NERA
ECONOMIC CONSULTING

International precedent on cost of equity

A Report for Heathrow Airport

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Executive Summary

NERA Economic Consulting (NERA) has been engaged by Heathrow Airport Ltd. (HAL) to conduct a review of international cost of equity decisions for regulated companies operating in the energy and airport sectors. In particular, we review evidence on cost of equity determinations over time for US and Western Europe, to assess how regulators reacted to the reduction in government bond yields at recent reviews in setting cost of equity, and specifically the total market return (TMR) for regulated companies. We focus primarily on evidence from the energy sector, given there is limited information on airport decisions over time.

US energy regulators have set a constant TMR over the past 10 years or so, despite falling US Treasury yields

Our review of US rate case decisions shows stable allowed returns on equity over time, despite substantial reductions in US treasury yields. The stability of US cost of equity and TMR decisions is explained by the reliance on the dividend growth model (DGM) as the primary model for estimating equity returns, which ensures consistency of the input parameters and avoids the risk of setting cost of capital too low in a low government bond yield environment.

In its consideration of CAPM as a cross-check, US regulators explicitly recognise the negative relationship between the risk-free rate and equity risk-premium, producing results consistent with the DGM model even in a low risk-free rate environment.

European energy sector cost of equity allowances remain broadly unchanged

Our review of European energy regulators' decisions shows that within our sample most have maintained TMR decisions at the most recent review. European regulators have generally offset the impact of declining government bond yields by either modifying the methodology for calculating the risk-free rate (RfR) or implementing adjustments to the equity risk premium (ERP), with the sum of the two parameters, the total market return (TMR) stable or indeed increasing at the last two reviews.

In those cases where European regulators have determined a lower TMR at recent reviews, the impact on cost of equity has been offset by increasing beta allowances resulting in a higher overall cost of equity allowance.

Considering the full sample of all European countries surveyed, we find that the average allowed cost of equity for energy networks has increased at the most recent reviews, reflecting a reduction in the allowed RfR but more than offset by an increase in the ERP and/or asset beta.

Overall, based on our review of cost of equity determinations over time for US and Western Europe, we find no evidence of a reduction in allowed cost of equity in light of falling government bond yields at recent reviews.

Airport cost of equity determinations support a higher asset beta than allowed for HAL at Q6

We are not able to draw conclusions on the TMR over time from airport decisions, given the limited time-series data available. However, we have compared European and international airport cost of equity allowances and asset beta decisions to HAL's cost of equity and asset beta at Q6.

Our analysis shows that the cost of equity allowances for airport comparators were in general higher than that determined by the CAA at Q6, with the difference principally explained by higher asset beta allowances. For our sample of comparator airports, the average asset beta is 0.55 (zero debt beta) compared to HAL's 0.44 (zero debt beta). We also show that the allowed asset betas for Fraport and AdP, the two principal comparators considered by the CAA, taken together with the increase in empirical betas since the latest airport determinations, support an asset beta in line with our recommendations for HAL for H7.[1]

[1] As set out in NERA (February 2018), Cost of Equity for Heathrow in H7.

1. Introduction

Heathrow Airport Ltd (HAL) commissioned NERA Economic Consulting (NERA) to undertake a review of international precedent on allowed return on equity for regulated companies. The objective of the study is to understand how regulators in different jurisdictions responded to changes in financial market conditions following the global financial crisis, specifically in relation to falling government bond yields as a result of central banks' unconventional monetary policy.

In our study, we include international precedent from North America and Western Europe with comparable and established regulatory regimes. We focus our review on cost of equity decisions in the energy sector, which provides the most comprehensive evidence on regulatory determinations across the different jurisdictions, and allows us to identify any changes in cost of equity allowances over time. We also consider evidence for regulated airports, although information for this sector is relatively limited and does not allow us to undertake a comparison of regulatory determinations over time.

The rest of this report is structured as follows:

- Section 2 sets out precedent on regulatory decisions in the energy sector from North America;
- Section 3 discussed precedent on regulatory decisions in the energy sector from Western Europe;
- Section 4 considers evidence from the regulated airports sector;
- Section 5 concludes.

2. Precedent form energy sector in North America

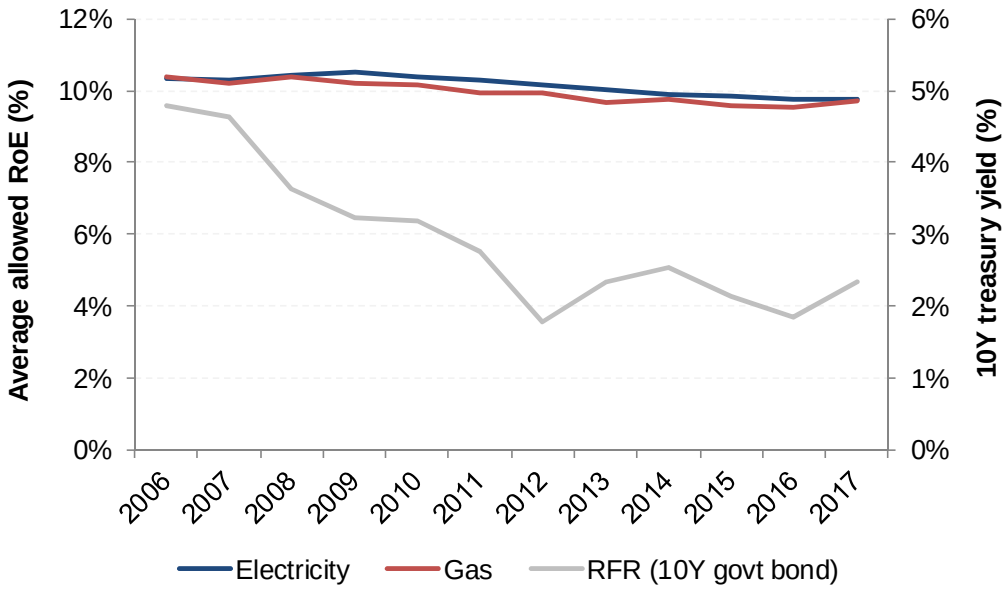
In this section, we set out precedent from rate case decisions on allowed returns on equity for regulated electricity and gas utilities in the USA.

In summary, we find that US regulators have not reduced allowed cost of equity for energy networks at successive reviews, despite substantial reductions in US treasury yields. This trend is driven by US regulators' reliance on the dividend growth model (DGM) as a basis of estimating allowed returns on equity, which implicitly takes into account the negative relationship between the RfR and the ERP.

2.1. Precedent from North America shows stable equity returns despite falling interest rates

Figure 2.1 sets out the median allowed return on equity (nominal, pre-tax) for regulated electricity and gas utilities over the period since 2006 until 2017.

Figure 2.1
US regulators kept stable cost of equity allowances despite falling treasury yields



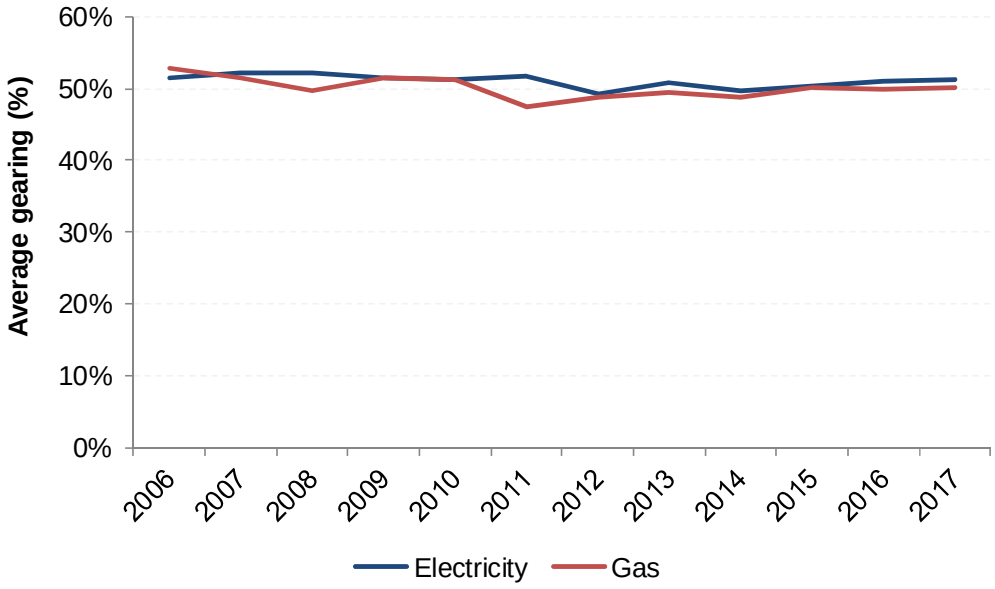
Source: S&P Global Market Intelligence (2018), RRA Regulatory Focus – Major Rate Case Decisions 2017
Note: We show overall RoE as information on individual parameters is not available, given the US regulators' reliance on DGM as a primary model, which produces a RoE directly.

Over the period 2006-2017, yields on US government bonds (proxied by the 10-year treasury yield) have fallen dramatically, but the allowed returns on equity (RoE) for regulated energy

utilities have not followed suit. The median RoE was remarkably stable at around 10 per cent (nominal, pre-tax) over the whole period 2006-2017.[2]

As shown in Figure 2.2 below, the average gearing assumed by US regulators in rate case decisions has also been stable over time, suggesting that the observed trend in RoE is not driven by changes in capital structure assumptions made by the regulators over time.

Figure 2.2
US RoE decisions not driven by assumed changes in capital structure: gearing remained stable over time



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

2.2. US regulators rely on DGM as a primary method, resulting in stable RoE decisions over time

The relative stability of US RoE decisions over time, despite substantial reductions in government bond yields, reflects the US regulators' reliance on the dividend growth model (DGM) as a principal model for setting allowed cost of equity for US energy companies. To estimate RoE, US regulators apply the DGM model to a proxy group of benchmark companies with dividend forecasts based on market expectations derived from equity analyst forecasts (e.g. IBES).[3]

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[2] We observe a slight decline in allowed returns on equity of around 50bps over the period since 2006, compared to a 250-300 bps reduction in US treasury yields over this period. However, this marginal decline in allowed RoE is likely explained by the decline in inflation expectations rather than a decline in the real cost of equity, as shown in Appendix A.

[3] United States of America – Federal Energy Regulatory Commission, Opinion no.531.

The reliance on the DGM as a primary model implicitly ensures consistency of the individual cost of equity parameters and avoids the risk of combining inconsistent estimates of the risk-free rate (e.g. based on short-run evidence) and the equity risk premium (e.g. based on long-run evidence), leading to lower sensitivity of the results to changes in the interest rate environment.

In addition to DGM, US regulators also consider evidence from alternative models, such as the CAPM, as a cross-check on the DGM results. In their application of CAPM, US regulators have explicitly recognised the inverse relationship between the risk-free rate and equity risk premium components of the CAPM. For example, the Federal Energy Regulatory Commission (FERC) explicitly acknowledged this relationship in a number of rulings:

"current low treasury bond rate environment creates a need to adjust the CAPM results, consistent with the ***financial theory that the equity risk premium exceeds the long-term average when long-term US Treasury bond rates are lower than average****, and vice-versa."*[4]

"[I]nvestors' required ***risk premiums expand with low interest rates*** *and* ***shrink at higher interest rates****. The link between interest rates and risk premiums provides a helpful indicator of how investors' required returns on equity have been impacted by the interest rate environment."*[5]

[4] US FERC (January 2014), Docket No, ER14-500-000, p36 para 105.

[5] US FERC (September 2016), Docket No. EL14-12-002, p77 para 173.

3. Precedent form energy sector in Western Europe

In this section, we set out precedent on allowed returns on equity for regulated energy networks in Western Europe. We present evidence from the following countries: Norway, Sweden, Finland, Belgium, Netherlands, Luxembourg, France, Germany, Austria, Switzerland, Italy, Portugal and Ireland.[6]

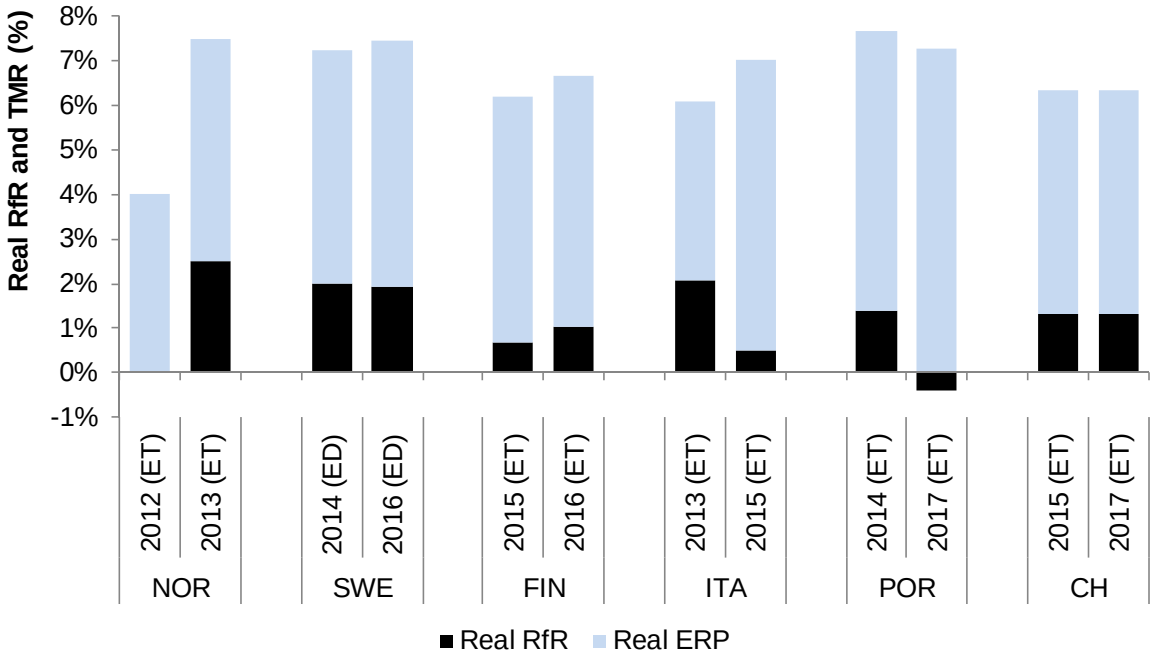
In summary, we find that a number of energy regulators in Western Europe have not reduced TMR allowances at most recent reviews, despite the observed reduction in government bond yields. We find that some regulators have reduced the TMR in light of recent government bond yield evidence, but have also substantially increased beta allowances, offsetting the impact on the cost of equity. Looking at the full sample of countries we surveyed, we find that on average allowed cost of equity for energy networks have increased at the most recent reviews. We therefore find no evidence of reduction in allowed cost of equity in light of falling government bond yields at recent reviews.

3.1. A number of Western European regulators have not reduced TMR in light of falling RFRs at recent reviews

Similarly to the trend observed in US rate case decisions discussed in section 2, a number of energy regulators in Western Europe have not reduced the total market return at recent reviews, despite the reduction in government bond yields since the GFC. As shown in Figure 2.1, the TMR determined at the last review has remained broadly at the same level or indeed increased compared to the previous decision in Norway, Sweden, Finland, Italy, Portugal and Switzerland.

[6] We do not present data for Spain and Denmark where cost of equity decisions are not available.

Figure 3.1
A number of energy regulators have not reduced the total market returns at the most recent reviews, despite falling interest rates



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

Our review of the regulatory decisions shows that regulators in these countries offset the decrease in risk-free rates (RfR) by either modifying their methodology to calculating the risk-free rate or by implementing adjustments to the equity risk premium (ERP), with the sum of the two parameters, the total market return (TMR) stable or indeed increasing over the last

two reviews. The approach followed by each of the regulators to determine the TMR and comparison of previous approach is summarised in Appendix B.

In **Norway**, the energy regulator (NVE) has updated the nominal risk-free rate on an annual basis until 2012, based on the annual average of the 5-year government bond yields. [7] In 2013, NVE introduced a new WACC model which fixed the real risk-free rate at 2.5 per cent. NVE justified the change in methodology to estimating the RfR to reflect a long-term approach to funding network investments:

> *"NVE justifies an interest rate of 2.5 percent* ***in the pursuit of a long-term model and the desire to facilitate future investments****. In October 2012 the Ministry of Finance's new report on economic analysis (NOU (2012:16) provides recommendations for the discount rate from a sample using a risk-free real interest rate of 2.5 percent for investments with a time span of 0-40 years."*[8]

This led to a substantial increase in the TMR in Norway in the latest decision, relative to the previous determination.

In **Sweden**, the energy regulator Ei set its first WACC for electricity grid companies in 2011, which was appealed by the companies and the appeals court in 2014 determined a nominal risk-free rate of 4 per cent in reference to long-run parameters (long-run GDP growth plus inflation). The appeals courts justified their reliance on long-run parameters for estimating the cost of equity based on their preferred approach of taking a long-term view of the cost of equity parameters:

> *"The Administrative Court finds, in accordance with the above, that the risk-free interest rate can is calculated based on the Riksbank's inflation target of 2.0 percent with the addition of Expected GDP development.* ***The parties agree that a long term perspective should be applied.*** [9]
>
> *"A* ***long-term stable cost of capital will in the longer term generate an average compensation that is in line with the actual cost of capital****, although it can lead network companies to be under- or overcompensated over a certain period. The risk of over- or under compensation is significantly greater with a calculation rate calculated on the basis of more short-term forecasts. The reason for this is that the economy over a four-year period is affected by cyclical fluctuations and extraordinary events that are very difficult to forecast. A long-term stable cost of capital can instead be the starting point for long-term economic relationships where the need to predict temporary economic fluctuations is significantly lower.*[10]

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7 NVE's website: https://www.nve.no/reguleringsmyndigheten-for-energi-rme-marked-og-monopol/okonomisk-regulering-av-nettselskap/reguleringsmodellen/referanserenten/historiske-parameterverdier-for-referanserenten/

8 Norges Vassdrags- og Energidirektorat (NVE) (December 2012), Rapport nr 70 2012 - Endringer i kontrollforskriften, p.28

9 Kammarratten i Jonkoping (11 December 2013), Mal nr 8015-11

10 Kammarratten i Jonkoping (10 November 2014), Mal nr 61-14, p.26

The Ei then set its second WACC in 2015, which was also appealed by the companies and the administrative court in 2016 determined a nominal RfR of 4 per cent, in line with the 2014 appeals court decision, albeit using a different methodology .[11]

The TMR in Sweden has slightly increased at the last two reviews, reflecting a slight increase in the ERP in the 2016 administrative court decision compared to the 2014 appeals court decision and an unchanged RfR.[12]

In **Finland**, the energy regulator modified its approach to calculating the risk-free rate in 2015, moving away from relying on short term evidence to calculating the RfR based on 10-year averages of long term government bond yields, resulting in an increase in TMR at the last review.

In **Italy**, the energy regulator AEEGSI decided to adopt a TMR approach to estimating the cost of equity at the latest review in 2015, replacing its previous approach of estimating the RfR and ERP separately, recognising the inverse relationship between the two components of the TMR.[13] The TMR approach was coupled with a floor on the real risk-free rate set at 0.5 per cent and a separate explicit allowance for a country risk premium.

The new approach differs from the previous approach applied in the 2011 decision, which estimated the equity risk premium based on long-run data and combined it with a risk-free rate based on short term evidence on Italian government bond yields (updated in 2013 based on latest evidence). As a result of the change in methodology, the reduction in the risk-free rate was more than offset by a corresponding increase in the ERP as well as the introduction of an explicit country risk premium in 2015, leading to an increase in the TMR relative to the previous determination.

In **Portugal**, the energy regulator **(**ERSE) retained the same methodology to calculating the risk-free rate relying on the 5-year average of 10-year government bond yields of AAA rated European countries, but modified its approach to calculating the country risk premium, reducing the averaging period from 15 to 5 years, resulting in a stable TMR at the last two reviews.[14] Mål nr 4711-15

In **Switzerland**, the energy regulator (BFE) updates the RfR and ERP components of the cost of equity on an annual basis, while applying caps and collars to the parameter values to avoid excess volatility. As a result, at the last two reviews, the risk-free rate has been set at 2.5 per

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[11] Specifically, the administrative court determined the RfR based on 9-year ahead forecasts of Swedish 10-year government bonds of 3.7 per cent and a 0.3 per cent adjustment for the longer asset life of electricity network assets. Source: Förvaltnjngsrätten I Linköping, (14 December 2016), Mål nr 4711-15, p.39.

[12] See Kammarratten i Jonkoping (10 November 2014), Mal nr 61-14, p.27 and Förvaltnjngsrätten I Linköping, (14 December 2016), Mål nr 4711-15, p.40-41.

[13] Documento per la consultazione 509/2015/R/Com (29 October 2015), Criteri per la determinazione e l'aggiornamento del tasso di remunerazione del capitale investito per le regolazioni infrastrutturali dei settori elettrico e gas - orientamenti finali

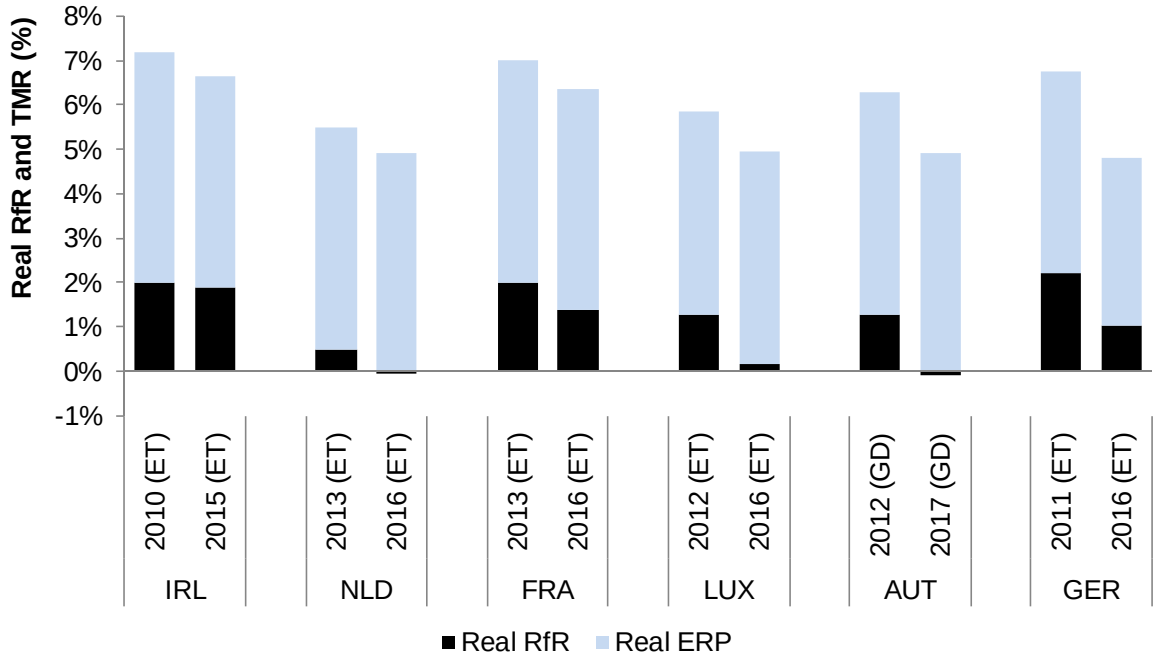
[14] ERSE, Parametros de Regulacao para o period 2018 a 2020; ERSE, Parametros de Regulacao para o period 2015 a 2017

cent nominal, in line with the assumed floor for the risk-free rate parameter, resulting in a stable TMR over time.[15]

3.2. Some regulators have reduced TMR in light of falling RFRs, but impact on CoE offset by higher beta allowances

There are a number of other Western European regulators who have not reacted to the reduction in government bond yields by modifying the approach to calculating RfR and ERP parameters, resulting in falling TMR at recent reviews. As shown in Figure 3.2, TMR allowances have fallen in Ireland, Netherlands, France, Luxembourg, Austria and Germany in the latest determination compared to the previous decision.

Figure 3.2
Other regulators in Western Europe have factored in reduction in interest rates in regulatory determinations, resulting in reduction of TMR at recent reviews



Note: Real TMR calculated as Real Risk-Free Rate +Equity Risk Premium + additional components (Country Risk Premium, Liquidity Premium). Nominal values are deflated using the inflation provided in the regulatory decision or, if not available, using inflation forecasts from Datastream (for Ireland and Austria).
Source: **Ireland:** 2015 ET: *Commission for Energy Regulation (CER), Decision on TSO and TAO Transmission Revenue for 2016 to 2020;* 2010 ET: *Commission for Energy Regulation (CER), Decision on TSO and TAO Transmission Revenue for 2011 to 2015*. ***Netherlands:*** 2016 ET : *Autoritei Consument & Markt, Methodebesluiten GTS 2017-2021, kenmerk ACM/DE/2016/201585, zaak 16.0110.52 Bijlage 2 - Uitwerking van de methode voor de WACC;* 2013 ET: *Methodebesluit regionale netbeheerders elektriciteit 2014 – 2016, Bijlage 2 - Uitwerking van de methode voor de WACC.* **France:** 2016 ET : *Délibération de la Commission de régulation de l'énergie du 19 octobre 2016 portant projet de décision sur les tarifs d'utilisation des réseaux publics d'électricité dans le domaine de tension HTB ;* 2013 ET : *Délibération de la Commission de régulation de l'énergie du 3 avril 2013 portant décision relative aux tarifs d'utilisation d'un réseau public d'électricité*

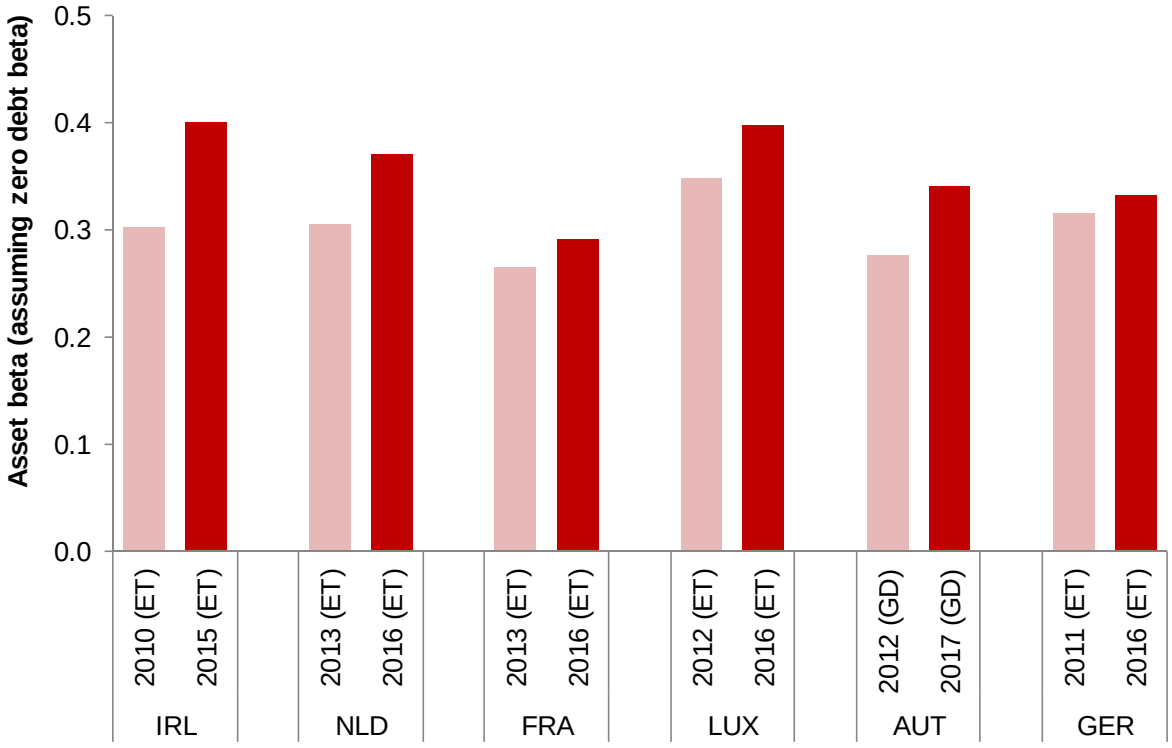
[15] IFBC AG (28 August 2015), Risikogerechte Entschädigung für Schweizer Stromnetzbetreiber

dans le domaine de tension HTB. **Luxembourg:** 2016 ET : *Journal Officiel du Grand-Duché de Luxembourg, N.91 17 mai 2016;* 2012 ET :*Journal Officiel du Grand-Duché de Luxembourg, N.75 20 avril 2012.* **Austria**: 2017 GD : *Regulierungssystematik für die dritte Regulierungsperiode der Gasverteilernetzbetreiber 1. Jänner 2018 - 31. Dezember 2022;*2012 GD: *Regulierungssystematik für die zweite Regulierungsperiode GAS 1.1.2013-31.12.2017.* **Germany:** 2016 ET: *Bundesnetzagentur, BK4-16-160_Strom;* 2011ET: *Bundesnetzagentur, BK4-11-304*

However, the same regulators which chose to set a lower TMR at recent reviews (as summarised in Figure 3.2 above) have also chosen to determine higher asset betas following the emergence of European economies from the financial crisis (as shown in Figure 3.3 below).

The trend of higher asset beta allowance also applies to some of the countries where TMR remained stable or increased at recent reviews (as discussed in section 3.1), but is more pronounced for countries where the TMR has fallen, with asset betas increasing on average by 0.05.

Figure 3.3
In countries where TMR has fallen, regulators have also substantially increased the asset beta allowances

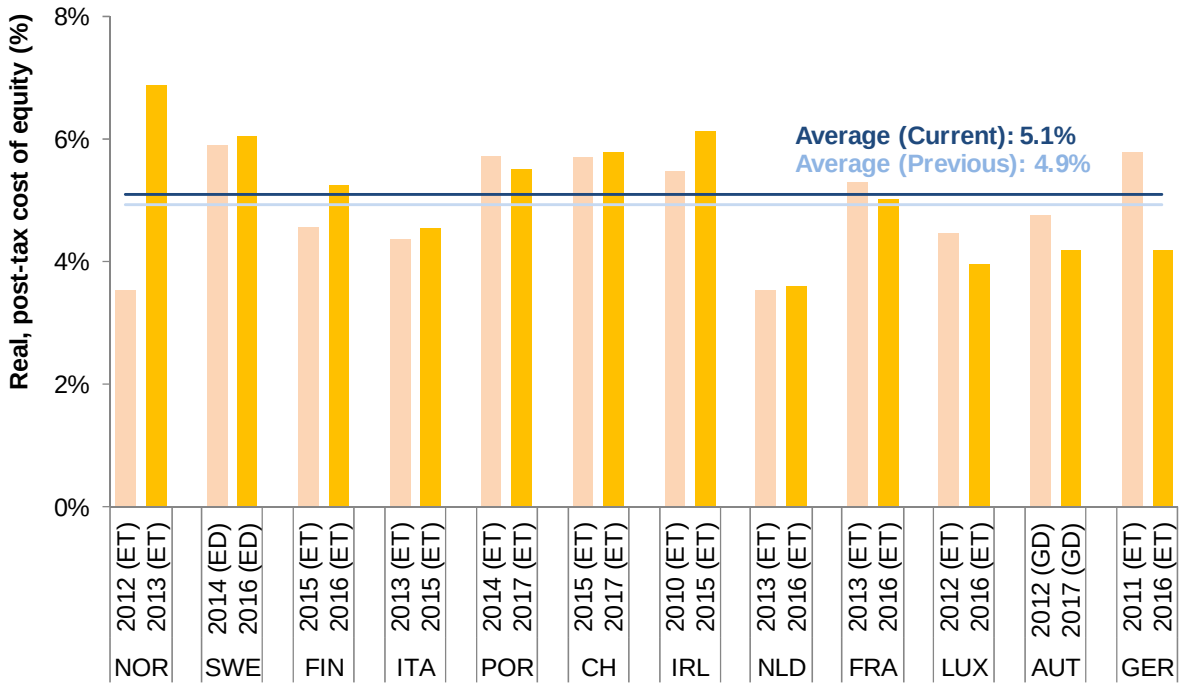


Note: Asset betas are calculated by de-levering the allowed equity beta using the Miller formula, regardless the method used by each regulator. For this reason, asset betas presented in Figure 3.3 may differ from the values presented in the regulatory decision, as the method used to de-lever the equity beta may not be the same.
Source: See sources for Figure 3.2

As shown in Figure 3.4 below, the increase in allowed asset betas more than offsets the effect of lower TMRs, with the overall allowed cost of equity increasing in Ireland and Netherlands. For France, Luxembourg and Austria, the increase in asset beta is insufficient to offset the reduction in TMR, with cost of equity allowances slightly falling at recent reviews. A particular outlier among the international comparators is Germany, which has experienced a reduction in the TMR and limited increase in asset beta to offset the impact on the cost of equity. However, the German decision is currently under appeal, with the independent court expert recommending a cost of equity above the figure proposed by the regulator.[16]

Taking the evidence from all the countries we surveyed together, we find that cost of equity decisions by European regulators have increased slightly, from 4.9 per cent (real, post-tax) in the previous regulatory decision to 5.1 per cent (real, post-tax) for the current regulatory period, as shown in Figure 3.4 below. This reflects a reduction in the average real RfR (from 1.4 to 0.9), offset by an increase in average ERP and additional CoE parameters (e.g. CRP) (from 4.9 to 5.3 per cent) and an increase in the average asset beta (from 0.31 to 0.34).

Figure 3.4
Despite the reduction in the TMR in some countries, the offsetting effect of increase in asset betas resulted in stable CoE determinations at the two most recent reviews



Source: See sources for Figure 3.1 and Figure 3.2
Note: The cost of equity figures are based on a notional gearing assumption in line with the regulatory determination. For countries where regulators have determined different gearings over time, we adjust the result to be based on a consistent capital structure over time (applies to Finland and Sweden, where we have presented CoE at 50 and 52 per cent gearing respectively, in line with the latest decisions). As a result, allowed

[16] See https://www.welt.de/regionales/nrw/article172556688/Kuerzungen-Gerichtsgutachter-kritisiert-Bundesnetzagentur.html#Comments

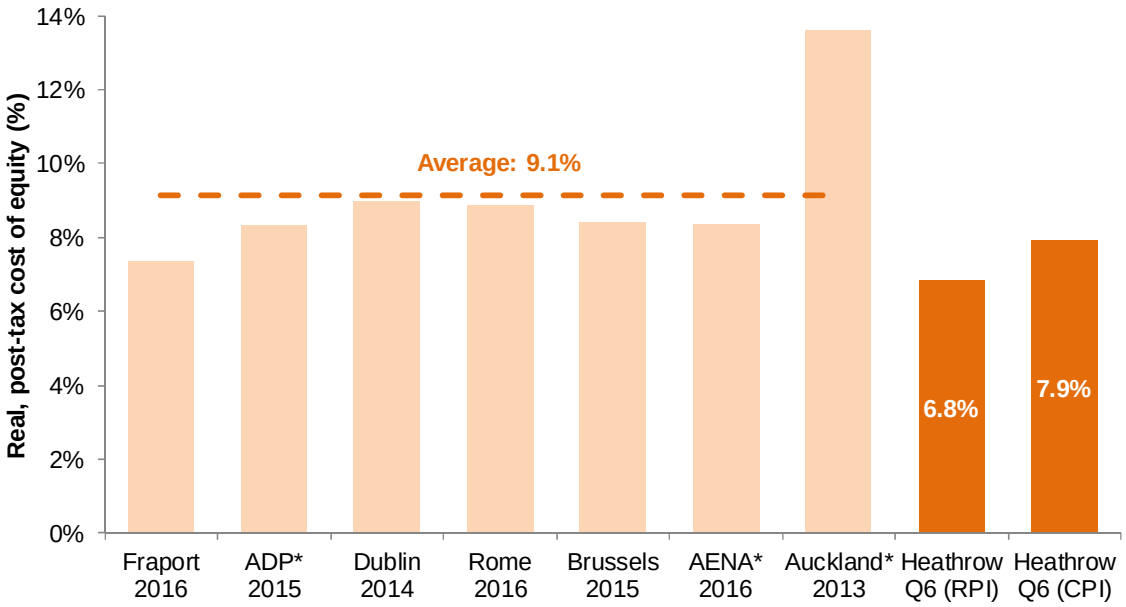
cost of equity should not be compared across countries as different countries are based on different capital structure assumptions.

4. Evidence from regulated airports

In this section, we set out evidence on allowed cost of equity for regulated airports. We note that, unlike in the energy sector, information on cost of capital allowances for regulated airports is relatively limited and does not allow us to undertake a comparison of decisions over time (as we have done in section 2 for energy networks). In this section, we therefore only present evidence on the current level of allowed cost of equity for the airports where we were able to identify information in the public domain.[17]

Figure 4.1 below shows the allowed cost of equity (real, post-tax) for regulated airports at the most recent price controls. We present the allowed cost of equity re-geared at 60 per cent, in line with the notional gearing for Heathrow in Q6.

Figure 4.1
Real, post-tax cost of equity of regulated airports



Note: Figures for AdP, AENA and Auckland are back-solved based on available information, as breakdown of final WACC not available in the final determinations. For AdP and AENA, the WACC was set based on the airports' submissions and advice from a consultation commission to the respective regulators. We solve for the effective percentile of the decision between the commission and airport view of the WACC and apply it to the individual parameters of the two estimates to back-solve for the implied cost of equity allowance. For Auckland, the allowed WACC was set as the 75th percentile of the regulator's estimate, however the final decision only shows the individual parameters for the 50th percentile. We therefore increase each of the WACC parameters by the same proportion in backing-out the effective cost of equity allowance. Heathrow Q6 real CPI CoE calculated by adding 110bps to the real RPI allowed TMR.
AdP's 2015 agreed final parameters not available (except for WACC). Figures reported are back solved from the final agreed WACC and calculated as weighted average between AdP's and Commission Consultative

[17] We also note that data availability on the individual parameters of the final determinations for each airport is limited. A number of the figures presented below are therefore back-solved from the available sources (as explained in detail under each figure).

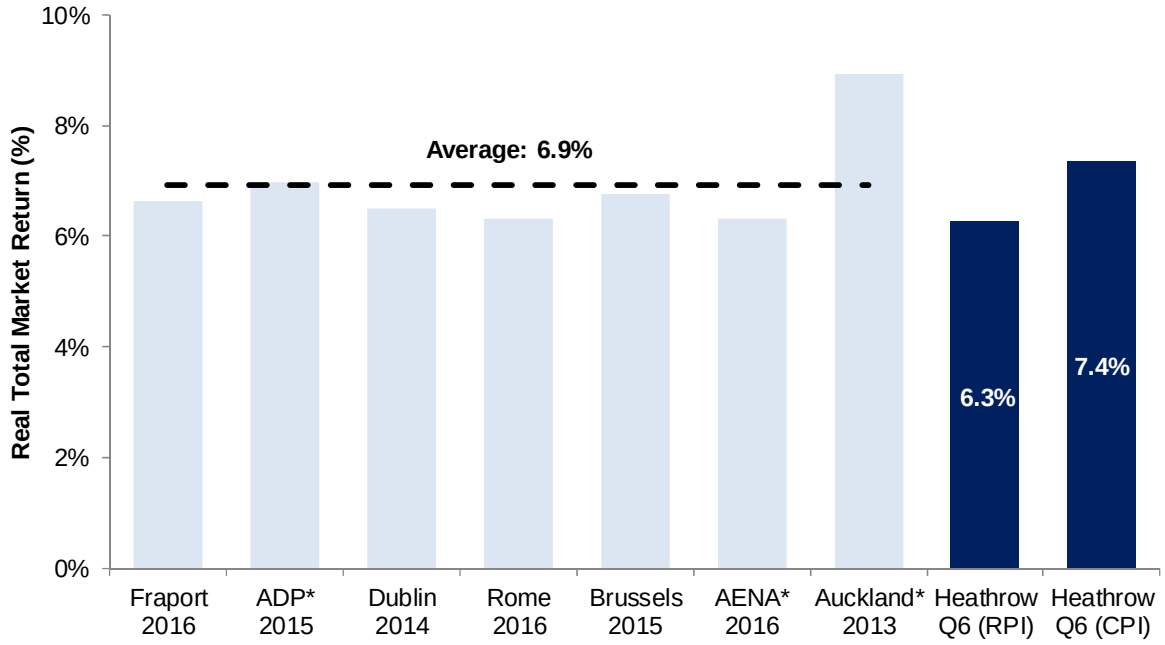
Aéroportuaire's proposals, using the relevant percentile resulting from the comparison between the two proposed WACC levels and the final agreed WACC.
Source: **Fraport***: Visual Fact Book 2016;* **Aéroports de Paris***: AdP's press release (29 July 2015), Aéroports de Paris welcomes the agreement with the government on the draft 2016-2020 Economic Regulation Agreement; Commission consultative aéroportuaire (27 June 2015), JORF n°0147; Aéroports de Paris (19 January 2015), 2016-2020 Economic Regulation Agreement, Public consultation document;* **Dublin***: Commission for Aviation Regulation, Maximum Level of Airport Charges at Dublin Airport – 2014 Determination;* **Rome***: ADR Economic Regulation Agreement – Users consultation on the proposal of 2017-2021 fee update;* **Brussels,** *Dienst Regulering van het Spoorwegvervoer en van de Exploitatie van de Luchthaven Brussel-Nationaal, Beslissing van 3 november 2015 betreffende de aanpassing van het tariefsysteem en de formule voor tariefcontrole voor de gereguleerde periode van 1 april 2016 – 31 maart 2021, zoals finaal voorgesteld door Brussels Airport Company;* **AENA:** *Dirección General de Aviación Civil (January 2017), Documento de regulación aeroportuaria 2017-2021; Comision Nacional de los Mercandos y la Competencia (CNMC), Acuerdo por el que se emite el informe previsto en el articulo 25.3 de la ley 18/2014, de 15 de octubre, de aprobacion de medidas urgentes para el crecimiento, la competitividad y la eficiencia en relacion al documento de regulacion aeroportuaria;* **Auckland:** *Commerce Commission New Zealand (31 July 2013), Final report to the Ministers of Commerce and Transports on how effectively information disclosure regulation is promoting the purpose of Part 4 for Auckland Airport.*

On average, the allowed cost of equity for the regulated airports in our sample is 9.1 per cent (real, post-tax), substantially higher than HAL's allowed cost of equity at Q6 of 6.8 per cent (RPI-deflated basis) and 7.9 per cent (CPI-deflated basis).[18]

Figure 4.2 and Figure 4.3 below show the two key components of the cost of equity, the total market return and allowed asset beta for the regulated airports. Appendix C summarises the approaches to estimating the individual parameters (where available).

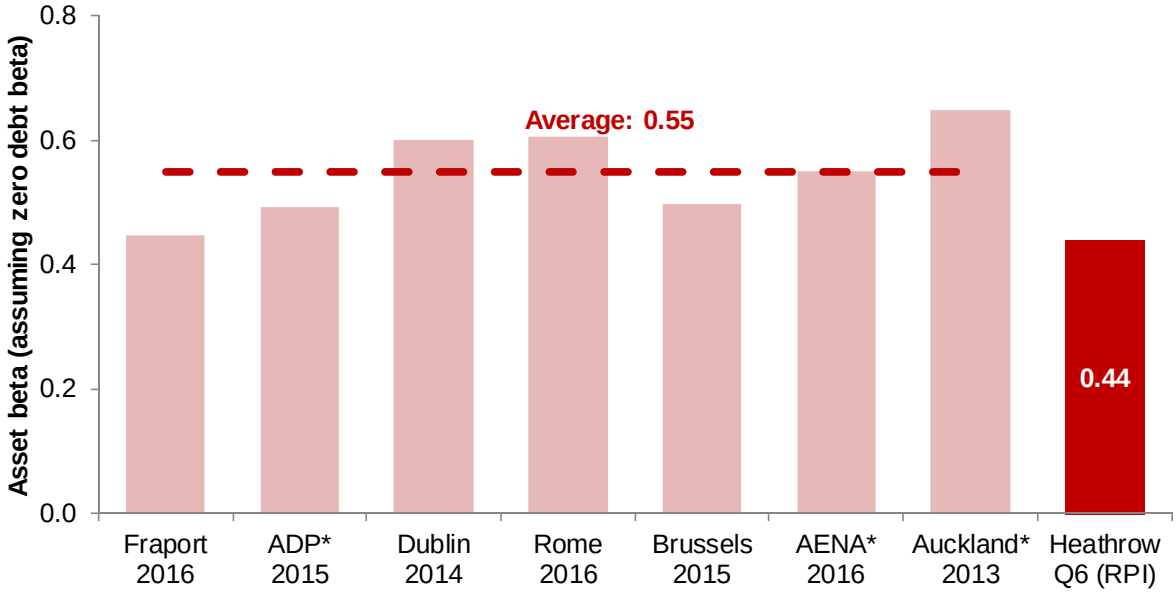
[18] As shown in Figure 4.1, the average allowed cost of equity of 9.1 per cent is affected by inclusion of Auckland in the sample which has a higher cost of equity allowance compared to the other airports. The average excluding Auckland is 8.5 per cent, also above HAL's Q6 allowed cost of equity.

Figure 4.2
Real TMR for regulated airports



Source: See Figure 4.1.

Figure 4.3
Asset beta for regulated airports

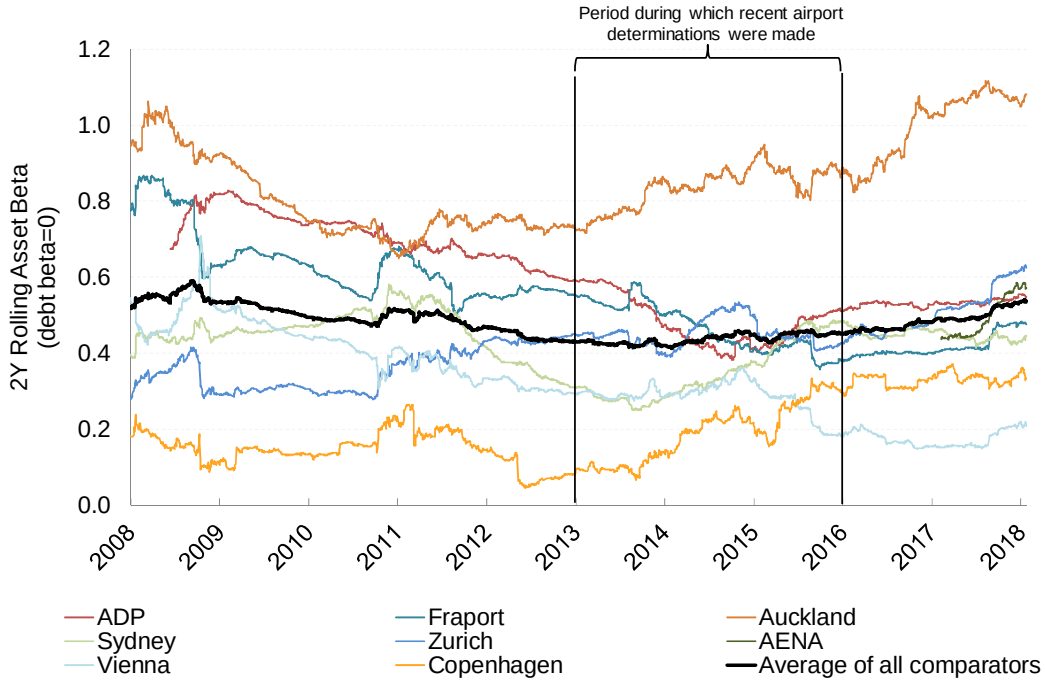


Source: See Figure 4.1

The average allowed asset beta for regulated airports of 0.55 (assuming zero debt beta) is substantially higher than the allowed asset beta for HAL in Q6 of 0.44 (assuming zero debt beta). Allowed asset betas (assuming zero debt beta) for Fraport and AdP, the two principal comparators for HAL, are 0.45 and 0.49 respectively, also above the allowed asset beta for HAL in Q6 of 0.44, despite the fact that HAL faces greater risk than Fraport and is at least as risky as AdP.[19]

In a recent NERA report, we estimated an asset beta for HAL for H7 of 0.55 to 0.6 assuming 0.05 debt beta, equivalent to asset beta of 0.52 to 0.57 assuming a zero debt beta.[20] Our proposed beta range is consistent with the asset beta precedent for airports presented above. Specifically, it is consistent with the average allowed asset beta for regulated airports of 0.55. It is also consistent with the allowed asset betas for Fraport and AdP of 0.45 and 0.49 respectively, given that HAL is subject to greater risk than Fraport and at least as risky as AdP and also taking into account that empirical betas for listed airport comparators have increased relative to the time of the most recent determinations (between 2013 and 2016), in particular for AdP since 2015, as shown in Figure 4.4 below.

Figure 4.4
Empirical betas for airports have increased since the latest determinations, in particular for AdP, HAL's key comparator



Source: NERA analysis of Bloomberg data
Note: The comparator asset betas are calculated against the local/regional index (Stoxx Europe for European airports and local indices for Australian/New Zealand airports), assuming 0 debt beta and Bloomberg net debt

[19] As explained in a recent NERA report on the cost of equity for HAL for the H7 period. NERA (February 2018), Cost of Equity for Heathrow in H7, section 3.2.

[20] NERA (February 2018), Cost of Equity for Heathrow in H7, section 3.

As explained above, evidence on the allowed TMR for regulated airports over time is relatively limited and does not allow us to undertake a comparison of decisions over time. However, as we explain in sections 2 and 3, we find that energy regulators in the US and Western Europe have generally kept the TMR to be largely constant through the recent period of falling government bond yields, explicitly or implicitly recognising the negative relationship between the RfR and ERP components of the TMR. This supports the reliance on long-run evidence on the TMR for estimating cost of equity for HAL for H7, as we argue in a recent NERA report. [21]

[21] NERA (February 2018), Cost of Equity for Heathrow in H7, section 2.

5. Conclusions

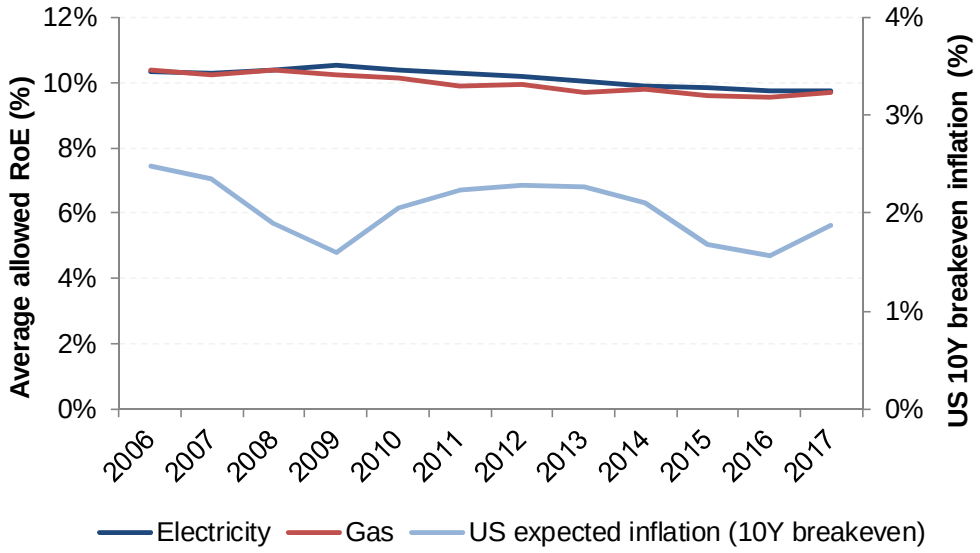
After reviewing international cost of equity precedent decisions from North America and Western Europe, we show that regulators have chosen not to reduce the TMR allowance despite substantial reductions in bond yields. US regulators have drawn on the DGM as the principal means to determine the cost of equity, resulting in a stable TMR. Where US regulators have drawn on the CAPM based on a relatively low RFR, we show that they have made an explicit adjustment to the ERP, again providing a stable TMR/ cost of equity. In Europe, we show that European regulators have offset the reduction in risk-free rates by setting higher ERPs or higher beta allowances, with an overall slight increase in cost of equity determinations at recent reviews.

Our analysis of airport cost of equity determinations shows that HAL's Q6 cost of equity allowance is comparatively low, principally explained by a relatively low asset beta. We show that the comparator evidence, taken together with the increase in empirical betas for listed airports since the last determinations, , support an asset beta in line with our recommendations for HAL for H7.[22]

[22] As set out in NERA (February 2018), Cost of Equity for Heathrow in H7.

Appendix A. Breakeven evidence suggests US inflation expectations have fallen over the last 10 years or so

Figure A.1
Minor reduction in allowed RoE decisions accompanied by reduction in US inflation expectations since 2006



Source: S&P Global Market Intelligence (2018), RRA Regulatory Focus – Major Rate Case Decisions 2017 and US Federal Reserve Bank of St. Louis data

Appendix B. Methodology for determining TMR by European energy regulators

Table B.1
Comparison of recent TMR decisions of European energy regulators

	Norway	Sweden	Finland	Italy	Portugal	Switzerland
RfR methodology (latest decision)	Long-run real RfR of 2.5% + average inflation	9-year forecast of 10-year government bond yields (3.7%) + uplift for longer life of network assets (0.3%)	Higher value of 6-months or 10-year average yield of 10-year government bonds	Real RfR capped at 0.5%	Average yield of 10-year bonds of EU countries with AAA rating over the last 5 years	Average of monthly yields in the previous year, capped at 2.5% nominal
ERP methodology (latest decision)	Fixed at 5.0%	Fixed at 5.0%	Fixed at 5.0%	Difference between TMR (set at 6.0%) and real RfR	Average of differences between S&P500 and 10-year T-notes using different historical periods	Difference in yields between Swiss stock market and 10-year Swiss Bonds between 1926 and 2014
Additional components (latest decision)	-	0.5% premium reflecting the specific risk of the business	Liquidity premium of 0.6% (0.5% in 2012-2015)	CRP as difference in yields between Italian and German 10-year government bonds	CRP as average spread between 10-year Portuguese and German + Dutch government bond over the last 5 years	-
Main changes vs previous decision	Nominal RfR was 1-year average of 5-year-Norwegian government bonds	Nominal RfR was based on long-run GDP (2%) and inflation (2%), but level unchanged at 4%. Increase in the ERP from 4.74% to 5%.	RfR was 1-month average of 10-year bond yields	Adoption of TMR approach, real RfR capped, introduction of CRP	CRP was calculated over the last 15 years	In the methodology in force before 2012, RfR was the average government bond yields over the previous 5 years
Current (previous) real TMR	7.5% (4.0%)	7.4% (7.2%)	6.6% (6.2%)	7.0% (6.1%)	7.3% (7.6%)	6.3% (6.3%)

Source: See Figure 3.1

Appendix C. Methodology for determining CoE by airport regulators

Table C.1
Comparison of methodologies used by regulators to estimate cost of equity for airports

	Fraport	AdP	Dublin	Rome	Brussels	AENA	Auckland
Latest decision	2016	2015	2014	2016	2015	2016	2017
Risk-free rate methodology	n.a.	n.a.	AAA rating European government bonds' yields with upward adjustment based on recent market decisions	10-year government bond yield with upward adjustments reflecting ECB's monetary policy	Average yield of 10-year government bond over the last 2 years	n.a	n.a
ERP methodology	n.a.	n.a.	Based on DMS estimates	Based on DMS for Italy	Damodaran's Market Risk premium based on rating method	n.a	n.a
Beta methodology	n.a.	n.a.	Comparator-based approach with upwards adjustment to reflect higher riskiness compared to Heathrow and Gatwick	Comparator-based approach with 0.3 equity beta increase for additional specific risk	Average between asset beta in previous regulatory period and ADP's asset beta	n.a	n.a

Source: See Figure 4.1; for Fraport, AdP, AENA and Auckland, details on the regulators' methodology are not available.

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