NERA
ECONOMIC CONSULTING

Cost of Equity for RP3

Prepared for NERL

April 2019

CONFIDENTIALITY

Contents

List of Tables

List of Figures

Executive Summary

NATS En Route plc (NERL) has commissioned NERA Economic Consulting (NERA) to review the Civil Aviation Authority (CAA)'s and its advisors' analysis on NERL's cost of capital for its RP3 regulatory period. Our comments on the CAA's RP3 cost of capital proposals focus on: i) errors that the CAA's advisors have made in their analysis; ii) unexplained deviations from regulatory precedent, and iii) unsupported assumptions.

CAA estimates substantial reduction in NERL asset beta at RP3, but no evidence of reduction in risk since RP2 and relative to other regulated companies provided

The CAA estimates an asset beta of 0.46 to 0.505 for NERL for RP3. The bottom end of the CAA's range is based on the bottom end of the recommended range by the CAA's consultant Europe Economics (EE) while the top end is set based on NERL's allowed asset beta for RP2. The CAA proposes to select a point estimate of 0.46, at the bottom of its proposed range, which taken together with the CAA's proposed debt beta of 0.13 implies a substantial reduction in NERL's equity beta and cost of equity at RP3.

The CAA's proposed asset beta implies a substantial reduction in risk for NERL in RP3 relative to RP2 as well as other regulated sectors, for which the CAA provides no justification or evidence. Indeed, the CAA concludes on a significant asset beta reduction relative to RP2, despite its own consultant EE concluding that risks for NERL in RP3 have, if anything, increased compared to RP2 due to additional risks associated with Brexit.[1] The CAA's proposed asset beta also implies a substantial reduction in relative risk for NERL compared to UK regulated airports and UK utilities such as water, for which the CAA fails to provide any supportive evidence. In contrast, empirical asset betas for listed airports have increased relative to RP2 and the same is true for betas of E&W water companies, as recognised by Ofwat in its proposals to increase the asset beta for water in PR19 compared to PR14.

We conclude there is no basis for the CAA to set an asset beta for RP3 below the asset beta of 0.505 used for RP2 (assuming a 0.1 debt beta), given that NERL's risk going forward is expected to be at least as high or higher than RP2, as recognised by EE.

Indeed, we believe that the appropriate asset beta for NERL for RP3 should be higher than for RP2, taking into account the evolution of asset betas for comparator companies including airports as well as for the Italian ANSP ENAV since RP2, as we explain below.

Evidence from ENAV supports an asset beta for NERL of 0.53 to 0.58 (at 0.05 debt beta), when the ENAV beta is correctly estimated against European benchmark index and adjusted for NERL relative risk

The CAA's advisors EE estimate a "comparator range" for NERL's asset beta of 0.29 to 0.54, drawing on EE's empirical beta estimates for the Italian ANSP ENAV estimated against the local index (lower bound) and European index (upper bound) and adjusted downwards due to alleged greater risk of ENAV's terminal services compared to en-route services.

[1] *"These has also been some additional emerging potentially systematic risk associated with "no deal Brexit" scenarios. We believe that these factors, in combination, should have been* ***expected to tend to raise asset betas****. By contrast, we do not believe that other factors,[...], imply any material shift, either up or down, in asset betas."* Source: Europe Economics (December 2018), Components of the Cost of Capital for NERL, p.1.

We agree with EE that it is appropriate to place weight on beta estimates for ENAV as a comparator for NERL, given additional data available since ENAV's listing in July 2016. However, EE's beta estimates for ENAV are based on a flawed estimation methodology, which leads to a substantial understatement of ENAV's beta, as we explain below. Indeed, EE's asset beta range for ENAV's en route services is implausibly low, with its lower bound equal to 0.29 (at debt beta of 0.1 to 0.19 recommended by EE), which is even lower than the allowed asset beta for E&W water companies in PR14 of 0.3 (at zero debt beta) or 0.36 to 0.41 (at a debt beta of 0.1 to 0.19 as per EE).

The first error that EE make is that they use a local Italian market index (FTSE MIB) with only 40 companies included as the reference index for calculating ENAV's beta. We find EE's use of local indices as market benchmarks leads to an understatement of asset betas for ENAV (and other European comparators AdP and Fraport) as a proxy for NERL's asset beta and instead a wider Europe Stoxx 600 index should be used for the following reasons:

- *Local indices do not reflect the investment universe of the marginal investor*: Our analysis of shareholder composition for ENAV, AdP and Fraport, shows that the investor base is highly international with a number of large international investment funds holding stakes. It follows that the Italian or other local indices are not a representative benchmark for these investors when calculating beta. Moreover, the local indices used by EE contain only very large cap stocks and do not include ENAV, AdP or Fraport themselves and hence cannot represent the investment universe for investors in these stocks.
- *Wider European benchmark is more similar to UK FTSE than local indices*: Given that the overall purpose is to estimate a beta for NERL, the reference market for comparator companies should be similar to the UK stock market. We show the Europe Stoxx 600 index is similar to the FTSE All Share index in terms of size and sector composition, further supporting the use of a Europe wide index as the market benchmark.

The second error that EE make in their beta analysis is that they incorrectly assume that ENAV's terminal services are higher risk compared to ENAV's en-route services, applying a downward adjustment to ENAV overall beta to derive an en-route beta.

However, by contrast, our review of risk for ENAV's different services suggests ENAV's terminal services are actually *lower risk* compared to ENAV's en-route services, given the regulatory regime shields terminal services from volume (and in some cases cost) risks. Our findings are consistent with the allowed asset betas for ENAV en-route vs. terminal services in RP2, as reported in the ENAV IPO prospectus. Correcting this error supports an 8 per cent uplift to ENAV's total beta to derive a beta for ENAV's en-route services only.

EE correctly identify that NERL is exposed to greater operational leverage risks compared to ENAV and correctly conclude that NERL's en-route beta should lie above ENAV's en-route beta. However, we find that EE's proposed 9 per cent uplift to the ENAV asset beta for NERL's greater operational leverage lies at the bottom end of plausible adjustments applied by the CMA and should therefore be considered as a lower bound on the necessary adjustment.

Overall, we calculate an asset beta for NERL in RP3 based on ENAV evidence of 0.53 to 0.58 (at 0.05 debt beta). Our estimate is based on ENAV's asset beta estimated against the correct European benchmark index, adjusted upwards by 8 per cent for greater risk of ENAV en-route services compared to terminal services and a further 9 per cent upward adjustment for NERL's greater operational leverage compared to ENAV (as per EE's estimate).

Airport comparators support an asset beta for NERL of 0.58 (at 0.05 debt beta)

The CAA's advisors EE estimate a "constraint range" for NERL's asset beta of 0.46 to 0.54, with the lower bound based on betas for UK utilities and upper bound based on betas for UK airports, consistent with EE's argument than NERL's asset beta should be higher than that of UK utilities and lower than that of UK airports.

We disagree with EE that UK utility betas are relevant comparators for NERL, even as a lower bound, given UK utilities are regulated under a revenue cap framework which protects them from volume risk and also have lower operating leverage compared to NERL, which implies NERL asset beta should be well above utilities, consistent with established UK regulatory precedent.

We also disagree with EE's assumption that UK airport betas represent an upper bound on NERL risk, given NERL is exposed to more internationally diversified traffic from overflights and is also subject to risk sharing. Our review of peak-to-trough traffic volatility reveals that NERL has experienced greater not lower underlying traffic volatility compared to UK airports. Moreover, we show that despite traffic risk sharing, NERL is exposed to greater *cash-flow* volatility for a given demand shock compared to Heathrow and Gatwick, due to NERL's greater operating leverage. As a result, we find no support for EE's assertion that NERL is lower risk compared to UK airports.

As explained in our March 2018 report, we consider NERL's beta should be estimated directly using available listed airport comparators. We concluded that the closest comparator for NERL is AdP, given similar traffic composition and noting that AdP is also subject to a volume risk sharing mechanism. We also explained that we would expect NERL to face greater systematic risk than ADP because of NERL's high operating leverage. Updated evidence supports an asset beta for AdP of 0.58 (at 0.05 debt beta), which is also consistent with the average beta for the wider airport comparator set.

We conclude on an asset beta range for NERL in RP3 of 0.53 to 0.58 (assuming debt beta of 0.05), drawing on evidence from airports and ENAV

Overall, we conclude on an asset beta range of 0.53 to 0.58 for NERL in RP3 (assuming debt beta of 0.05). Our conclusions draw on i) updated beta estimates for ENAV 0.53 to 0.58 and ii) updated beta estimates for airport comparators of 0.58 (AdP and wider comparators in general).

We consider the point estimate for NERL should lie towards the top end of the range, given NERL's greater exposure to traffic risk compared to ENAV for which we make no adjustments, our conservative adjustment for NERL greater operational leverage based on EE method as well as NERL's greater operating leverage compared to AdP.

We find no evidence of increase in debt beta from previous reviews, we recommend a debt beta of 0 to 0.1 with a point estimate of 0.05

The CAA proposes a debt beta of 0.13 for RP3, higher than the RP2 debt beta of 0.1. The CAA's proposal is based on i) EE's debt beta estimate (0.19), ii) PwC's empirical analysis which shows increasing debt betas and iii) regulatory precedent.

We consider that there is little support for the CAA's assumption to set the debt beta for NERL at 0.13. We believe that the CAA have erroneously reached this conclusion by placing too much weight on very limited evidence presented by EE and PwC, and that they have ignored the wider academic literature on debt betas.

In response to the CAA's proposals on debt beta, we have considered the evidence presented by Professor Ania Zalewska (2019) from the University of Bath in her separate paper on debt beta commissioned by NERL, which presents empirical evidence on debt betas using NATS and Heathrow bonds, as well as iBoxx indices, therefore providing empirical estimates that can be compared to those of PwC. Professor Zalewska derives debt betas using a variety of methods (OLS, ML, GARCH, Kalman-Filter) and considers the sensitivities of the results to alternative definitions of the market portfolio, the period of assessment and data frequency. She concludes that there is evidence that the debt beta from the NATS-bond is significantly smaller than 0.1 and not statistically different from zero. Other academics have also provided empirical debt estimates, including two papers by Schaefer and Myers, which also show debt betas below 0.1 for comparable rated debt to NERL and HAL (for Heathrow and Gatwick, Schaefer recommended a debt beta of 0.04, while Myers recommended a debt beta of 0 for comparable rated debt).

We have also considered the evidence from the "indirect" method proposed by EE, but we do not find support for a debt beta of 0.19 as estimated by EE. We find that EE's formula omits a key component of the debt premium – liquidity premium – as considered by the CMA in its calculation of debt betas in 2007. In addition, we identify several issues with EE's assumptions used in the decomposition, including: i) understating the default premium; ii) overstating the debt spread and iii) understating the ERP. Correcting for these issues and applying the CMA formula, we calculate substantially lower debt betas of 0.05 to 0.1, closer to the empirical beta estimates.

We conclude that the plausible value of debt beta lies in a range of 0 to 0.1, with a point estimate of 0.05 as per our October 2018 report. A debt beta of 0 is consistent with the empirical analysis of Professor Zalewska, Schaefer and Myers while a debt beta of 0.1 is consistent with the upper end of the indirect method and regulatory precedent (e.g. CAA's assumption of 0.1 in RP2).

CAA provides no evidence that TMR has fallen since RP2

The CAA proposes a TMR range of 5 to 6.25 per cent, RPI deflated, drawing on analysis of its consultant PwC, other regulators and their consultants as well as a recent report by Wright et al. from their 2018 report for the UKRN ("UKRN report"). The CAA proposes a point estimate of 5.4 per cent (RPI deflated), which implies a substantial reduction in the TMR compared to the RP2 estimate of 6.25 per cent (RPI deflated).

We believe that the CAA has based its TMR assumptions on an incorrect premise that the TMR has fallen since RP2, where there is little evidence to support this. In this report, we show that a robust assessment of historical data shows no reduction in realised returns over the recent period in light of falling risk free rates (RFR) across global equity markets. Forward looking evidence from dividend growth models (DGM), including PwC's own evidence, shows no reduction in expected TMR estimates relative to RP2. Similar, forward-looking survey evidence shows no reduction in expected TMR either.

All of this evidence supports the notion of a broadly constant TMR over time, with reductions in RfR broadly offset by increases in ERP, and provides no reason for the CAA to reduce its estimate from RP2, which was already lower than the latest estimate from the CMA of 6.5 per cent from the NIE 2014 and Bristol Water 2015 determinations.

The CAA estimated TMR range and point estimate rely on selective evidence

The CAA's assessment of the TMR for RP3 relies on selective evidence. In forming its proposed range, the CAA appears to mainly rely on the evidence in the UKRN report and advice from PwC, both of which support unprecedentedly low TMR figures. We note that both UKRN's report and the PwC analysis depart substantially from regulatory precedent, including CMA precedent, and their research has not been subject to scrutiny in the refereed academic literature.

The CAA places no weight on the alternative evidence presented by others, including a range of academic papers and evidence from institutions such as the Bank of England, which would lead to higher values for the TMR.

In addition to considering only evidence which supports low TMR figures, the CAA also selects a point estimate of 5.4 per cent, towards the bottom of its estimated range, thus further exacerbating the downward bias in its TMR estimate. This is not the usual approach taken by regulators: given the potential issues resulting from setting a cost of capital that is below the efficient level, regulators have typically erred on the side of caution and consider either the midpoint or the top end of the range. For example, the CMA in its 2014 NIE determination stated that it wished to avoid the cost of capital being too low and selected a point estimate at the top of its range.

The UKRN report understates the historical TMR due to flawed conclusions on historical inflation and "predictability" of returns

The CAA estimates a historical TMR of 5 to 6 per cent real RPI-deflated based on the UKRN report.

We show that the UKRN report historical TMR estimates are understated due to the authors:

- drawing on a hybrid RPI/CPI historical inflation series, which they incorrectly interpret to represent CPI inflation, thus understating historical real CPI-deflated returns (given RPI inflation is generally higher than CPI); and
- applying an excessive adjustment for long holding periods and alleged predictability of returns, compared to established methods in financial literature as used by the CMA.

Correcting for the above issues, we calculate historical evidence supports a higher TMR range of 6.2 to 6.8 per cent RPI-deflated.

PwC's application of the DGM is flawed due to reliance on UK GDP forecasts as a basis for estimating investors' expectations of dividend forecasts for FTSE stocks

The CAA also presents a forward looking TMR of 4.0 to 6.3 per cent RPI-deflated, drawing on PwC's as well as other UK regulators' consultants' application of the dividend growth models (DGM).

We show that PwC's as well as other consultants' DGM-based TMR estimates are understated due to:

- using UK GDP growth to estimate future dividend growth, which ignores UK FTSE companies' 70 per cent exposure to international markets where expected growth is higher; and
- ignoring analyst forecasts of dividend growth which are substantially higher than forecast GDP growth, and which are used as a basis of estimating DGM in academic literature, by financial institutions including central banks and US regulatory precedent.

In contrast, the Bank of England, whose estimates the CMA relied on in the NIE 2014 and Bristol water 2015 determinations, relies on analyst forecasts for short-term dividend growth and global GDP forecasts for long-term dividend growth, supporting substantially higher DGM-based TMR of 7 to 8 per cent RPI-deflated compared to the CAA's estimates.

We conclude on a TMR range of 6.2 to 6.8 per cent (RPI-deflated) drawing on historical evidence

We calculate updated historical returns of 6.2 to 6.8 per cent RPI-deflated, which draw on historical returns deflated using the RPI index and established methods for estimating TMR for long-holding periods used by the CMA in its NIE 2014 and Bristol water 2015 determinations. We adjust the historical data by the difference between the historical and forward-looking RPI-CPI wedge, drawing on available data on CPI and RPI. This adjustment corrects for any structural changes to the RPI index arising from the 2010 ONS change measuring clothing prices and derives an appropriate forward-looking TMR in RPI-deflated terms.

We also present forward-looking evidence from Bank of England DGM models which supports a TMR of 7 to 8 per cent RPI-deflated, which corrects for issues with the PwC / other consultants' application of the DGM.

We conclude on a TMR range for RP3 of 6.2 to 6.8 per cent RPI deflated, drawing on the historical estimates as the primary evidence. We recommend that forward-looking evidence should be considered as a cross-check only, although we note that BoE estimates support even higher TMR compared to historical estimates.

1. Introduction

NATS En Route plc (NERL) has commissioned NERA Economic Consulting (NERA) to review the Civil Aviation Authority (CAA)'s and its advisors' Europe Economics (EE) and PwC analysis of NERL's cost of capital for the RP3 regulatory period. Specifically, we have been asked to respond to the CAA's assessment of NERL's cost of equity for RP3, in relation to the key parameters including the asset beta, the debt beta, and the total market return.

This report is structured as follows:

- Section 2 responds to the CAA's and EE's assessment of asset beta for NERL in RP3;
- Section 3 responds to the CAA's and EE's assessment of debt beta for NERL in RP3; and
- Section 4 responds to the CAA's and PwC's assessment of the total market return for RP3.

2. Asset Beta

In this section, we respond to the analysis presented by the CAA and its consultant EE on the asset beta for NERL for RP3. We focus on errors that the CAA's consultants make in their analysis, unexplained deviations from regulatory precedent, and unsupported assumptions.

In Section 2.1, we first summarise CAA and EE's analysis of NERL's asset beta for RP3. In Section 2.2 we explain that the CAA provides no evidence for a substantial reduction in NERL's risk relative to RP2 and other UK regulated companies which would support the CAA's proposed asset beta reduction in RP3. Instead, NERL's beta for RP3 should be no lower compared to RP2. Indeed, we believe comparator evidence supports a higher asset beta for NERL in RP3. In Section 2.3 and 2.4, we explain evidence from ENAV beta, once corrected for EE's flawed beta estimation methodology based on local Italian benchmark indices and incorrect adjustments for relative risk of ENAV's terminal vs. en-route services, supports an asset beta of 0.53 to 0.58 (at 0.05 debt beta). In Section 2.5, we explain evidence from listed airport comparators with similar risk exposure to NERL supports asset beta of 0.58, at the top end of ENAV range. In Section 2.6, we conclude on an asset beta range of 0.53 to 0.58 (at 0.05 debt beta) drawing on ENAV and airport comparators. We propose a point estimate for NERL at the top end of ENAV's range, given greater NERL exposure to traffic risk, for which we make no adjustments to ENAV beta, and our conservative operating leverage adjustment and NERL's greater operating leverage compared to AdP.

2.1. Summary of CAA's and EE's Analysis of NERL's Asset Beta for RP3

In its February 2019 Draft UK RP3 Performance Plan proposals, the CAA proposes an asset beta range of 0.46 to 0.505. [2] The lower bound of the CAA's asset beta range is based on the analysis by EE, specifically the minimum asset beta that EE considers would be appropriate for NERL based on asset betas for utility comparators, while the upper bound is set equal to NERL's asset beta for RP2, which is lower than the upper bound of 0.54 recommended by the CAA's consultant EE.[3]

The CAA proposes an asset beta point estimate of 0.46, which it considers to be slightly above the mid-point of EE's estimates of ENAV's asset beta, and is within the range of UK utility and airport comparator betas. CAA also "sense-checks" the 0.46 asset beta against the recent regulatory precedent, and argues that 0.46 is above the beta estimates from other UK regulators, while slightly below the mid-point of PwC's beta estimates for Heathrow Airport.[4]

In its December 2018 report for the CAA,[5] EE presents empirical evidence on asset betas for three types of comparators as relevant for estimating the asset beta for NERL in RP3: i) UK utilities, ii) UK Airports, and iii) ENAV. EE considers that NERL's asset beta should be higher than that of UK utilities, and lower than that of UK airports (proxied by AdP and Fraport betas for Heathrow), which would support a so called "constraint range" of 0.46 to

---

2 CAA (February 2019), Appendices to Draft UK Reference Period 3 Performance Plan proposals, CAP 1758, pp.42-46

3 CAA (February 2019), op. cit., p 45, para D73

4 CAA (February 2019), op. cit., p 45, para D71

5 Europe Economics (December 2018), Components of the Cost of Capital for NERL, pp. 36-45.

0.54.[6] EE also estimates a second so-called "comparator range", which is based on empirical beta estimates for the listed Italian air navigation service provider (ANSP) ENAV. EE calculates an asset beta range of 0.29 to 0.54 for a notional "en-route" portion of ENAV, based on the 2-year asset betas estimated against Italian domestic and European reference markets respectively, adjusted downwards for ENAV's alleged greater risk of terminal services compared to en-route services. In addition, EE finds that NERL has higher operating leverage than ENAV, and estimates a 9 per cent uplift to the average ENAV asset beta of 0.42, which provides an estimate *"just below 0.46"*, the bottom end of EE's "constrained range 0.46 to 0.54 based on utilities and airports.[7] Based on the "constraint range" of 0.46 to 0.54, and the mid-point of adjusted "comparator range", EE concludes that NERL's asset beta for RP3 should lie at or higher than 0.46.[8]

We have identified a number of significant issues with the CAA's and EE's analysis, which lead to a substantial understatement of NERL's asset beta for RP3. We discuss these errors in the following sections.

In the remainder of this section, unless otherwise stated, we present asset beta estimates assuming a 0.05 debt beta in line with the mid-point of the plausible debt beta range for RP3, as discussed in Section 3. This allows direct comparisons of the asset beta figures across the different estimates.

2.2. CAA RP3 Proposed Asset Beta Implies Substantial Reduction in NERL's Risk Since RP2 and Relative to Other Regulated Companies for Which CAA/EE Provide No Evidence

CAA's proposed asset beta of 0.46 for RP3 is substantially lower than the asset beta of 0.505 used for RP2. In addition, given the CAA proposed increase in debt beta from 0.1 used in RP2 to 0.13 for RP3, the proposed reduction in the equity beta, the relevant measure for calculating the CAPM cost of equity, is even higher from 1.11 in RP2 to 0.96 in RP3. [9]

However, as we discuss in this section, neither the CAA nor EE explained the reasons or provided any evidence underlying the proposed reduction in risk and consequently in NERL's asset beta. We find there is no basis for the CAA to set an asset beta for RP3 below the asset beta of 0.505 used for RP2 (at 0.1 debt beta), given that NERL's risk going forward is expected to be at least as high or higher than RP2 (as recognised by EE) and indeed no change in relative risk compared to other UK regulated companies (e.g. water).

We also note that the CAA's proposed asset beta for RP3 relies on a selective and biased interpretation of the evidence provided by its own consultant EE: the CAA uses EE's lower bound asset beta estimate for NERL of 0.46, but ignores EE's upper bound of 0.54 and instead constrains the upper bound at 0.505 based on RP2. The CAA then selects a point

6 Europe Economics (December 2018), Components of the Cost of Capital for NERL, p.43.

7 Europe Economics (December 2018), Components of the Cost of Capital for NERL, p.44

8 Europe Economics (December 2018), Components of the Cost of Capital for NERL, p.2.

9 If the CAA had assumed a debt beta of 0.1, the equity beta for RP3 would have been 1 (retaining the CAA's asset beta of 0.46 and gearing of 60 per cent), as opposed to the 0.96 proposed by the CAA. Source: NERA calculations; CAA (February 2019), op. cit., p.53.

estimate at the low end of its range, further exacerbating the downward bias in its beta estimate.

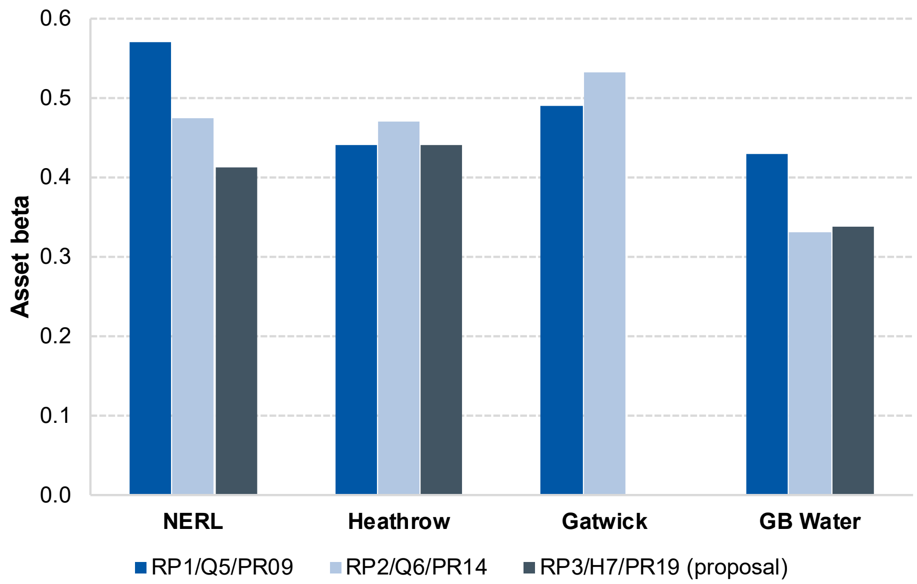
2.2.1. CAA's point estimate for RP3 implies substantial reduction in risk relative to RP2 which is unjustified

CAA's proposed asset beta for NERL in RP3 is significantly lower than its RP2 allowed asset beta, which in turn was lower than the RP1 allowed asset beta, as shown in Figure 2.1.

In RP2, CAA and its advisor PwC argued that risk faced by NERL has fallen relative to RP1, and reduced the beta estimate, taking into account the traffic risk sharing mechanism, the "portfolio effect" for NERL compared to individual airports, and the point that initial round of demand shocks are absorbed by airlines.[10]

For RP3, the CAA presents no evidence on changes in NERL risk relative to RP2 which would support a further reduction in NERL's asset beta at RP3. The CAA's repeated proposed asset beta reductions for NERL are an outlier among other regulated companies across sectors, as shown in Figure 2.1.

Figure 2.1: Comparison of Changes in Regulatory Decisions on Asset Beta Over Last Three Reviews



Source: NERA analysis of regulatory precedent
Note: We compare the asset beta across regulatory control period on a consistent debt beta basis of 0.05 to ensure the asset betas are comparable across industries and across regulatory periods. We note that these values may differ from the asset betas stated in the regulatory determinations.

Indeed, there is evidence that NERL's risk has increased in RP3 relative to RP2. In our March 2018 report, we considered that the risks NERL faces are expected to increase as a

10 CAA (June 2014), UK-Ireland FAB RP2 Performance Plan – Supporting Document, Appendix E, pp.254-257; PwC (February 2014), Estimating the cost of capital for NERL, Section 7.4, pp.36-47.

result of Brexit.[11] The key channels through which Brexit is expected to affect NERL's risk include:

- **Increase of macroeconomic uncertainty:** the UK is facing greater macroeconomic uncertainty (as reported by the Bank of England in its February 2019 inflation report using several economic indicators[12]) around future economic developments in the run-up to and following Brexit, leading to greater uncertainty around demand for air travel. This would expose NERL to greater risk.
- **Increase in regulatory risk:** it is unclear what future regulatory arrangements NERL will be subject to following Brexit, which may include continued application of the Single European Sky (SES) regulatory framework, but potentially without UK involvement in shaping the rules, or an alternative yet unknown regime. This increase in regulatory risk will increase NERL's cost of capital relative to the CAPM estimate.

EE acknowledges that the risks associated with a "no deal Brexit" scenario should theoretically increase the asset betas, while it considers that no other factor implies "*any material shift, either up or down, in asset betas*".[13] The CAA's proposed asset beta reduction for RP3 relative to RP2 directly contradicts CAA's own consultants' view of no change or increase in NERL's risk for RP3 relative to RP2.

We conclude that there is no evidence that NERL's risk has decreased in RP3 relative to RP2 and there are potential factors which increase risk (Brexit). This suggests that the RP3 asset beta should be no lower than in RP2.

2.2.2. CAA point estimate for RP3 implies substantial reduction in risk relative to UK airports and water utilities which is unjustified

Figure 2.2 compares recent regulatory decisions on equity beta for NERL and Heathrow and the CAA's and its advisors' proposed estimates for the upcoming regulatory period. Since the CAA used the same notional gearing assumption of 60 per cent for both NERL and Heathrow in the last two regulatory periods and there is no proposed change to the gearing assumption going forward, it is reasonable to compare the equity betas.

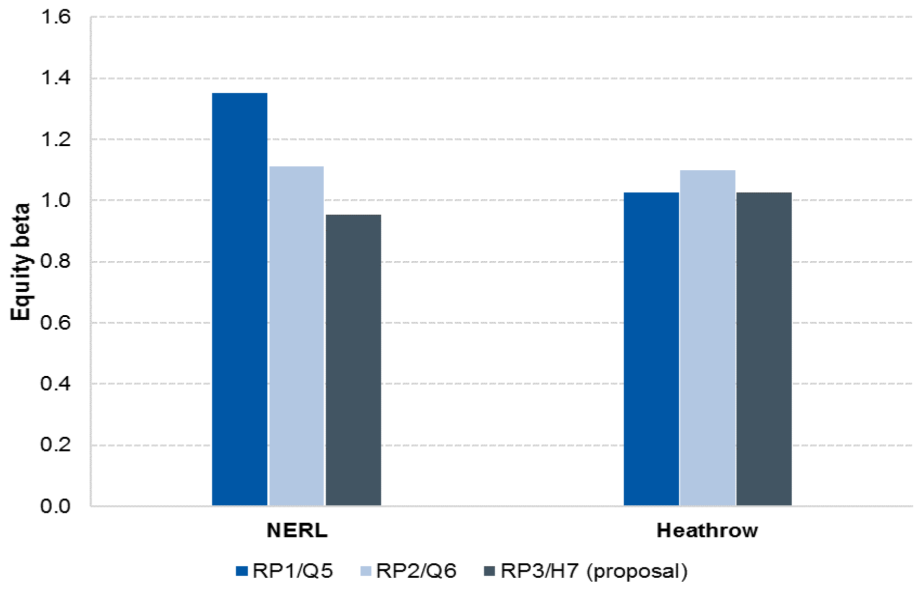
---

[11] NERA (March 2018), The Weighted Average Cost of Capital for NATS (En-Route) plc at RP3, Section 2.2, pp.15-17.

[12] Bank of England (February 2019) Inflation Report, p.41

[13] Europe Economics (December 2018), Components of the Cost of Capital for NERL, p.1.

Figure 2.2: Reduction in NERL's Equity Beta Significantly Greater than HAL's

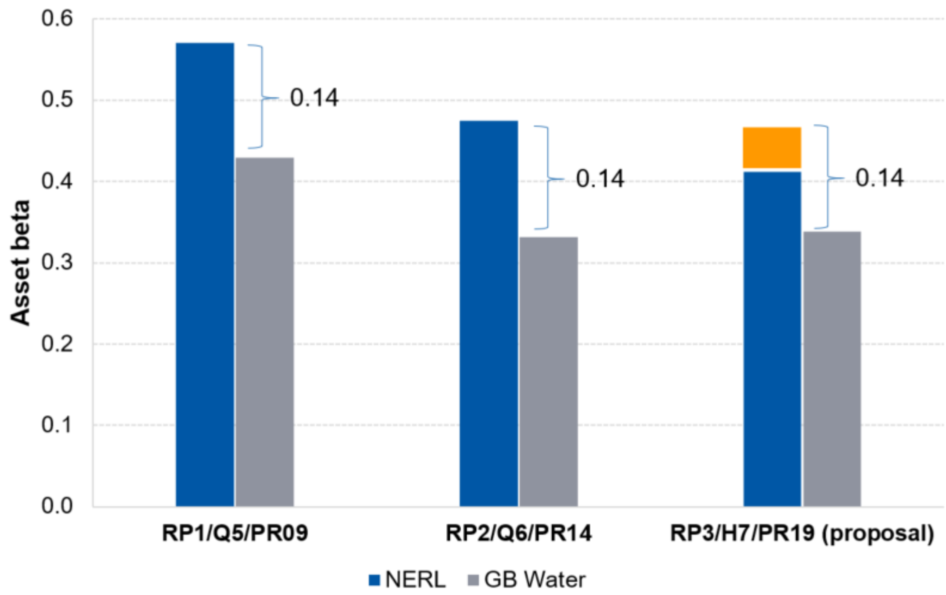


Source: NERA analysis of CAA's regulatory documents.

As shown in Figure 2.2, the CAA has reduced NERL's equity beta significantly over the last two price controls compared to Heathrow, and is proposing to reduce NERL's equity beta even further for RP3. The RP3 proposed beta estimates suggest that CAA and its consultants believe that there has been substantial change in the relative risk between NERL and Heathrow airport, although neither the CAA nor its consultants have provided any evidence for such major shift in NERL's risk.

Similarly, Figure 2.3 shows that the CAA proposed asset beta for NERL (restated on a 0.05 debt beta basis) implies a substantial reduction in relative risk for NERL compared to E&W regulated water companies. In the last two price controls, the differential in the asset beta decisions for NERL and water has been stable with NERL asset betas 0.14 higher compared to water and the CAA provides no evidence which would support a reduction of relative risk of NERL compared to water for RP3/PR19.

Figure 2.3: Recent Regulatory Decisions Show a Stable Wedge of 0.14 in Asset Beta Between NERL and E&W water, Supporting NERL Asset Beta of 0.53 for RP3 (Using CAA Debt Beta of 0.13)



Source: NERA analysis of regulatory precedent
Note: We compare the asset beta across regulatory control period on a consistent debt beta basis of 0.05 to ensure the asset betas are comparable across industries and across regulatory periods. We note that these values may differ from the asset betas stated in the regulatory determinations.

As shown in Figure 2.3, the historical NERL-to-water asset beta wedge has been of c.0.14 in both RP1/PR09 and RP2/PR14. If we were to apply this historical wedge of 0.14 to the Ofwat proposed asset beta for water companies for PR19 of 0.34 (converted using a debt beta 0.05),[14] we would calculate an asset beta for RP3 of around 0.48, assuming a debt beta of 0.05. This is equivalent to an asset beta of 0.53 if we were to adopt the CAA's proposed debt beta assumption of 0.13 for RP3, which is substantially higher than CAA's proposed asset beta of 0.46 (at 0.13 debt beta). Therefore, the CAA's proposed asset beta implicitly suggests a reduction in the relative risk for NERL compared to water, for which it provides no supporting evidence.

2.2.3. Conclusion: NERL asset beta should be no lower than RP2 given no reduction in risk relative to RP2 and other regulated utilities

We conclude there is no basis for the CAA to set an asset beta for RP3 below the asset beta of 0.505 used for RP2 (assuming a 0.1 debt beta), equivalent to 0.52 using CAA's higher debt beta of 0.13 proposed for RP3, given that NERL's risk going forward is expected to be at least as high or indeed higher than RP2 (as recognised by EE).

Indeed, we believe that the appropriate asset beta for NERL for RP3 should be higher than for RP2, taking into account the evolution of asset betas for comparator companies including

[14] Asset beta of 0.34 is based on the debt beta assumption of 0.05. We computed the 0.14 wedge in asset beta using a consistent debt beta of 0.05. We converted stated asset beta of NERL in RP1/RP2 and Ofwat in PR09/PR14 using a common debt beta of 0.05.

airports as well as the Italian ANSP ENAV since RP2, as we explain in the following sections.

2.3. EE Empirical Beta Estimates Rely on a Flawed Methodology Which Leads to Understating Asset / Equity Beta for NERL

EE relies on the average asset betas of ENAV, AdP, and Fraport calculated against: i) large-cap domestic indices; and ii) Stoxx Europe 600. For ENAV, EE uses the asset beta estimated against the local index as its lower bound estimate (0.29), while for the upper bound it uses the wider European index (0.54). For AdP and Fraport, EE uses the average asset beta calculated against the local and the wider European index to calculate a beta of 0.55 (AdP) and 0.48 (Fraport).[15]

In section 2.3.1 below, we explain the issues with using domestic equity indices as the market portfolio when estimating beta and set out the rationale for using a European-wide regional equity index for these comparators.

We note that EE also uses differing assumption on debt betas for different comparators and for NERL itself, which introduces unjustified differences in asset betas. In section 2.3.2 below, we explain why a single consistent debt beta assumption should be used instead.

2.3.1. Europe-wide index should be used as benchmark for estimating betas of European comparators

EE's approach of estimating betas for ENAV, AdP and Fraport based on domestic large-cap indices is flawed for a number of reasons:

- Using domestic stock indices does not accurately reflect the investment universe of the marginal investor in ENAV, AdP and Fraport;
- The domestic large-cap stock indices used by EE do not include ENAV, Fraport and AdP itself, which means that these indices cannot represent the investor universe for ENAV, AdP and Fraport investors by definition; and,
- There are major differences in the industry composition of domestic indices DAX index (Germany), CAC40 index (France) and FTSE MIB (Italy), and the domestic indices are not sufficiently representative of the investor universe.

We discuss each of the above issues below.

Local stock market indices do not reflect the investment universe of the marginal investor in AdP and Fraport

The asset beta parameter is a measure of the systematic (i.e. non-diversifiable) risk of an asset relative to the risk of the market portfolio, proxied by the stock market index. Beta only captures systematic risk, which is the risk that an investor cannot diversify away by holding the market index.

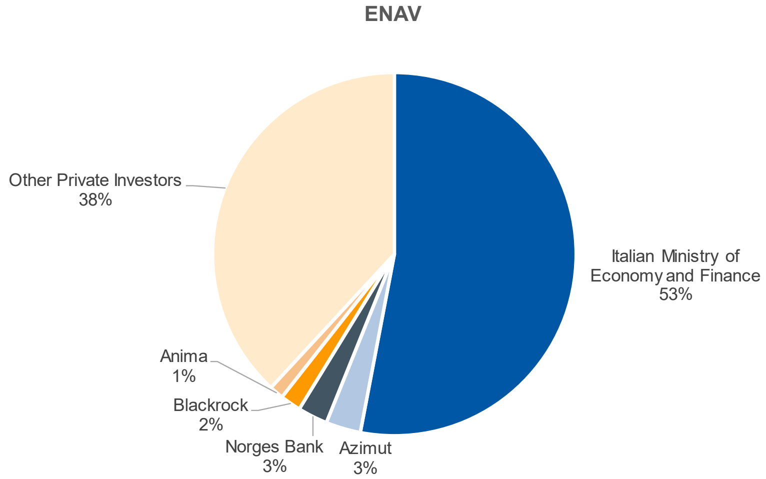
15 Europe Economics (December 2018), Components of the Cost of Capital for NERL, Section 7.

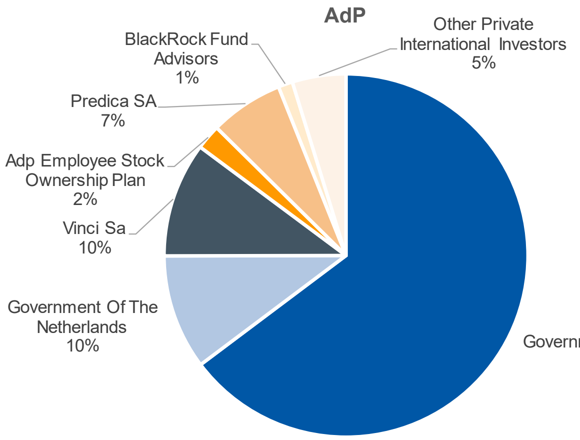
As established in finance literature, the asset beta should be calculated using the investment universe of the marginal investor in the company.[16] The marginal investor is defined as an investor who is more likely to complete a trade, and hence the investor whose behaviour is more likely to affect the share price (and, as a result, the beta of the asset). Once the marginal investor in the company is identified, the stock market index should represent the investment universe available to the marginal investor to diversify its portfolio of assets.

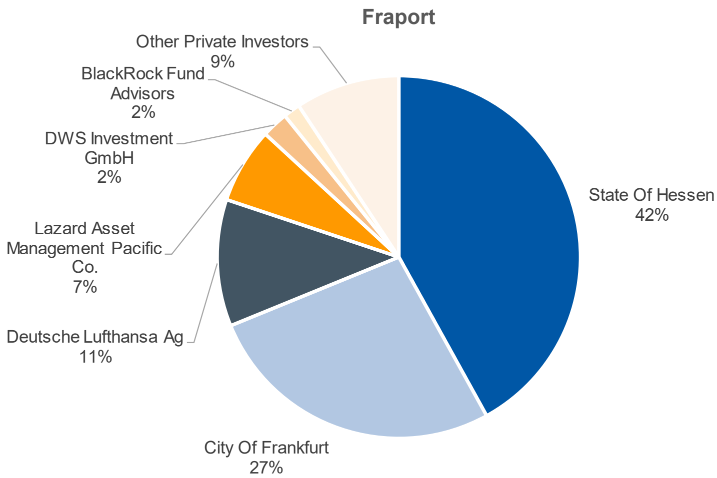
Figure 2.4 shows the shareholder base for ENAV, AdP and Fraport. Whilst the state is the major shareholder for ENAV, AdP and Fraport, the remaining investor breakdown suggests that the marginal investor in the three companies is likely to be a large international investment fund holding a geographically diversified portfolio of assets. The appropriate investment universe for this type of investor is wider than just the country in which this specific asset is located. For this reason, local stock market indices are not representative of the investment universe of the marginal investors in the three companies and instead the wider Stoxx Europe index is more appropriate to reflect the international diversification opportunities available to such investors.

[16] For example, Damodaran states: "While most risk and return models in use in corporate finance agree (…) that risk should be measured from the perspective of a marginal investor who is well diversified". Source: Damodaran, A., Applied Corporate Finance: Second Edition, 2004, Chapter 3, page 21.

Figure 2.4: ENAV, AdP, and Fraport Investor Base Supports Marginal Investor Is Diversified Beyond Domestic Large-cap Market Index







Note: International investment funds (i.e. marginal investors) shown in orange.
Source: NERA Analysis, Bloomberg.

ENAV, AdP, and Fraport are not constituents of the large-cap local indices used by EE

The Italian, French and German large-cap local indices used by EE as the market benchmark capture the performance of the largest and most traded companies in each stock exchange. However, ENAV, AdP, and Fraport themselves are not constituents of these large-cap indices, i.e. the FTSE MIB, CAC40 and DAX indices respectively.[17]

ENAV, AdP and Fraport should be included in the investment universe of the stocks' respective marginal investors. Therefore, EE's use of the domestic large-cap indices for calculating asset betas by construction does not reflect the investment universe of the marginal investor. The conceptually correct market portfolio index should include the entire universe of investable assets, which is better proxied by the Europe Stoxx 600 index.[18]

Sectoral composition of local indices differs from FTSE All share (UK benchmark)

Since the purpose of estimating the betas of ENAV and comparator airports is to assess the correct beta for NERL, it follows that the stock market that is being used as a reference market should be similar in terms of risk profile to the UK stock market.

As shown in Table 2.1, the domestic indices used by EE to calculate asset betas are different according to various key indicators, such as the total number of stocks, market capitalisation and the sectoral and geographical breakdown of the market. For example, the FTSE All Share contains 641 stocks, compared to only 40, 40 and 30 in the FTSE MIB, CAC40 and DAX, respectively. Equally, the market capitalisation for the FTSE All Share is more than double that of the CAC40 and DAX five times larger than FTSE MIB.

In estimating ENAV's, AdP's and Fraport's asset beta as a proxy for NERL's beta, the correct reference market index should be as similar as possible to the UK index in terms of relative risk and stock composition. The stock market indices used by EE differ considerably from the FTSE All Share, whereas the European regional index Euro Stoxx is similar to the FTSE All Share index under our criteria. To ensure that ENAV, AdP and Fraport beta estimates are relevant to the beta risk faced by NERL investors, it is imperative to use the wider Stoxx Europe 600 index.

[17] They are instead both included in their respective "Mid-Cap", as well as the domestic wider "All Share" indices.

[18] We note that while AdP and Fraport are included in the Stoxx Euro 600 index, ENAV is not. ENAV is instead included in the wider Stoxx All Europe index. We have tested the sensitivity of the ENAV asset beta estimated against the Stoxx Europe 600 and All Europe indices and find no difference in the resulting asset beta estimates. We therefore also use the Stoxx Europe 600 index for ENAV, in line with Fraport and AdP in our own estimates.

Table 2.1: Comparison of Local and European Stock Market Indices

Country	Index	# of stocks	Sectoral breakdown	Geographical breakdown	Mkt Cap (€bn)
UK	FTSE All Share	641	- Finance: 26% - Consumer: 26% - Energy: 14% - Industrials: 11% - **Utilities: 1%**	UK: 30% Overseas: 70%	2,551
Europe	Stoxx Europe 600	600	- Finance: 21% - Consumer: 22% - Energy: 8% - Industrials: 11% - **Utilities: 4%**	- US: 19% - UK: 10% - Germany: 7% - France: 7% - China: 5% - Italy: 4%	8,168
Italy	FTSE MIB	40	- Finance: 33% - Consumer: 14% - Energy: 14% - Industrials: 12% **- Utilities: 17%**	Italy: 42% Overseas: 58%	475
France	CAC40	40	- Finance: 12% - Consumer: 36% - Energy: 9% - Industrials: 16% **- Utilities: 2%**	France: 18% Overseas: 82%	1,200
Germany	DAX	30	- Finance: 19% - Consumer: 18% - Energy: 3% - Industrials: 12% **- Utilities: 3%**	Germany: 19% Overseas: 81%	1,342

Note: ENAV, AdP and Fraport are not included in the local indices presented above.
Source: Nera analysis of Factset and Bloomberg data.

<u>The home bias argument does not apply to European countries</u>

The choice of the market index should reflect the investment portfolio of the marginal investor of our comparators. In principle, we consider that an investor in European assets is likely to diversify his or her portfolio across the European market, given the common currency in major countries and free capital movement. We note that despite economic integration at the global level, some academic studies observe "home bias", which shows that some equity investors have preferences for investing in domestic stocks despite the wider benefits of diversification.

However, the extent of the "home bias" would depend, amongst other, on the explicit or implicit barriers to trade such as informational asymmetries. We do not consider such investment constraints would apply to the major countries in the European Union, such as Italy, France and Germany. On the contrary, the use of a domestic market index for a country may not offer the required level of diversification for an investor, since a domestic index implicitly restricts the investor's investment universe to stocks in that country.

In summary, we conclude that the wider European market index, rather than the domestic large-cap stock indices, should be used as the reference market for estimating betas for ENAV, AdP and Fraport, given:

- The Europe-wide index reflects the appropriate investment universe for the marginal investor in ENAV, AdP and/or Fraport and
- The Europe-wide index is also more similar to UK FTSE than local indices.

2.3.2. EE uses differing debt beta assumptions for different comparators which introduces unjustified differences in asset betas

EE uses a number of different debt beta assumptions in its empirical beta estimation: 0 for ENAV, 0.1 for airports, 0.13 for UK utilities and 0.1-0.19 recommended range for NERL.[19]

This is inconsistent and creates differences when converting the different estimates into an asset beta and equity beta for NERL.

As discussed in Section 3, debt beta estimates are sensitive to the estimation method applied and EE has not provided robust evidence which supports that debt beta estimates should vary as much, or indeed at all, across the different comparators for which it estimates empirical betas and NERL. In the absence of robust evidence on differences in debt betas for the different comparators, we conclude a consistent debt beta assumption should be used when estimating betas for comparators and NERL in RP3. We recommend a debt beta of 0.05, as discussed in Section 3.

2.4. EE's "Comparator Range" for NERL Asset Beta Based on ENAV is Understated Due to Several Flaws in EE's Methodology

EE estimates an asset beta for ENAV of 0.34 to 0.54, using a 2-year estimation window and a local index and European index benchmark respectively. It then decomposes the ENAV beta into the "en route" and "terminal" services components which are assumed by EE to constitute 80 per cent and 20 per cent of ENAV's business respectively, using the following equation:[20]

$$Beta_{ENAV} = 0.8 * Beta_{en-route} + 0.2 * Beta_{terminal}$$

EE argues that the "terminal" service component of ENAV's risk can be proxied by beta for airports, which it estimates to be at 0.54 based on Fraport and AdP, which results in an adjusted range of 0.29 - 0.54 for ENAV's "en route" services, which EE considers to be directly comparable to NERL.

EE's asset beta range for ENAV's en route services is implausibly low, with its lower bound equal to 0.29 (at debt beta of 0.1 to 0.19 recommended by EE), which is even lower than the allowed asset beta for E&W water companies in PR14 of 0.3 at zero debt beta or 0.36 to 0.41

[19] Europe Economics (December 2018), Components of the Cost of Capital for NERL, Section 7.

[20] Europe Economics (December 2018), Components of the Cost of Capital for NERL, Section 4, p.22.

assuming debt beta of 0.1 to 0.19 as per EE. Assuming a lower beta for ENAV which is exposed to traffic risk and greater operating leverage compared to E&W regulated water companies which operate under a revenue cap regime is implausible and demonstrates the flaws in EE's beta estimation methodology.

In the remainder of this section, we explain flaws with EE's methodology for estimating beta for ENAV's "en route" services, which leads to an understatement of EE's asset beta for NERL. Correcting for these errors, we estimate an asset beta range for ENAV of 0.53 to 0.57 (at 0.05 debt beta).

2.4.1. ENAV terminal services are lower not higher risk than en-route services

EE provides no analysis or evidence to support its assumption that ENAV's terminal services are higher risk (and significantly higher than the lower bound) compared to ENAV's en-route services.

Below, we explain that regulatory regime of ENAV's terminal services implies it is exposed to lower risks than en route services, as confirmed by the allowed asset betas in RP2 for ENAV's individual services. As a result, ENAV's total beta should be adjusted upwards to proxy en-route services, not downwards as argued by EE.

In its January 2019 investors presentation, ENAV explains the different types of risk faced by its terminal services, divided into three different airport zones, as summarised in Table 2.2 below.

Table 2.2: ENAV's Terminal Services Risk Profile

	% of reg. revenues	Airports	Difference from en-route
Terminal Zone 1 (over 225,000 IFR movements)	5%	▪ Rome Fiumicino	Same as en-route
Terminal Zone 2 (70,000 to 225,000 IFR movements)	7%	▪ Milan Linate ▪ Milan Malpensa ▪ Venice ▪ Bergamo	Full traffic protection
Terminal Zone 3 (less than 70,000 IFR movements)	14%	▪ Other airports	Full cost recovery

Source: ENAV (January 2019), Investor presentation, p.9.

Airports belonging to Terminal Zone 1 are subject to the same traffic risk sharing mechanism as NERL (and ENAV) in RP2: [21]

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

[21] 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

- Between 2 and 10 per cent traffic variation, ENAV bears 30 per cent of the risk; and
- Greater than 10 per cent traffic variation, ENAV bears no risk.

For airports belonging to Charging Zone 2, member states can decide not to apply the traffic risk sharing mechanism from RP2,[22] which is the approach taken in Italy. Instead, Italian airports in Charging Zone 2 benefit from full traffic risk protection, consistent with Zone 2 airports in 13 other European countries.[23] Terminal Zone 3 airports are excluded from the EU performance plan and are subject to a National regulation, which consists of a monetary allowance based on a full cost recovery mechanism.[24]

In summary, while ENAV's Terminal Zone 1 traffic risk profile is equivalent to its en-route services, Zone 2 and Zone 3 bear lower traffic risk, while also representing a greater proportion of ENAV's regulated revenues. In total, ENAV's terminal services are therefore less exposed to traffic risk than en-route services.

The above conclusion is also supported by the analysis of allowed returns for ENAV's various services. ENAV's IPO Prospectus discloses the allowed WACC for terminal and en-route services in the 2015-2019 Performance Plan.[25] Using the parameters provided in the IPO Prospectus, we calculated the implied allowed asset betas for ENAV's individual services as follows:

- We take the risk-free rate, ERP, gearing, and vanilla WACC for ENAV's en-route, and Zone 1 and 2 terminal services as reported in the IPO prospectus and the cost of debt based on ENAV's average cost of debt as per 2014 Annual Report. This allows us to back-solve the implied asset beta for these services.

- For Zone 3 terminal services, for which there is no WACC available, we assume an asset beta of 0.33 (at 0.05 debt beta) based on Ofwat's allowed asset beta for PR14.[26] This represents an upper bound estimate of a hypothetical asset beta for Zone 3, as airports belonging to Zone 3 are subject to full cost recovery while water companies bear some cost risk.

Using relative revenue shares from Table 2.2 as weights, we calculate a weighted average beta for ENAV's terminal services of 0.44, which is lower than the implied asset beta of ENAV's en-route services of 0.62, as shown in Table 2.3. This result is consistent with our above findings that ENAV's terminal services are exposed to lower risk than its en-route services.

---

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.

[22] Eurocontrol (November 2015), PRB Proposal on Terminal Air Navigation Services - Union-wide cost-efficiency targets for 2017-19: approach, issues and proposal

[23] Eurocontrol (November 2015), PRB Proposal on Terminal Air Navigation Services - Union-wide cost-efficiency targets for 2017-19: approach, issues and proposal, p.6.

[24] Eurocontrol (November 2015), PRB Proposal on Terminal Air Navigation Services - Union-wide cost-efficiency targets for 2017-19: approach, issues and proposal, p.14 and para 8.1.4.

[25] ENAV (2016), IPO Prospectus, p.279-280.

[26] Ofwat (December 2014), Final price control determination notice: policy chapter A7 – risk and reward, p.36.

Table 2.3: ENAV's Allowed Cost of Capital in RP2

	En-route (2015-2016)	Terminal Zone 1 (2015)	Terminal Zone 2 (2015)	Terminal – weighted avg. (2015)
Risk-free rate	2.22%	2.22%	2.22%	2.22%
ERP	5.0%	5.0%	5.0%	5.0%
TMR	7.22%	7.22%	7.22%	7.22%
Asset Beta	**0.62**	**0.86**	**0.38**	**0.44**
Gearing	30%	30%	30%	30%
Equity Beta	0.86	1.20	0.52	0.61
Cost of Equity	6.5%	8.2%	4.8%	5.2%
Vanilla WACC	5.1%	6.3%	3.9%	4.2%

Note: ENAV IPO Prospectus presents risk-free rate, ERP, gearing, and vanilla WACC. Cost of debt is based on ENAV's average cost of debt as per 2014 Annual Report. Asset betas back-solved from these inputs assuming a 0.05 debt beta.
Sources: ENAV (2016), IPO Prospectus, p.279-280. ENAV (2015), Bilancio consolidato del gruppo ENAV al 31 dicembre 2014, p.87.

In summary, we conclude that ENAV's terminal services are exposed to lower risk than ENAV's en-route services. ENAV's total beta should therefore be adjusted upwards to calculate a beta for ENAV's en-route services only.

We calculate the applicable upward beta adjustment based on our analysis of asset betas for ENAV's en-route and terminal services presented in Table 2.3 above. Specifically, we assume that the ratio of terminal/en-route betas calculated for RP2 is applied to de-compose the ENAV beta into terminal and en/route services, i.e. that the beta for terminal services is equal to 0.44/0.62 of the beta for en-route services. We also assume a revenue split between ENAV's en-route and terminal services of 74 and 26 per cent respectively, in line with the estimates presented in Table 2.2. Using these relationships, we re-write EE's decomposition equation as:

$$Beta_{ENAV} = 0.74 * Beta_{en-route} + 0.26 * (Beta_{en-route} * \frac{0.44}{0.62})$$

Re-arranging terms supports an upward adjustment to ENAV's beta of 8 per cent to calculate a beta for en-route services only.

2.4.2. NERL is exposed to greater risk than ENAV from operating leverage and traffic risk

In this section, we explain that EE's adjustment to ENAV's beta for operating leverage is at the bottom end of potential adjustments and is therefore conservative. We also explain that NERL is exposed to greater traffic risk compared to ENAV, supporting a higher asset beta for NERL.

2.4.2.1. EE's operating leverage adjustment is at the low end of potential adjustments

EE acknowledges that NERL has higher operating leverage compared to ENAV, drawing on operating leverage measures including capex/opex, capex/total assets and opex/total, replicated in Table 2.4 below.

Table 2.4: EE Estimates NERL Has Higher Operating Leverage Metrics Compared to ENAV

	ENAV	NERL
Capex/opex	16%	40%
Capex/Total assets	5.5%	12.5%
Opex/Total assets	32.5%	32.5%

Source: Europe Economics (December 2018), Components of the Cost of Capital for NERL, p. 22 Table 4.2.

Table 2.4 shows that NERL has higher operating leverage compared to ENAV based on comparatively higher capex. However, there is no established method in financial literature or in regulatory precedent of how to calculate an adjustment to ENAV's asset beta to account for NERL's greater operating leverage.

EE proposes to calculate an adjustment by calculating a ratio of (1+ $\text{NERL}_{\text{OL ratio}}$) and (1+$\text{ENAV}_{\text{OL ratio}}$) and applying an equal weight to the three above ratios, which supports an uplift of 9 per cent to ENAV's beta to calculate a beta for NERL.

However, there are alternative approaches which would support higher adjustments. For example, the CMA in its Bristol water determination in 2010 and 2015 applied an adjustment to the asset beta calculated by calculating a ratio of the operating leverage metrics themselves, i.e. a ratio of $\text{NERL}_{\text{OL ratio}}$ to the $\text{ENAV}_{\text{OL ratio}}$, as opposed to a ratio of (1+ OL metric) for the two comparators.[27] Applying this method to the operating leverage metrics calculated by EE in Table 2.4 would support a substantially higher adjustment of close to 100 per cent.

We consider a 100 per cent adjustment to ENAV's beta for NERL's operating leverage appears implausibly high. Nevertheless, it demonstrates that EE's proposed adjustment of 9 per cent is conservative compared to alternative potential adjustments which could be applied.

2.4.2.2. NERL's traffic risk exposure supports NERL beta above ENAV

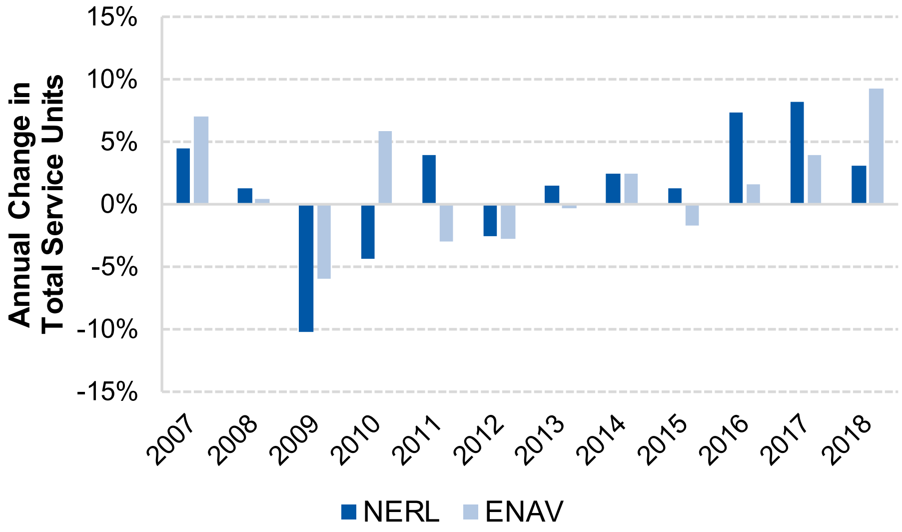
In this section we consider the evolution of NERL's traffic risk over time compared to ENAV. Our comparison reveals that NERL is exposed to greater traffic risk compared to ENAV.

Figure 2.5 compares the annual percentage change in the total service units for NERL and ENAV. The figure shows that both NERL and ENAV experienced a substantial decrease in traffic at the time of the Global Financial Crisis in 2009, indicating a potential structural

[27] CMA (October 2015), Bristol Water plc, A reference under section 12(3)(a) of the Water Industry Act 1991, Appendices 5.1 – 11.1 and glossary, pp.A10(1)-24 to A10(1)-33; CC, Bristol Water plc, A reference under section 12(3)(a) of the Water Industry Act 1991, Appendix N, pp.N33-N38.

break in the trends of traffic paths. We therefore focus our analysis using traffic data from 2009-onwards.

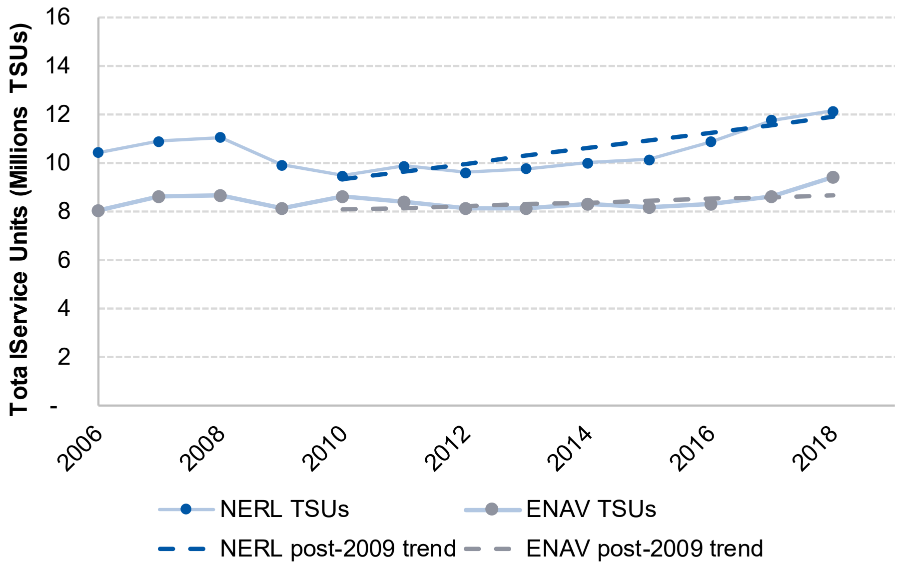
Figure 2.5: Annual Change in NERL's and ENAV's Total Service Units



Source: NERA analysis of data from NERL and STATFOR

In Figure 2.6, we show the level of traffic for NERL and ENAV, and their respective traffic trends based on the total service units after the Global Financial Crisis.

Figure 2.6: Post-2009 Traffic Trend for NERL and ENAV

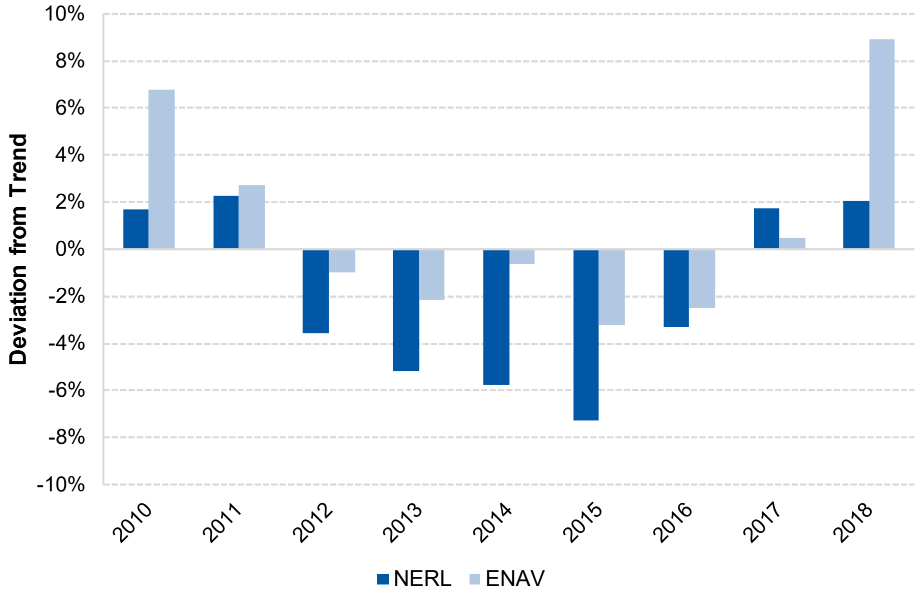


Note: Trend fitted using OLS regression.
Source: NERA analysis of data from NERL and STATFOR.

To compare the volatility of traffic between NERL and ENAV on a like-for-like basis, we calculate the annual percentage deviations from the trend based on traffic data after the Global Financial Crisis period.

As shown in Figure 2.7, NERL is exposed to a greater annual deviation of traffic from its trend compared to ENAV, and NERL has experienced more negative deviations than positive ones since the financial crisis. Although NERL and ENAV are both subject to the RP2 European-wide traffic risk sharing mechanism, the greater deviation from trend suggests that on average NERL faces a greater traffic risk than ENAV.

Figure 2.7: NERL's and ENAV's Percentage Deviation From the Trend



Source: NERA analysis of data from NERL and STATFOR

2.4.3. Conclusion: We estimate a corrected ENAV en-route beta of 0.53 to 0.58

We estimate a corrected ENAV en-route asset beta as a "direct" comparator for NERL as follows:

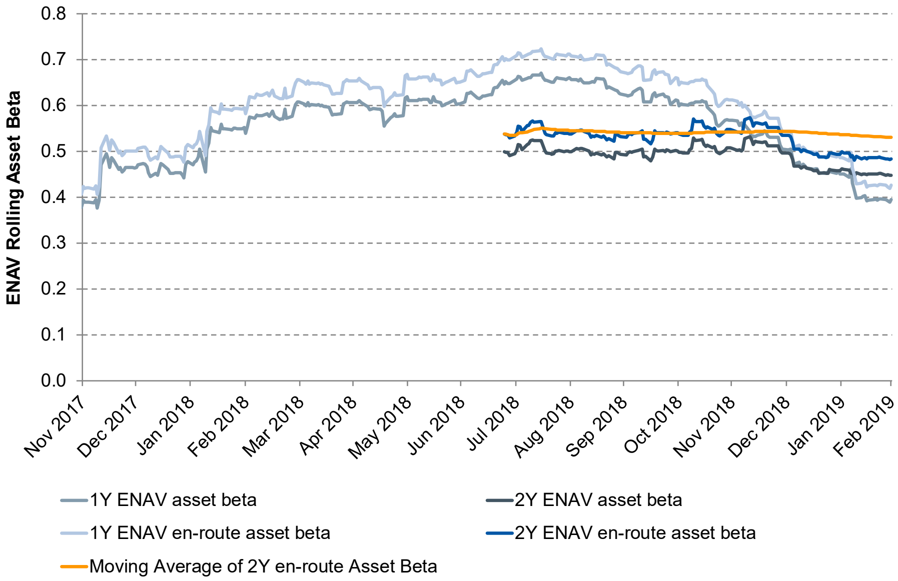
- We use a Euro Stoxx 600 index as the appropriate market benchmark, as explained in Section 2.3.1.
- We use a debt beta of 0.05, as discussed in Section 3.
- We estimate an asset beta range using the spot 2-year asset beta estimate, as well as the average of the 2-year asset beta estimates since listing.[28] The approach of using rolling asset beta estimates smoothes out volatility in beta estimates over the recent period and has been used by the CMA in its previous determinations, including for example the 2015 Bristol Water determination.[29]

---

28 ENAV's 2-year asset beta is only available since July 2018, given listing in July 2016.

29 See, for example, CMA (2015) Bristol Water plc price determination, Appendix 10, para. 83-100 https://assets.publishing.service.gov.uk/media/5627997640f0b60368000001/Appendices_5.1_-_11.1_and_glossary.pdf

Figure 2.8: ENAV's Rolling Asset Beta



Source: NERA analysis of Bloomberg data using 28 February 2019 cut-off date and debt beta of 0.05.

- This provides an estimate of ENAV's asset beta of 0.45 to 0.49.
- To derive the equivalent asset beta for ENAV's en-route services, we apply the 8 per cent upward adjustment to the ENAV beta which reflects our assessment than ENAV's en-route services are subject to greater risk than ENAV's terminal services, as discussed in Section 2.4.1.
- Finally, we apply the 9 per cent adjustment to the beta estimate for NERL's greater operational leverage compared to ENAV, based on EE's conservative estimate.

We conclude on an asset beta range of 0.53 to 0.58 (at 0.05 debt beta) as "direct" evidence on the asset beta for NERL based on ENAV, as summarised in Table 2.5.

We consider the point estimate for NERL should lie towards the top end of the ENAV range, given NERL's greater exposure to traffic risk compared to ENAV, for which we make no adjustments, as well as our conservative adjustment for NERL greater operational leverage based on EE's method.

Table 2.5: Asset Beta Range for NERL based on ENAV

	Average asset beta as of 28/02/2019	Average asset beta since listing
ENAV's 2y asset beta	0.45	0.49
Uplift for en-route services	0.04	0.04
Uplift for operating leverage	0.04	0.05
NERL's corrected asset beta	**0.53**	**0.58**

Source: NERA analysis of Bloomberg data using 28 February 2019 cut-off date and debt beta of 0.05.

2.5. EE's Conclusion that NERL is Lower Risk Compared to Airports is Unsupported by Evidence

EE estimates a "constraint range" for NERL's asset beta of 0.46 to 0.54, with the lower bound based on betas for UK utilities and upper bound based on betas for UK airports, consistent with EE's argument than NERL's asset beta should be higher than that of utilities and lower than that of UK airports.

As explained in our March 2018 report,[30] we do not consider that UK utility betas are relevant comparators for NERL, even as a lower bound, given UK utilities are regulated under a revenue cap framework which protects them from volume risk and also have lower operating leverage compared to NERL, which implies NERL asset beta should be well above utilities. This is consistent with UK regulatory precedent, as shown for example in Figure 2.3, where NERL's asset beta has been consistently higher (by around 0.14) than allowed asset betas for E&W water companies.

We also disagree with EE's assumption that UK airport betas represent an upper bound on NERL risk, given NERL is exposed to more internationally diversified traffic from overflights and is also subject to risk sharing. As we explain below, there is no evidence that NERL is lower risk than UK airports and indeed international listed comparator airports.

2.5.1. We find no evidence to support that NERL is lower risk compared to UK airports

EE argues that NERL faces lower traffic volatility compared to UK airports given it is exposed to more internationally diversified traffic from overflights,[31] but provides no evidence to support its claim.

We have considered the peak-to-trough traffic movements as proposed by CAA's consultant PwC as a measure of underlying traffic volatility[32] for NERL compared to UK airports. We calculate the peak-to-trough TSU movements using annual TSUs over the period of 2008 to 2013, which covers the 2008-2009 financial crisis and the 2010-2013 Eurozone crisis, consistent with the approach taken by PwC and compare it to passenger number movements at HAL and GAL over the same period, as shown in Table 2.6.

Table 2.6: Analysis of Peak-to-Trough Traffic Volatility Over 2008-2013 Period Supports NERL Greater Risk Compared to UK Airports

2008-2013	Peak (m)	Trough (m)	Difference (m)	Difference (%)
NERL	11.0	9.5	-1.6	-14.1%
HAL	72.4	66.0	-6.4	-8.8%
GAL	35.5	31.4	-4.1	-11.4%

Source: Eurostat data for HAL and GAL; for NERL we rely on data provided by NERL.

30 NERA (March 2018), The Weighted Average Cost of Capital for NATS (En-Route) plc at RP3, Section 2.2.

31 Europe Economics (December 2018), Components of the Cost of Capital for NERL, p.17.

32 PwC (February 2019), Estimating the cost of capital for H7 – Response to stakeholder views, pp.67-68.

We find that NERL has experienced greater fluctuations in service units over recent economic crises compared to the passenger volatility at HAL and GAL, indicating that NERL does not appear to be exposed to lower underlying traffic volatility compared to UK airports, as argued by EE.

EE also argues that NERL should be lower risk compared to UK airports due to its risk sharing arrangements, while UK airports are fully exposed to volume risk.

We agree that NERL is part protected from underlying traffic volatility through its risk sharing arrangements. However, NERL is exposed to greater risk compared to UK airports due to higher operational leverage. It is the effects of volume risk and operational leverage which taken together determine the volatility of investor returns and therefore beta. As we explain, NERL is exposed to substantially greater cash-flow/return volatility compared to UK airports for a given change in volumes despite its risk sharing mechanism due to greater operating leverage.

In Table 2.7, we show NERL's allowed return as a proportion of allowed revenues compared to UK regulated airports, which reveals that NERL has substantially greater operational leverage (lower share of return in allowed revenues) compared to UK airports in RP2 and indeed that CAA's proposed reduction in WACC for RP3 are expected to substantially exacerbate this risk.

We assess the impact of NERL's and the UK airports' underlying traffic volatility on their respective cash-flow volatility, taking into account NERL's greater operational leverage compared to UK airports as follows:

- First, we consider the impact of a 2 per cent demand shock, in line with the average deviation of NERL's outturn traffic from CAA's forecast over the period 2006-2017,[33] on NERL's cash-flow volatility. We assume a 2 per cent demand shock would lead to a 2 per cent change in total regulated revenues for NERL and UK airports, given no protection under NERL's risk sharing mechanism. We assume, based on information from NERL, that NERL's costs are likely to change by 7.5 per cent of the change in revenue in light of the assumed change in volumes. Absent equivalent information for Heathrow and Gatwick we use the same percentage change in costs as for NERL. We then calculate the change in returns for NERL, Heathrow and Gatwick, calculated as the change in revenues less change in costs and express them as a percentage of the ex-ante expected return. As Table 2.7 reveals, a 2 per cent demand shock results in substantially greater change in cash-flows / returns for NERL compared to Heathrow and Gatwick, due to NERL's greater operational leverage.
- Second, we consider the impact of a 5 per cent demand shock. We assume a 5 per cent demand shock for NERL results in a 2.9 per cent change in NERL's revenues,[34] given the application of the risk sharing mechanism. For Heathrow and Gatwick, we assume a 5 per cent change in revenues given no risk sharing. We use the same assumptions on

[33] NERA calculations based on NERL TSU data and CAA assumptions.

[34] This is calculated based on the RP2 regulatory arrangement for NERL's traffic risk sharing, which states that i) between 0 and 2 per cent traffic variation, NERL bears all of the associated revenue risk; ii) between 2 and 10 per cent traffic variation, NERL bears 30 per cent of the risk; and iii) greater than 10 per cent traffic variation, NERL bears no risk. Thus, 5% and 10% demand shocks translate to 2.9% and 4.4% revenue impact with risk sharing.

change in costs as in the first example and calculate the impact of the demand shock on the change in expected returns. As Table 2.7 reveals, a 5 per cent demand shock results in a substantially greater change in cash-flows / returns for NERL compared to Heathrow and Gatwick, due to NERL's greater operational leverage and despite NERL's risk sharing mechanism.

- Finally, we do the same calculation assuming a 10 per cent demand shock, using the same method as explained above. As Table 2.7 reveals, a 10 per cent demand shock also results in a substantially greater change in cash-flows / returns for NERL compared to Heathrow and Gatwick, due to NERL's greater operational leverage and despite NERL's risk sharing mechanism.

Table 2.7: Proportion of Regulatory Return at Risk (Operating Leverage)

		NERL RP3 (CAA proposal)	NERL RP3 (NERL's BP)	NERL RP2	HAL Q6	GAL Q6
Pre-tax WACC (%)	A	2.8%	5.1%	5.9%	5.6%	6.0%
Total Revenue Requirement (£m)*	B	571	631	588	2414	573
Average annual regulatory return (£m)	C	30	55	61	768	143
Allowed return / revenue (%)	D = C / B	5.2%	8.8%	10.3%	31.8%	25.0%
Δ revenue given +/- 2% volume (£m)	E	11.4	12.6	11.8	48.3	11.5
Δ revenue given +/- 5% volume (£m)	F	16.6	18.3	17.1	120.7	28.6
Δ revenue given +/- 10% volume (£m)	G	25.1	27.8	25.9	241.4	57.3
Δ cost given +/- 2% change in volume (£m)	H	0.9	0.9	0.9	3.6	0.9
Δ cost given +/- 5% change in volume (£m)	I	2.1	2.4	2.2	9.1	2.1
Δ cost given +/- 10% change in volume (£m)	J	4.3	4.7	4.4	18.1	4.3
Δ return given +/- 2% change in volume (£m)	K = E - H	10.6	11.7	10.9	44.7	10.6
Δ return given +/- 5% change in volume (£m)	L = F - I	14.4	15.9	14.8	111.6	26.5
Δ return given +/- 10% change in volume (£m)	M = G - J	20.8	23.0	21.5	223.3	53.0
Δ return / allowed return given +/- 2% change in volume	**N = K / C**	**35%**	**21%**	**18%**	**6%**	**7%**
Δ return / allowed return given +/- 5% change in volume	**O = L / C**	**48%**	**29%**	**24%**	**15%**	**18%**
Δ return / allowed return given +/- 10% change in volume	**P = M / C**	**70%**	**42%**	**35%**	**29%**	**37%**

*Note: The allowed return and Δ return are both on a pre-tax basis. *For NERL, the "total revenue requirement" represents the total determined costs, and for airports this represents the total revenue including operating costs, depreciation and regulatory return, i.e. total revenues to be recovered via aeronautical charges and commercial revenues.*
Source: NERA analysis of CAA documents.

Overall, we conclude there is no evidence to support EE's claim that NERL is exposed to lower risk compared to UK airports. There is no evidence that NERL is exposed to lower underlying traffic volatility than UK airports (indeed NERL experienced slightly higher peak-to-trough traffic volatility over the period 2008-2013). It is correct that NERL is protected from some of the underlying traffic variation by the risk sharing arrangements compared to UK airports. However, this protection is more than offset by NERL's greater operational leverage, which implies that NERL experiences greater cash-flow volatility for a given demand shock even after taking into account the impact of the traffic risk sharing mechanism.

2.5.2. Conclusion: Evidence from listed comparator airports supports asset beta for NERL in RP3 of 0.58 based on AdP

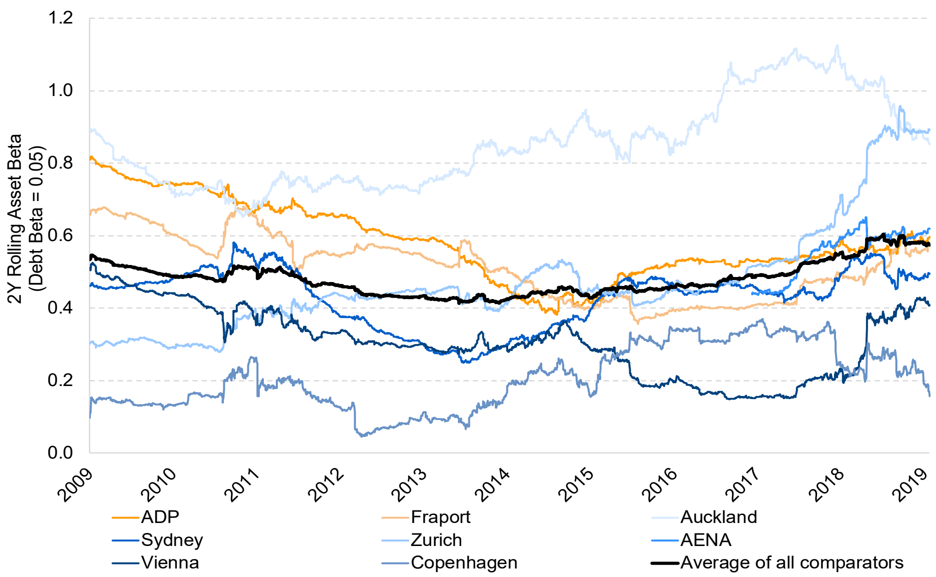
As explained in our March 2018 report,[35] we do not consider using UK airports as comparators for NERL is practical, given lack of direct evidence on UK airport betas, and instead NERL asset beta should be estimated using available listed airport comparators directly.

We concluded that of all the international listed airports we have reviewed, AdP appears to be most appropriate comparator for NERL because it operates under a similar volume risk sharing mechanism to NERL and has a similar mix of international and transfer passenger traffic as NERL. Other listed airports either have volume risk mitigation in their regulatory framework (e.g. Fraport can renegotiate its price with the regulator if demand falls) or their beta estimates may be biased by the impact of state ownership. We would expect NERL to face greater systematic risk than ADP because of NERL's high operating leverage.

We have updated empirical asset betas for international listed airports using the latest available data up to February 2019 as shown in Figure 2.9. Table 2.8 presents current asset beta estimates for international airports for different estimation windows.

35 NERA (March 2018), The Weighted Average Cost of Capital for NATS (En-Route) plc at RP3, Section 2.2.

Figure 2.9: Updated Estimates of Airport Comparators 2-Year Rolling Asset Betas



Note: NERA calculations use daily data and regional stock indices (STOXX 600 index for EU, ASX200 index for Australia, NZX 200 Index for New Zealand). Asset beta estimates delivered using net debt. ADP and Fraport estimates based on net debt derived from the annual reports.
Source: NERA analysis of Bloomberg data using 28 February 2019 cut-off date and debt beta of 0.05.

Table 2.8: Updated Asset Beta Estimates for International Airports

	2Y asset beta	5Y asset beta
ADP (Paris)	0.58	0.53
Fraport (Frankfurt)	0.58	0.46
Zurich	0.89	0.57
Vienna	0.42	0.23
Copenhagen	0.19	0.29
Sydney	0.48	0.47
Auckland	0.87	0.94
AENA	0.61	-
Simple Average	**0.58**	**0.50**

Note: The asset beta for Fraport is calculated by de-levering their equity betas using its 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. Therefore, we have used the net debt from the accounts to de-lever the equity betas.
Source: NERA analysis of Bloomberg data using 28 February 2019 cut-off date and debt beta of 0.05.

Based on the above evidence, we conclude on an updated asset beta for NERL of 0.58 based on the asset beta estimate for AdP which we consider is the closest comparator. We note an asset beta of 0.58 is also consistent with the average for all airport comparators.

2.6. Conclusion: We Estimate an Asset Beta of 0.53 to 0.58 for RP3 Drawing on ENAV and Airport Evidence

The CAA's proposed asset beta of 0.46 (at 0.13 debt beta) for RP3 implies a substantial reduction in risk for NERL in RP3 relative to RP2 as well as compared to other regulated sectors, for which the CAA provides no justification or evidence. We conclude there is no basis for the CAA to set an asset beta for RP3 below the asset beta of 0.505 used for RP2 (assuming a 0.1 debt beta), equivalent to 0.52 using CAA's higher debt beta of 0.13 proposed for RP3, given that NERL's risk going forward is expected to be at least as high or indeed higher than RP2 (as recognised by EE).

Indeed, we believe that the appropriate asset beta for NERL for RP3 should be higher than for RP2, taking into account the evidence on asset betas for comparator companies including airports as well as the Italian ANSP ENAV.

We calculate an asset beta for NERL in RP3 based on ENAV of 0.53-0.58 (at 0.05 debt beta), correcting for errors in EE's estimation methodology and relative risk assessment, as follows:

- We use a European-wide index as the reference market instead of a local index used by EE;
- We adjust ENAV's total beta upwards for greater risk of ENAV's en-route services compared to its terminal services; and
- We apply a further adjustment for NERL greater operational leverage (in line with EE)

We also calculate an updated asset beta for NERL in RP3 based on AdP, which we consider is the closest comparator for NERL. Updated evidence supports an asset beta for AdP of 0.58 (at 0.05 debt beta), which is also consistent with the average beta for the wider airport comparator set. Our updated estimate for airport comparators is consistent with the top end of the ENAV range.

Overall, we conclude on an asset beta range of 0.53 to 0.58 for NERL in RP3 (assuming debt beta of 0.05), based on evidence from ENAV and airport comparators. We consider the point estimate for NERL should lie towards the top end of the range, given NERL's greater exposure to traffic risk compared to ENAV for which we make no adjustments, our conservative adjustment for NERL greater operational leverage based on EE method as well as NERL's greater operating leverage compared to AdP.

3. Debt Beta

In this section, we respond to the analysis presented by the CAA and its consultant EE on the debt beta for NERL for RP3.

In Section 3.1 we summarise the CAA's and its consultants' debt beta analysis and recommendations. In Section 3.2 we present empirical debt beta estimates by Professor Ania Zalewska, as well as estimates by other academics (Schaefer and Myers), all of which support lower debt betas than PwC's empirical estimates and relatively closer to zero. In Section 3.3 we consider evidence from the "indirect" method proposed by EE, identifying several issues with the EE's proposed formula and the inputs used by EE. Correcting for the issues with EE's analysis, we calculate a debt beta of 0.05 to 0.1 based on the application of the CMA formula. In Section 3.4 we conclude on a debt beta range for RP3 of 0 to 0.1 with a point estimate of 0.05.

3.1. Summary of CAA and Its Consultants' Debt Beta Analysis

The CAA proposes a debt beta for RP3 of 0.13, which is higher than the debt beta used by the CAA in RP2 of 0.1. The CAA considers that there is evidence supporting an increase in the debt beta since the RP2, citing EE's support for a higher debt beta and PwC's increase in the recommended debt beta (from 0.05 to 0.1). The CAA also refers to recent regulatory precedent, with Ofgem's proposed range of 0.1 to 0.15 and Ofcom and Ofwat's estimate of 0.1.[36]

In its December 2018 report for the CAA, EE recommends adopting a debt beta range of 0.1 to 0.19 for NERL at RP3. The lower bound is set in line with the Competition Commission's 2007 decision and Ofcom's 2017 determination, while the upper bound is the result of a formula developed by EE.[37]

In its February 2019 report for the CAA, PwC also presents its own empirical debt beta estimates. Specifically, PwC estimates debt betas by regressing returns on bond indices (iBoxx) against an equity market index (UK MSCI index), providing debt beta estimates ranging from -0.09 to 0.26, with higher values estimated for the most recent period.[38] PwC also regresses the returns on HAL bonds against the same equity market index, estimating debt betas ranging from -0.06 to 0.18, with higher values estimated for the most recent period.[39] Based on this evidence, PwC concludes that there is evidence supporting an increase in the debt beta estimate and recommends to increase the debt beta from 0.05 used in its earlier reports to 0.1.[40]

36 CAA (February 2019), op. cit., p.46.

37 Europe Economics (December 2018), Components of the Cost of Capital for NERL, p.44.

38 PwC (February 2019), Estimating the cost of capital for H7 – Response to stakeholder views, pp.72-73.

39 PwC (February 2019), Estimating the cost of capital for H7 – Response to stakeholder views, pp.73-74.

40 PwC (February 2019), Estimating the cost of capital for H7 – Response to stakeholder views, p.74.

As set out by the CMA (then CC) in its 2007 BAA Ltd determination, there are generally two approaches to estimating debt betas:[41]

- Direct method: Estimate debt betas empirically by regressing bond returns against a market portfolio;
- Indirect method: Decompose the observed cost of debt into several smaller components and back out an estimate of the premium for systematic risk.

While EE and the CMA rely on the indirect method, academics such as Schaefer and Myers have estimated debt betas using the direct method.

In this section, we consider the evidence on debt betas applying both methods.

3.2. Empirical Estimates Support Lower Debt Betas Than Calculated by PwC

The CAA's conclusion that debt betas have increased in RP3 relative to RP2 appears, in part, driven by PwC's empirical analysis of debt betas for HAL's bonds and the iBoxx index.

However, empirical estimates of debt betas are not as straightforward as empirical estimates of equity betas and estimates can vary considerably depending on the methodology and specifications chosen.

In response to PwC's recommendations on debt beta, we have considered the evidence presented by Professor Ania Zalewska (2019) from the University of Bath in her separate paper on debt beta, commissioned by NERL. [42] This separate paper presents empirical evidence on debt betas using NATS and Heathrow bonds, as well as iBoxx indices, thus providing empirical estimates that can be compared to those of PwC.

Professor Zalewska derives debt betas using a variety of methods (OLS, ML, GARCH, Kalman-Filter) and considered the sensitivities of the results to alternative definitions of the market portfolio, the period of assessment and data frequency.

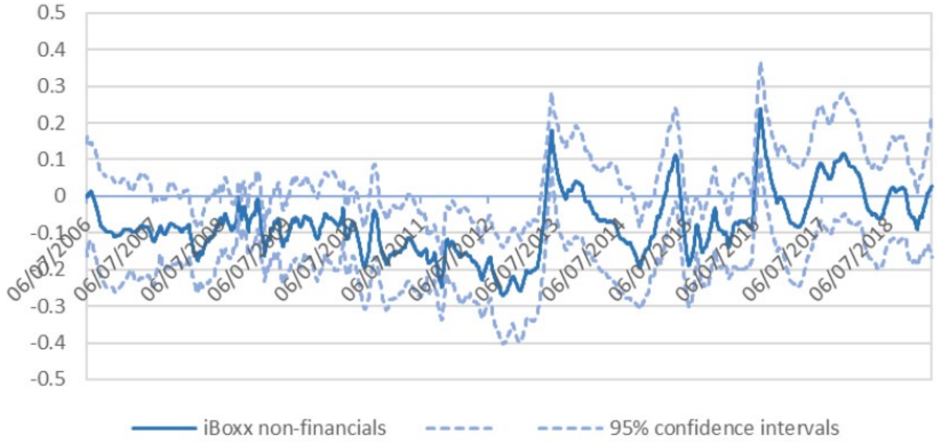
Professor Zalewska starts by regressing the excess returns on the iBoxx indices against an equity market index (FTSE All Share), which results in negative debt beta estimates over several estimation periods, although relatively closer to zero in the most recent period, as shown in Figure 3.1.[43]

41 Competition Commission (28 September 2007), BAA Ltd, A report on the economic regulation of the London airport companies (Heathrow Airport Ltd and Gatwick Airport Ltd), Appendix F, p.F-24.

42 Zalewska, A. (April 2019), Estimation of the debt beta of the bond issued by Nats (En-Route) plc.

43 Zalewska, A. (April 2019), Estimation of the debt beta of the bond issued by Nats (En-Route) plc, pp.9-12.

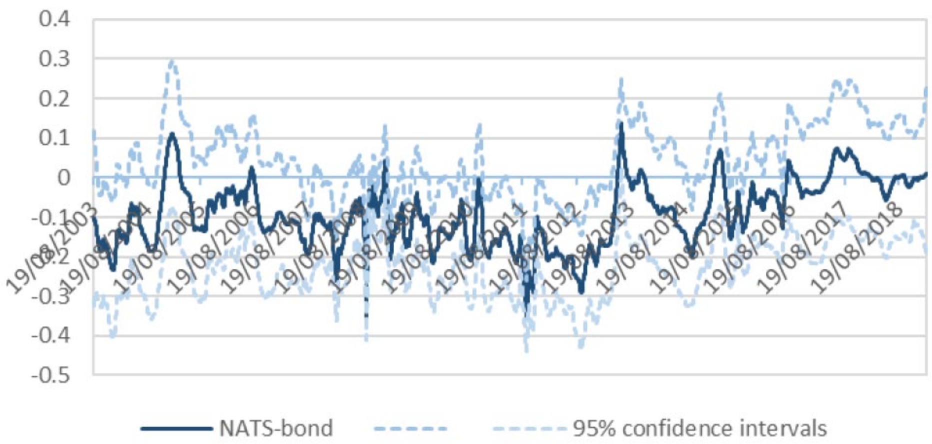
Figure 3.1: Kalman Filter Estimates of the Daily Betas of Selected iBoxx Non-Financial Index Against the FTSE All Share Index



Source: Zalewska, A. (April 2019), Estimation of the debt beta of the bond issued by NATS (En-Route) plc., Figure 5, p.12.

Professor Zalewska obtains similar results when regressing excess returns on the NATS bond against the equity market index (FTSE All Share), i.e. negative debt betas but relatively closer to zero recently, as shown in Figure 3.2. She also obtains similar results using Heathrow bonds instead.

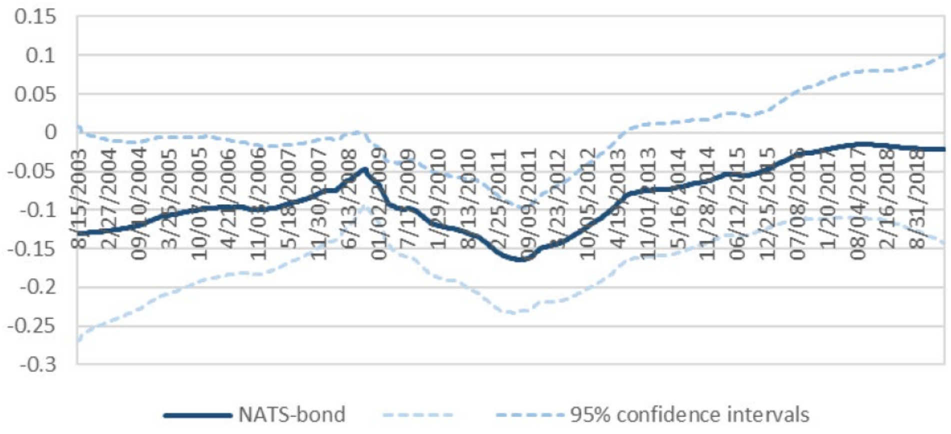
Figure 3.2: Kalman Filter Debt Beta Estimates for the NATS-Bond



Source: Zalewska, A. (April 2019), Estimation of the debt beta of the bond issued by NATS (En-Route) plc., Figure 7, p.17

Professor Zalewska also considers debt beta estimates using lower frequency weekly data. Her results are consistent with her calculations based on daily data (as shown above), i.e. she finds evidence of negative debt betas, but closer to zero in the most recent period, as shown in Figure 3.3.

Figure 3.3: Kalman Filter Estimates of the Weekly Betas of NATS bond Against the FTSE All Share Index



Source: Zalewska, A. (April 2019), Estimation of the debt beta of the bond issued by NATS (En-Route) plc., Figure 11, p.19.

Drawing on the above analysis, Professor Zalewska concludes that there is evidence that the debt beta from the NATS-bond (and by extension HAL bonds) is significantly smaller than 0.1 and indeed not statistically different from zero.[44]

Regarding recent trends in debt betas, while PwC's debt beta estimates show an increasing trend in the asset beta estimates, Professor Zalewska's beta estimates based on advanced econometric models show declining trends over the recent period for several model specifications (as shown e.g. in Figure 3.3).[45] This further supports that a wide range of empirical evidence should be reviewed before concluding on a debt beta for RP3.

Other academics have also provided empirical debt estimates similar to those from Professor Zalewska. For example, during the Q5 review, BAA submitted two papers by Schaefer and Myers which provided empirical estimates for debt betas.

- Schaefer estimates debt betas by regressing excess bond returns against the corresponding excess equity return for the company issuing the bond for a large sample of US non-financial companies. Using this methodology, Schaefer estimates debt betas ranging from 0 for AAA-rated bonds to 0.15 for B-rated bonds, with an average of 0.04. For Heathrow and Gatwick, Schaefer recommended a debt beta of 0.04.[46]
- Myers estimates debt betas by regressing the returns of a bond portfolio composed of BAA bonds against an equity market index (the FTSE All Share), concluding that these were not significantly different from 0. Myers also estimates the debt betas of three UK bond indices (government and corporate indices) against the FTSE All Share, finding support for a debt beta of zero. Finally, Myers also presents beta estimates for US

[44] Zalewska, A. (April 2019), Estimation of the debt beta of the bond issued by Nats (En-Route) plc, p.1.

[45] See for example Figure 4 and Figure 9 (for the NATS-bond). Source: Zalewska, A. (April 2019), Estimation of the debt beta of the bond issued by Nats (En-Route) plc, Figure 4 and Figure 9, pp11 and 18.

[46] Schaefer, S. (December 2007), BAA Quinquennial Review: The Cost of Capital for Gatwick and Heathrow, pp.13-15.

government and corporate bonds against the S&P500, finding that estimates had fallen below zero in recent years.[47]

Given that empirical estimates produce a range of possible debt betas, with many of them supporting debt betas close to zero, we conclude that PwC's debt beta estimate of 0.1 should be considered at most as an upper bound of the plausible range starting at zero.

3.3. Indirect Methods Supports Debt Betas in Line with Empirical Estimates Once Correcting for Errors in EE's Calculations

EE derives a debt beta formula assuming that the CAPM can be applied to debt and setting an expected return on debt as the weighted average of the promised cost of debt and the loss given default. Its debt beta (β_D) formula relies on the following three equations:

(1) $Expected\ return\ on\ debt\ =\ Prob(default) * \%loss\ given\ default\ +\ (1 - prob(default)) * promised\ cost\ of\ debt$

(2) $Debt\ premium\ =\ promised\ cost\ of\ debt\ -\ Risk-free\ rate$

(3) $Expected\ return\ on\ debt\ =\ Risk-free\ rate\ +\ \beta_D * Equity\ risk\ premium$

Relying on these equations, EE then presents the following formula for estimating debt beta:[48]

(4) $$\beta_D = \frac{(1 - P_d) * DP - P_d * (RFR + LGD)}{ERP}$$

where P_d = probability of default, DP = debt premium, RFR = risk-free rate, LGD = % loss given default and ERP = equity risk premium

To estimate the 0.19 debt beta, Europe Economics uses the following estimates for the individual parameters:[49]

- Nominal risk-free rate of 1.6 per cent based on PwC's midpoint estimate;
- Probability of default = 0.2 per cent, based on an S&P's 2015 study;
- Debt premium = 1.65 per cent, based on the formula $\text{debt premium} = \text{promissed cost of debt} -$ RFR, where the promised cost of debt is 3.32 per cent (Europe Economics own recommendation) minus 7bps for transaction costs and the risk-free rate is 1.6% based on PwC's midpoint estimate;
- %loss given default = 20 per cent, a "typical estimate of "costs of bankruptcy" across many sectors" according to Europe Economics;
- ERP of 8.3 per cent, based on the midpoint of PwC's nominal TMR estimate.

---

47 Myers, S. (January 2008), CAA price control proposals Heathrow and Gatwick Airports, Appendix B.

48 Europe Economics (December 2018), Components of the Cost of Capital for NERL, p.38.

49 Europe Economics (December 2018), Components of the Cost of Capital for NERL, p.38.

In the next section we explain EE makes several errors in deriving a debt beta using the "indirect" approach which lead to an overstatement of the debt beta compared to the approach used by the CMA in 2007.

3.3.1. EE makes mistakes in calculating debt beta based on its own formula

Our review of EE's calculations reveals that EE's application of its debt beta formula assumes an incorrect ERP estimate.

EE states that it uses an ERP estimate of 8.3 per cent and that this is based on the midpoint of PwC's range. However, 8.3 per cent is the mid-point of PwC's TMR range not the ERP range. Subtracting PwC's midpoint risk-free rate estimate (1.6 per cent) from the mid-point of its TMR estimate (8.3 per cent) would result in an ERP of 6.7 per cent, which is the figure EE should have used in its calculations.

Correcting EE's calculation to use an ERP of 6.7 per cent in line with the mid-point of PwC's range, we calculate a debt beta of 0.24 under EE's own methodology. This reflects a considerable increase from EE's debt beta of 0.19, and is also out of line with other debt beta estimates, including empirical debt beta estimates by academics including Zalewska, Schaefer and Myers support values relatively closer to 0, as discussed in Section 3.2.

3.3.2. EE's formula fails to take into account the liquidity premium considered by the CMA when estimating debt betas

EE's debt beta formula omits the effect of liquidity premium considered by the CMA when estimating debt betas.

In the 2007 BAA Ltd determination, the CMA (then CC) applied the indirect method of estimating debt betas using the following formula:[50]

$$(5)\ \beta_D = \frac{DP - LP - P_d * (RFR + LGD + DP)}{ERP}$$

where LP = liquidity premium, P_d = probability of default, DP = debt premium, RFR = risk-free rate, LGD = % loss given default and ERP = equity risk premium.

If we combine the debt premium terms in equation (5), we can rewrite it as:

$$(6)\ \beta_D = \frac{(1 - P_d) * DP - LP - P_d * (RFR + LGD)}{ERP}$$

Comparing EE's debt beta formula (equation (4)) with the CMA's debt beta formula (equation (6)), we find that EE's formula fails to take into account the effect of the liquidity premium.

The CMA's formula decomposes the debt-premium into three constituent elements: 1) compensation for holding illiquid assets; 2) compensation to cover the expected costs of default and 3) the residual which reflects investors' compensation for systematic risk exposure. In contrast, EE's formula omits the first element and instead assumes that the debt premium only compensates investors for the expected costs of default, with the remainder

[50] Competition Commission (28 September 2007), BAA Ltd, A report on the economic regulation of the London airport companies (Heathrow Airport Ltd and Gatwick Airport Ltd), Appendix F, p.F-24.

assumed to compensate for systematic risk. As a result, EE overstates the systematic risk component of the debt premium and therefore the debt beta.[51] The CMA estimated that the liquidity premium explains between 27 and 37 per cent of the total debt premium,[52] suggesting EE's omission leads to a material overstatement of the debt beta.

3.3.3. Correcting for EE's unjustified assumptions used to decompose debt premia support substantially lower debt betas in line with empirical estimates

Moreover, we consider several inputs used by EE in the debt beta calculation are incorrect:

- First, EE's estimate for the default premium is understated compared to the assumption used by CMA's in its 2007 determination. In 2007, the CMA estimated the default premium to be 12.4 to 34.7 per cent of the debt premium, based on estimates from academic literature and corroborated with expected default probabilities and a 45 per cent recovery rate assumptions from Moody's.[53] In contrast, EE estimates the default premium to represent only around 3 per cent of the overall debt premium, substantially below the CMA's estimate. The difference from the CMA's default rate estimate appears driven by two factors: i) EE assumes a probability of default of 0.2 per cent, which appears to be an annual default rate rather than a cumulative default rate over the entire duration of the bond, which understates the expected default probability as cumulative default increases with the time horizon; ii) EE assumes a much lower loss given default of 20 per cent compared to the CMA, without providing any reference.[54]

- Second, EE's assumed debt premium of 1.65 per cent is overstated. We have calculated debt spreads for the A/BBB rated iBoxx GBP corporate non-financial index with 10+ years maturity over the risk-free rate with the same maturity, as shown in Figure 3.4. Evidence from iBoxx indices supports a debt spread of around 1.29 per cent on average over the last two years for A/BBB investment grade rated debt.

---

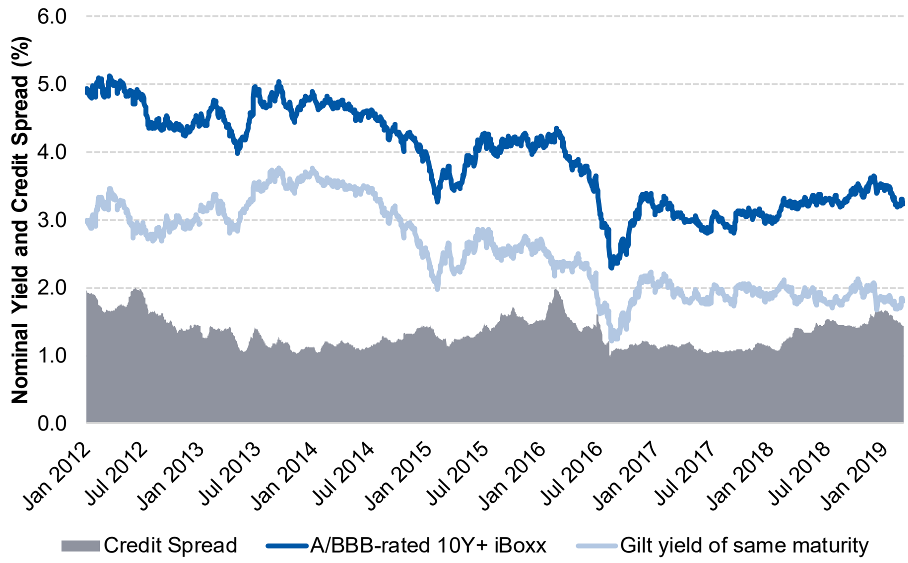
51 In its report, EE includes a footnote in which it states: "*We note that the Competition Commission 2008 disaggregation of the debt premium into the debt beta included an allowance for transaction costs, referred to there as "liquidity cost"*." (Source: Europe Economics (December 2018), Components of the Cost of Capital for NERL, p.38 fn 38.) It is unclear whether EE's footnote argues that its approach of subtracting 7bps from its cost of debt estimate for NERL, which it previously added to derive the cost of debt from information on traded yields in the first place, is supposed to address the issue of a liquidity premium. If this is EE's argument, then it is flawed, given the liquidity premium reflects the element of the observed debt spreads calculated from traded yields which compensate investors for holding illiquid assets like bonds. This premium is unrelated to EE's estimate that costs of issuing and maintaining a debt portfolio, such as underwriting costs or rating agency fees, add an additional 7bps to the cost of debt estimated from traded yields which should be recognised in the calculation of WACC for regulated companies like NERL.

52 In its 2007 determination, the CC calculated the liquidity premium as a percentage of the debt premium between 27 and 37 per cent. Source: Competition Commission (28 September 2007), BAA Ltd, A report on the economic regulation of the London airport companies (Heathrow Airport Ltd and Gatwick Airport Ltd), Appendix F, pp.F-25 para 100.

53 Competition Commission (28 September 2007), BAA Ltd, A report on the economic regulation of the London airport companies (Heathrow Airport Ltd and Gatwick Airport Ltd), Appendix F, p.F-26

54 Source: Europe Economics (December 2018), Components of the Cost of Capital for NERL, p.38, footnote 39.

Figure 3.4: Debt Premium Implied from iBoxx A/BBB-Rated 10Y+ Index Yields



Source: NERA analysis of iBoxx data and Bank of England yield curves

- Third, we consider PwC's proposed TMR (and therefore ERP) is understated as explained in Section 4. We calculate a higher TMR of 6.2 to 6.8 per cent (real RPI-deflated). Using the mid-point of our TMR range of 6.5 per cent (real, RPI-deflated) and the mid-point of PwC's estimate of the real risk-free rate of -1.25 per cent (real, RPI-deflated),[55] we calculate an ERP of 7.75 per cent.

If we use our estimate of the debt spread for A/BBB rated bonds, the CMA's estimate of the default premium and liquidity premium, and our estimate of the ERP together with the CMA's debt beta formula, we calculate a debt beta of 0.05 to 0.1, broadly consistent with the empirical estimates discussed in Section 3.2.

3.3.4. Conclusion: EE debt beta analysis does not provide a reasonable estimate of debt beta for the upcoming price controls

Based on the evidence above, we conclude that the debt beta formula proposed by EE does not provide a reasonable estimate for the debt beta for upcoming price controls.

We find that EE incorrectly estimated the debt beta resulting from its own formula and, correcting for these issues results in higher values of 0.24, substantially above empirical estimates and regulatory precedent, which appears implausibly high, casting doubt on the reliability of EE's proposed debt beta estimation method.

Moreover, we find that EE's formula omits a key component of the debt premium – liquidity premium – as considered by the CMA in its calculation of debt betas in 2007. In addition, we identify several issues with EE's assumed inputs used in the decomposition, including: i) understating the default premium, ii) overstating the debt spread and iii) understating the

55 PwC (February 2019), Estimating the cost of capital for H7 – Response to stakeholder views, p.14

ERP. Correcting for these issues and applying the CMA formula, we calculate substantially lower debt betas of 0.05 to 0.1.

3.4. Conclusion on Debt Beta

We conclude there is no evidence for the CAA to increase its debt beta assumption for RP3 relative to RP2.

Empirical beta estimates from Professor Zalewska and other academics produce a range of estimates, with many of them supporting debt betas close to zero. We therefore conclude that the CAA's RP2 debt beta estimate of 0.1 should be considered at most as an upper bound of the plausible range starting at zero.

Indirect evidence, drawing on the formula approach proposed by the CMA in 2007, supports debt beta estimates within the range of 0.05 to 0.1, broadly consistent with the evidence from empirical estimates. This is substantially lower compared to EE's estimate, due to error in EE's formula which omits a key component of the debt premium – liquidity premium as well as several issues with EE's assumed inputs used in the decomposition, including: i) understating the default premium, ii) overstating the debt spread and iii) understating the ERP.

Overall, we conclude on a debt beta for NERL in RP3 of 0 to 0.1 with a point estimate of 0.05, in line with our September 2018 report. A debt beta of 0 is consistent with the empirical analysis of Professor Zalewska, Schaefer and Myers while a debt beta of 0.1 is consistent with the upper end of the indirect method and regulatory precedent (e.g. CAA in RP2). Overall we believe that a point estimate of 0.05 is an appropriate assumption for RP3, where weight is given to the academic papers that show lower debt betas than the CAA used at RP2.

4. Total Market Return

In this section, we comment on the Total Market Return (TMR) proposed by the CAA for the RP3 period for NERL. We understand that the CAA's assessment of market-wide parameters for NERL's cost of capital for RP3, such as the TMR, builds on the CAA's and its consultant PwC's earlier analysis for HAL for Q7 including an updated report prepared by PwC on HAL's cost of capital for Q7.

In Section 4.1 we start by summarising the CAA's TMR analysis and proposals for RP3, which suggest a substantial reduction in the TMR relative to RP2. In Section 4.2 we explain that there is no evidence that expected returns have fallen since RP2, drawing on historical realise returns and forward-looking evidence. In Section 4.3 we explain the historical returns evidence the CAA relies is downward biased due to flawed assumptions regarding historical inflation and adjustments for alleged predictability of returns, while correcting for these issues supports TMR values at least as high as the CAA's RP2 decision. In Section 4.4 we explain that the forward-looking estimates evidence the CAA relies is downward biased, due to PwC's flawed application of the DGM which relies on UK GDP growth forecasts as a proxy for FTSE dividends, while the Bank of England DGM model provides substantially higher estimates drawing on analyst forecasts and global GDP. In Section 4.5 we explain that the recent consultations by other UK regulators cited by the CAA are also affected by the same biases as the CAA's own estimates. In Section 4.6 we conclude on a TMR range of 6.2 to 6.8 per cent (real, RPI deflated), drawing on historical data appropriately adjusted for inflation and long holding periods, consistent with the latest CMA determination for BIE (2014) and Bristol water (2015) of 6.5 per cent (real RPI deflated).

4.1. Summary of the CAA's TMR Proposals for RP3

In its proposals for RP3, the CAA proposes to use a "TMR approach" of directly estimating the TMR and risk-free rate (RFR), with the equity risk premium (ERP) calculated as the residual. The CAA considers that the TMR for RP3 should be estimated drawing on a range of evidence, including evidence on: historical realised returns, forward looking estimates based on dividend growth models (DGM) as well as regulatory precedent.

In relation to historical returns, the CAA presents estimates from Wright et al. from their 2018 report for the UKRN ("UKRN report") of 6-7 per cent real CPI-deflated, which the CAA converts to 5-6 per cent real on an RPI-deflated basis using its forward-looking estimate of the RPI-CPI wedge of 100bps.[56]

The CAA also comments on two issues related to the UKRN TMR estimates: i) the appropriate inflation index to use to deflate historical returns into real terms and ii) appropriate holding period and adjustment for serial correlation.

- In relation to the appropriate inflation index, the CAA notes the use of Bank of England's CPI index is appropriate, given the CPI series is consistent over time while RPI is not due to changes in 2010 to the ONS' measure of clothing prices, which implies historical RPI-deflated returns may not be an accurate indicator of forward-looking RPI returns.[57]

[56] CAA (February 2019), op. cit., para D19.

[57] CAA (February 2019), op. cit., para D20-D24.

- In relation to the second issue, the CAA notes that the UKRN report estimates a TMR as the sum of a geometric mean and 1-2 per cent volatility adjustment, where the top end is consistent with an arithmetic mean (assuming returns are less predictable) while the bottom end includes some degree of predictability, as supported by PwC's analysis for holding periods of around 10 years. [58]

The CAA concludes the UKRN historical returns estimate of 5-6 per cent real RPI-deflated is consistent with other evidence, including recent consultations by UK regulators (Ofgem and Ofcom) and their advisors (Europe Economics, PwC and CEPA).[59]

In relation to forward-looking evidence, the CAA presents a range of TMR estimates derived using the dividend growth model (DGM), including estimates from Ofwat, Ofcom and Ofgem prepared by their advisors Europe Economics, CEPA and PwC, which according to the CAA show a DGM-based TMR of 4.0 to 6.3 per cent real RPI-deflated. The CAA also presents updated estimates from PwC of 5.3 to 6.2 per cent real RPI-deflated.[60]

The CAA also comments on the alternative DGM-based TMR from the Bank of England (BoE) highlighted in our October 2018 report and by Oxera, stating that PwC concludes that the BoE estimates are focussed on movements of analyst equity return expectations rather than levels and are therefore unsuitable for informing the view of a forward-looking TMR.[61]

The CAA concludes that forward-looking evidence presents a relevant piece of evidence on the TMR and that the evidence presents some overlap with the historical returns evidence, supporting a range of 5-6 per cent RPI-deflated. [62]

Finally, the CAA presents evidence from recent consultations by UK regulators including Ofwat, Ofcom and Ofgem, which all support an RPI-deflated return below 6 per cent. The CAA also comments on international precedent, including: international TMR estimates collected by Europe Economics for Ofwat in the range of 5.3 to 6.8 per cent in RPI-deflated terms and PwC's estimate of the TMR for Charles de Gaulle airport of 6.3 per cent real RPI-deflated.[63]

Drawing on the above evidence, the CAA concludes on a TMR range of 5 to 6.25 per cent real RPI-deflated, with the bottom end consistent with evidence on historical returns (UKRN report), forward looking returns (PwC's DGM estimate for HAL and other advisors to UK regulators) and UK precedent (Ofwat, Ofcom and Ofgem) and the top end consistent with the CAA's RP2/Q6 estimates. The CAA notes that the top end reflects its RP2/Q6 estimate, consistent with the finding that expected returns have fallen since previous reviews and that most sources suggest a TMR of no more than 6 per cent.[64]

58 CAA (February 2019), op. cit., para D25-D29.

59 CAA (February 2019), op. cit., para D30-D33.

60 CAA (February 2019), op. cit., para D34-D36.

61 CAA (February 2019), op. cit., para D37.

62 CAA (February 2019), op. cit., para D38.

63 CAA (February 2019), op. cit., para D39-D42.

64 CAA (February 2019), op. cit., para D46-D47.

The CAA selects a point estimate of 5.4 per cent real RPI-deflated, toward the low end of its overall range, but near the mid-point of the historical evidence (UKRN report), other UK regulators' proposals (Ofgem for RIIO-2 and Ofwat for PR19) and PwC's TMR range for H7.[65]

We consider the CAA's proposed TMR range and point estimate for RP3 are downward biased, as many of the TMR estimates the CAA relies on are based on flawed assumptions. We have raised a number of these issues with the CAA's (and its advisor PwC's) estimates in our previous submissions and we refer to these submissions in the rest of this section, where these issues have not been addressed by the CAA.

In particular, we find that the CAA has provided no support for its implicit assertion that the TMR has fallen by 85 bps since the RP2/Q6 reviews from 6.25 to 5.4 per cent real RPI-deflated. We discuss this fundamental point in the following section, while we discuss the detailed issues with the CAA's historic evidence, forward looking evidence and precedent in the subsequent sections.

4.2. There Is No Evidence that Expected Returns Have Fallen Since the Last Review

The CAA presents a point estimate for the TMR of 5.4 per cent, which is 85 bps lower than the point estimate of 6.25 per cent used at the previous RP2/Q6 reviews, consistent with the CAA's assertion that *"expected returns have fallen since previous price reviews"*.[66] Similar assertions have also been made by other UK regulators and their advisors, justifying a reduction in allowed cost of equity in recent UK regulatory consultations.[67]

In this section, we show that these assertions are incorrect and there is no evidence that expected returns have fallen since previous reviews and indeed recent market evidence is consistent with a broadly constant TMR over time.

Realised returns from major equity markets do not support a trend decline in expected returns

Some UK regulators and their advisors argued that UK *realised* returns have fallen in the recent past due to the low interest rate environment, which is indicative that the *expected* returns have fallen as well.[68]

If this thesis was correct, we would expect to see a decline in equity returns across global equity markets. However, our analysis of recent historical *realised* returns for the five largest global equity markets reveals that there is an upward trend in returns in three of the five

[65] CAA (February 2019), op. cit., para D49.

[66] CAA (February 2019), op. cit., para D47.

[67] Ofwat states that "evidence points to a materially lower cost of equity for the 2020-2025 period than set for PR14" (Source: Ofwat (December 2017), Delivering Water 2020: Our methodology for the 2019 price review, Appendix 12: Aligning risk and return, p.26).

[68] See for example Ofwat (December 2017), Delivering Water 2020: Our methodology for the 2019 price review, Appendix 12: Aligning risk and return, Section 5.4.1 and PwC (November 2017), Estimating the cost of capital for H7, pp.35-38.

largest markets, US, Germany and Japan, while realised returns in France and in the UK do not display any discernible trend, as shown in Figure 4.1 below.[69]

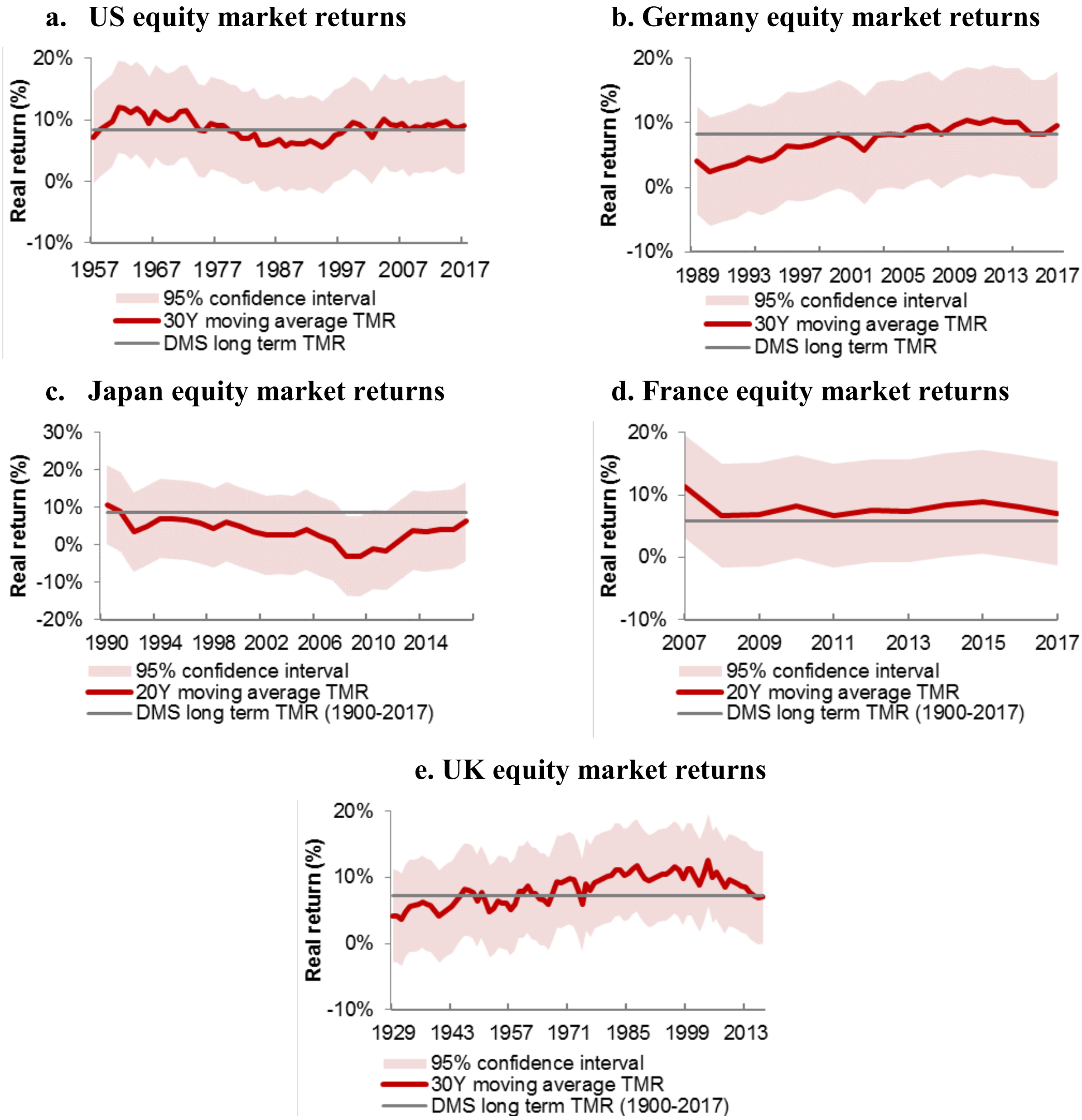
Moreover, in all countries the realised return over the recent period is not statistically different from the long-run average, supporting the conclusion that there is no evidence for the alleged reduction in realised returns.

Evidence from realised returns data therefore does not support the CAA's assumed decline in the TMR since RP2/Q6.

---

69 We calculate real realised returns as a rolling 20-year and 30-year average noting that we can only make inferences around expected returns from market data over relatively long-time period given underlying volatility in annual returns (i.e. minimum 20 to 30-year period). We have calculated 30-year moving average returns for US, Germany, and the UK, while for France and Japan we use 20-year moving average returns, given the shorter available historical series. However, we note that our conclusions that we do not observe a systematic reduction in realised returns in light of falling government bond yields also hold if we were to use a shorter 10-year trailing average.

Figure 4.1: Major Global Equity Markets Show No Discernible Decline in Realised Returns Over the Recent Period



Source: NERA analysis based on data from Bloomberg, OECD, US Bureau of Labour Statistics and DMS (February 2018), Credit Suisse Global Investment Returns Yearbook 2018.

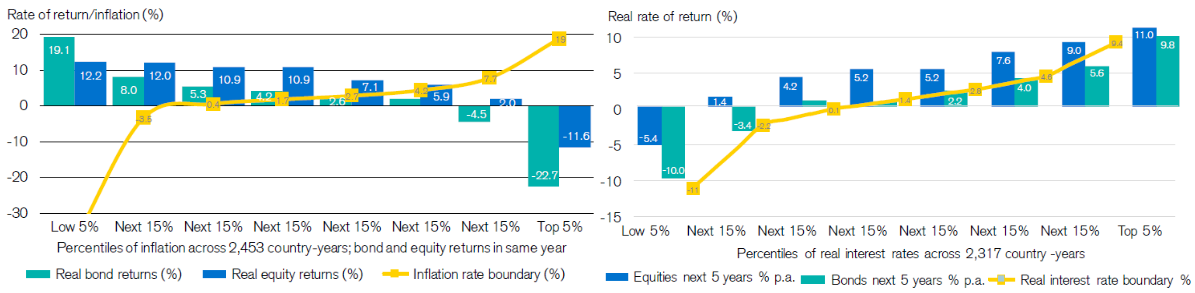
DMS data does not provide evidence of low TMR in today's low RFR environment

Some UK regulators also argued that the current low interest rate environment would lead to low equity returns, based on evidence 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.[70]

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

However, this argument is based on an incorrect interpretation of the DMS evidence: the DMS recognise that *"historically, the bulk of the low real rates occurred* ***in inflationary periods****, in contrast to today's low-inflation environment"*.[71] Thus, the apparent positive relationship between real interest rates and equity returns presented by DMS from cross-country data is in fact driven by a negative relationship between both variables and inflation. As DMS show, historically bond and equity returns have shown a negative relationship with inflation, with bond returns particularly affected compared to equities, as shown in Figure 4.2.

Figure 4.2: Bond returns React More Negatively to High Inflation Compared to Equities (LHS), Giving Rise to Apparent "Positive" Relationship Between Low Real Bond Returns and Low Equity Returns (RHS)



Source: DMS (February 2018), Global Investment Returns Yearbook 2017 – Slide Deck, p.11 and 14.

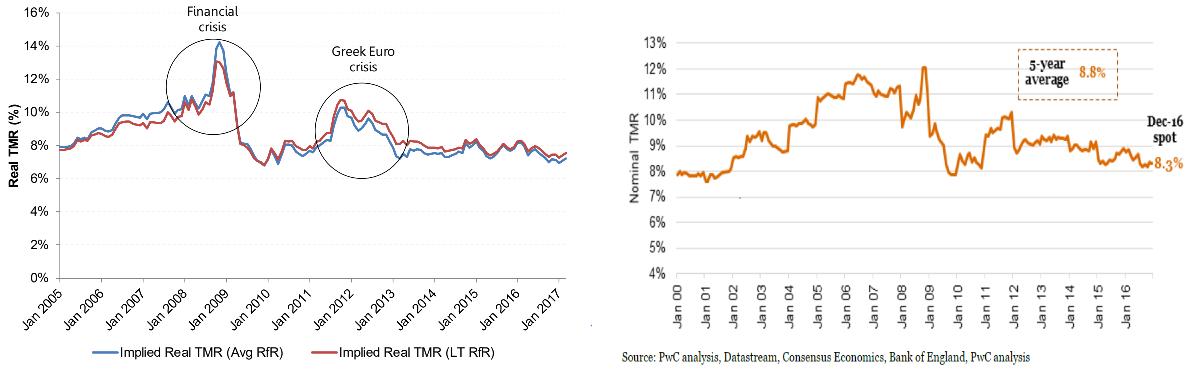
However, the relationship between bonds and equity returns in high inflation periods is not relevant for the assessment of the implications of the current low risk-free rate environment on equity returns, as the low risk-free rate is not driven by high inflation but is a result of loose monetary policy. The evidence from DMS therefore also does not support a reduction in TMR relative to previous reviews.

Forward-looking DGM evidence from BoE and PwC does shows TMR relatively stable in recent period

Similarly, evidence from forward looking DGM models, including from the Bank of England and PwC, shows no discernible trend in the TMR estimates over the recent past, as shown in Figure 4.3.

[71] DMS (February 2018), Credit Suisse Global Investment Returns Yearbook 2018, p.20.

Figure 4.3: DGM Estimates from BoE and PwC Do Not Show a Decline in TMR Over Recent Period



Source: NERA analysis based on data from Bloomberg, OECD, US Bureau of Labour Statistics and DMS (February 2018), Credit Suisse Global Investment Returns Yearbook 2018.

Although we have concerns with the use of DGM to inform the absolute value of TMR given the sensitivity of the results to the dividend growth assumption, as we discuss further in Section 4.4, we can draw on the trend in DGM estimates to assess the CAA's assertion that market evidence supports a decline in market returns. We find that neither the BoE's nor PwC's DGM models shows a trend decline in TMR since RP2/Q6. [72]

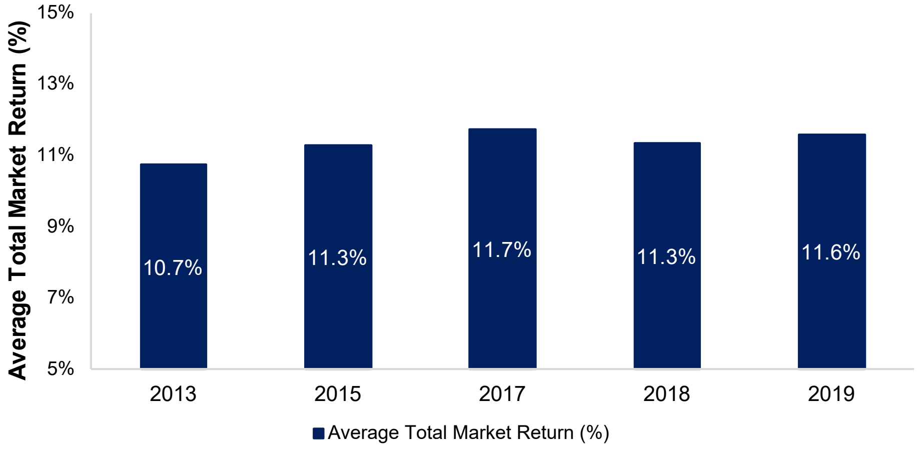
Forward-looking survey evidence also does not show any reduction in TMR in recent period

Finally, forward-looking survey evidence on the TMR from over 40 countries from Fernandez et al., as quoted by PwC in its recent report for Ofwat,[73] shows no systematic decline in the required returns over the wide sample of countries, as shown in Figure 4.4. Indeed, our analysis of Fernandez data shows that the average TMR has increased from 10.7 per cent in 2013 to 11.6 per cent in 2019 on average for the 39 countries included in the survey during 2013 to 2019.

[72] For example, PwC's latest DGM spot estimate from February 2019 of 9.4 per cent nominal appears no lower than the value for 2014 in Figure 4.3, which does not support a decline in the TMR for RP3/H7 relative to RP2/Q6.

[73] PwC (December 2017), Updated analysis on cost of equity for PR19, p.4.

Figure 4.4: Survey Evidence from Fernandez Does Not Show a Trend Decline in TMR



Source: NERA analysis of Fernandez data.

In summary, we show that there is no market evidence to support a decline in either realised or expected returns relative to RP2/Q6. Moreover, the CAA's TMR estimate of 6.25 per cent from RP2/Q6 is lower than existing UK determinations including the CMA's latest determination of 6.5 per cent for NIE in 2014 and Bristol water in 2015 and the CAA does not provide evidence that the TMR would have fallen even further since 2014.

In the following sections, we discuss the detailed issues with some of the evidence the CAA relies on in estimating its TMR range for RP3, which leads to a downward biased TMR estimate.

4.3. CAA Estimate of CPI Historical Returns is Downward Biased Due to Reliance on BoE Hybrid RPI/CPI Data and Excessive Adjustment for Long Holding Periods

The CAA relies on the estimate of historical realised returns presented in the 2018 UKRN report of 5 to 6 per cent real RPI-deflated, calculated based on the UKRN recommended TMR range of 6 to 7 per cent real CPI-deflated minus the CAA's estimate of the forward looking RPI-CPI wedge of 100 bps.[74]

As explained in our May 2018 report for National Grid[75] and our November 2018 report for the Energy Network Association (ENA),[76] there are a number of issues with the UKRN report estimate of historical realised returns, namely in relation to the use of the Bank of England hybrid CPI/RPI index for deriving historical CPI-deflated returns and the downward adjustment to historical data for alleged predictability of returns at long horizons which forms the basis of the UKRN's lower bound estimate.

[74] CAA (February 2019), op. cit., para D18.

[75] NERA (May 2018), Review of UKRN recommendations on the appropriate inflation index for estimating historical TMR.

[76] NERA (November 2018), Review of UKRN report recommendations on TMR.

4.3.1. Use of BoE hybrid CPI/RPI historical index understates historical CPI deflated returns

As we explained in our May 2018 report for National Grid, the key issue with the data labelled as "CPI" by the Bank of England is that it does not represent a CPI index going back to 1900. Instead, it is a mix of an actual and back-casted CPI index for the period 1950-2016 and the RPI index for the earlier period 1915-1949 (as well as another cost of living index for the period 1900-1914). In other words, the alleged "CPI" index from the BoE does not represent measure historical CPI but instead is a hybrid CPI/RPI index.[77]

In its RP2 proposals the CAA argues that using the "CPI" index form the Bank of England is appropriate because the BoE CPI data is calibrated to exclude the RPI "formula effect" and other differences and should be consistent over time, while the structural change to RPI in 2010 implies caution should be exercised in using historical RPI series as an indicator of future RPI-deflated returns.[78]

The CAA fails to address the fundamental point that the BoE "CPI" data does not represent a historical series of CPI inflation but is in fact a hybrid series which combines historical CPI and RPI inflation data (as well as a third cost of living index for part of the period). This hybrid BoE CPI/RPI series therefore cannot be labelled by the CAA as a consistent CPI historical series and indeed no such series which would measure historical CPI inflation going back to 1900 exists for the UK.[79]

The RPI inflation series is therefore the only historical series available as a measure of UK inflation going back to 1900. This conclusion is consistent with the view presented in the ONS paper by O'Donoghue et. al. (2004), which concludes that RPI data presented in Feinstein (1972) for the period before 1947 and the official RPI data post-1947, i.e. the same as the BoE RPI data, represent the appropriate data to be used for making *"long-run comparisons [...] of consumer price inflation"*.[80] Similarly, the ONS recently published a *Long term indicator of prices of consumer goods and services* also uses the same RPI data as the Bank of England.[81]

If indeed the CAA wanted to derive a historical real CPI-deflated return, we consider that instead of relying on a hybrid CPI/RPI series form the Bank of England, it should first estimate historical returns using the historical RPI index and then adjust the result for the estimate of the historical RPI-CPI wedge. The historical RPI-CPI wedge in turn should be estimated from available data on the historical difference between RPI and CPI inflation.

---

77 NERA (May 2018), Review of UKRN recommendations on the appropriate inflation index for estimating historical TMR, section 3.

78 CAA (February 2019), op. cit., para D23.

79 The CAA also appears to argue that the RPI data used by the BoE for the period prior to 1949 (based on Feinstein (1972) appears to have a different coverage than RPI. As explained in our May 2018 report for National Grid, according to the ONS paper by O'Donoghue (2004) which compiled the historical RPI data from different sources and that the BoE uses as a source for its RPI, the Feinstein (1972) data was "*put together in a form which was as nearly as possible consistent in concept and definition with the then Central Statistical Office's (post-1947) official estimates of the National Accounts* [i.e. RPI]" and hence reflects the best estimate of historical RPI available. (Source: O'Donoghue, Goulding, Allen (March 2004), Consumer price inflation since 1750, p.38-46.)

80 O'Donoghue, Goulding, Allen (March 2004), Consumer price inflation since 1750, p.39.

81 Available at ONS website: https://www.ons.gov.uk/economy/inflationandpriceindices/timeseries/cdko/mm23

- The most reliable evidence on the historical RPI-CPI wedge is available from the period 1989 onwards, when both the RPI and CPI data exists as official indices published by the ONS. Using evidence from this period shows a historical RPI-CPI wedge of 72bps.[82]
- We also have *some* evidence on the historical RPI-CPI wedge over the period 1950 to 1988, drawing on the official RPI index and the back-casted CPI index from the ONS, although the value of the CPI index over this period is less certain given the ONS series reflects a back-cast estimate based on available RPI data rather than a bottom-up derived CPI series from the underlying data. Using evidence from this period shows a historical RPI-CPI wedge of 28bps. [83]
- We have no evidence on the value of CPI inflation (actual or back-casted) prior to 1950 and therefore no evidence on the RPI-CPI wedge.

Based on the above evidence, we consider a historical estimate of the RPI-CPI wedge would lie between 47 bps (calculated over the full historical period since 1950 when *some* CPI data is available) and 72 bps (calculated over the most recent period since 1988 when official CPI data is available).

Applying the above historical RPI-CPI wedge of 47 to 72 bps to historical returns deflated using the historical RPI index would then provide an estimate of historical CPI-deflated returns. The CAA could then adjust the above historical figure by its forward-looking RPI-CPI wedge of 100bps[84] to calculate a forward-looking return in RPI-deflated terms. This approach would also address the CAA concern around structural changes to the RPI in 2010, which is corrected for by effectively adjusting the historical real RPI returns by the difference between the historical and the forward-looking RPI-CPI wedge, thus correcting for any structural change in RPI data over time.

4.3.2. Evidence on predictability is contentious and a lower adjustment for long holding periods should be applied based on established methods

As we explained in our November 2018 report for ENA,[85] we consider that the UKRN report 100bps downward adjustment to the arithmetic return for alleged predictability at long-horizons is excessive.

We explained that predictability of returns at long horizons is a contentious issue and there is no consensus in financial literature which provides clear-cut evidence to support the notion of predictability. This was also the conclusion of the earlier 2003 MMW report and the updated analysis from 2013 by Wright and Smithers for Ofgem and the UKRN 2018 report provides no new evidence which would strengthen the case for predictability.[86] The CAA appears to accept the point that returns predictability is a contentious issue, although it argues that

---

82 NERA calculations based on ONS data.

83 NERA calculations based on Bank of England (2017), A millennium of macroeconomic data for the UK, tab A47. Wages and prices.

84 CAA (February 2019), op. cit., para D19.

85 NERA (November 2018), Review of UKRN report recommendations on TMR, section 2.2.

86 NERA (November 2018), Review of UKRN report recommendations on TMR, section 2.2.

PwC's econometric analysis supports the notion of predictability at longer horizons (10 years).

Even if we were to accept the existence of returns predictability at long horizons, which we do not based our review of the evidence in financial literature,[87] we consider the 1 per cent downward adjustment to the arithmetic mean applied by the UKRN report is excessive.

As explained in our November 2018 report for ENA, the UKRN report derives its 1 per cent adjustment from its analysis of decline in variances over long horizons, which ignores the more established methods developed by Blume or JKM for estimating unbiased estimators of the TMR for long investment horizons which also consider serial dependence. These estimators were also used by the CMA in its NIE 2014 and Bristol water 2015 determinations.[88] As we show in Table 4.1, these established estimators provide a more modest downward adjustment relative to the 1 per cent adjustment applied in the UKRN report, below. For example, assuming a 10-year holding period implies a downward adjustment of only 10 to 40bps, which is substantially below the UKRN report assumed 1 per cent adjustment for a 10-year holding period.

4.3.3. NERA updated estimates of historical TMR supports a range of 6.2 to 6.8 per cent (RPI-deflated)

In this section, we present our updated estimate of the TMR derived from historical realised returns, which:

- uses the historical RPI index and RPI-CPI wedge to calculate historical CPI-deflated returns and converts them to a forward-looking RPI-deflated return by applying the forward-looking RPI-CPI wedge; and
- applies the established methods such as Blume and JKM to estimating returns for long investment horizons /holding periods, in line with the CMA approach for NIE in 2014 and Bristol in 2015, which address any potential issues of serial correlation/predictability.

Table 4.1 shows historical realised returns in RPI-deflated using the different methods which account for long-holding periods (such as Blume and JKM discussed above).

[87] NERA (November 2018), Review of UKRN report recommendations on TMR, section 2.2.2 and 2.2.3.

[88] CMA (March 2014), Northern Ireland Electricity Limited price determination, p.13-27, Table 13.7. In its 2015 Bristol Water determination, the CMA states that the "NIE (2014) represented an appropriate comparison for estimating the equity market return" and adopted the same 6.5 per cent TMR as in NIE (2014) (Source: CMA (October 2015), Bristol Water plc, A reference under section 12(3)(a) of the Water Industry Act 1991, p.332.

Table 4.1: 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).[89].

As explained in our March 2018 report for NERL, we consider that evidence supports relatively short holding periods of 1 to 5 years,[90]. This is less than the 10 years advocated by the UKRN report and PwC who argues that many market investors (e.g. pension funds and retail investors) typically have longer-term investment horizons.[91] We find that the average holding periods for the alleged long-term investors mentioned by PwC are typically less than 5 years:

- A 2018 survey of asset management firms by the Investment Association found that UK retail investors typically held a particular fund for around 3 years;[92]
- A 2016 survey by Schroders found that individual investors typically hold their investments for around 3 years, while pension fund investors have an average holding period of 4.7 years (4.4 years if we consider only the UK and Europe).[93]

We therefore conclude that a holding period assumption of 1 to 5 years remains appropriate for estimating historical TMR. This supports a historical range of 6.8 to 7.1 per cent (RPI-deflated).

As shown in Table 4.2 below, we convert the historical RPI-deflated range to a CPI equivalent using the estimate of RPI-CPI wedge of 47 to 72 bps to calculate a historical CPI-deflated return of between 7.3 and 7.9 per cent. This is higher than the equivalent range from the UKRN report of 6 to 7 per cent, due to i) UKRN report understating the historical CPI returns by relying on a BoE hybrid CPI/RPU series and ii) UKRN report applying an

89 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 an 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.

90 NERA (March 2018), The Weighted Average Cost of Capital for NATS (En-Route) plc at RP3, section 2.1.

91 PwC (February 2019), Estimating the cost of capital for H7 – Response to stakeholder views, para 5.68.

92 The Investment Association (September 2018), Asset Management in the UK 2017-2018, The Investment Association Annual Survey, p.71; available at https://www.theinvestmentassociation.org/assets/files/research/2018/20180913-fullsummary.pdf.pdf

93 Schroders (2016), Global Investor Study 2016 – Plan Sponsors, pp.4-5; available at: https://www.schroders.com/en/sysglobalassets/digital/insights/2016/pdfs/global-investors-study-pension-funds.pdf

excessive adjustment for long holding periods compared to established methods used by the CMA.

Finally, given the CAA is setting returns under an RPI indexation methodology, we convert the CPI return into an RPI forward-looking return using an estimate of the forward looking RPI-CPI wedge of 100bps (in line with the CAA). This provides a forward-looking RPI-deflated return of 6.2 to 6.8 per cent.

Table 4.2: RPI-deflated TMR Ranges Based on NERA's CPI-deflated TMR

Historical wedge:	1989 Onwards Historical Wedge		1950 Onwards Historical Wedge	
	Low	High	Low	High
Historical RPI TMR	6.80%	7.10%	6.80%	7.10%
RPI-CPI historical wedge	0.72%	0.72%	0.47%	0.47%
Historical CPI TMR	7.57%	7.87%	7.30%	7.60%
RPI-CPI forward-looking wedge	1%	1%	1%	1%
Adjusted RPI TMR range	**6.50%**	**6.80%**	**6.24%**	**6.54%**

Note: Inflation adjustments calculated using the Fisher equation
Source: NERA analysis based on DMS (February 2018) and BoE (2017).

We note our updated real RPI-deflated TMR estimate of 6.2 to 6.8 per cent is lower than the range of 6.5 to 7.1 presented in our September 2018 report for NERL.[94] This reflects an update for the new evidence on different inflation indices raised in the UKRN 2018 report.

4.4. CAA DGM-based Forward-looking TMR Evidence is Based on Erroneous Assumptions and Downward Biased

The CAA also presents evidence on forward looking TMR calculated using DGM models, including updated estimates from PwC of 5.3 to 6.2 per cent as well as estimates from other UK regulators and their consultants which lies in a range of 4.0 to 6.3 per cent.[95]

As explained in our September 2018 report for NERL, we consider evidence from forward-looking DGM models should be treated with caution, given the relative sensitivity of the results e.g. to the long-term dividend growth assumption, for which there are no equity analyst forecasts available. We therefore recommend relying on historical evidence as the primary source given it is more objective, with forward-looking evidence only as a cross-check. Our recommendation is consistent with the recommendations of the UKRN report as well as Ofgem's consultation for RIIO-2.[96]

[94] NERA (September 2018), Updated Weighted Average Cost of Capital for NATS (En-Route) plc at RP3, section 2.1.

[95] CAA (February 2019), op. cit., para D35-D36.

[96] Ofgem states that "we propose to maintain our approach of placing most weight on the average of long run returns, as the most objective measure of investor expectations" (Source: Ofgem (18 December 2018), RIIO-2 Sector Specific Methodology Annex: Finance, p.30). The UKRN report authors recommend that "regulators should continue to base their estimates of the EMR on long-run historic averages" (Source: 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), p.48.

Notwithstanding the above general point, the CAA's evidence from forward-looking DGM models (from PwC and other UK regulators' consultants CEPA and EE) is based on erroneous assumptions regarding dividend growth which lead to a substantial downward bias in the TMR estimates, as we summarise below.

4.4.1. UK GDP growth cannot be used to proxy FTSE dividends given 70 per cent of FTSE earnings comes from overseas

In our September 2018 report for NERL,[97] we reiterated our earlier criticism that PwC's DGM-TMR estimate is flawed, given it relies on UK GDP growth as a proxy of dividend growth of the FTSE UK all share index. We explained that this assumption is flawed given 70 per cent of earnings of FTSE companies come from overseas and hence the prospects of future dividends depends not only on expected growth for the UK (which is currently somewhat depressed due to Brexit) but also on expected growth from overseas where 70 per cent of the earnings and therefore dividends comes from, which is higher than for the UK. Using a lower UK GDP growth assumption would lead to understating future FTSE dividends and therefore the implied TMR (discount rate) for a given level of the FTSE index.

In its response, PwC acknowledged that FTSE companies derive earnings from overseas but argued that estimates of cost of capital for UK companies require UK specific inputs. PwC further notes that if it were to use a global GDP growth assumption, this would produce cost of equity for UK listed firms with global exposure, which would further need to be deconstructed into a UK figure and a non-UK figure. This is, according to PwC, unnecessary and a better estimate for the cost of equity of UK companies can be obtained using UK GDP growth assumptions. PwC also notes that if a global GDP assumption was used, this would also require a global approach to estimating betas, which for utilities would provide lower beta estimates, and the resulting cost of equity may not provide a definitive answer.[98]

PwC's argument in defence of its UK GDP growth assumption for estimating a DGM for the FTSE is illogical. PwC is using a DGM model to estimate a TMR for the UK FTSE index as a whole. The FTSE index reflects all listed UK companies, not just companies with UK activities, and these companies on average derive 70 per cent of their earnings from overseas and hence the forecast dividends have to reflect their international exposure. PwC is correct to say that the use of global GDP growth would result in a cost of equity for UK firms with global activities. But this is precisely the definition of the FTSE index: an index of UK firms with global activities deriving 70 per cent of their earnings from overseas. Hence use of global GDP leads to the correct estimate of the TMR for the FTSE index, which is what PwC is trying to estimate and no further "decomposition" into UK and non-UK activities is necessary. We therefore also disagree with PwC that the use of global GDP growth to proxy dividend growth for the local FTSE index requires a global approach to beta, although we note that for airports the use of a global index would generally produce higher betas than the use of local indices, as shown in our February 2018 report for Heathrow Airport Limited (HAL).[99]

---

97 NERA (September 2018), Updated Weighted Average Cost of Capital for NATS (En-Route) plc at RP3, Appendix A.2.

98 PwC (February 2019), Estimating the cost of capital for H7 – Response to stakeholder views, para 5.122-5.123.

99 NERA (February 2018), Cost of equity for Heathrow in H7, Table 3.1.

The above criticism of relying on UK GDP growth as a proxy applies to the DGM estimates prepared by other UK regulators' consultants CEPA and EE who also erroneously use this assumption, leading to an understatement of the TMR for the FTSE.[100]

4.4.2. Analyst forecast should be used to proxy short term dividend growth

In our March 2018 report for NERL,[101] we also explained that the use of GDP growth as a proxy of short-run dividend growth is problematic, given there is no evidence that short run GDP growth provides a good proxy of investors' expectations of dividend growth.

PwC argues that the use of analyst forecasts for estimating DGM-based TMR for regulatory purposes is problematic, given analyst forecasts are biased and inefficient.

Our review of recent literature reveals that any evidence of historical optimism bias is not relevant today:

- Much of the historical literature on optimism bias focussed on US companies prior to institutional reforms in 2003, when leading investment banks agreeing to reform analyst pay structures and to rely more on external analyst input in order to mitigate bias in analyst forecasts.[102]
- As a result of the reforms, post-2003 US literature suggests that any bias has been substantively addressed: for example, Ashton et al. (2011) find that the bias in the long-run dividend growth rate due to analyst optimism is insignificant when a US dataset running up to 2006 is used.[103]
- Academic literature based on non-US market data also questions the existence of optimism bias. For example, for the UK, Ryan and Taffler (2006) find that the ratio of sell and buy recommendations is less distorted than in the US.[104] Galanti and Vaubourg (2017) find that optimism bias significantly reduced after the implementation of Commission Sharing Agreements (CSA), which unbundle brokerage and investment research fees, drawing on evidence from France.[105]

Based on our survey of these more recent studies, we conclude there is no evidence that optimism bias in the UK is as prevalent as it may have been in the US in the past.

The use of analysts' forecasts as inputs in to the DGM has a long history in US rate of return testimony and US court decisions consider it the most reliable way of applying a DGM. For example, in 2014, the Federal Energy Regulatory Commission (FERC) relied on security

---

[100] Europe Economics (December 2017), PR19 – Initial Assessment of the Cost of Capital, Section 5; CEPA (February 2018), Review of cost of capital ranges for Ofgem's RIIO-2 for onshore networks, Section 5.1.2 and Annex E.

[101] NERA (March 2018), The Weighted Average Cost of Capital for NATS (En-Route) plc at RP3, section 3.1.

[102] Sudarsanam, S. (2011), Cost of Equity for Regulated Companies: An International Comparison of Regulatory Practices, p.11.

[103] Ashton, D.; Gregory, A. & Wang, P. (2011): Analysts' Optimism in Earnings Forecasts and Biases in Estimates of Implied Cost of Equity Capital and Long-run Growth Rate, University of Bristol Working Paper.

[104] Ryan, P. and Taffler, R. (2006), Do Brokerage houses add value? The market impact of UK sell-side analyst recommendation changes, British Accounting Review, vol.38, no.4, pp.371-386.

[105] Galanti, S., and Vaubourgm A.G. (May 2017), Optimism bias in financial analysts' earnings forecasts: Do commission sharing agreement rules reduce conflicts of interest?

analyst forecasts published by the Institutional Brokers Estimate Systems, when estimating short-term growth rates in the first step of the model.[106]

The use of analyst forecasts also reflects the general approach in academic literature, for example:

- Chin, M. and Polk, C. (2015) use I/B/E/S survey data for calculating short-term dividend growth rates in a DGM model used for estimating expected UK returns;[107]
- Li et al (2013) also use I/B/E/S analyst forecasts as the basis for estimating growth rates that are then used for solving a DGM.[108]
- Patterson, C. (1995) states that "*in valuation tests …. offered strong evidence that investors place the greatest weight on forecasts from Institutional Brokers of Analysts*"[109]

The use of analyst forecasts in the DGM model is also consistent with approaches by central banks including the BoE as well as the European Central Bank (ECB). While the ECB notes that the use of analyst forecasts may be problematic, it also points that:

> *"a better gauge for earnings and dividend expectations than analysts' expectations is hard to come by. (...) In fact,* ***these data constitute the most widely used source of forward-looking earnings expectations for practitioners****"*[110]

We therefore conclude that analyst forecasts should be used as best available evidence on the expected dividends in the short term, in line with approaches by practitioners, academic literature, financial institutions including central banks and US regulatory precedent.

4.4.3. NERA forward-looking evidence supports TMR higher than historical evidence

As explained in the previous sections, the PwC (and other UK regulators' consultants CEPA and EE) DGM estimates are downward biased due to relying on UK GDP growth as a proxy of dividends for the FTSE which ignores the FTSE companies' exposure to global markets where expected growth is higher compared to UK GDP and disregards higher analyst forecasts in estimating short-term dividend growth.

We consider the correct method to estimate DGM for the UK FTSE index is to use analyst forecasts as a basis of short-term assumptions and GDP growth from countries from which FTSE companies derive their earnings (30 per cent UK and 70 per cent overseas). This is

106 Federal Energy Regulatory Commission, Docket No. EL11-66-001, Opinion No. 531 – Order on Initial Decision, Issued: June 19 2014, p.10, para 17.

107 Chin, M. and Polk, C. (January 2015), Bank of England Working Paper No 520, A forecast evaluation of expected equity return measures, pp.6-7

108 Li, Y., Ng, D. and Swaminathan, B. (2013), Predicting market returns using aggregate implied cost of capital, Journal of financial economics Volume 110 Issue 2, pp.419-436.

109 Patterson, C. (1995), "The Cost of Capital", p.95

110 ECB (2018), Measuring and interpreting the cost of equity in the euro area – Published as part of the ECB Economic Bulletin Issue 4/2018, Section 3. Available at: https://www.ecb.europa.eu/pub/economic-bulletin/articles/2018/html/ecb.ebart201804_02.en.html#toc1

consistent with the approach used by the Bank of England, which provides forward-looking DGM-based estimate of the TMR of between 7.2 and 8.1 per cent RPI-deflated.[111]

We therefore conclude that the forward-looking evidence shows higher estimates compared to the historical evidence of 6.2 to 6.8 per cent RPI-deflated.

4.5. CAA Draws on Recent UK Consultations Which Are Affected by Same Issues as CAA's Own Analysis

The CAA also supports its proposed TMR for RP3 of 5.4 per cent RPI-deflated by pointing to recent consultations by other UK regulators including Ofwat, Ofgem and Ofcom.[112]

However, these proposals do not yet represent final decisions and are influenced by the very same issues we point out above with the CAA's own estimates (i.e. understatement of historical returns in UKRN report, errors in consultants' reports in estimating DGM-based TMR).

The most recent precedent from the CMA from its 2014 NIE and 2015 Bristol water determinations, which were made after the CAA's RP2/Q6 decision supports a TMR estimate of 6.5% RPI-deflated. Our update of the different approaches the CMA considered in determining the TMR at the 2014 NIE and 2015 Bristol water determinations shows a slight increase in the estimates using updated data compared to the evidence presented by the CMA in 2014 and 2015, which does not support a reduction in TMR.[113]

4.6. Conclusion on a TMR Range

We conclude the CAA proposed TMR range of 5 to 6.25 per cent and especially its point estimate of 5.4 per cent proposed for RP3 is downward biased.

The CAA provides no evidence that the TMR has fallen since the RP2 decision of 6.25 per cent by 85 bps: indeed, historical data shows no reduction in realised returns over the recent period across global equity markets, forward looking DGM data shows no reduction in expected TMR and forward-looking survey evidence shows no reduction in expected TMR. All this evidence supports the notion of a broadly constant TMR over time and provides no reason for the CAA to reduce its estimate from RP2, which was already lower than the latest estimate from the CMA of 6.5 per cent from the NIE 2014 and Bristol water 2015 determinations.

The CAA's assessment of the TMR for RP3 relies on selective evidence. In forming its proposed range, the CAA appears to mainly rely on the evidence in the UKRN report and advice from PwC, both of which support unprecedentedly low TMR figures. The CAA places no weight on the alternative evidence presented by others, including a range of academic papers and evidence from institutions such as the Bank of England, which would lead to higher values for the TMR.

---

[111] NERA (September 2018), Updated Weighted Average Cost of Capital for NATS (En-Route) plc at RP3, section 2.1 and Appendix A.

[112] CAA (February 2019), op. cit., para D39.

[113] NERA (September 2018), Updated Weighted Average Cost of Capital for NATS (En-Route) plc at RP3, Appendix A.1.

In addition to considering only evidence which supports low TMR figures, the CAA also selects a point estimate of 5.4 per cent, towards the bottom of their estimated range, thus further exacerbating the downward bias in its TMR estimate. This is not the usual approach taken by regulators: given the potential issues resulting from setting a cost of capital that is below the efficient level, regulators have typically erred on the side of caution and consider either the midpoint or the top end of the range. For example, the CMA in its 2014 NIE determination stated that it wished to avoid the cost of capital being too low and selected a point estimate at the top of its range. [114]

The CAA's proposal that the TMR should be substantially reduced at RP3 is driven by a number of issues with the evidence the CAA relies on, which lead to a downward biased TMR range proposed for RP3:

- The historical returns of 5 to 6 per cent real RPI-deflated, which draw on UKRN report estimates, are understated due to: i) UKRN understating CPI-deflated historical returns by relying on a hybrid CPI/RPI inflation series and ii) UKRN excessive adjustment for long-holding periods and alleged predictability of returns.
- The forward-looking DGM-based TMR estimates drawing on PwC's as well as other UK regulators' consultants' calculations are understated due to PwC and other consultants: i) using UK GDP growth to proxy long-term FTSE dividends when FTSE companies derive 70 per cent of earnings from overseas where expected growth is higher and ii) using UK GDP growth to proxy short term dividend growth, which is substantially lower than analyst forecast which we consider represents the best available evidence of short term dividend forecasts.

We calculate updated historical returns of 6.2 to 6.8 per cent RPI-deflated, which draw on historical returns deflated using the RPI index and established methods for estimating TMR for long-holding periods used by the CMA in its NIE 2014 and Bristol water 2015 determinations. We adjust the historical data by the difference between the historical and forward-looking RPI-CPI wedge, drawing on available data on CPI and RPI. This adjustment corrects for any structural changes to the RPI index arising from the 2010 ONS change measuring clothing prices and derives an appropriate forward-looking TMR in RPI-deflated terms.

We also present forward-looking evidence from Bank of England DGM models which supports a TMR of 7 to 8 per cent RPI-deflated, which corrects for issues with the PwC / other consultants' application of the DGM.

We conclude on a TMR range for RP3 of 6.2 to 6.8 per cent RPI deflated, drawing on the historical estimates as the primary evidence. We recommend that forward-looking evidence should be considered as a cross-check only, although we note that BoE estimates support even higher TMR compared to historical estimates.

[114] CMA (March 2014) Northern Ireland Electricity Limited price determination, final determination, p.13-39.

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

NERA UK Limited, registered in England and Wales, No 3974527
Registered Office: Marble Arch House, 66 Seymour Street, London W1H 5BT