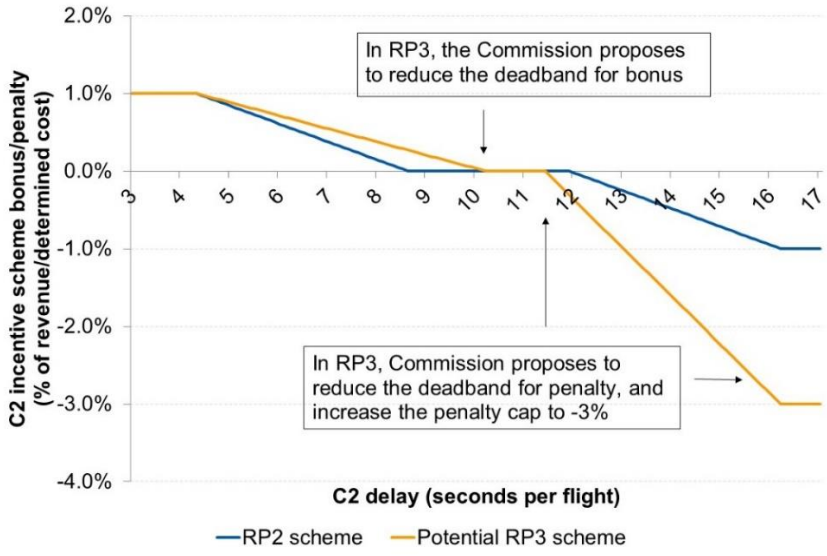
31 European Commission (2018): RP3 regulation, Article 10, para 2(f), page 16.

Under the RP2 regulation, NERL may receive financial incentives in the key performance area of capacity the bonuses and penalties for capacity is limited to 1 per cent of the revenue from air navigation services in year n.[32]

Under the Commission's revised draft SES regulations for RP3, the Commission proposes to set an asymmetric cap for bonuses and penalties, with bonuses capped at 1 per cent and penalty capped at 3 per cent of the determined cost of year n+2. [33] In addition, the proposed incentive scheme appear to reduce the deadband where NERL receives no bonuses or penalties. The proposed deadband is equal to reference value +/- 0.01 minute, which is narrower compared to the 80 to 110 per cent of reference value in RP2. The reference value is proposed to adjust each year to reflect the latest projections in the Network Manager's Network Operations Plan.

Figure 3.1 compares the change in the C2 capacity incentive scheme. For illustration, we have assumed that the RP3 reference values and lower/upper bound for the C2 incentive scheme remain unchanged from RP2. As shown in the figure, under the proposed capacity incentive scheme, NERL will face a smaller deadband for both bonuses and penalties, and higher penalty cap and incremental penalty rate, which could lead to greater tail risk in capacity incentive. Figure 3.2 illustrates that the revised regulation implies an asymmetric distribution with a decreased expected mean value and negative skewness, as well as greater downside risk and tail risks for NERL.

Figure 3.1: Illustration of RP2 and potential RP3 incentive scheme for capacity

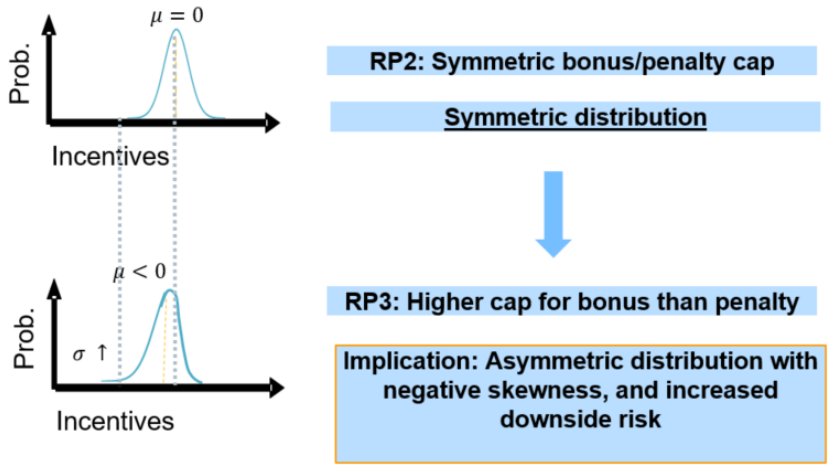


Source: NERA analysis of the RP2 and RP3 incentive scheme.

[32] Commission implementing regulation (EU) No 391/2013 of 3 May 2013 laying down a performance scheme for air navigation services and network functions, Article 15, para1, page 40.

[33] European Commission (2018): RP3 regulation, Article 11, para 3, page 19.

Figure 3.2: NERL could face higher risk around incentives schemes due to potential increase in cap for penalties in RP3



Source: NERA illustration

3.2. Proposed changes to the traffic risk sharing

For traffic risk sharing, the revised proposal increases NERL's traffic risk sharing threshold from 10 per cent to 15 per cent, which increase NERL's risk exposure. The proposal also allows the CAA to have the option to set the parameters of the traffic risk sharing mechanism in an asymmetric manner[34], which can potentially increase NERL's asymmetric downside risks.

Under the RP2 regulation, NERL is exposed to 4.4% revenue risk in total[35] under the following traffic risk sharing mechanism: [36]

- Between 0 and 2 per cent traffic variation, NERL bears all of the associated revenue risk;
- Between 2 and 10 per cent traffic variation, NERL bears 30 per cent of the risk; and
- Greater than 10 per cent traffic variation, NERL bears no risk.

Under the proposed changes to the SES regulatory framework, the proposed change to the traffic risk sharing mechanism is as follows:[37]

- Between 0 and 2 per cent traffic variation, NERL bears all the risk;

[34] European Commission (2018): Commission implementing regulation (EU) …/… laying down a performance and charging scheme in the Single European Sky and repealing Implementing Regulations (EU) No 390/2013 and (EU) No 391/2013, Article 27, para 5, page 34.

[35] The 4.4% revenue risk under RP2 regulation is calculated as the sum of 100% of the 0-2% traffic variation and 30% of the 2-10% traffic variation.

[36] The Article 13 of Implementing Regulation (EU) No 391/2013 sets out the traffic risk sharing arrangement for air navigation service providers for the RP2 period. European Commission (3 May 2013): Commission implementing regulation (EU) No 391/2013 of 3 May 2013 laying down a performance scheme for air navigation services and network functions, Article 15, para.1. page 40.

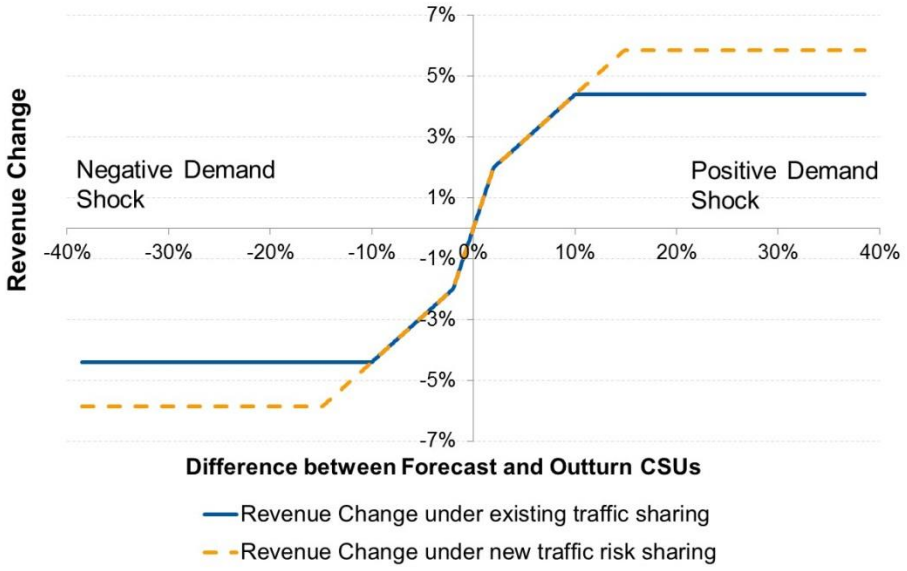
[37] European Commission (2018): RP3 regulation, Article 27, para 2-4, page 33-34.

- Between 2 and 15 per cent traffic variation, NERL bears 30 per cent of the risk; and
- Greater than 15 per cent traffic variation, NERL bears no risk.

Under the proposed RP3 traffic risk sharing mechanism, NERL is exposed to 5.9% revenue risk in total[38], which is 1.5% higher than that of RP2.

Figure 3.3 shows the higher risk exposure faced by NERL due to the increase in the traffic risk sharing threshold from 10 per cent to 15 per cent. As shown in the figure, under the new proposed traffic sharing scheme, NERL will have to bear 30 per cent of the risk in the event of a negative demand shock that is between 10 and 15 per cent. Figure 3.4 illustrates the wider distribution for NERL's demand risk under the proposed changes to the traffic risk sharing in RP3.

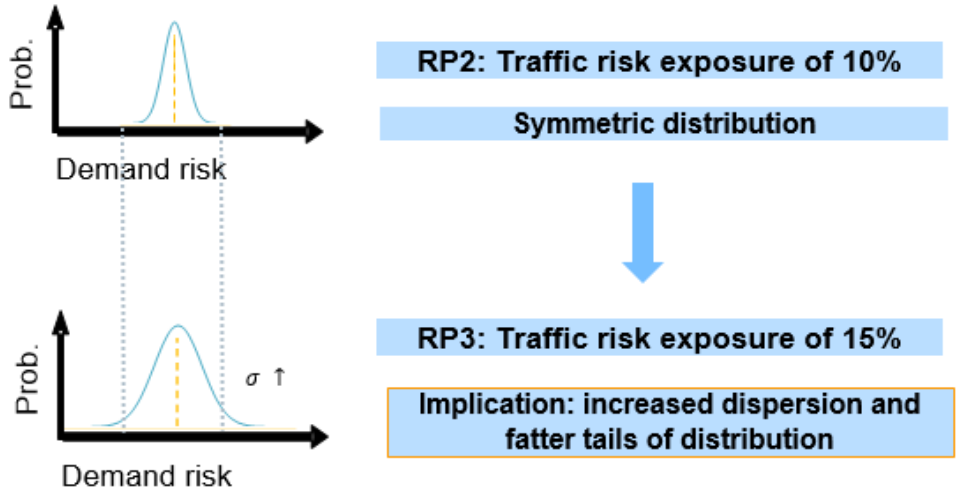
Figure 3.3
Relationship between Demand Shocks and their Impact on NERL's Revenues



Source: NERA illustration

[38] The 5.9% revenue risk under RP3 regulation is calculated as the sum of 100% of the 0-2% traffic variation and 30% of the 2-15% traffic variation.

Figure 3.4: Illustration of the implications of traffic risk sharing changes



Source: NERA illustration

3.3. Proposed changes to traffic forecast

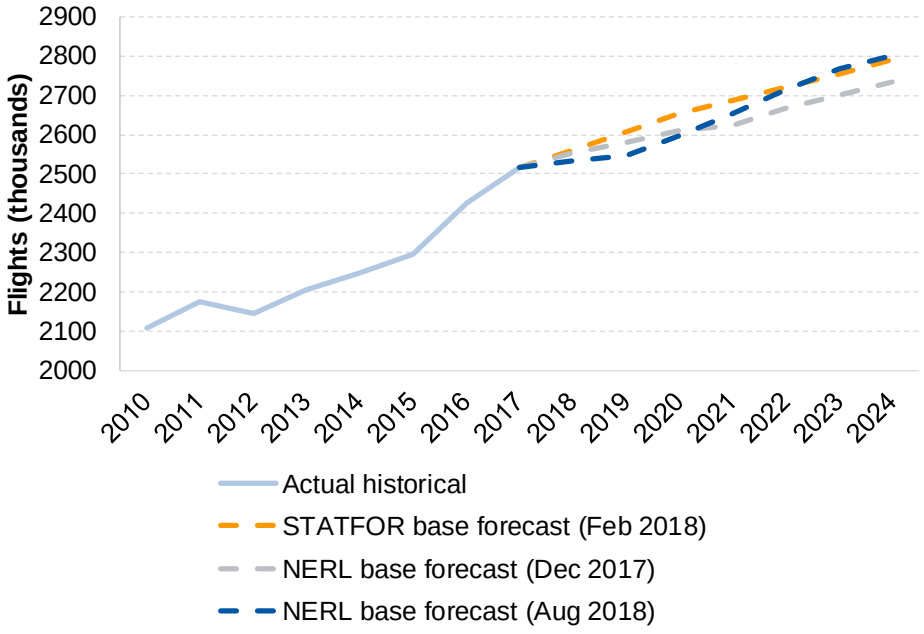
The proposed RP3 regulation requires that the *en route* traffic forecasts for the performance plans shall be based on the Eurocontrol's STATFOR base forecast, with no provision of using alternative traffic forecast.[39]

In principle, we consider that the National Supervisory Authorities (NSAs) should be allowed to have the option to consider the Air Navigation Service Providers' (ANSPs) own traffic forecast, instead of solely having to rely on STATFOR's forecast. The ANSPs, such as NERL, have extensive knowledge and expertise in local traffic conditions, and could provide valuable information in forming the basis for planning. The option for the NSAs to evaluate different evidence of traffic forecasts mitigates the risk of relying on a single forecast source, which could potentially have high forecasting errors. We show below that NERL's forecasts have been historically more accurate than STATFOR's, which means that NERL's forecast could be the better basis for planning for the UK. Therefore, we consider that the proposed mandatory use of STATFOR forecast could potentially increase the risk for NERL and the required return for investors.

Figure 3.5 and Figure 3.6 compares the latest UK flight and total service unit forecasts by STATFOR (February 2018) and NERL (December 2017 and August 2018). On average, the STATFOR February 2018 forecast projected around 0.5 per cent more flights, and 1.7 per cent more total service units compared to NERL's August 2018 forecast for UK over RP3.

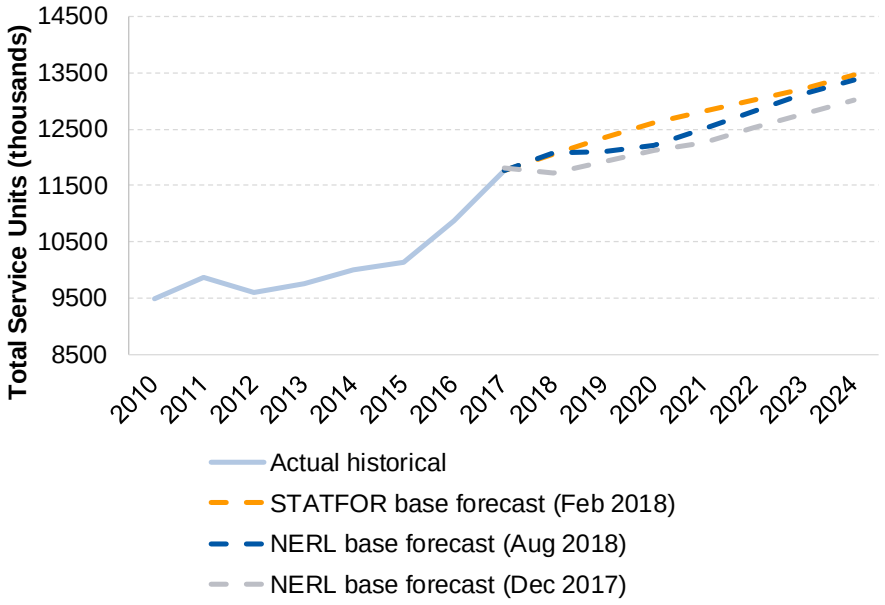
[39] European Commission (2018): RP3 regulation, Article 10, para 2(f), page 16.

Figure 3.5: STATFOR and NERL latest forecasts for UK flight over RP3



Source: NERA analysis based on data from Eurocontrol STATFOR and NERL.

Figure 3.6: STATFOR and NERL recent forecasts for UK total service units



Source: NERA analysis based on data from Eurocontrol STATFOR and NERL.

We understand that a main difference between STATFOR's February 2018 and NERL's December 2017 forecasts for UK flights is the assumption of how the failure of Monarch Airlines and Ryanair's cancellations and cutting capacity in winter of 2017/18 would affect future UK traffic. STATFOR's traffic forecast assumes a full recovery during the summer

2018 schedule of the traffic losses of the winter 2017/18,[40] whereas NERL's forecast assumes that the traffic would slow down in the near-term generally. STATFOR also projects that military and civil-exempt flights grow at the same rate as other flights, whereas NERL's forecast assumes that these flights will remain relatively constant, reflecting historical trends. STATFOR's higher forecast for flights also leads to a higher forecast for total service units than NERL's. In addition, STATFOR's latest forecast assumes a continuing growth in total service units based on recent traffic flows in North Atlantic tracks, whereas NERL considers that the recent strong growth in North Atlantic track is likely to return to normal. Overall, these factors lead to circa 4 per cent difference between STATFOR's and NERLs latest total service units forecast for RP3.

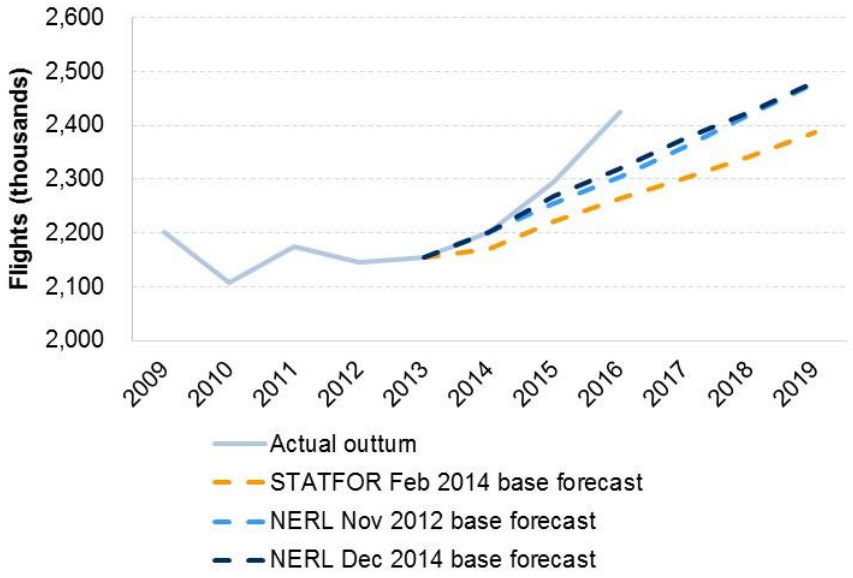
NERL's August 2018 flights forecast is lower than the December 2017 flights forecast until the end of RP2. We understand this is because some of the growth forecast for 2018 did not materialise, and because the underlying economic parameters have been updated to reflect the effects of Brexit uncertainty. However, between 2018 and 2024, the August 2018 TSU forecast is higher than the December 2017 TSU forecast. This is because there has been stronger TSU growth in 2018 than expected, due to the position of the North Atlantic tracks. Over RP3, NERL's August 2018 flights and TSU forecast is above the December 2017 flights and TSU forecast. We understand this is caused by higher airport growth assumptions and lower growth in 2018/2019 (leading to faster growth in RP3) compared to the December 2017 forecast.

To evaluate the accuracy of STATFOR's and NERL's forecasts for RP3, we review the evidence on historical forecasting accuracy. We compare STATFOR's February 2014 forecast for flights to the nearest NERL's forecasts of November 2012 and December 2014, as shown in Figure 3.7. We find that NERL's average forecasting error for both forecasts were around 2 per cent lower than STATFOR's forecast made in February 2014, which means that NERL's forecasts for RP2 have been more accurate than STATFOR's.[41] We perform the same analysis with STATFOR's forecast made in September 2015, which was updated to a higher traffic projection compared to its 2014 forecast. However, compared to NERL's forecast made in December 2014 and December 2015, STATFOR's forecasting error is circa 1 per cent greater than NERL's. Therefore, we consider that NERL's flight forecasts have been historically more accurate than STATFOR's, which indicates that NERL's forecast is the better basis for planning for the UK.

[40] EUROCONTROL (February 2018): Seven-Year Forecast, Flight Movements and Service Units 2018 – 2024, p.35.

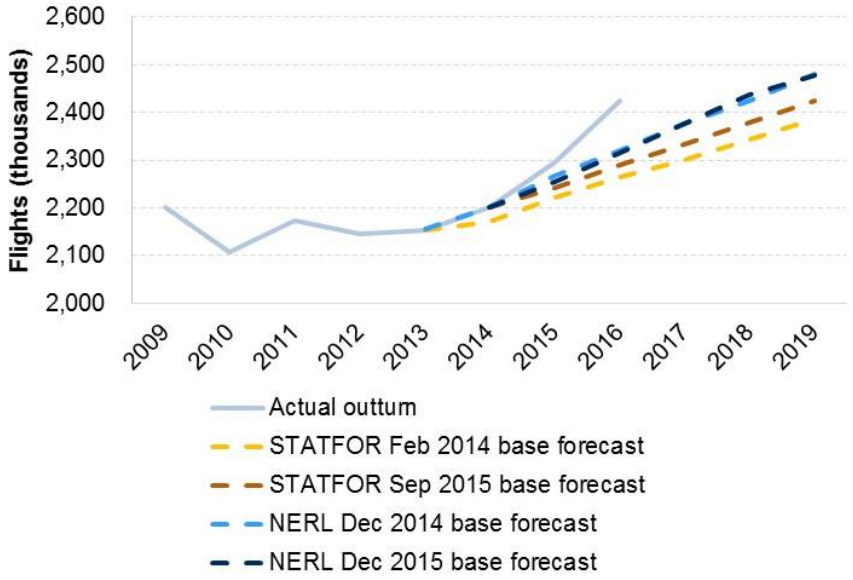
[41] We calculate the forecasting error as the percentage difference between forecast and outturn actual data.

Figure 3.7: Comparison of STATFOR's February 2014 forecast and NERL's forecasts



Source: NERA analysis of data from NERL and STATFOR

Figure 3.8: Comparison of STATFOR's September 2015 forecast and NERL's forecasts



Source: NERA analysis of data from NERL and STATFOR

3.4. Estimation of impact on cost of capital

In this section, we set out our methodology to estimating the impact of the proposed changes to capacity incentive schemes and traffic risk sharing in the RP3 regulation on NERL's cost of capital. We first explain our general approach, and then set out our estimates of the impact based on Monte Carlo simulation of the risk factors.

We consider that the proposed changes to the incentive schemes and traffic risk sharing may affect NERL's cost of capital through two channels:

- First, the proposed changes in RP3 regulation may reduce NERL's expected rate of return on equity. As a result, NERL will require a higher allowed cost of capital in order to achieve the same expected return on equity as per RP2 arrangements.
- Second, NERL's risk distribution may have longer tails and greater downside risks due to the regulatory changes. This may put pressure on NERL's credit metrics and may lead to a lower credit rating. If so, NERL's cost of debt allowance and allowed cost of capital will need to increase to reflect the weaker rating.

We assess the impact on NERL's cost of capital using the following method:

- We identify the key risks that NERL is expected to face during RP3, including the expected changes in the regulation described in sections above;
- For each of the identified risk factors, we construct a risk distribution, e.g. an expected value and a standard deviation around the expected value;
- We conduct Monte Carlo simulations using the defined distribution for each risk, and NERL's financial model to calculate distribution of the financial ratios; and
- We examine the distribution of the simulated financial ratios both with and without the expected regulatory changes to estimate the net impact on NERL's cost of capital.

Below, we consider the impact of the proposed changes to RP3 regulation independently, holding the other regulation regime unchanged.

At this stage, we have not attempted to quantify the impact of mandatory STATFOR forecasts on NERL's cost of capital. Since the latest NERL forecast is made in August 2018, while the latest STATFOR forecast is made in February 2018, the underlying assumptions relate to two different points in time that are six months apart. The estimated impact on RoRE based on these forecasts would reflect not only the difference in forecasting methodology and assumptions, but also the information gap between the two forecasts. Therefore, we consider it more appropriate to compare NERL's August 2018 to the STATFOR forecast at September 2018, once it becomes available. We will then apply this methodology to assess the impact that mandating this forecast could have on NERL's cost of capital.

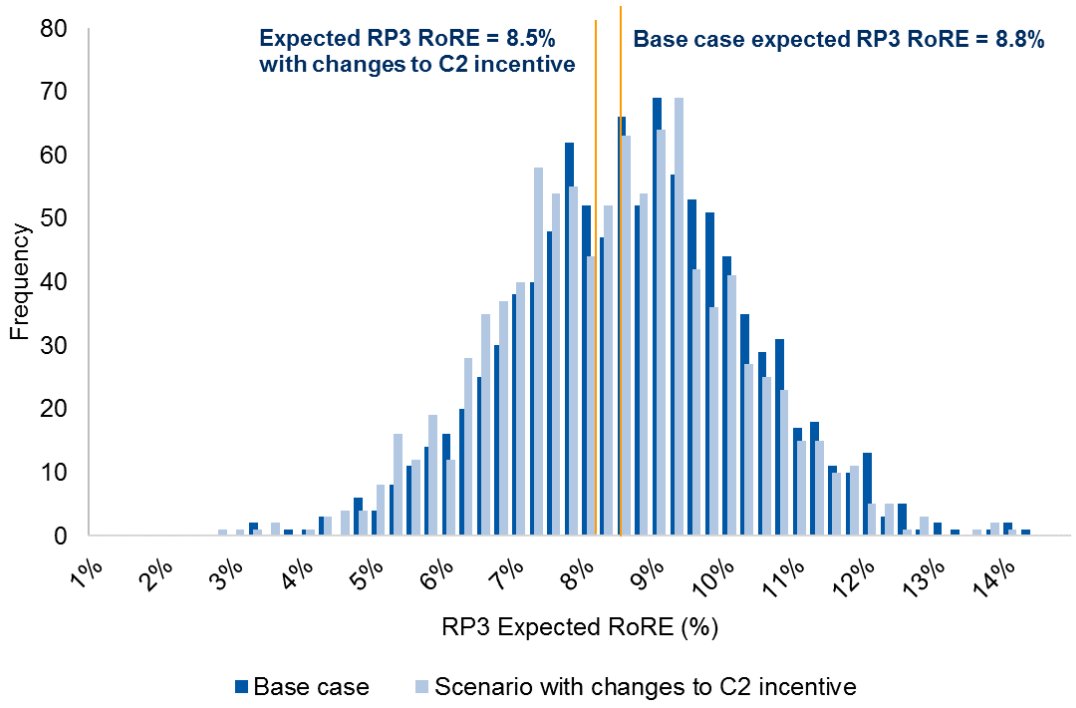
Scenario 1: Proposed change to the C2 capacity incentive scheme

For changes to the capacity incentive scheme, we estimate a risk premium of 30 basis point on the cost of equity allowance, as the differential between the simulated expected RoRE in the base case and in the scenario where the proposed C2 incentive scheme is implemented. As explained in Section 3.1, the proposed C2 capacity incentive scheme introduces a higher

penalty cap and incremental penalty rate, and smaller deadbands for both bonuses and penalties, which would lead to greater downside risks. Therefore, investors of NERL will require a higher cost of equity allowance to compensate for the higher risks, and to achieve the same expected return on equity as per RP2 arrangements. For the purposes of this analysis, it is assumed that the reference value corresponds to NERL's projected performance outcome of 10.8 seconds per flight throughout RP3.

Figure 3.9 compares the simulated distributions of NERL's return on regulated equity (RoRE) over the RP3 period with and without the proposed change to the C2 capacity incentive scheme. The Monte Carlo simulation indicates that NERL's expected RORE over RP3 would be lower by around 30 basis point, if the proposed capacity incentive scheme is implemented, keeping other part of the regulatory regime unchanged. Importantly, this analysis is predicated on the RP3 performance targets being the same as for RP2. Were these targets to change, then a revised risk distribution would need to be established. As a result, this 30 basis point adjustment remains illustrative and this analysis will need to be re-performed once the RP3 performance targets are known.

Figure 3.9: Distribution of simulated RoRE for NERL in RP3 (base case vs. scenario with changes to C2 incentive scheme)



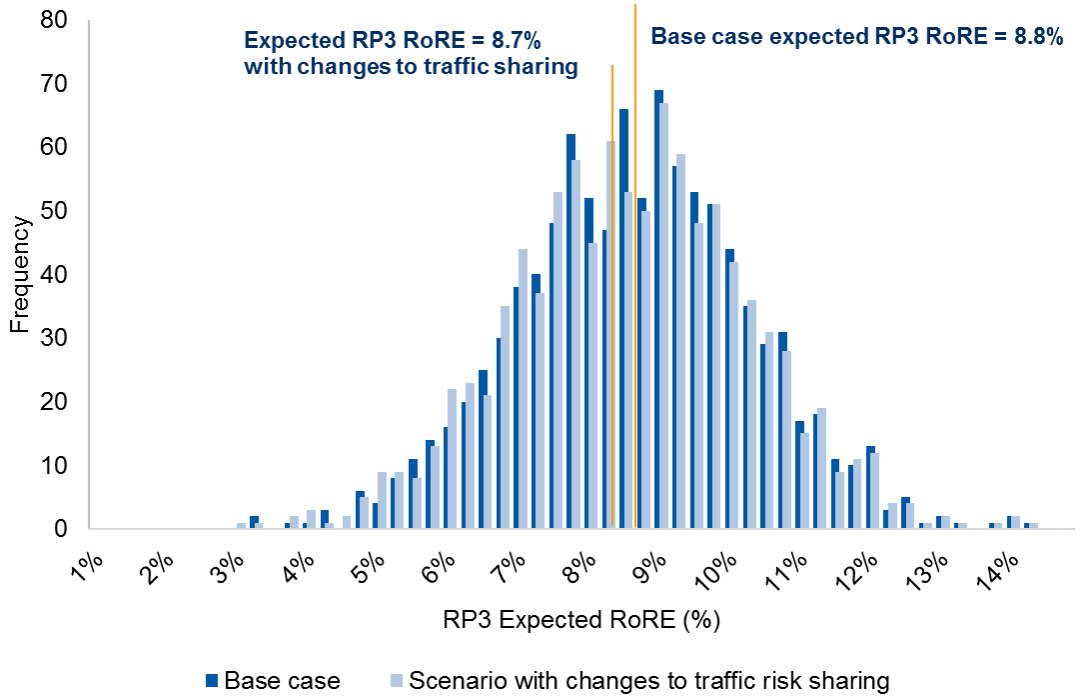
Source: NERA analysis of Monte Carlo simulation data from NERL.

Scenario 2: Proposed change to the traffic risk sharing mechanism

For the changes to the traffic risk sharing, we estimate a risk premium of 10 basis point on the cost of equity allowance, as the differential between the simulated expected RoRE in the base case and in the scenarios where the proposed traffic risk sharing is implemented. Under the proposed RP3 traffic risk sharing mechanism, NERL's traffic risk sharing threshold

would increase from 10 per cent to 15 per cent, which increases NERL's revenue risk by 1.5% relative to RP2. As shown in Figure 3.10, Monte Carlo simulation indicates that this increase of revenue risk would translate to around 10 basis point reduction in NERL's expected RoRE over RP3 period. This estimate would need to be refreshed and the associated traffic risk distribution, were the STATFOR forecast at September 2018 to be adopted for RP3.

Figure 3.10: Distribution of simulated RoRE for NERL in RP3 (base case vs. scenario with changes to traffic risk sharing)



Source: NERA analysis of Monte Carlo simulation data from NERL.

Scenario 3: Proposed change to the traffic forecasts

As explained above, we have not attempted to quantify the impact of mandatory STATFOR forecasts on NERL's cost of capital at this stage. This is because NERL's August 2018 forecast and STATFOR's February 2018 forecast are prepared at different points in time, and the information gap between the two forecasts will make the estimated impact imprecise. Therefore, we consider it appropriate to assess the potential impact of mandating STATFOR forecast on NERL's cost of capital, when the STATFOR forecast at September 2018 is known.

Absent the STATFOR forecast at September 2018, we have considered the difference between the February 2018 STATFOR forecast and its August 2018 forecast. On average, the STATFOR February 2018 forecast for total service units is 1.7% higher than NERL's forecast over RP3. The corresponding loss in revenue, if applied to average en route Determined Costs (in 2017 prices) of £631 million per annum, equates to 19% of NERL's annual en route regulatory return (ignoring impact on tax).

4. Responses to CAA's comments

In this section, we address the CAA's comments on the cost of capital submission in NERL's initial business plan, which were raised by the CAA in discussions with NERL[42]. We first respond to the CAA's initial observations on overall WACC, and then address the CAA's comment on individual components of the WACC in greater detail.

4.1. Response to the CAA's initial observations on overall WACC

The CAA argues that the UK regulators have proposed reductions in real-RPI vanilla WACC in recent documents, and invites NERL to address why the trend in returns for air traffic services is different to other regulated sectors, and why NERL would require a higher cost of equity and required return in RP3 than in RP2.

NERL's higher cost of capital in RP3 reflects increased risks faced by NERL and the CAA's underestimation of NERL's risks at RP2, as we explain in Section 1 of this report. NERL's higher asset beta reflects the increase in listed airport asset betas since RP2, and NERL's higher operating leverage than its peer group, which the CAA did not adjust for at RP2. Also, we use the long-run historical returns to estimate TMR, consistent with the CMA's approach. Although our current estimate assumes that the RP2 regulation will continue, RP3 regulation could potentially introduce additional asymmetric risk to NERL, leading to higher required return.

In addition, we do not consider there is robust evidence for a reduction in cost of capital for other regulated sectors, and the analysis proposed by the UK regulators' advisors contain several flaws. For example, regarding Ofwat's PR19 methodology[43], our analysis shows there is no evidence to support Ofwat's assumption that expected equity returns have fallen as a result of the low risk-free rate environment, and Ofwat's evidence on the TMR is selective with many estimates based on flawed assumptions. In our March 2018 report, we have also criticised PwC's approach to cost of equity for RP3, which, for example, contains arbitrary and selective interpretation of evidence that no UK regulatory has thus far recognised.[44] We discuss our review of the recent methodology papers in Appendix A.

We also note that while betas for UK utilities and international airports have both increased since last price control, international airports' betas have increased more than UK water and energy sectors' betas, as shown in Figure 2.2 and Figure 2.3. This suggests that the beta risks of the airport comparators and NERL have increased more than those of the other regulated sectors, leading to a bigger increase in required return for NERL compared to the trend in other regulated sectors.

---

42 CAA (September 2018), Letter from CAA to NERL regarding NERL Revised Business Plan, page 4.

43 Ofwat (December 2017), Delivering Water 2020: Our methodology for the 2019 price review Appendix 12: Aligning risk and return.

44 NERA (20 March 2018): The Weighted Average Cost of Capital for NATS (En-Route) plc at RP3, A Report for NATS, p.25-29.

4.2. Response to the CAA's comment on WACC parameters

4.2.1. Total Market Return

The CAA argues that there is wide range of sources point to lower TMR than NERL's proposal, and presents the following evidence. We address each of them below.

4.2.1.1. UKRN report

The CAA references the UKRN report on cost of equity by Wright, Burns, Mason and Pickford[45], which suggests that the TMR for UK (real-CPI) is 6-7 per percent. After adjusting for future RPI-CPI wedge of around 1 per cent, the CAA states that this would suggest a real-RPI TMR is 5 to 6 per cent.

The UKRN report argues that historical real returns should be analysed based on historical CPI inflation published by the Bank of England (BoE) in the Millennium dataset, as it is more consistent over time and thus a better measure than RPI over the historical period since 1900. Using BoE's historical CPI inflation, the UKRN report estimates a real (CPI) TMR of 6 to 7 per cent based on long-run realised returns.

Based on our review of these different data sources, we find that the BoE "CPI" data is unreliable and inconsistent for the years before 1989 when CPI official data started being published, which represents most of the historical period used for analysis since 1900. Therefore, our view is that the historical inflation data labelled as "CPI" in the BoE Millennium dataset is not a reliable measure of CPI inflation going back to 1900 and should not be used as a basis of estimating historical real TMR.

Instead, we consider historical real TMR should be estimated using RPI inflation, which is the most reliable measure of UK historical inflation going back to 1900. We find that the historical RPI inflation estimates available from Dimson Marsh and Staunton (DMS) support a real (RPI) TMR of around 7 per based on the arithmetic average of realised returns.

4.2.1.2. Adjustment to historical return

The CAA argues that NERA's estimates for average historical return appears to need two adjustments: i) ONS's 2010 change to clothing, and ii) reduction for return predictability.

The CAA argues that NERA should consider removing the structural increase in RPI. However, as explained in this report and section 2.1 in our March 2018 report, we have taken into account the 2010 changes to the ONS methodology of data collection ("formula effect"), and our current view is to apply a downward adjustment of 0 to 30 bps to the historical returns data to reflect this effect. Our adjustment captures the uncertainty around the effect of the change in data collection on RPI and the appropriateness of applying a single known adjustment, which ignores all other potential changes over the 100+ years of historical data.

The CAA also argues that arithmetic average could be upwardly biased due to evidence of negative autocorrelation in UK returns. The CAA references the UKRN report's

[45] Wright, S, Burns, P, Mason, R, and Pickford, D (2018), Estimating the cost of capital for implementation of price controls by UK Regulators, An update of Mason, Miles and Wright (2003).

recommendation that the TMR should be based on a geometric return of 5 per cent (CPI-deflated, but based on inaccurate proxies for CPI as we explain above), plus an adjustment of 1 to 2 per cent to calculate the arithmetic return. The UKRN report also argues that the case for an adjustment to arithmetic averages as large as 2 percentage points is weakened if regulators wish to set returns on a consistent basis at a relatively long (e.g. 10-year) horizon, given evidence on the predictability of returns over long horizons.

However, we note that the UKRN report provides no compelling evidence of return predictability. UKRN report draws conclusion on predictability of returns based on a single (and dated) source, which is the cyclically adjusted P/E ratio (or CAPE) and the authors' supposed prediction of the end of the 1990s bull run[46]. In Mason Miles and Wright (MMW) 2003 report concluded that predictability of returns was a contentious issue and eminent academics were divided.[47] The Wright and Smithers 2013 report, the authors also noted that "evidence of predictability is contentious" and that any evidence is "extremely limited". [48] Furthermore, our review of recent literatures on the topic of predictability of stock market returns does not support predictability of returns, and concluded that there was no clear-cut empirical evidence either way.[49]

4.2.1.3. International TMR evidence

The CAA argues that there is international evidence supporting lower real-RPI return, referencing the UKRN report that world-wide real-CPI historical average return of 4.2 to 5.1 per cent on a geometric basis. The CAA also references that Europe Economics' advice on international regulatory precedent that real-CPI returns is 6.3 to 7.8 per cent, and real-RPI range is around 5.2 to 6.8 per cent.

Based on our review of international regulatory precedent, we find no evidence supporting a reduction of TMR from previous reviews. We find that the US energy regulators have set a constant return on equity over the past 10 years despite falling US Treasury yields, as shown in Figure 4.1.[50] We also find that a number of European regulators have not reduced TMR despite the reduction in government bond yields at recent reviews. The TMR determined at the recent review has remained broadly at the same level or indeed increased compared to the previous decision in Norway, Sweden, Finland, Italy, Portugal and Switzerland, as shown in Figure 4.2. The regulators in these countries have generally offset the impact of declining government bond yields by either modifying the methodology for calculating the risk-free rate (RfR) or implementing adjustments to the equity risk premium (ERP), with the sum of the two parameters, the total market return (TMR) stable or indeed increasing at the last two reviews.

---

46 Wright, S, Burns, P, Mason, R, and Pickford, D (2018), Estimating the cost of capital for implementation of price controls by UK Regulators, An update of Mason, Miles and Wright (2003), section 4.4.3., p.39-42.

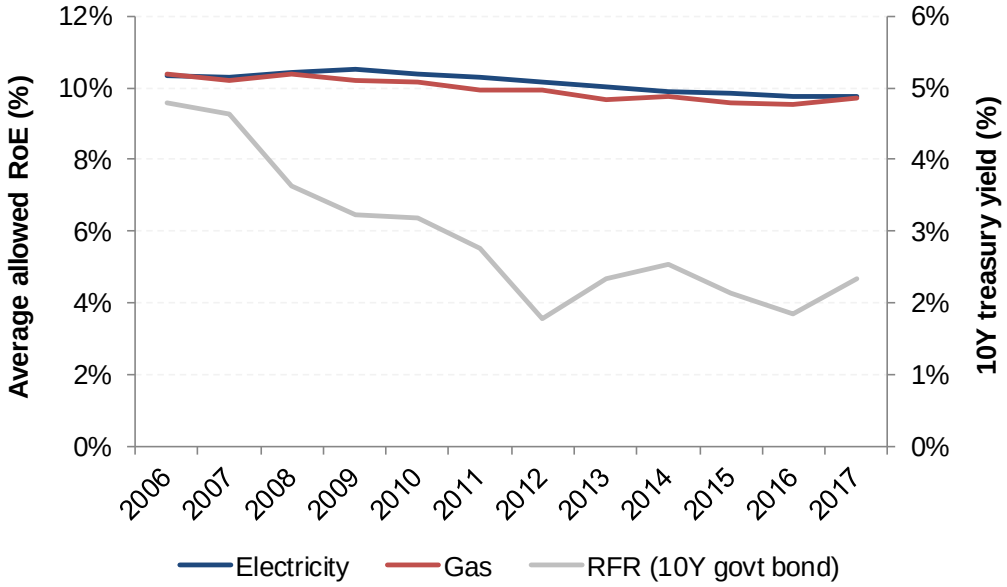
47 Mason, Miles, and Wright (2003), A study into certain aspects of the cost of capital for regulated utilities in the UK, p.36-37, 41-42.

48 Wright, and Smithers (2013), The cost of equity capital for regulated companies: a review for Ofgem, pp. 8 &13.

49 For example, Ang and Beckaert (2001) find that returns are not predictable at long horizons. The authors argue that, although predictability of returns is often taken as a starting point for many studies, fewer studies focus on actually testing for predictability.

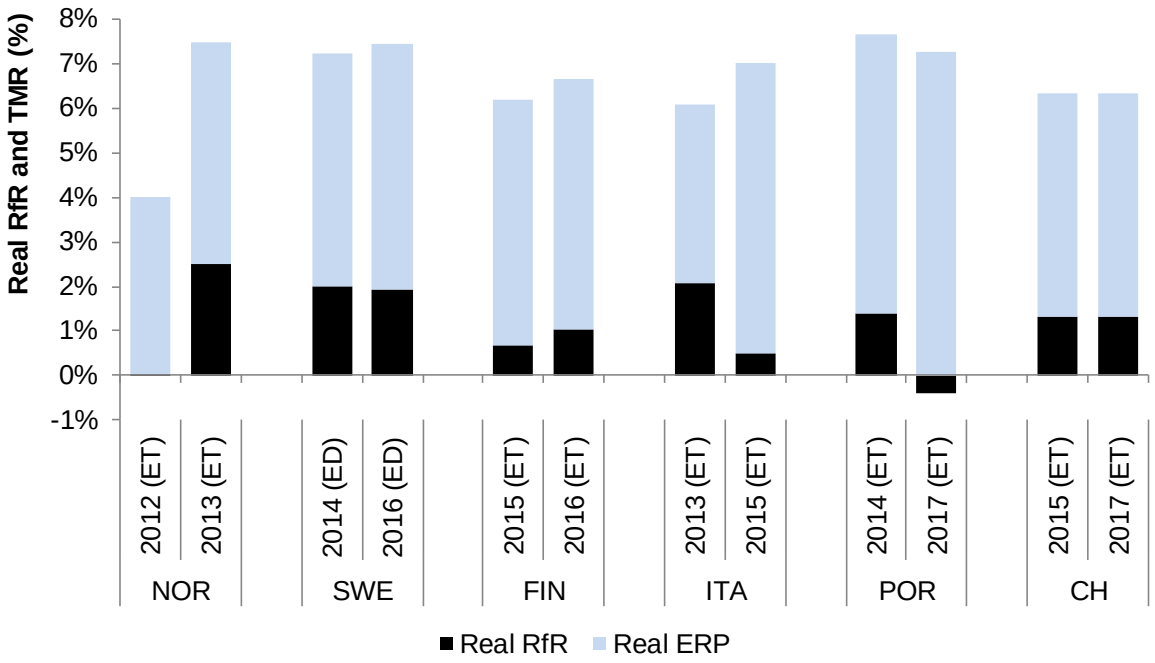
50 S&P Global Market Intelligence (2018), RRA Regulatory Focus – Major Rate Case Decisions 2017.

Figure 4.1
US regulators kept stable cost of equity allowances despite falling treasury yields



Source: S&P Global Market Intelligence (2018), RRA Regulatory Focus – Major Rate Case Decisions 2017. Note: We show overall RoE as information on individual parameters is not available, given the US regulators' reliance on DGM as a primary model, which produces a RoE directly.

Figure 4.2
A number of energy regulators have not reduced the total market returns at the most recent reviews, despite falling interest rates



Note: Real TMR calculated as Real Risk-Free Rate +Equity Risk Premium + additional components (Country Risk Premium, Liquidity Premium, Special Risk Premium). Nominal values are deflated using inflation provided in the regulatory documents or, if not available, using inflation forecasts from Datastream (for Finland and Switzerland). The dates represent the year in which the regulatory determination was made, with the exception of Finland and Norway, where we show the TMR for the last year of the previous regulatory period and compare it to the first year of the new regulatory period (given the RfR was or is updated on an annual basis in these countries).
Sources: ***Norway:*** *Infoskriv ETØ-4/2017: Om beregning av inntektsrammer og kostnadsnorm for 2018; https://www.nve.no/reguleringsmyndigheten-for-energi-rme-marked-og-monopol/okonomisk-regulering-av-nettselskap/reguleringsmodellen/referanserenten/historiske-parameterverdier-for-referanserenten/;* ***Sweden:*** *Förvaltnjngsrätten I Linköping, (14 December 2016), Mål nr 4711-15; Kammarratten i Jonkoping (10 November 2014), Mal nr 61-1;.* ***Finland:*** *Valvontamenetelmät neljännellä 1.1.2016 – 31.12.2019 ja viidennellä 1.1.2020 – 31.12.2023 valvontajaksolla;* *Appendix 1 – Regulation methods for the assessment of reasonableness in pricing of electricity transmission network operations in the third regulatory period starting on 1 January 2012 and ending on 31 December 2015.* ***Italy:*** *Criteri per la determinazione e l'aggiornamento del tasso di remunerazione del capitale investito per i servizi infrastrutturali dei settori elettrico e gas per il periodo 2016-2021 (TIWACC 2016-2021); Deliberazione 29 dicembre 2011 - ARG/elt 199/11 - Disposizioni dell'Autorità per l'energia elettrica e il gas per l'erogazione dei servizi di trasmissione, distribuzione e misura dell'energia elettrica per il periodo di regolazione 2012-2015 e disposizioni in materia di condizioni economiche per l'erogazione del servizio di connessione.* ***Portugal****: ERSE, Parametros de Regulacao para o period 2018 a 2020; Parametros de Regulacao para o period 2015 a 2017.* ***Switzerland:*** *Bundesamt für Energie BFE (21 February 2017), Erläuterungen zur Berechnung des kalkulatorischen Zinssatzes gemäss Art. 13 Abs. 3 Bst. b der Stromversorgungsverordnung (StromVV) für das Tarifjahr 2018; Bundesamt für Energie BFE (9 January 2015), Erläuterungen zur Berechnung des kalkulatorischen Zinssatzes gemäss Art. 13 Abs. 3 Bst. b der Stromversorgungsverordnung (StromVV) für das Tarifjahr 2016.*

4.2.1.4. Forward-looking approach

The CAA argues that forward-looking approach is relevant for consideration, based on CMA's approach for NIE in 2014. The CAA also suggests that forward -looking estimates for real-RPI TMR presented by regulators and consultants are generally below 6 per cent.

We have considered forward-looking evidence on the TMR based on the dividend growth model (DGM) by the Bank of England, consistent with the CMA's approach in its 2014 NIE determination. The recent Bank of England DGM supports a real TMR estimate of 7.2 to 8.1 per cent (RPI-deflated) depending on the time period chosen.[51] Therefore, the forward-looking evidence from Bank of England DGM does not support a reduction in TMR relative to previous reviews.

We consider that forward looking DGM evidence should be treated with caution, given the sensitivity of the results to dividend growth assumptions. Therefore, we recommend relying primarily on long-run historical returns in estimating TMR, and use forward-looking evidence only as a cross-check.

4.2.2. Risk Free Rate

On RfR, the CAA commented that UK regulators have signaled a move to using current market rates. The CAA considers there to be a strong case for using current market evidence, which suggests lower RfR. The CAA shows that the index-linked gilt yields suggest a real-RPI RfR around -1.5 per cent, and the nominal gilt yields deflated using HM Treasury RPI forecast for 2022 suggest a real-RPI RfR of around -1.2 per cent.

Our RfR range of -1.1 to 1.5 per cent reflects both long-run historical average and current market evidence. Our upper end of the range is consistent with UK regulators' approach of placing greater weight on long-run evidence to avoid setting the allowed rate of return which varies with the business cycle which contributes itself to co-variant risk, as well as regulatory risk[52]. Our lower bound for the real risk-free rate reflects the current macro environment.

4.2.3. Betas

On beta comparators, the CAA commented that there is now enough data for ENAV to be considered as a beta comparator and the comparator choices should be carefully assessed. Our analysis in Section 1 of this report has addressed the CAA's comment on the choice of comparators and the reasons for higher asset beta for NATS in RP3.

On debt beta, The CAA commented that the use of a debt beta of 0.05, following PwC, could be obsolete, and the CAA suggested that more recent debt premia could imply a higher debt beta. Our analysis shows that UK regulators' recent debt beta determinations range from 0 to 0.1. Ofgem, in its recent consultation for the next regulatory period (RIIO-2), has used a debt beta of zero. Ofwat adopted a debt beta assumption of 0.1 in its most recent price review (PR19). Ofcom's current assumption is 0.1. For NATS, given its stable outlook and

[51] See NERA report: http://www.nera.com/content/dam/nera/publications/2017/171103_TMR_report_NERA.PDF.

[52] We show in our 20 March 2018 report, Table 2.3, that in recent times UK regulators have left comfortable margins in their risk-free rate estimates above spot rates.

relatively high credit rating, our initial view is that an increase in debt beta does not appear to be warranted.

The CAA also commented that the Generalized Autoregressive Conditional Heteroskedasticity (GARCH) adjustment and other features of the UKRN report should be considered. In our work for energy networks in May 2018[53], we have reviewed the UKRN report[54] recommendations on beta estimation. We find that the lower betas that the UKRN report found were primarily driven by their choice of time frame and aggregation of return, not by the introduction of a new GARCH model, which produces much higher estimates when estimated using more recent data (2 years) and daily frequency. Additionally, when applying GARCH and Ordinary Least Squares (OLS) to consistent time periods/data frequencies, both produce similar beta estimates. Our findings are consistent with the fourth author of the UKRN report, Burns, who notes that MPW "[A]dopt the highly unusual practice of estimating the CAPM on quarterly data, which is the key factor that drives the lower estimates of beta", while "MPW's results based on higher frequency data are recognizably similar to existing regulatory estimates over the relevant time frames".[55]

4.2.4. Gearing

The CAA commented that NERL's notional gearing of 60 per cent appears to be higher than NERL's forecast actual gearing over RP3, since NERL's current gearing is around 30 per cent and projected to increase to around 60 per cent by the end of RP3.

Our initial view is that the notional gearing of 60 per cent could remain appropriate for NERL at RP3.

We consider there is a strong case to continue to use the notional gearing approach to maintain consistency of the regulatory approach across price controls. In principle, the regulated company is best placed to assume the responsibility and bear the risks of the financing structure. Under the notional gearing approach, the regulated companies and their shareholders bear the risk of financing structure and are incentivised to outperform, while the customers face the efficient cost of debt for a notionally structured company. Alternatively, using an actual gearing approach would transfer the risks of financing structure from the regulated companies to the customers, and could weaken the incentives for efficient financing in the longer term. For these reasons, the UK regulators, including the CAA at Q6[56], Ofwat at PR14[57] and Ofgem at RIIO-1[58], have all adopted the notional gearing approach, and we consider these rationales to remain valid for NERL in RP3.

---

53 NERA (2018), Review of UKRN report recommendations on beta estimation, Prepared for National Grid.

54 Wright, S, Burns, P, Mason, R, and Pickford, D (2018), Estimating the cost of capital for implementation of price controls by UK Regulators, An update of Mason, Miles and Wright (2003).

55 Wright, S, Burns, P, Mason, R, and Pickford, D (2018), op. cit., p. 9.

56 CAA (February 2014): Estimating the cost of capital: technical appendix for the economic regulation of Heathrow and Gatwick from April 2014: Notices granting the licences, CAP 1155, p.5.

57 Ofwat (December 2014): Final price control determination notice: policy chapter A7 – risk and reward, p.41.

58 Ofgem (November 2014): RIIO-ED1: Final determinations for the slowtrack electricity distribution companies, p.40.

We note that the final gearing assumption depends on the outcome of the financeability assessment, which will show whether a notional gearing of 60% continues to allow NERL to maintain a targeted investment-grade credit rating.

4.2.5. Cost of New Debt

The CAA commented that forward market typically includes a "structural premium" of around 20 to 30 bps, and therefore our estimate from the forward market overstates the rise in bond yield.

We understand that the CAA is referring to the concept of "term risk premium", which assumes that risk-averse investors demand a premium (positive or negative) for holding securities with longer maturities[59]. Because of this risk premium, the interest rate expectation derived from forward curves might overstate or understate future short-term interest rates, and one could estimate the risk premia to extract the pure interest rate expectation. However, it is commonly known that measuring term risk premia is highly complicated and difficult.[60] There is no consensus model for risk premia, and various estimation methods provide very different results, reflecting the limited ability in accurately estimating the risk premia, and the uncertainty in measuring market expectation over relatively long-time horizon. A study by the Federal Reserve Bank of San Francisco finds that different models estimate substantially different US term premia, with all model estimates falling and some being negative, as shown in Figure 4.3. A study by the Bank of England[61] also finds that term premia (green line in Figure 4.4) have been falling in the UK, EU and US. In addition, the BoE study finds that the term premia for UK has become negative by some measures since 1998, and remained negative thereafter, while US and EU term premia have remained positive, as shown in Figure 4.4.

Finally, there is no regulatory precedent of adjusting forward expectation of interest with term premia. In recent determinations, Ofwat[62] and Ofgem's advisor[63] have also not considered such adjustment.

Therefore, we recommend against adjusting the forward rate expectation with risk premium adjustment, given that the risk premium estimates are highly uncertain depending on the model and time horizon, and there is no regulatory precedent in allowing for the adjustment.

---

59 Although term premium is sometimes considered to be positive, empirical evidence shows that term risk premium could be positive or negative, depending on the market segment in bond market. For example, institutional investors such as pension funds could be willing to accept a lower yield for long-term bonds (a negative term premium) for asset-liability risk management.

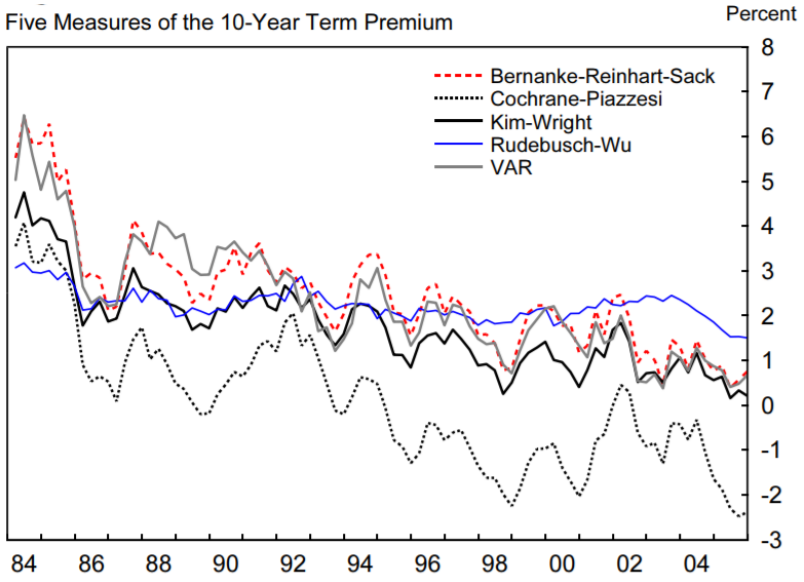
60 A growing list of academic literatures exist for various method to estimating the term premia and it is commonly accepted that the ability to estimate risk premia is limited. For example, see Cochrane (2007): Commentary on 'Macroeconomic Implications of Changes in the Term Premium. FRB St. Louis Review 89(4) pp.271–282. Kim, Don, and Wright (2005): An Arbitrage-Free Three-Factor Term Structure Model and the Recent Behavior of Long-Term Yields and Distant-Horizon Forward Rates. Federal Reserve Board Finance and Economics Discussion Series 2005-33. Rudebusch, Sack, and Swanson. 2007. "Macroeconomic Implications of Changes in the Term Premium." FRB St. Louis *Review* 89(4) pp. 241–269.

61 Bank of England (April 2011): A global model of international yield curves: no-arbitrage term structure approach, Kaminska, Meldrum and Smith, Working Paper No. 419.

62 Ofwat (December 2017), Delivering Water 2020: Our methodology for the 2019 price review Appendix 12: Aligning risk and return.

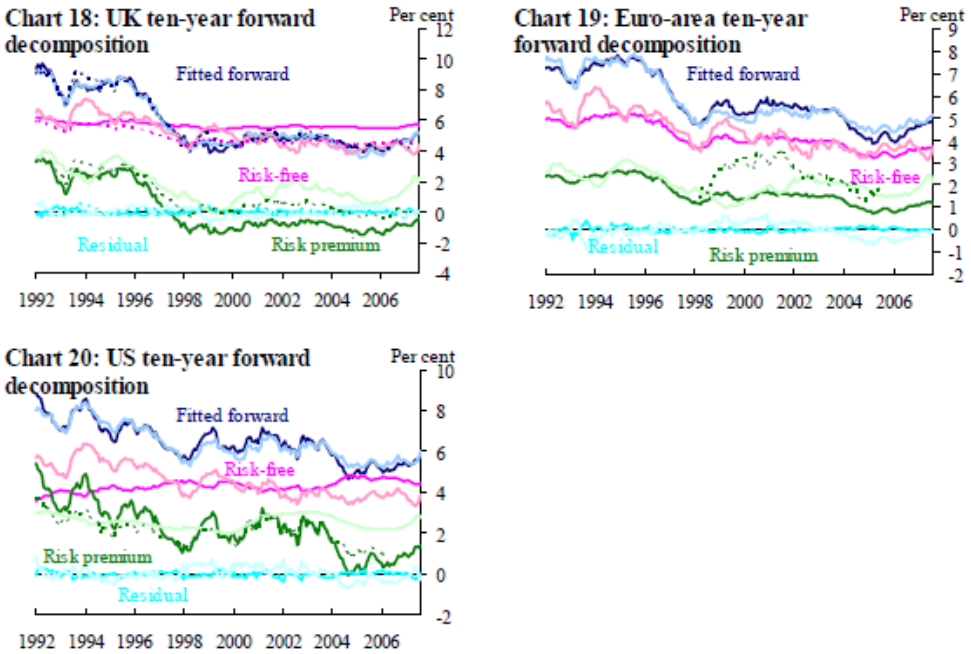
63 CEPA (February 2018): Review of cost of capital ranges for Ofgem's RIIO.

Figure 4.3: Estimates for US 10Y term premium differ substantially depending on measuring methods



Source: Federal Reserve Bank of San Francisco (November 2006): Macroeconomic Implications of Changes in the Term Premium, Rudebusch, Sack, and Swanson, Working Paper 2006-46

Figure 4.4: Bank of England's model shows that UK term premium is lower than the US and EU term premia, and has declined and became negative since 1998



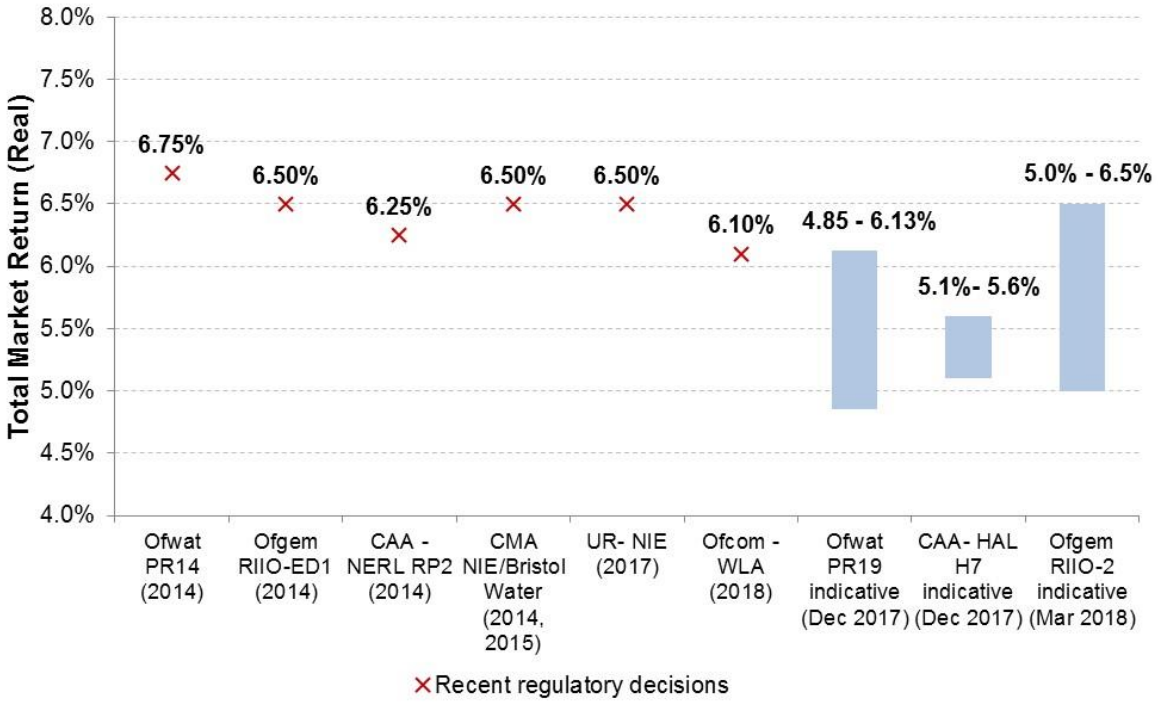
Source: Bank of England (April 2011): A global model of international yield curves: no-arbitrage term structure approach, Kaminska, Meldrum and Smith, Working Paper No. 419, p.25.

Appendix A. Review of TMR regulatory precedent

In this section, we discuss the regulatory precedent on the TMR, and provide our initial view on the evidence on the TMR presented by recent methodology documents and advisor reports.

Figure A.1 below shows the recent TMR determination for each UK regulated sector, and the indicative TMR range proposed in recent price control methodology documents. The recent regulatory decisions on TMR ranges from 6.10 per cent (Ofcom WLA, 2018) [64] to 6.75 per cent (Ofwat PR14, 2014), and the CMA's last detailed consideration of the TMR gives 6.5 per cent. In recent methodology documents, the early view on the TMR estimates proposed by the CAA, Ofwat and Ofgem are below the CMA's determination of 6.5%. However, as we have shown in Section 2.1, the latest evidence does not support a TMR lower than the CMA's NIE and Bristol Water decision of 6.5 per cent. In the following sections, we first set out our update of the different approaches the CMA considered in determining the TMR at the 2014 NIE and 2015 Bristol water determinations using latest available data (Appendix A.1), and discuss the evidence in recent methodology documents (Appendix A.2, A.3, and A.4).

Figure A.1: Regulatory precedent and proposed estimates for TMR



Source: NERA analysis based on regulatory decisions.

[64] We note that Ofcom has historically estimated a relatively low real-RPI TMR, partly because Ofcom sets a nominal cost of capital and has used a relatively high inflation assumption compared to the CMA decision. In its 2018 decision, Ofcom has decided not to lower the real TMR in current low RfR environment, citing there is no clear evidence of TMR changing since previous review in 2016. Source: Ofcom (March 2018): Wholesale Local Access Market Review: Statement, Annexes 17-27, p.105, para A20.110.

A.1. Updating CMA Approach to Estimating TMR at NIE 2014

In this section, we update the different approaches that the CMA considered in determining the TMR at the 2014 NIE and 2015 Bristol water determinations, which indicates a slight increase in the estimates using latest available data compared to the evidence presented by the CMA in 2014 NIE and 2015 Bristol water determinations. This supports our conclusion that the TMR for RP3 should be no lower than 6.5 per cent.

In its NIE 2014 price control determination, the CMA considered three types of evidence for estimating the TMR:[65]

- studies that assume that historical realised returns are equal to investors' expectations (so-called "historical ex post" approaches);
- studies that fit models of stock returns to historical data to separate out ex-ante expectations from ex-post good or bad fortune (so-called "historical ex ante approaches");
- studies that use current market prices and surveys of market participants to derive current forward-looking expectations (so-called "forward-looking approaches").

The CMA noted that it used historical approaches (both ex-ante and ex-post) as its primary sources for estimating the equity market return, with forward-looking approaches being used as a cross-check.[66]

Historical ex-post approaches

The CMA used the DMS and Barclays capital databases as the basis for its long-run historical estimate. Drawing on a number of different measures differentiated by holding period and averaging technique, the CMA concluded a TMR of around 6 to 7 per cent (real RPI) for UK and world markets in 2014.[67]

Our replication of the CMA's NIE calculations using DMS data up to 2017, as shown in Table 2.2, shows that the long-run historical averages have increased slightly relative to the 2014 NIE decision, with updated estimates in a range between 6.2 and 7.1 per cent (real RPI).

Historical ex-ante approaches

The CMA noted that an alternative approach to estimating expected returns from historical data can be made under the assumption that the dividend-price ratio is stationary, referred to as the Fama and French underlying return.[68] Under this assumption, the expected return can be estimated as the sum of the average dividend yield and the average annual dividend growth rate. Drawing on Barclay's data set up to 2009, the CMA estimated an expected market return of 4.5 to 5.5 per cent. The top end of the range was based on the CMA's application of the Fama French estimate to the historical data from Barclay's, while the

65 CMA (March 2014), NIE Limited price determination, para, p.13-26, para 13.137.

66 CMA (March 2014), NIE Limited price determination, para, p.13-26, para 13.137.

67 CMA (March 2014), NIE Limited price determination, p.13-27, para 13.141.

68 Estimated based on the approach developed in Fama and French (April 2002), The Equity Premium, the Journal of Finance, Vol. 57, No. 2, pp. 637-659.

bottom end of the range reflected a downward adjustment to the historical data to account for the fact that current dividend yields were about 1 per cent below historical averages.[69]

The CMA also acknowledged that the application of the Fama French approach may lead to an understatement of the expected market return due to dividend growth being less volatile than equity price index growth, with the understatement being equal to half the variance of the two growth rates (as suggested by Fama and French).[70] Applying the CMA's estimate of this understatement of around 75 bps results in a market return estimate between 5.25 and 6.25 per cent.

We have updated the CMA's calculations of the Fama French underlying return for the UK market based on the updated Barclay's data set up to 2015 and found that the estimate remains broadly unchanged relative to NIE 2014.[71]

The CMA also cited the DMS estimate of the expected market return for the world index. The DMS decomposes the historical returns into four elements: i) dividend yield (the dominant effect), ii) dividend growth rate, iii) the annual expansion in the price/dividend ratio, and iv) real exchange rate changes. The DMS then determines an expected market return based on consideration of which elements correspond to investor expectations, and elements of non-repeatable good or bad luck. Drawing on DMS forecasts, the CMA cited a value of 5.5 to 6 per cent for the world index.[72]

Our review of the most recent DMS forecast indicates that the forecast has not changed relative to NIE 2014.[73]

Forward-looking approaches

Finally, the CMA considered evidence from the Bank of England's DGM which it concluded supported a market return of between 5 and 6 per cent.[74]

Current estimates of the market return from the Bank of England's DGM are between 7.1 and 8.2 per cent (with the range based on a spot and 5-year average of monthly DGM estimates ending December 2016).[75]

Table A.1 below summarises the CMA's estimates of the total market return for the different approaches considered in the NIE decision, and our updated estimates drawing on latest evidence, as discussed above.

---

69 CMA (March 2014), NIE Limited price determination, p.13-27, para 13.143-13.144

70 CMA (March 2014), NIE Limited price determination, pp. A13(2)3-A13(2)4, para 8.

71 Based on Barclay's (March 2016), Equity Gilt Study 2016, we calculate an updated estimate of the Fama French underlying return of 6.27 per cent, using data up to 2015 (based on 4.5 per cent historical dividend yield, 1.1 per cent historical dividend growth and 70bps historical volatility adjustment).

72 CMA (March 2014), NIE Limited price determination, para 13.145.

73 DMS (20178), Credit Suisse Global Investment Returns Yearbook 2018., p. 36. DMS (2018) cites an arithmetic risk premium of 5 per cent relative to bills, and reports a historical bill return of around 0.81 per cent, supporting a forward-looking TMR of around 6 per cent.

74 CMA (March 2014), NIE Limited price determination, p.13-31, para 13.155.

75 We note that the Bank of England changed its methodology in applying the DGM in 2017, compared to the approach used in the 2013 study cited by the CMA in the NIE (2014) decision.

Table A.1: Updating studies used by CMA at NIE 2014 does not support a reduction in the TMR

	CMA NIE 2014 evidence	Latest evidence
DMS long run *(historical ex post)*	6 – 7 %	6.2 – 7.1%
DMS decomposition *(historical ex ante)*	5.5 – 6 %	6 %
Fama-French *(historical ex ante)*	5.25 – 6.25 %	5.27 – 6.27 %
Bank of England DDM *(forward looking)*	5 – 6%	7.1 – 8.2 %

Sources: NERA analysis of CMA (March 2014) Northern Ireland Electricity price determination. section 13; DMS (February 2018), Credit Suisse Global Investment Returns Yearbook 2018; Barclay's (March 2016), Equity Gilt Study 2016; Bank of England (2017), An improved model for understanding equity prices, Quarterly Bulletin 2017Q2(4) and Bank of England yield curves.

A.2. Review of PwC Approach to TMR at H7

In its report for the CAA[76], PwC estimates a real total market return range of 5.1 to 5.6 percent, significantly below our estimated range of 6.5 to 7.1 per cent. PwC's range is based on current market evidence, including its own dividend growth model and market to asset ratios for listed UK utilities, whereas our range was based primarily on long-run historical evidence.

In our March report for NERL, we commented in detail on PwC's current market evidence and its interpretation of the long-run historical evidence.[77]

Current Market Evidence

We showed that PwC's estimates of the TMR based on DGM and MAR analysis are based on incorrect assumptions and methodology, which resulted in a substantial understatement of the "forward-looking" TMR. In respect of PwC's DGM analysis, we explained that PwC's DGM-based TMR is understated, due to implausibly low assumptions around dividend growth rates, when compared to independent estimates from the Bank of England. In respect of PwC's MAR analysis, we showed that PwC's calculations include two methodological errors: confusing real and nominal terms, and ignoring real growth in the RCV, which lead to PwC substantially understating the implied TMR by 140-170 bps.[78]

Long-run Historical Evidence

PwC also considers estimates of the TMR based on long-run historical evidence, but makes two adjustments to the long-run average historical returns: i) RPI Formula effect, and ii) forward looking returns adjustment. In relation to the RPI formula effect, we have taken this into account in our TMR estimate, and recognising there is greater uncertainty as to the quantum of the formula effect adjustment, and estimate it in the range of 0 to 30 basis points, instead of PwC's estimate of 30 basis points. In relation to PwC's proposed "forward-looking adjustment", we do not consider it appropriate to adjust historical returns for good fortune in the absence of any firm evidence on what proportion of historical growth in dividends may be due to good fortune. Also, PwC's adjustments appear to be an arbitrary and selective interpretation of existing evidence that no UK regulator has thus far recognised when considering long-run historical returns. We therefore reject PwC's adjustments to the long-run average historical returns, and continue to believe our TMR range of 6.5 to 7.1 per cent is appropriate.

[76] PwC (November 2017): "Estimating the cost of capital for H7".

[77] NERA (20 March 2018): The Weighted Average Cost of Capital for NATS (En-Route) plc at RP3, A Report for NATS, p.25.

[78] NERA Economic Consulting (1 December 2017): "Implications of Observed Market-to-Asset Ratios for Cost of Equity at RIIO-T2", p9-10. Source: http://www.nera.com/content/dam/nera/publications/2017/171201_MAR_report_final.pdf

A.3. Review of Ofwat Approach to Estimating the TMR at PR19

In its December 2017 methodology document, Ofwat presented its "early view" on the cost of capital for PR19 including a real (RPI-deflated) TMR estimate 4.85 to 6.13 per cent with a point estimate of 5.44 per cent.[79] Ofwat's estimate of the TMR is based on the work undertaken by its advisors PwC[80] and Europe Economics (EE)[81], as well as Ofwat's own analysis.[82] Ofwat's early view of the TMR is substantially lower than regulatory precedent at recent reviews, including the most recent CMA decision for Bristol Water in 2015, which determined a real (RPI-deflated) TMR of 6.5 per cent.[83] This reflects Ofwat's view that equity returns have fallen due to the current low interest rate environment.

In estimating the TMR, Ofwat considers a range of evidence, including "ex-post" (historical realised returns data), "ex-ante" (decomposing historical returns into expected return plus good/bad luck) and "forward-looking" approaches (e.g. evidence from dividend growth models), placing most weight on "ex-ante" and "forward looking" approaches in selecting the point estimate.[84]

In our review of the analysis presented by Ofwat in the December 2017 methodology document, we find that Ofwat's range of TMR is not justified as it is not supported by empirical evidence, and appears to be based on a selective view of the evidence it considers.

There is no evidence that equity returns are low in current low RfR environment

In its December 2017 methodology document, Ofwat argues that interest rates over PR19 are expected to remain low compared to historical standards and that this low interest rate environment will lead to low equity returns as a result. To support this statement, Ofwat presents data from DMS which shows a positive relationship between real interest rates and real equity returns from cross-country data (i.e. the lower the interest rate, the lower the equity return and vice versa).[85]

We find that there is no evidence that expected market returns have fallen in the current low risk-free rate environment, due to the offsetting increase in the equity risk premium.[86] We note that Ofwat appears to accept this relationship, given it reports estimates of negative

---

79 Ofwat (December 2017), Delivering Water 2020: Our methodology for the 2019 price review Appendix 12: Aligning risk and return, p.16.

80 PwC (June 2017), Refining the balance of incentives for PR19; PwC (December 2017), Updated analysis on cost of equity for PR19.

81 Europe Economics (December 2017), PR19 – Initial Assessment of the Cost of Capital.

82 Ofwat (December 2017), Delivering Water 2020: Our methodology for the 2019 price review Appendix 12: Aligning risk and return, section 5.4.

83 CMA (March 2014) Northern Ireland Electricity price determination, para. 13.146, link: https://assets.publishing.service.gov.uk/media/535a5768ed915d0fdb000003/NIE_Final_determination.pdf

84 Ofwat (December 2017), Delivering Water 2020: Our methodology for the 2019 price review Appendix 12: Aligning risk and return, pp.32-33.

85 Ofwat (December 2017), Delivering Water 2020: Our methodology for the 2019 price review Appendix 12: Aligning risk and return., section 5.4.1.

86 We discuss our findings in detail in our November 2017 and December 2017 reports prepared for National Grid. NERA (November 2017), Total Market Return for Determining the Cost of Equity at RIIO-2 and NERA (December 2017), Implications of Observed Market-to-Asset Ratios for Cost of Equity at RIIO-2.

correlation between the RfR and the ERP of -0.88 for the period 2010 to 2016 estimated by its advisors PwC.[87] Also, we consider it is unsafe to draw conclusions from short-term (e.g. decadal) averages of realised returns, given the volatility of stock market returns which results in high standard errors of these short-run averages, an accepted point in the academic literature.[88]

Ofwat's evidence on the TMR is selective with several estimates based on flawed assumptions

In its December 2017 methodology document, Ofwat presents a range of evidence on the TMR based on different approaches (consistent with those considered by the CMA in its 2014 NIE determination), including i) historical "ex-post" approaches, ii) historical "ex-ante" approaches and iii) forward looking evidence. [89]

We show that Ofwat presents a selective view of the evidence on the TMR for the various methods it considers, and many of Ofwat's estimates are based on flawed assumptions. For example:

- ***Historical "ex-post" evidence***:

  Ofwat presents estimates of 4.7 to 5.7 per cent for geometric and 6.0 to 6.9 per cent for arithmetic averages using different holding periods, and incorporating a downward adjustment for RPI formula effect of 33 bps. It concludes that the true estimate lies between these two estimates.[90]

  Ofwat correctly cites Blume and JKM approaches as a potential means to determine unbiased estimates for the expected TMR from long horizons, where these papers show that an unbiased estimate is a weighted average of the arithmetic and geometric mean, where the weights depend on the length of the historical time series and forecast period. However, Ofwat does not actually apply the established Blume and JKM approaches to derive unbiased estimates of the expected rate of return. As we show in Appendix A.1, the application of these methods to long run historical data provide unbiased estimates for the TMR of between 6.2 and 7.1 per cent, a substantively higher range than Ofwat's cited range of 4.7 to 6.9 per cent.

- ***Historical "ex-ante" evidence***:

  Ofwat presents an estimate of the TMR of 4.2 per cent to 5.6 per cent using the Fama French approach applied to Barclays equity gilts study data 1990-2016 (lower bound) and 1900-2016 (upper bound).[91]

---

87 Ofwat (December 2017), Delivering Water 2020: Our methodology for the 2019 price review Appendix 12: Aligning risk and return, p.38.

88 NERA (November 2017), Total Market Return for Determining the Cost of Equity at RIIO-2, pp. 6-8.

89 Ofwat (2018) Delivering Water 2020: Our methodology for the 2019 price review Appendix 12: Aligning risk and return, p. 31.

90 Ofwat (2018) Delivering Water 2020: Our methodology for the 2019 price review Appendix 12: Aligning risk and return, p. 40.

91 Ofwat (2018) Delivering Water 2020: Our methodology for the 2019 price review Appendix 12: Aligning risk and return, p. 42.

However, we note that the historical "ex-ante" estimates presented by Ofwat do not represent any new evidence or information on this topic, and do not demonstrate that TMR has fallen in the current low risk-free rate environment. These estimates have been fully considered by the CMA in its NIE 2014 (and Bristol Water 2015) determinations, and have been quoted by the CMA as one of the principal reasons in determining a TMR of 6.5 per cent.

- ***Forward looking evidence:***

  Ofwat presents DGM estimates of the TMR in a range of 5.1 to 5.9 per cent, based on its advisors' application of the DGM to the FTSE All Share index. Ofwat's advisors' DGM estimates are substantially below independent DGM-based estimates of the TMR from the Bank of England, which the CMA relied on in its 2014 NIE determination, and which support a real TMR of 7 to 8 per cent (RPI-deflated).[92] Ofwat advisors' DGM estimates are understated due to low assumptions on dividend growth based on UK GDP, which fail to reflect that over 70 per cent of FTSE companies derive earnings from outside the UK, where expected GDP growth is higher.

  Ofwat notes that Bank of England DGM is overstated because it relies on analyst forecasts which suffer from optimism bias. However, Ofwat did not provide any evidence that supports its assertion of bias. By contrast, the CMA did rely on the Bank of England DGM evidence in its 2014 NIE decision.

  Ofwat also presents evidence from MAR analysis by its advisors, which supports a TMR 7.4 to 8.6 per cent (nominal). As we explain in our November 2017 and December 2017 report prepared for National Grid, [93] the MAR evidence by Ofwat's advisors is based on errors and correcting for these errors supports a far higher range.

Therefore, we consider that Ofwat's proposed TMR range is not justified by robust evidence, and there is no reason to support a TMR lower than the NIE and Bristol Water decision of 6.5 per cent.

[92] Ofwat advisors' DGM estimates are understated due to low assumptions on dividend growth based on UK GDP, which fail to reflect that over 70 per cent of FTSE All Share listed companies derive earnings from outside the UK, where expected GDP growth is higher. We discuss our findings in detail in our November 2017 report prepared for National Grid. NERA (November 2017), Total Market Return for Determining the Cost of Equity at RIIO-2

[93] NERA (November 2017), Total Market Return for Determining the Cost of Equity at RIIO-2 and NERA (December 2017), Implications of Observed Market-to-Asset Ratios for Cost of Equity at RIIO-2.

A.4. Review of Ofgem and CEPA's Approach to TMR at RIIO-2

In its report for Ofgem, CEPA estimates a real total market return range of 5.0 to 6.5 percent (real RPI) which it states is in line with the CMA's NIE decision.[94] Our review of CEPA's approach to the TMR shows that much of CEPA's TMR evidence is flawed and leads to a substantial understatement of the TMR for RIIO-2.

CEPA relies on CMA's NIE TMR decision, but misinterprets as 5-6.5 per cent; updating CMA's methods supports a higher range

CEPA's interpretation of the CMA NIE decision as supporting a TMR range of 5 to 6.5 per cent is erroneous. Although the CMA cited 5 per cent as a lower bound in its report, it concluded that the evidence for a TMR of 5 per cent was not well-supported, and the *weight of evidence* supported a TMR range between 5.5 and 6.5 per cent.[95] In addition, given that only the Bank of England DGM approach supported the lower bound of 5 per cent at NIE 2014, and updated studies from the Bank of England support a value of 7 to 8 per cent, CEPA's 5 per cent lower-bound does not represent a reasonable application of the CMA NIE 2014 approach for RIIO-2.

As we have shown in Appendix A.1, drawing on the different methods considered by the CMA in the 2014 NIE determination, the evidence supports an increase in the CMA's NIE 2014 preferred range of 5.5 to 6.5 per cent. Both the historical ex post and DGM methods supporting values above the higher-bound value of 6.5 per cent. The increase in the Bank of England's DGM estimates reflect improvements in its model specification to take account of changes in the expected dividend growth rate over time, share buybacks and variation in risk-free interest rate across maturities.

CEPA's own DGM approach to estimating the TMR is flawed

CEPA also presents forward looking estimates on the TMR, although it does not rely on such evidence in making recommendations for its TMR. CEPA recommends a range of between 4.5 to 5 per cent based on its own DGM, and 5.3 to 5.8 per cent (real, RPI-deflated) based on PwC's DGM in a recent study commissioned by Ofwat for PR19.

Both CEPA and PwC's DGM evidence is substantially below independent estimates of the TMR from the Bank of England's DGM, which the CMA relied on in its 2014 NIE determination (as noted above). Independent estimates of the TMR from the Bank of England support a range of around 7 to 8 per cent (real, RPI-deflated), substantially above the evidence presented by CEPA.[96] CEPA's (and PwC's) DGM is understated, due to implausibly low assumptions around dividend growth rates, which is a key determinant of the implied TMR.

We conclude that CEPA's TMR range of 5 to 6.5 per cent is based on an inappropriate update of the CMA's method for estimating the TMR at NIE 2014 and a flawed DGM approach.

---

94 CEPA (February 2018): Review of Cost of Capital Ranges for Ofgem's RIIO-2 for Onshore Networks, p.49.

95 CMA (March 2014) op. cit., para. 13.38.

96 We discuss our findings in detail in our November 2017 and December 2017 reports prepared for National Grid. NERA (November 2017), Total Market Return for Determining the Cost of Equity at RIIO-2 and NERA (December 2017), Implications of Observed Market-to-Asset Ratios for Cost of Equity at RIIO-2.

Our update of the CMAs analysis for NIE shows that in most cases the evidence supports a higher TMR than the value of 6.5 per cent determined by the CMA in 2014, with a marked increase in the Bank of England's DGM based TMR relative to 2014. We therefore conclude that based on the CMA NIE methodology the TMR should be at least as high as the NIE decision of 6.5 per cent.

Qualifications, assumptions and limiting conditions

This report is for the exclusive use of the NERA Economic Consulting client named herein. This report is not intended for general circulation or publication, nor is it to be reproduced, quoted or distributed for any purpose without the prior written permission of NERA Economic Consulting. There are no third party beneficiaries with respect to this report, and NERA Economic Consulting does not accept any liability to any third party.

Information furnished by others, upon which all or portions of this report are based, is believed to be reliable but has not been independently verified, unless otherwise expressly indicated. Public information and industry and statistical data are from sources we deem to be reliable; however, we make no representation as to the accuracy or completeness of such information. The findings contained in this report may contain predictions based on current data and historical trends. Any such predictions are subject to inherent risks and uncertainties. NERA Economic Consulting accepts no responsibility for actual results or future events.

The opinions expressed in this report are valid only for the purpose stated herein and as of the date of this report. No obligation is assumed to revise this report to reflect changes, events or conditions, which occur subsequent to the date hereof.

All decisions in connection with the implementation or use of advice or recommendations contained in this report are the sole responsibility of the client. This report does not represent investment advice nor does it provide an opinion regarding the fairness of any transaction to any and all parties.

NERA
ECONOMIC CONSULTING

NERA Economic Consulting
Marble Arch House
66 Seymour Street
London, UK W1H 5BT
+44 207 659 8500
www.nera.com