

PwC Economics

# *Estimating the cost of capital for H7*

A report prepared for the Civil Aviation Authority (CAA)

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# Summary

The CAA is currently in the process of consulting on a number of issues relating to the regulation of Heathrow Airport Limited (“HAL”). The focus of this consultation is on the upcoming price control for HAL – referred to as “H7” – and in particular, issues relating to new capacity. As part of this process of consultation, the CAA has commissioned PwC to provide our view of an initial range for the weighted average cost of capital (“WACC”) for the H7 period (currently defined as the 2020-2024 period).

The purpose of providing this initial WACC range is to help guide the initial preparation of the H7 price control. This report does not provide a final WACC estimate that will be used in the setting of the price control.

Our report begins with an introduction setting out the assumptions applied in conducting our work and also the broader methodological considerations relating to the use of current market evidence in setting the WACC (Section 1). It then sets out the context to H7 - summarising HAL's performance over the Q5 and Q6 periods, and highlighting key macroeconomic trends that could impact H7 (Section 2). The report then sets out the appropriate initial WACC range for HAL 'as is', which captures the balance of risk and reward for HAL *without* the third runway scheme. This 'as is' assessment is structured into three parts:

1. the level of notional gearing (Section 3);
2. the cost of debt (Section 4); and
3. the cost of equity (Section 5).

Having provided this assessment of the H7 WACC for HAL 'as is', we then discuss the impact that the third runway scheme could have on the risk profile of HAL and its WACC (Section 6). We then provide a brief overview of tax rate impacts on the WACC (Section 7) before concluding with an initial view on the H7 WACC (Section 8).<sup>1</sup>

We provide an overview of each of these sections in the remainder of this summary.

## **Assumptions and methodological considerations**

Given the early stage of the H7 consultation process, in providing a view of the initial range for the H7 WACC we have made a number of assumptions. Four key assumptions are listed below:

1. The CAA continues to apply a single WACC to a single measure of the regulatory asset base (RAB). This means that the RAB is not segmented or treated any differently for different types of existing assets or new assets. In this circumstance, the WACC has to encompass the risks associated with the delivery of new capacity as well as the risks associated with the existing 'as is' regulated business;
2. The CAA sets the cost of new debt allowance on an ex-ante basis (as was the case in Q6). We do not consider an alternative approach whereby the WACC could change throughout the price control if an indexation approach were adopted by the CAA<sup>2</sup>;
3. The CAA calculates the control in constant prices using the Retail Price Index (RPI) as the basis of indexation for both revenues and the RAB; and
4. The H7 period begins in January 2020 in line with the current one year extension in place.<sup>3</sup>

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<sup>1</sup> Consistent with the CAA's approach to the WACC in previous price controls, for the purpose of this report we set out both the range for a vanilla and a pre-tax WACC.

<sup>2</sup> The CAA commissioned CEPA to consider indexation of the cost of debt in CEPA (2016), “Alternative approaches to setting the cost of debt for PR19 and H7”

<sup>3</sup> The CAA is considering a further extension to Q6 but a decision on the length of the future extension has not been made at the time of publication.

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As well as these assumptions, it is important to understand the wider methodological considerations associated with the approach taken in setting the WACC. Specifically, of key consideration is the trade-off between long-run historical approaches and current market approaches.

Broadly speaking, as long-run historical approaches typically rely on long-run averages of financial time-series, WACC estimates produced by this approach tend to be slow to evolve. This gives WACC estimates greater stability, but increases the risk that allowed returns are unreflective of current market conditions. In contrast, current market based approaches reflect current market conditions, but by their nature are more sensitive to changes in the economic and market outlook - meaning the WACC produced by this approach can be more volatile.

As such, given that there is still a relatively long lead-time from now until the beginning of the H7 period, where the estimates in this report are based upon current markets approaches, the estimates should be reviewed and/or updated to reflect material changes in the economic and market outlook.

We therefore recommend that the CAA monitors changes to the economic and market outlook between the cut-off date used in this report (end of October 2017) and later in the H7 process, updating the WACC estimate accordingly.<sup>4</sup>

Ultimately, the decision over whether to draw upon evidence from current market approaches or long-term historical approaches will be one for the CAA to consider in the build up to the H7 determination.

## **H7 context**

As the H7 control period approaches there are some key differences in the macroeconomic environment compared to the equivalent period in the build-up to Q6. The key inputs to the Q6 WACC range were formed against a backdrop of rising government yields (from 31<sup>st</sup> December 2012 to 31<sup>st</sup> October 2013 nominal 10yr gilt yields increased by 0.8 percentage points), an expectation that interest rates would continue rising over the control period (the 10-year nominal gilt yield spread over the 2-year nominal gilt at 31<sup>st</sup> October 2013 was +2.2%) and that the outlook for UK economic growth was robust.<sup>5</sup> This backdrop differs materially from how the Q6 control period actually unfolded.

Moving towards H7, two key differences from Q6 are that:

- The yields on government and corporate bonds have reached new historic lows (the average real yield on 10-year index-linked gilts over the period November 2016 to October 2017 was -1.92%); and
- Expectations of future interest rates rises are considerably softer (as shown by the flattening slope of the yield curve). In particular, market expectations of the real 10-year gilt yield in 10-years' time has fallen by around 1.75 percentage points between the start of 2014 and the end of October 2017.

We also note that expectations of a “lower for longer” interest rate environment have been largely unaffected by the recent (November 2017) monetary policy decisions from the Bank of England. The modest change to short-term interest rates of 25bps is small compared to the scale of interest rate reductions since 2007.<sup>6</sup>

These differences between the build-ups to the Q6 and H7 periods are reflected in our estimates for each component of the H7 WACC.

Consistent with the macroeconomic and financial market environment set out above, HAL has been able to secure low cost financing below the cost of new debt assumed by the CAA for Q6. Achieving a low cost of new

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<sup>4</sup> In most instances, unless otherwise stated, the data cut-off for this report was the end of October 2017, but where relevant we also consider information regarding the Bank of England's 2nd November 2017 base rate change.

<sup>5</sup> As at October 2013, the consensus economics view for the UK GDP growth rate was 2.2% for 2014 (with a small standard deviation across the sample of forecasters).

<sup>6</sup> Following the interest rate rise on 2 November 2017, gradual and limited future interest rate movements have been signalled by the MPC. Specifically, the MPC dropped their guidance that the Bank Rate may need to rise more than markets imply, and Governor Mark Carney said two additional 25bp rate hikes over three years “are consistent with” inflation falling back towards target by the end of the forecasting horizon.

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debt alongside strong levels of passenger growth has helped HAL deliver higher than expected returns on average RAB in the Q6 period to date.

## **Gearing**

In setting a gearing assumption for HAL 'as is' we assume a notional capital structure. We see this approach as being an integral part of the RPI-X incentive based regulation and one that provides company management with the incentive to manage the actual financing of the airport efficiently.

Based on evidence from HAL's actual gearing, credit rating agency methodologies and the regulatory decisions taken by other regulators, we find that a notional gearing range consistent with achieving an investment grade credit rating could be as wide as 60% to 75%. However, a reasonable point estimate would be towards the bottom end of this range – particularly given the notional gearing figures selected by other regulators in sectors which benefit from a greater degree of predictability of cashflows. As such, we consider **60%** to be an appropriate notional gearing figure for using in the WACC.<sup>7</sup> A selection at the bottom of the range provides financial headroom to manage shocks and allow for short-term deviations in capital structure without placing undue pressure on ratings or the cost of debt.

## **Cost of debt**

### **Cost of new debt**

Consistent with the notional approach taken to gearing we focus on a notional cost of new debt for an investment grade credit rating cross-checked to HAL's actual financing cost. In providing an estimate for the cost of debt we focus on a single 'ex-ante' cost of debt figure that is reflective of an average expected cost of debt over the H7 period.

Based on current market yields for long-term investment grade corporate debt, the real cost of new debt is close to 0%.<sup>8</sup> This represents a substantial decline in yields from the first quarter of 2016, where real yields were around 1.5%.

As yields are unlikely to persist at their current levels through the H7 period, we consider it appropriate to apply a forward-looking adjustment to current yields, factoring in the market expectations for the future path of interest rates.<sup>9</sup> One source of these market expectations is forward-yields as implied by gilts. Based on data from index-linked gilt yields (at October 2017) we find an expected uplift (to be added to current market yields) to October 2022 of approximately +0.4 percentage points.<sup>10</sup> Applying this uplift to the current market yields of 0%, and factoring in some degree of inaccuracy from forward-looking adjustments based on forward yields, we conclude that the cost of new debt could be 0.4% +/-0.25%, producing a range of **0.15% to 0.65%** in real terms.

While there is uncertainty over the degree to which current market yields are being driven by temporary or permanent factors, evidence from the future direction of long-term interest rates supports the view that long-term equilibrium interest rates may have declined.<sup>11</sup> However, as there is a risk that current rates used for the purposes of our analysis are being distorted by shorter-term market uncertainty, market movements should be monitored between now and the final determination of the H7 controls.

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<sup>7</sup> In Appendix A of the report we discuss the implications of different notional capital structures for the WACC. We find that overall there is little impact on the WACC from considering alternative notional structures.

<sup>8</sup> As at October 2017.

<sup>9</sup> Market based expectations should factor in forward-looking views of both the future path for short-term rates and the prospect for future unwinding of quantitative easing.

<sup>10</sup> The uplift implied by nominal gilts is larger than this and is approximately 0.9 percentage points.

<sup>11</sup> Even in the US, where short-term rates have been rising, the Federal Reserve Chair has highlighted that recent studies suggest that the neutral level of the federal funds rate appears to be much lower than it was in previous decades (Yellen (2017), 'A Challenging Decade and a Question for the Future', At the 2017 Herbert Stein Memorial Lecture)

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## *Cost of embedded debt*

For the cost of embedded debt we also adopt a notional approach cross-checked to HAL's actual financing. In order to calculate the cost of embedded debt we focus on trailing averages of investment grade corporate bond yields.<sup>12</sup> Specifically, we consider 10yr and 15yr trailing averages. We do not consider periods longer than this as, at the time H7 begins, the proportion of HAL's outstanding funding associated with their August 2008 re-structuring will be a small percentage of embedded debt.

While recent 10yr and 15yr trailing averages are around 1.9% and 2.2% respectively (in real terms), rolling forward these averages on a basis consistent with the cost of new debt set out above, we anticipate the 10yr and 15yr averages could be around 1.1% and 1.8% by the end of 2019.<sup>13</sup> The upper end of this range, as informed by the 15yr average, may better reflect past-trends in HAL's issuances and could be considered more consistent with an assumption of long-term notional financing. On that basis, we use this **1.8%** figure as our estimate for the real cost of embedded debt.

## *Overall cost of debt*

For HAL 'as is' we find that a weighting on new debt of 12.5% is appropriate. Combining this with an allowance for issuance costs of 10bps produces an overall real cost of debt estimate of **1.7% to 1.8%**.

## *Cost of equity*

### *Total market returns and risk-free rate*

The Capital Asset Pricing Model ("CAPM") approach to setting the cost of equity requires that total market returns ("TMR") are the sum of the risk-free rate ("RFR") and the equity market risk premium ("EMRP"). Broadly speaking, there are two approaches that can be taken when calculating the cost of equity. The first is to build up to the cost of equity through individually estimating the RFR and EMRP; the second is to estimate the TMR and deconstruct into RFR and EMRP.

In this report we focus on estimating the TMR, then deconstruct into RFR and EMRP by reviewing evidence on government bond yields. However, where the equity beta is close to one – as it has been for HAL in previous regulatory decisions – the exact decomposition of the TMR into RFR and EMRP makes little difference to the cost of equity.

### *Total market returns*

When reviewing the appropriate TMR for the H7 period there are two broad types of evidence that can be used. The first is long-term historical equity returns (ex-post sources) and the second is forward-looking evidence from current market expectations of TMR using techniques such as dividend discount modelling, market valuation and investor surveys (ex-ante sources). We review both sources in this report. However, given the wider economic and market context within which investors are forming their return expectations, which of late has been characterised by 'lower for longer' interest rates, we place more emphasis on the use of ex-ante sources of evidence. This is because the periods on which long-term historical evidence is based do not contain a comparable period of ultra-low interest rates – increasing the risk that this evidence is unrepresentative of equity financing costs in the H7 period.

Specifically, we focus on three sources of ex-ante evidence:

- Dividend discount modelling (DDM) – DDM is a long established technique and is undertaken by a range of market analysts. A multi-stage DDM model has the advantage of capturing both short-term

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<sup>12</sup> Nominal yields are converted into real yields using long-term breakeven inflation as inferred from gilts. Nominal yields used are the average of the A and BBB rated iBoxx non-financial 10Y+ series.

<sup>13</sup> These averages are rolled forward on the assumption that observed yields increase linearly from October 2017 spot yields through the yields for October 2022 for the real cost of new debt. However, it should be noted that forward curves suggest a larger proportion of increases could occur in early time periods (rather than being linear as assumed). The large decline in the forward-looking 10-year average is caused by higher yields from 2008 dropping out of the sample as the averaging window rolls forward to 2019.

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expectations of future dividend growth as well as long-term expectations of future dividend growth, making it suited to the dynamics of a 'lower for longer' scenario. The outputs from our monthly DDM analysis produce a nominal TMR spot rate of 8.4%, while the average since January 2014 has also been 8.4%.

- Market valuation evidence – Another observation is provided by evidence from RCV premia on regulated utility transactions. Recently, there have been several transactions that have achieved premiums above the x1.24 long-run average. There could be two major factors driving these elevated premiums. One is outperformance of regulatory allowances (including the cost of debt). The second is that the cost of equity allowed by regulators is regarded by investors as being in excess of required returns. Given the magnitude of the recent RCV premia across regulated assets, it seems unlikely that outperformance alone can explain recent premiums, and therefore this appears to imply that investor required rates of return are below earlier regulatory assumptions (in recent years regulators have coalesced around a 6.5% real TMR assumption - approximately 9.5% in nominal terms). Our work for Ofwat on publicly listed water company RCV premia suggested a nominal TMR of 7.5% to 8.2%.
- Investor survey evidence – A further piece of ex-ante evidence that can be used to triangulate estimates of TMR is investor survey evidence. We find that the most up to date survey evidence for the UK market shows investors are, on average, applying a nominal TMR assumption of 8.1%.

Based on our review of the three sources above, we conclude that an appropriate TMR in current market conditions is in the range **8.0% to 8.6%** (nominal).<sup>14</sup> Using an RPI inflation assumption of 2.8%, this is equivalent to a real TMR of **5.1% to 5.6%**. This range is lower than regulatory precedents on TMR, but lies within the 5.0% to 6.5% TMR range proposed by the CMA in the determination for Northern Ireland Electricity (NIE) in 2014.

Greater use of ex-ante source of evidence does come with associated policy implications though, and these should be carefully considered by the CAA. In particular, by placing weight on current market data, rather than more stable long-run averages, greater volatility can be introduced into the WACC, and hence greater volatility to overall charges. For example, using forecast data on WACC, RAB and passengers for 2018 as a representative year from HAL's April 2014 notice on the proposed licence, we find that a 1 percentage point widening in the TMR range adds around £1 (2011/12 prices) additional variability to regulated yield per passenger. This is equivalent to approximately 5% of the overall regulated yield per passenger. Furthermore, with greater use of ex-ante sources of evidence, there tends to be a wider scope for subjectivity. This is because the outputs from ex-ante techniques are often sensitive to the underlying input assumptions applied. For example, any approach which attempts to infer TMRs from transactions requires an assumption for expected outperformance; and, a DDM approach to estimating TMR requires an assumption for future dividend growth. Therefore, the risks associated with increased subjectivity, divergence from past regulatory approaches to TMR and bill volatility must be weighed against the risks that long-term averages are unrepresentative of required returns over the H7 period.

Where a longer-term historical approach is used as a reference point in setting TMR, it is important that the raw figures are adjusted for key elements that are not considered to be persistent and for structural changes to inflation measurement such as the formula effect. Our analysis suggests that real TMR estimates on an adjusted long-run historical basis could lie in the range 5.6% to 6.3%. This shows that our current market approach is resulting in a negative adjustment to long-term (adjusted) historical returns of around 0.5% to 0.6%.

Drawing upon evidence that there is a less than perfect negative correlation between the RFR and EMRP, for the purposes of this report we use the TMR range from current market evidence.

### *Risk-free rate*

In assessing the risk-free rate for H7, we use market data on index-linked gilt yields to produce an estimate. Since the final proposals were developed for Q6, gilt yields have declined substantially, and dropped sharply in

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<sup>14</sup> We note that the upper limit for the real TMR proposed by the CMA in the 2014 determination for NIE is equivalent to an upper limit of 9.5% in nominal terms using an RPI assumption of 2.8% (the RPI assumption adopted in Q6).

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2016 as expectations of ‘lower for longer’ interest rates set in. As expectations for future interest rate increases have also softened relative to the pre-Q6 period, this suggests that the risk-free rate should be lower than the 0.5% figure the CAA adopted for Q6.

Forward yields from index-linked gilts show that a forward-looking adjustment to current spot yields (of around -1.8% in real terms) could be relatively small e.g. +0.4 percentage points from spot yields. This would suggest a real RFR estimate of -1.4%. Comparing this figure to recent regulatory decisions on the RFR, an estimate as low as this would depart significantly from other regulatory decisions. Taking account of this, and factoring in a degree of uncertainty, we propose an upper end figure of -1.0% for the real risk-free rate. Our recommended range based on current market data is therefore **-1.4% to -1.0%**. Combining this with the upper and lower end of the TMR range implies an EMRP of 6.5% to 6.6%.<sup>15</sup>

Consistent with the approach to TMR, this approach places more emphasis on current market evidence, and less weight on long-run averages or historical regulatory precedents. However, where the equity beta is close to one, the deconstruction of the TMR between RFR and EMRP makes only a minor difference to the overall cost of equity. Nevertheless, this approach would require updating for capital market movements between now and the final determination for the H7 period.

### *Asset beta*

The TMR represents the returns required by investors on equities of average risk. The actual returns needed for a particular equity investment vary with the degree of risk to which it exposes the investor. Using the CAPM framework, investors only require compensation for bearing systematic risk. The asset beta captures the systematic risk of an equity on an unlevered basis. The higher the asset beta, the more compensation equity investors require for bearing additional systematic risk.

Our approach to estimating the asset beta for HAL is twofold. Firstly, we review key systematic risk drivers at HAL, to provide an initial view on whether there has been a fundamental movement in the systematic risk affecting the airport. Secondly, we review evidence from comparator airport asset betas, contrasting their exposure to systematic risk to that of HAL.

#### *Systematic risk drivers at HAL*

In considering the asset beta of HAL in the ‘as is’ H7 case, there is little reason to conclude the asset beta range applied in Q6 should be amended. This is for three reasons:

- Firstly, there is no reason to consider that HAL will be any differently exposed to demand risk, as the airport can be expected to continue to operate in an environment of excess demand and capacity constraints.
- Secondly, there is no expectation of a fundamental change in HAL’s cost structure compared to Q6. Therefore, in terms of the impacts of input price risk, operational leverage and capex risk in beta, there is no reason to anticipate a change.
- Thirdly, there is no anticipated material change to regulatory protections or incentives that drive systematic risk e.g. no step change in the protections against capex risk. Were the regulatory regime to change incentives significantly, then there would be grounds for revisiting the Q6 asset beta range.

#### *Evidence from comparator asset betas*

Given the rationale set out above, only a marked departure as suggested by comparator airport evidence should lead to a revision to the ‘as is’ asset beta range of 0.42 to 0.52 adopted for Q6.

Overall, this comparator cross-check shows that the average asset beta across the international airport comparator group reviewed is 0.43 (both for daily and monthly data). Furthermore, focusing on Fraport

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<sup>15</sup> A lower figure for the RFR is paired with a lower figure for TMR (and vice versa) – reflecting whether there is a higher or lower general returns environment.



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(Frankfurt) and ADP (Charles de Gaulle), which are the two comparators closest to HAL in terms of size, geography and hub status, we find that:

- The asset betas for both airports have declined since the Q6 final determination.
- Using daily data, the outputs for ADP are close to 0.5 more recently, while for Fraport the outputs more recently are between 0.3 and 0.4.
- Using monthly data, the recent outputs for ADP are broadly between 0.4 and 0.5, while for Fraport they are closer to a 0.45 to 0.55 range.

We therefore find that there is consistency between the **0.42 to 0.52** range used for HAL in the Q6 price control and the review of evidence from comparator asset betas, and recommend its continued use for HAL ‘as is’.

### *Overall cost of equity and overall ‘as is’ WACC*

Applying our estimates for the RFR, asset beta and TMR we estimate a cost of equity range (real, post-tax) for HAL ‘as is’ in H7 of **4.9% to 7.1%**. Combining this with the cost of debt assumptions above, and a notional gearing assumption of 60%, this produces a real vanilla WACC of **3.0% to 3.9%** for H7 ‘as is’. Where a statutory corporation tax rate assumption of 17% is applied, this equates to a real pre-tax WACC of **3.4% to 4.5%** for H7 ‘as is’.

### *Third runway impacts*

In October 2016, the UK government announced its support for a new northwest runway at Heathrow. The scheme is still going through parliamentary and planning processes and is subject to revision. The planned third runway at Heathrow represents a major long-term investment with an estimated overall cost of the scheme of £17.6bn (2014 prices).<sup>16</sup> In this report we consider three third runway impacts on the WACC: (i) construction phase risk impacts; (ii) financing structure impacts; and (iii) issuance cost impacts.

### *Construction phase risk impacts*

In terms of the scheme’s implementation, the construction phase is expected to take place predominantly over the years 2019 to 2025. Under the proposed scheme, the third runway is expected to be open by 2026 – overlapping with some residual construction risk. In terms of the regulatory cycle, this means that the period of construction risk associated with the scheme lies mostly in H7, with operational and demand risk associated with the opening of the third runway concentrated in the subsequent regulatory period (“H8”).

In order to assess the impact of the scheme on HAL’s WACC we review six case studies of other cost of capital adjustments which have been made to capture the impact of additional risks in the construction phase of a project. We then consider the relevance of these case studies to the third runway scheme. Specifically, we consider six key case studies (i) Thames Tideway Tunnel (ii) Ofgem RIIO, (iii) HAL – Terminal 5 (iv) Offshore wind projects (v) OFTOs and (vi) Hinkley Point C. In the table below we summarise the findings from each of these case studies.

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<sup>16</sup> Cost and timing information regarding the expansion is prepared using 2015 costs estimates from the Airports Commission for the Heathrow Airport Northwest Runway (LHR NWR).

Table 1: Case studies

Case study	Notes	Relevance for H7	Scale of WACC uplift in ascending order (percentage points)
Thames Tideway Tunnel	The Thames Tideway Tunnel is being delivered through an infrastructure provider distinct from Thames Water. The project also received some governmental assistance, reducing its risk profile.	<b>Low</b> – similar regulation but a distinct project with additional government support.	~0
Ofgem RIIO-T1 relative risk	The WACC uplift (calculated) associated with the scale of investment between different transmission network companies represents an upper bound estimate. Other relative risk factors associated with totex mean that a central uplift for scale of investment alone is likely to be lower than this. Specifically, the figure of 0.23 percentage points shown is commensurate with approximately a 14 percentage point increase in the Capex:RAB ratio.	<b>Medium</b> – related to scale of investment.	Up to 0.23
CC/CAA T5	The T5 WACC uplift was for the large terminal capital programme occurring alongside the existing regulated business. The uplift factored in aspects such as construction risks, some element of demand risk, potential increases in financing premiums and considered asymmetric risks arising from the limited ability to outperform. The CC applied a 0.25 percentage points uplift to the entire BAA group, which is equivalent to 0.33 percentage points if applied to Heathrow only.	<b>High</b> – HAL specific case study.	0.33
Crown Estate Offshore Wind	Developer risk has been driven by the complexities and relative inexperience in the construction of offshore wind projects, which has previously resulted in some severe project cost overruns.	<b>Low</b> – bearing significant long-term project risk.	0.33
Ofgem OFTOs	Offshore transmission projects are bespoke and complex assets and involve bearing construction risk. Technology risk specific to OFTOs are potentially less relevant.	<b>Low</b> – additional risks not relevant to HAL.	0.50
Hinkley Point C	The NAO report specifically considered the level of return required under a 'hybrid' RAB model. However, there is a history of considerable cost overruns and delays associated with the technology being used.	<b>Low</b> – could become more relevant where construction capex risk was entirely borne by investors.	1.1

Source: PwC

As shown by the case studies above, there is support for the provision of an uplift for construction phase risk impacts. Within the set of case studies reviewed the similarities between T5 and the third runway scheme, and the uplift implied from benchmarking against Ofgem's RIIO-T1 determination, suggest that a logical positioning against precedents supports a WACC uplift towards the lower end of the range set out above. However, a case could also be made for the uplifts towards the upper end of the range, particularly in a scenario where capex incentives exposed HAL's investors to a greater degree of risk – especially if such risk was asymmetric. In terms of forming a plausible range for this uplift, we propose an indicative range of **0.25% to 1.0%**; this relatively wide range reflects the developmental stage of the H7 price control.

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## Financing structure impacts

When considering financing structure impacts, we assume our notional gearing level is sustained throughout the construction of the third runway. This requires that the additional capex is funded in the same proportions as the notional capital structure. So for every £100 of capex, £60 is funded through debt and £40 through equity, either by way of retained earnings or through issuance of new equity.

The impact on HAL's credit metrics will depend upon the regulatory approach adopted and the associated charging profile. Where revenues start recovering capital expenditure in the year in which it is incurred then there is likely to be little impact on credit metrics, rating and cost of debt. Where charging for the investment in the new runway is not allowed prior to its operational launch, then credit metrics will likely deteriorate in the construction phase, and maintaining the notional capital structure may suggest a higher cost of debt is warranted.

Assuming a constant 60% notional capital structure, we estimate that the proportion of new debt relative to total debt in H7 will be approximately 60%. The viability of this notional funding structure will require testing through financeability analysis and will also depend on the regulatory approach implemented by the CAA for H7.

As set out above, the estimate for the cost of new debt is based on current market yields plus a forward-looking uplift. However, projections of future yields based on forward curves are not always accurate predictors of outturn yields. Given the significantly higher proportion of new debt (associated with the capital required to fund the third runway scheme) expected in H7, the risk associated with forecast error on the cost of new debt is magnified. While this report does not review the approach to the cost of new debt in H7, we note that any cost of new debt projection is susceptible to forecasting error, particularly over long time periods.<sup>17</sup> Therefore, although we have factored in a small margin of uncertainty around the cost of new debt projection, the range of possible outcomes may be much wider than this in practice.

## Issuance cost impacts

Due to the large amount of capital required in H7, including equity as well as debt, the CAA could consider an allowance for equity issuance costs. A similar recognition of these costs was made by Ofgem for RII0-T1. Specifically, Ofgem made an ex-ante allowance for equity issuance costs of 5% of the amount of notional new equity required during the regulatory period – with a clawback mechanisms based on actual equity issuance. We recommend a similar approach where new equity issuance costs are incorporated into the allowed revenues as part of the H7 financial modelling.

## Conclusion

Combining all the evidence set out above, and focusing on the **lower end of the third runway impacts** adjustment of +0.25 percentage points, we derive a real vanilla WACC of **2.8% to 3.8%**. This is broadly similar to the 'as is' real vanilla WACC range for H7 because the third runway uplift to the WACC is counterbalanced by more weight in the capital structure being placed on relatively low cost new debt. Where a statutory corporation tax rate assumption of 17% is applied, this equates to a H7 pre-tax WACC of **3.2% to 4.4%**.

Focusing on the **upper end of the third runway impacts** adjustment of +1.0%, we derive a real vanilla WACC of **3.5% to 4.6%**. In this instance, the effect of the third runway adjustment is larger than the downward pressure on the WACC arising from more weighting on relatively low cost new debt. Where a statutory corporation tax rate assumption of 17% is applied, this equates to a H7 pre-tax WACC of **3.9% to 5.1%**

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<sup>17</sup> The CAA commissioned CEPA to consider indexation of the cost of debt in CEPA (2016), "Alternative approaches to setting the cost of debt for PR19 and H7"

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# 1. Introduction

- 1.1 The CAA is currently in the process of consulting on a number of issues relating to the regulation of Heathrow Airport Limited's (HAL's) price control and in particular issues relating to new capacity. For this work, the CAA is specifically interested in the financial issues relating to HAL's new capacity and the related price control. The current price control for HAL ends on 31 December 2019. The CAA is therefore now starting their review to decide what regulatory arrangements should be put in place from 1 January 2020. This new price control is referred to as H7.
- 1.2 As part of this process of consultation, the CAA has commissioned PwC to provide our view of an initial range for the weighted average cost of capital ("WACC") for the H7 period (currently defined as the 2020-2024 period). The purpose of providing this initial WACC range is to help guide the initial preparation of the H7 price control. The purpose of this report is not to provide a final result that will be used in the setting of the price control.
- 1.3 In most instances, unless otherwise stated, the data cut-off for this report was the end of October 2017, but where relevant we also consider information regarding the Bank of England's base rate change on 2 November 2017 and updated OBR forecasts produced for the budget on 22 November 2017.

## Assumptions

- 1.4 Given the early stage of the H7 consultation process, in providing a view of the H7 WACC we have made a number of assumptions. Four key assumptions are listed below:
1. The CAA continues to apply a single WACC to a single measure of the regulatory asset base (RAB). This means that the RAB is not segmented or treated any differently for different types of existing assets or new assets. In this circumstance, the WACC has to encompass the risks associated with the delivery of new capacity as well as the risks associated with the existing 'as is' regulated business;
  2. The CAA sets the cost of new debt allowance on an ex-ante basis (as was the case in Q6). We do not consider an alternative approach whereby the WACC could change throughout the price control if an indexation approach were adopted by the CAA<sup>18</sup>;
  3. The CAA calculates the control in constant prices using the Retail Price Index (RPI) as the basis of indexation for both revenues and the RAB; and
  4. The H7 period begins in January 2020 in line with the current one year extension in place.<sup>19</sup>

## Methodological considerations

- 1.5 Provided with these assumptions, it is also important to understand the wider methodological considerations associated with the approach taken in setting the WACC. Specifically, of key consideration is the trade-off between long-run historical approaches and current market approaches.
- 1.6 Broadly speaking, as long-run historical approaches typically rely on long-run averages of financial time-series, WACC estimates produced by this approach tends to be slow to evolve. This gives WACC estimates greater stability, but increases the risk that allowed returns are unreflective of current market conditions. In contrast, current market based approaches reflect current market conditions, but by their

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<sup>18</sup> The CAA has considered proposals for the indexation of the cost of debt in CEPA (2016), "Alternative approaches to setting the cost of debt for PR19 and H7"

<sup>19</sup> The CAA is considering a further extension to Q6 but a decision on the length of the future extension has not been made at the time of publication.

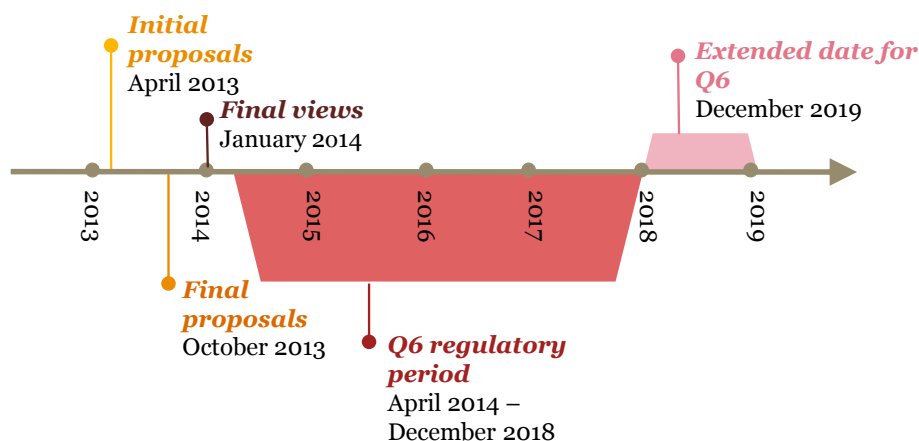
nature are more sensitive to changes in the economic and market outlook - meaning the WACC produced by this approach can be more volatile.

- 1.7 As such, given that there is still a relatively long lead-time until the beginning of the H7 period, where the estimates in this report are based on upon current markets approaches, they should be reviewed and/or updated to reflect material changes in economic outlook.
- 1.8 We therefore recommend that the CAA monitors changes to the economic and market outlook between now and later in the H7 process, updating the estimate of the WACC range accordingly.

## Q6 background

- 1.9 The Q6 consultation process took place over the 2012-13 period. This is shown in Figure 1.1 below. The CAA published their initial proposals in April 2013, its final proposals in October 2013 and its final views in January 2014. The Q6 regulatory period then commenced in April 2014 and was initially scheduled to conclude at the end of December 2018, however, it was subsequently extended by an extra year to December 2019.

Figure 1.1 Q6 timeline



Source: CAA

- 1.10 The cost of capital methodology applied in Q6 used a notional capital structure. For the cost of equity, it considered both current market evidence as well as long-term returns evidence. And for the cost of debt, it considered evidence from corporate bond indices as well as HAL's own bonds.
- 1.11 In terms of economic context, while monetary policy was loose in the build up to Q6, over 2013 there had been a significant rise in government and corporate bond yields. This was coupled with an increasingly upward sloping yield curve. This market evidence suggested some expectation of reversion towards long-term market returns.

## Cost of capital parameters in Q6

- 1.12 In this sub-section we set out the final parameters for the cost of capital used by the CAA in its final views. We also include a brief rationale for the main parameter selections. The table below sets out the WACC parameters applied in Q6.

Table 1.1: Q6 WACC calculation

	Q6 Final Views	
	Low	High
Gearing	60%	60%
RFR	0.50%	1.00%
TMR	6.25%	6.75%
Asset Beta	0.42	0.52
Debt beta	0.1	0.1
Equity beta	0.90	1.15
<b>Cost of equity (post-tax)</b>	<b>5.68%</b>	<b>7.61%</b>
Cost of debt embedded debt	3.15%	3.65%
Cost of new debt	2.20%	2.65%
Weighting of new debt	50.0%	30.0%
Issuance costs	0.10%	0.10%
<b>Real Cost of debt (pre-tax)</b>	<b>2.78%</b>	<b>3.45%</b>
<b>Vanilla WACC</b>	<b>3.94%</b>	<b>5.12%</b>

Source: CAA

#### Total market returns (TMR)

- 1.13 Throughout the Q6 consultation the CAA used a real TMR range of 6.25% to 6.75%. This was based upon a blend of historical and forward-looking evidence. For example, in terms of historical evidence, it drew upon a range of long-run average return estimates – focusing on shorter-term holding periods. And in terms of forward-looking evidence, the range drew upon Dividend Growth Model (DGM) analysis.
- 1.14 The final view of the CAA was a point estimate of 6.25%. This was lower than the 6.75% point estimate used for proposal stages. This point estimate was in part influenced by the NIE draft determination from the CC (now CMA) released in November 2013.
- 1.15 This CC document set out an in depth discussion on TMR. The CC concluded that a TMR range based on long-run historical evidence was 6.0% to 7.0%, but that when placing more weight towards ‘contemporary’ evidence (as the CC saw as appropriate), an upper bound value for TMR was 6.5%. At the lower end of the range, the CC selected a figure of 5.0%. While no point estimate for TMR was provided, the CC’s draft point estimate for the WACC overall was towards the centre of their range.<sup>20</sup>

#### Asset beta

- 1.16 In Q6 the CAA used an asset beta range of 0.42 to 0.52. This was the same asset beta range used for HAL in Q5, which in turn was derived from BAA stock market data that had been deconstructed by airport (including Gatwick and Stansted).
- 1.17 The continued use of this asset beta range was justified with reference to international airport betas and analysis of any changes to HAL’s relative risk versus the market.
- 1.18 In terms of HAL’s relative risk compared to the market, the CAA found that there was little evidence to suggest a material change in relative risk. The CAA view was that HAL remained a capacity constrained

<sup>20</sup> Ultimately, the final determination for NIE (published at the end of March 2014) selected a WACC figure which is consistent with a TMR value of 6.5% (real).

airport with excess demand and that the asset beta range was logical when placed against broader regulated companies.

1.19 In terms of international airport betas, the range of evidence supported retention of the Q5 range.

#### *Risk-free rate (RFR) and the cost of debt*

1.20 The real risk-free rate in the final view for Q6 was set in the range 0.5% to 1.0%. This was above prevailing market rates and represented an increase from the initial proposals range of 0.25% to 0.75%.

1.21 Both this figure and the cost of new debt were set against a monetary policy context of rising yields and a steepening yield curve – suggesting that rates rises, albeit gradual, were likely in the short-term. On this basis, the CAA made a material upward forward-looking adjustment to yields prevailing in the market at the time.

## ***Scope and structure of this report***

1.22 In this report we set out our view on the WACC as an initial estimated range for the H7 period. The estimate is formed of two parts. The first part is a WACC estimate for HAL ‘as is’, without the capital programme associated with a third runway, the second part then estimates the impact of the third runway on the overall HAL WACC.

1.23 The structure of the report is as follows:

- H7 context (Section 2) – this section sets out the economic context and the HAL specific factors that are most relevant to setting the H7 cost of capital.
- Gearing (Section 3) – this section sets out our approach and estimated range for gearing.
- Cost of debt (Section 4) – this section considers the use of notional and actual cost of debt parameters and sets out our approach and estimated range for the cost of debt.
- Cost of equity (Section 5) – this section considers the appropriate balance between current market estimates of the cost of equity and long-run historical approaches to the cost of equity; it then sets out our approach and estimated range for the cost of equity.
- Third runway impacts (Section 6) – this section provides an overview of the H7 capital programme and considers the case for any adjustments to the WACC associated with this capital programme to deliver new capacity.
- Tax (Section 7) – this section sets out the competing tax approaches that could be applied in converting the post-tax cost of equity to a pre-tax cost of equity, and sets out the tax assumptions we apply.
- Conclusion and overall WACC (Section 8) – this section presents our view on an appropriate initial WACC range that could be applied in H7.
- Appendix A sets out an alternative notional financing approach, which has been tailored to privately held airports.
- Appendix B sets out the details underlying our asset beta estimation.
- Appendix C sets out a comparison of risk-free rate estimates.
- Appendix D sets out the technical details of the Dividend Discount Model used.

1.24 In the next section we set out the context to the H7 price control, including the wider UK economic context and HAL’s recent business performance.

## 2. H7 Context

2.1 In this section we set out the context to the H7 WACC. This covers:

- The wider macroeconomic context to the H7 price control;
- An overview of HAL's recent business performance; and
- Financial market context;

### Macroeconomic context

2.2 Following the downturn in 2008-09, GDP growth over the period 2010 to 2016 averaged 2.0%, and has averaged 2.2% for the Q6 price control to date. This level of growth is broadly projected to continue. Figure 2.1 below shows past and forecasted real GDP growth for the UK going into the Q7 price control period.

2.3 According to Bank of England projections, the UK economy is expected to be growing at a rate of under 2% per annum by 2018, which is below its historical average from 1980-2007 of 2.8% growth per annum and long-term post-war average of around 2.5%.

Figure 2.1 UK GDP growth



Source: Thomson Reuters and Bank of England (November 2017 inflation report)

2.4 Looking further ahead, GDP forecasts from the Bank of England (BoE) suggest that growth is expected to be below 2% heading into H7, but there are clear risks around these forecasts, such as wider geopolitical uncertainties.<sup>21</sup>

### Inflation

2.5 Figure 2.2 below shows year-on-year growth rates of CPI and RPI. CPI and RPI inflation were 2.8% and 3.8% (in Q4 2016), respectively, with the wedge between the RPI and CPI being close to around 1 percentage point.<sup>22</sup> This recent estimate of the RPI-CPI wedge is higher than long-term averages –

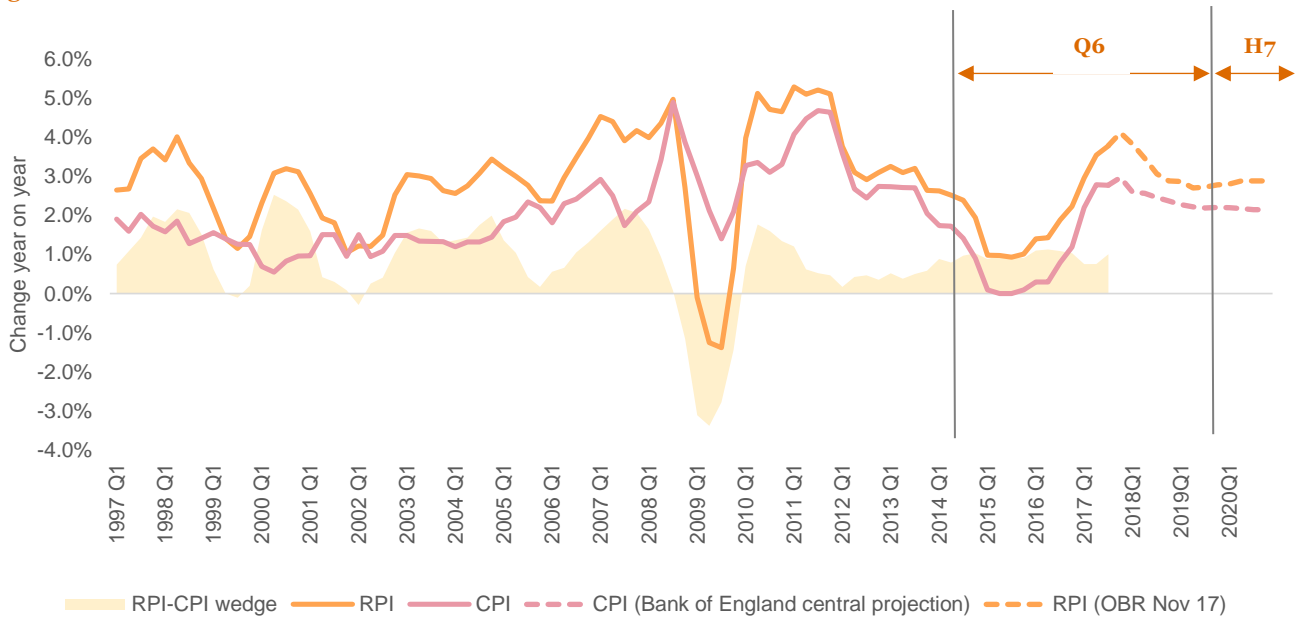
<sup>21</sup> As set out in PwC's June 2017 Global Economy Watch, forecasts of UK GDP in 2017 have become increasingly uncertain as shown by the standard deviation in projections of GDP growth.

<sup>22</sup> This wedge is driven by a combination of the formula effect and the different compositions of RPI and CPI. The calibration of the wedge on a forward-looking basis also needs to monitor the potential impact of proposed changes to RPI in 2017. Specifically, the proposal to update the housing components of RPI for the new UK house price index introduced by the ONS. Although the Bank of England has commented that the change is unlikely to materially impact holders of index-linked gilts, they did note that the proposal was a fundamental change to RPI.



which are driven by a combination of formulae and coverage effects – for example over the period since 1997, the average of the difference between the RPI and CPI has been around 0.8%.

Figure 2.2 Historical inflation evidence combined with forecasts



Source: ONS, OBR

- 2.6 The Bank of England in its November inflation report<sup>23</sup> has projected that CPI will remain above the target rate in the short term (CPI is estimated to be around 2.7% for 2017), one driver of this has been the fall in sterling that has occurred since the EU referendum leading to higher import prices. Inflation is then expected to trend back towards the target level of 2%.
- 2.7 Table 2.1 below shows independent forecasts for 2017 and 2018 for CPI and RPI compiled by HM Treasury (as at October 2017). These suggest that CPI inflation is expected to remain above the target rate of 2.0%. Generally, forecasts for RPI are marginally over 3.0% in the latter half of Q6.

Table 2.1: CPI and RPI - HMT's independent forecast (October 2017)

Inflation forecasts		March	
Inflation for 2017 (%)	Average	Low	High
CPI	2.9	2.6	3.3
RPI	3.9	3.3	4.4
Inflation for 2018 (%)	Average	Low	High
CPI	2.4	1.5	3.0
RPI	3.2	2.6	3.9

Source: HM Treasury

- 2.8 Implied inflation from gilts also provides another source of RPI expectations. In Figure 2.3 below we show the difference in yields between conventional gilts and index-linked gilts (net of an assumed inflation risk premium). As set out in Figure 2.3, evidence from 10yr gilts suggests that RPI expectations implied by spot yields at the end of October 2017 are approximately 2.8%, while evidence from 20yr gilts suggests an equivalent figure of approximately 3.3%.

<sup>23</sup> Bank of England (2017), *Inflation Report November 2017*

Figure 2.3 Implied inflation from gilts



Source: Bank of England

Note: Figures presented are net of a 0.3 percentage point inflation risk premium.

- 2.9 Based on a preliminary assessment of the evidence above, an RPI figure of approximately 3% is supported by independent forecasts. However, an RPI figure of 2.8% (as was used at Q6) continues to be supported by market evidence. An RPI assumption in the range 2.8% to 3.0% therefore seems most relevant to the H7 period at this stage. For our analysis in this report – in line with market evidence – we continue to use the **2.8%** RPI assumption adopted in Q6.

## *HAL's recent business performance*

- 2.10 HAL has delivered robust financial performance throughout Q6 and has outperformed its regulatory determination across a number of measures. This is partly a consequence of stable economic growth over the period. In a performance summary below we consider passengers and ATMs (Air Traffic Movements), financial performance and financing.

### *Passengers and ATMs*

- 2.11 HAL has achieved passenger growth faster than that assumed by the CAA in the Q6 determination. This follows a large (negative) differential between HALs passengers numbers and the CAA's projection in Q5. This is captured in Table 2.2 below. Cumulatively in the control period to the end of 2016, outperformance has totalled approximately 8 million passengers.

Table 2.2 Heathrow passenger numbers vs CAA projections

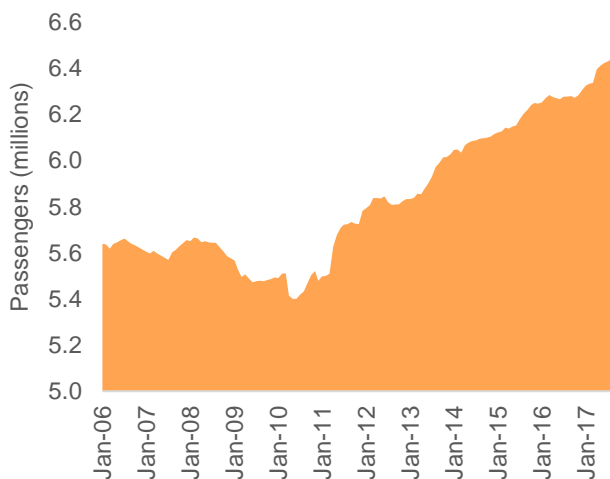
Time period (year ended)	CAA projected PAX (millions)	HAL realised PAX (millions)	Variance to CAA assumption (millions)
31 <sup>st</sup> Mar. 2009	70.4	65.9	-4.5
31 <sup>st</sup> Mar. 2010	72.5	66.1	-6.4
31 <sup>st</sup> Mar. 2011	74.5	66.1	-8.4
31 <sup>st</sup> Mar. 2012	76.2	70.1	-6.1
31 <sup>st</sup> Mar. 2013	78.2	70.3	-7.9
31 <sup>st</sup> Mar. 2014 <sup>24</sup>	-	72.4	-
31 <sup>st</sup> Dec. 2014 (9 months)	55.4	57.4	2.0
31 <sup>st</sup> Dec. 2015	72.0	75.0	3.0
31 <sup>st</sup> Dec. 2016	72.7	75.7	3.0

Source: Heathrow regulatory accounts

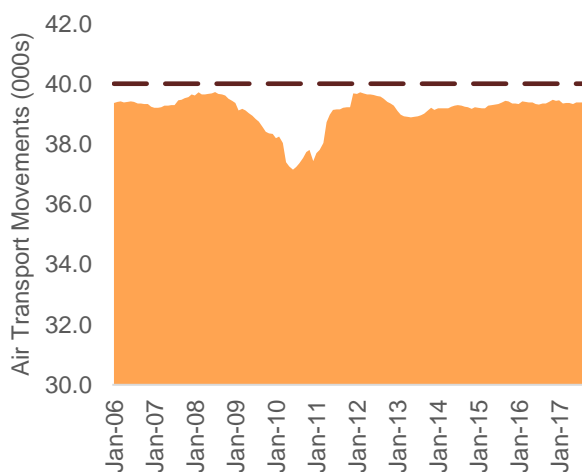
2.12 This strong growth in passenger numbers in recent years is shown in Figure 2.4 below. The figure also shows that PAX growth has been delivered despite more modest changes in ATMs. This strong recent performance contrasts with the previous (Q5) price control where HAL passenger growth was negatively impacted by the financial crisis and economic recession.

Figure 2.4 HAL ATM and passenger statistics

HAL monthly PAX (12 month rolling average)



Heathrow 12 month average ATMs v. cap



Source: Heathrow traffic statistics

2.13 Over the year to September 2017, HAL experienced a record 77.4m total passengers; 2.8% higher than the year before.<sup>25</sup>

## Financial performance

2.14 Consistent with below expected passenger volumes in Q5, HAL's average return on RAB was lower than projected in the years 2009-13. This is shown in Table 2.4 below. More recently, in 2016, higher revenue from airport charges was largely driven by increased passenger numbers. More broadly, over Q6 to date, revenue performance has exceeded the CAA price control target, with cumulative outperformance on revenue of approximately £419m between FY14 and FY16 (see Table 2.3 below).

<sup>24</sup> The Q5 period was originally planned to finish in March 2013 but was extended an extra year, for this reason we leave the forecast and variance columns empty for the period ending March 2014.

<sup>25</sup> Heathrow news release 11<sup>th</sup> October 2017

2.15 HAL's report on its December 2016 regulatory accounts<sup>26</sup> also suggests that regulatory operating profit was above the CAA's forecast due to higher passenger numbers, and this in turn brought a higher return on average RAB than assumed. This trend of higher return on average RAB than projected can be seen throughout Q6 in Table 2.3 below.

Table 2.3 Measures of financial performance

Time period (year ended)	Total revenue		Regulatory operating profit		Return on average RAB	
	Performance	Variance to CAA assumption	Performance	Variance to CAA assumption	Performance	Variance to CAA assumption
31 <sup>st</sup> Mar. 2009	£1629.7m	£-18.8m	£239.6m	£-111.8m	2.5%	-1.1%
31 <sup>st</sup> Mar. 2010	£1742.9m	£-32.1m	£155.0m	£-320.6m	1.5%	-2.9%
31 <sup>st</sup> Mar. 2011	£1853.6m	£-145.0m	£538.3m	£-67.6m	4.8%	-0.1%
31 <sup>st</sup> Mar. 2012	£2074.1m	£-155.1m	£396.8m	£-352.6m	3.2%	-2.4%
31 <sup>st</sup> Mar. 2013	£2225.4m	£-242.1m	£563.1m	£-331.6m	4.3%	-2.0%
31 <sup>st</sup> Mar. 2014	£2507.0m	-	£765.0m	-	5.4%	-
31 <sup>st</sup> Dec. 2014*	£2094.0m	£118.0m	£710.0m	£112.0m	4.79%	0.77%
31 <sup>st</sup> Dec. 2015	£2745.0m	£156.0m	£881.0m	£116.0m	5.92%	0.84%
31 <sup>st</sup> Dec. 2016	£2786.0m	£145.0m	£925.0m	£106.0m	6.13%	0.80%

Source: Heathrow regulatory accounts

\* Performance summary for the 9 months ending 31<sup>st</sup> December 2014

2.16 Lastly, although for the year ending 31st December 2016, net operating costs were 4% greater than the CAA price control target, at £1,138m<sup>27</sup>, for the three months ended 31st March 2017, operating cost per passenger was down by 2.9%.<sup>28</sup>

## HAL financing

2.17 In August 2016 a £400m fixed coupon bond with 35 years to maturity was issued. HAL was able to secure a nominal yield at issue of approximately 2.8% on this issuance. In real terms this is approximately 0%. This is significantly below the real cost of new debt allowance implied by the assumption used in the CAA's Q6 final view of approximately 2.5%.

2.18 More widely, HAL has financed itself steadily over Q6, with several senior and junior bond issuances since April 2014. In total, between April 2014 and December 2016, HAL issued a total of approximately £2.6bn worth of senior debt.

2.19 This steady financing over the control period means that HAL's average cost of debt on its historical issuance has tracked downwards, suggesting a lower cost of embedded debt in H7 relative to Q6 is appropriate.

<sup>26</sup> Heathrow (SP) Limited (2016) *Regulatory Accounts year ended 31 December 2016*

<sup>27</sup> Heathrow (SP) Limited (2016) *Regulatory Accounts year ended 31 December 2016*

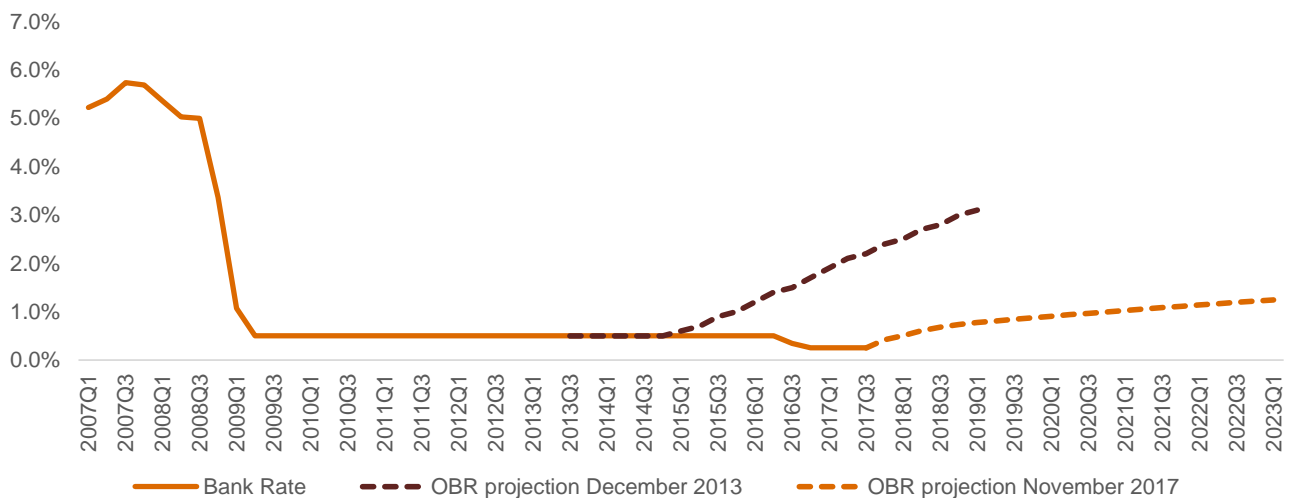
<sup>28</sup> Heathrow (SP) Limited (2017) *News Release 27 April 2017*

## Financial market context

### Interest rates

- 2.20 Despite expectations that interest rates would rise at the time of the Q6 proposals, these rises failed to materialise. Instead the Bank of England looks set to maintain ultra-low interest rates for the foreseeable future. This prolonged period of ultra-low interest rates is typically referred to as ‘lower for longer’.
- 2.21 Current market expectations are that short-term interest rates will only change very gradually. This is set out in Figure 2.5 below, with the latest OBR projections (based on market data) for the base rate compared to projections back in December 2013 (just before the Q6 final view).

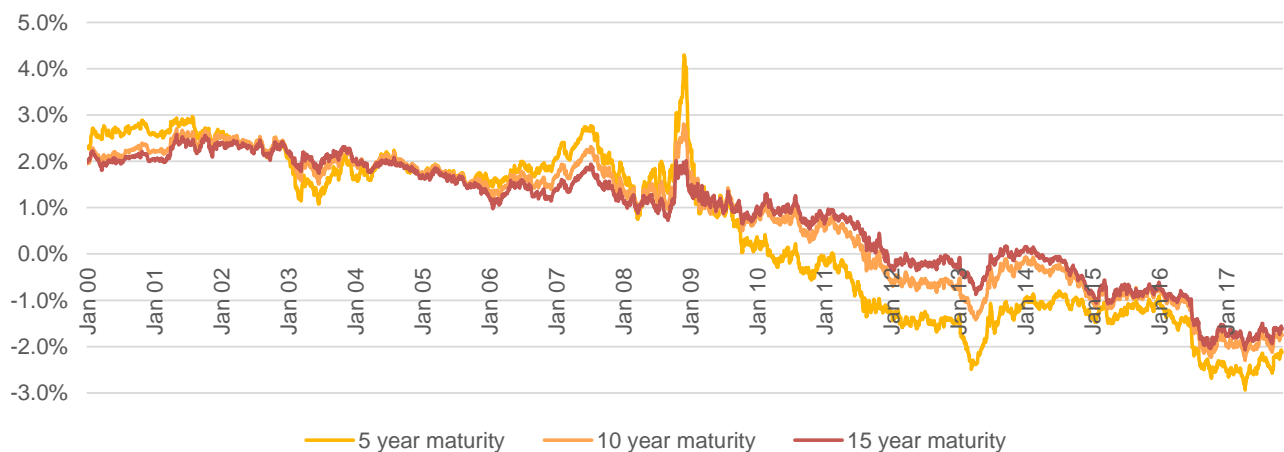
Figure 2.5 Base rate history and projections



Source: OBR, Bank of England

- 2.22 Ultra-low short term interest rates, combined with other monetary policy tools such as Quantitative Easing have also brought down longer-term interest rates. Government bond yields are close to historic lows and the current yield curve is relatively flat compared to recent years. This is shown in Figure 2.6 below, which tracks index-linked gilt yield over the period January 2000 to March 2017. The current market expectation is that the H7 period will be characterised by low interest rates.

Figure 2.6: Index-linked gilt yields



Source: Bank of England

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## *Infrastructure investment*

- 2.23 Helped by low interest rates and the search for higher yielding assets, demand for infrastructure assets is currently strong. The demand for high quality infrastructure assets which are able to provide stable real-terms cash flows is being driven by both UK and foreign institutional investors and sovereign wealth funds.
- 2.24 Since 2006, more than \$200bn has been raised by specialist funds – with at least the same again allocated by pension funds and other direct investors.<sup>29</sup> Of the capital raised by infrastructure funds since 2006, 48% has been by vehicles with a maturity of over 10 years.<sup>30</sup>
- 2.25 As a result of this strong demand, over half of investors see asset pricing as being a key issue in 2017 – with high valuations putting pressure on returns.<sup>31</sup> Nonetheless, the majority of managers were expecting to deploy more capital to infrastructure assets in 2017 relative to 2016.<sup>32</sup> This is consistent with the growing aggregate value of global infrastructure investment funds – which raised \$47bn last year, and have raised a further \$25bn in the first quarter of 2017 alone.<sup>33</sup>

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<sup>29</sup> PwC and GIIA (2017), *Global Infrastructure Investments*

<sup>30</sup> Source: PwC analysis of InfraDeals data

<sup>31</sup> Preqin (2017), *Preqin Global Infrastructure Report*

<sup>32</sup> Preqin (2017), *Preqin Global Infrastructure Report*

<sup>33</sup> Economist (2017), *How and when to use private money in infrastructure projects (based on InfraDeals data)*

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## 3. Gearing

- 3.1 In this section we set out a range for HAL's gearing in our 'as is' scenario. Specifically, gearing is defined as the ratio of net debt to the regulatory asset base.

### *Approach*

- 3.2 We consider the need to assume a notional capital structure approach in setting allowed revenues as an integral part of RPI-X incentive based regulation. It provides company management with the incentive to manage the actual financing of the airport. Management are best placed to manage finance risks, through the timing of finance raising, the maturity profile of debt raised, the types of finance raising instruments used (e.g. index-linked debt or more complex debt instruments) and which markets to tap (including international debt capital markets).
- 3.3 This form of control using notional capital structure assumptions incentivises companies and not the regulator to take responsibility for managing company finance risk and also wider movements in debt markets. For example, a company can seek to avoid raising finance at times of heightened debt finance costs by carefully managing cash flow.
- 3.4 In our opinion, an economic regulator is not best placed to make these detailed financing assumptions and decisions, and any approach which moves the management of finance risk from companies and on to customers through the regulatory regime risks dampening longer term incentives for efficient financial management by companies. For this reason we consider the notional gearing approach used by the CAA in Q6 remains fit for purpose in H7. Alternatives, such as mirroring actual gearing levels in the regulator's own assumptions, risk dampening incentives for efficient financing. In Appendix A we review a different notional structure which better reflects privately held companies, but note this has little impact on the resultant cost of capital.
- 3.5 Consistent with the financing duties of the CAA, we focus on a range of gearing values which are commensurate with an investment-grade credit rating.<sup>34</sup>

### *Evidence*

- 3.6 To estimate a range for H7 gearing we review three sources of evidence:
- The actual gearing level and credit rating of HAL in recent years;
  - Evidence from credit rating agency guidance on gearing levels which are consistent with investment-grade ratings; and
  - Regulatory benchmarks on notional gearing levels.

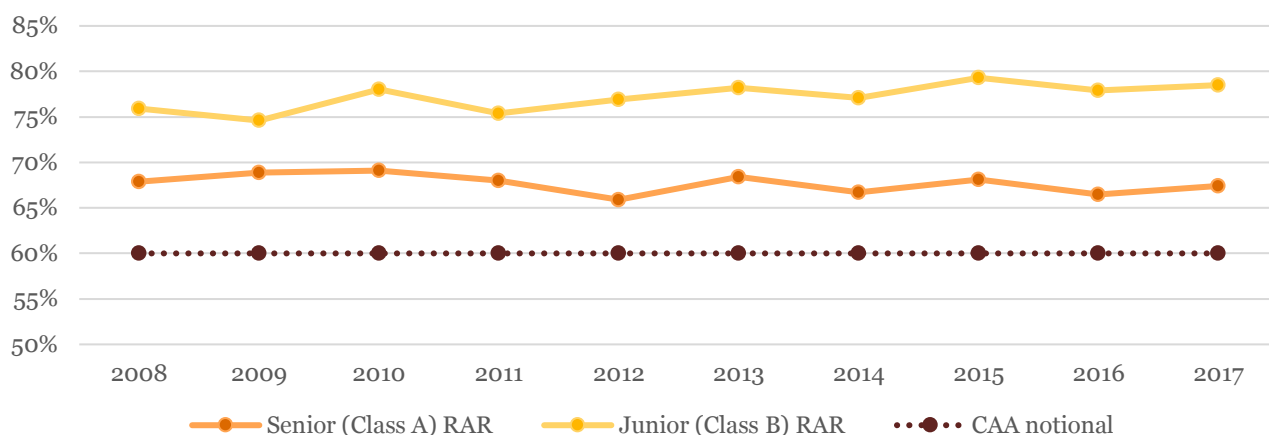
### *The actual gearing level and credit rating of HAL*

- 3.7 HAL's actual gearing level has been relatively stable over the last 10 years. This is shown in Figure 3.1 below. The orange line represents the amount of gearing attributable to senior debt, and the yellow line represents the total level of gearing, including junior debt. Over the period 2008 to 2017, total gearing has tended to stay within the 75% to 80% range – consistently higher than the notional gearing level set by the CAA in Q6 of 60%.

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<sup>34</sup> The statutory duties of the CAA are set out in CAP 1195: 'Discussion paper on the regulatory treatment of issues associated with airport capacity expansion'.

Figure 3.1 HAL regulatory gearing compared to notional gearing



Source: Heathrow Investor Reports, CAA

3.8 In terms of the risk associated with the different debt types, HAL has been able to attain a credit rating of A- on its senior debt (as rated by both S&P and Fitch) and has been able to attain a credit rating of BBB on its junior debt (as rated by both S&P and Fitch).<sup>35</sup>

### *Evidence from credit rating agency guidance*

3.9 In terms of credit rating agency guidance, we note that Moody's credit rating methodology document for privately managed airports is more focused on leverage ratios in respect of concession/lease based arrangements. This does not directly read across to HAL's form of regulation. We therefore look more broadly to guidance on regulated utilities.<sup>36</sup>

3.10 In the regulated utilities space, Moody's guidance for regulated electric and gas networks provides a useful reference point. In this guidance a gearing range associated with a Baa credit rating is set out as 60% to 75%, while the gearing range associated with an A credit rating is 45% to 60%.

3.11 While this guidance shows that a gearing level as high as 75% could be consistent with an investment-grade credit rating for these utility networks, HAL faces a greater degree of demand risk due to the price-cap regime it operators under.<sup>37</sup> Therefore, when considered in isolation from other aspects that influence an overall credit rating,<sup>38</sup> the upper end of a plausible investment grade gearing range is therefore likely to be under 75% for a price-cap regime such as HAL's.

### *Regulatory benchmarks on notional gearing levels*

3.12 The level of notional gearing adopted in the recent regulatory determinations in other sectors have been relatively similar – ranging from 60% to 65%. This is captured in Table 3.1 below.

<sup>35</sup> Heathrow (SP) limited has a senior debt gearing ceiling in its covenants of 70%. Heathrow refer to gearing as the Regulatory Asset Ratio or RAR. They define this as the ratio of nominal net debt (including index-linked accretion) to RAB.

<sup>36</sup> We note that HAL in its investor reports benchmarks itself against the gearing levels of other regulated utilities e.g. water companies.

<sup>37</sup> Regulated electric and gas networks often operate under a revenue-cap regime.

<sup>38</sup> Other aspects include other credit ratios and qualitative factors.



Table 3.1 Recent regulatory decisions on notional gearing

Regulator (determination)	Notional gearing
Ofwat (PR14)	62.5%
Ofgem (RIIO-ED1)	65.0%
Ofgem (RIIO-GD1)	65.0%
Ofgem (RIIO-T1)	60.0% - 62.5%
ORR (CP5)	62.5%

Source: Regulatory determinations

## *Discussion and conclusion*

- 3.13 Based on the evidence set out above, a notional gearing range for HAL consistent with achieving an investment grade credit rating could be as wide as 60% to 75%. However, a reasonable point estimate would be towards the bottom end of this range – particularly given the notional gearing figures selected by other regulators in sectors which benefit from a greater degree of predictability over cash flows.
- 3.14 We also note that the WACC is insensitive to the notional gearing assumption, indeed, our assessment of an alternative notional gearing assumption based upon privately held securitisation structures had limited impact on the WACC (see Appendix A).
- 3.15 We therefore recommend a notional gearing figure of **60%** as this should provide significant financial headroom to manage shocks and allow for short-term deviations in capital structure without placing undue pressure on ratings or the cost of debt.

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## 4. Cost of debt

- 4.1 In this section we set out a range for HAL’s real cost of debt in our ‘as is’ scenario. This real cost of debt is comprised the real cost of *new* debt and the real cost of *embedded* debt (with an allowance for issuance costs).

### Cost of new debt

- 4.2 The cost of new debt is a forward-looking allowance for debt costs on new debt issuance in the upcoming control period. The forward-looking nature of the allowance therefore relies upon an initial view as to average investment-grade bond yields over the control period.<sup>39</sup> Below we set out a range for this initial view.

### Approach

- 4.3 Our approach to assessing the cost of new debt is consistent with the notional financing assumption in the previous chapter. We therefore draw upon evidence from broader corporate bond market evidence rather than placing too much reliance on HAL specific data. Nevertheless, HAL specific debt data is used to cross-check the suitability of the corporate bond benchmarks applied.
- 4.4 To estimate the cost of new debt we first estimate a spot-yield – for which we use a recent average rather than over-relying on a figure from a single day. We then apply a forward-looking adjustments to this spot-yield based on expectations of the path for future interest rates.

### Evidence

- 4.5 In this subsection we set out evidence on the cost of debt. We begin with a review of the suitability of an iBoxx cost of debt benchmark for the notionally financed Heathrow airport.

#### *Suitability of an iBoxx notional benchmark*

- 4.6 An iBoxx cost of debt benchmark is used as a reference point for many different regulated sectors in the UK. For example, it is the benchmark that Ofgem uses to index the allowed cost of debt. Specifically, the index which is most typically referenced is the long-term, non-financial index for investment grade rated bonds (taken as an average of A and BBB ratings).<sup>40</sup>
- 4.7 To test whether this benchmark is suitable in the context of HAL’s cost of debt we review two pieces of evidence. The first is the comparison of yields on HAL’s bonds to the yields of the index. This is shown in Figure 4.1 below. Specifically, we focus on HAL’s bonds which are the closest to being ‘ordinary’ and without additional features which may impact their yield.<sup>41</sup> As shown in Figure 4.1 below, the yields on these bonds – all of which have an A- credit rating – track relatively closely to the selected iBoxx benchmarks.
- 4.8 The December 2026 bond exhibits the largest (negative) spread to the iBoxx benchmark, but this is expected given it has under ten years remaining to maturity, as compared the benchmark index within which all bonds have over ten years remaining to maturity (shown by the dashed line). Focusing on the remaining three bonds, as shown in Table 4.1 below, we find that these, on average, trade at yields close to but slightly below the average of the A & BBB iBoxx benchmark. This is consistent with their A- credit rating.

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<sup>39</sup> This is also referred to as an ‘ex-ante’ allowance. This allowances can either be fixed (with the airport bearing the interest-rate risk) or it can be indexed (where the customer bears a greater proportion of interest-rate risk).

<sup>40</sup> The 10 year and upwards (10Y+) version of the index contains the bonds with the longest time remaining to maturity.

<sup>41</sup> The yields shown are for HAL bonds which are sterling denominated, fixed coupon, senior debt and over £250m in size. Where optionality exists on the bonds, this could influence their yields. We focus on those bonds issued after the 2008 corporate securitization of BAA.

Figure 4.1 Comparison of iBoxx yields to selected HAL senior bond yields

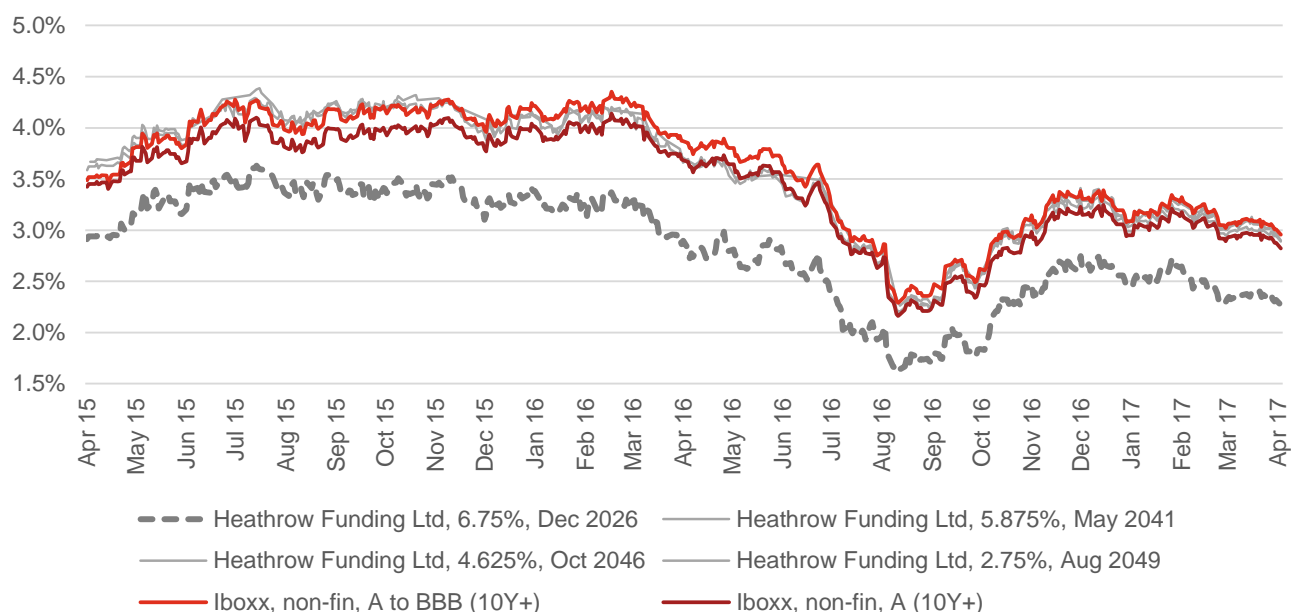


Table 4.1 spread of HAL bonds to iBoxx by time period

	Apr.15 – Mar.16	Apr.16 – Mar.17	Aug.16 – Oct.17
Spread of HAL yields to iBoxx (A and BBB)	-1bps	-9bps	-4ps

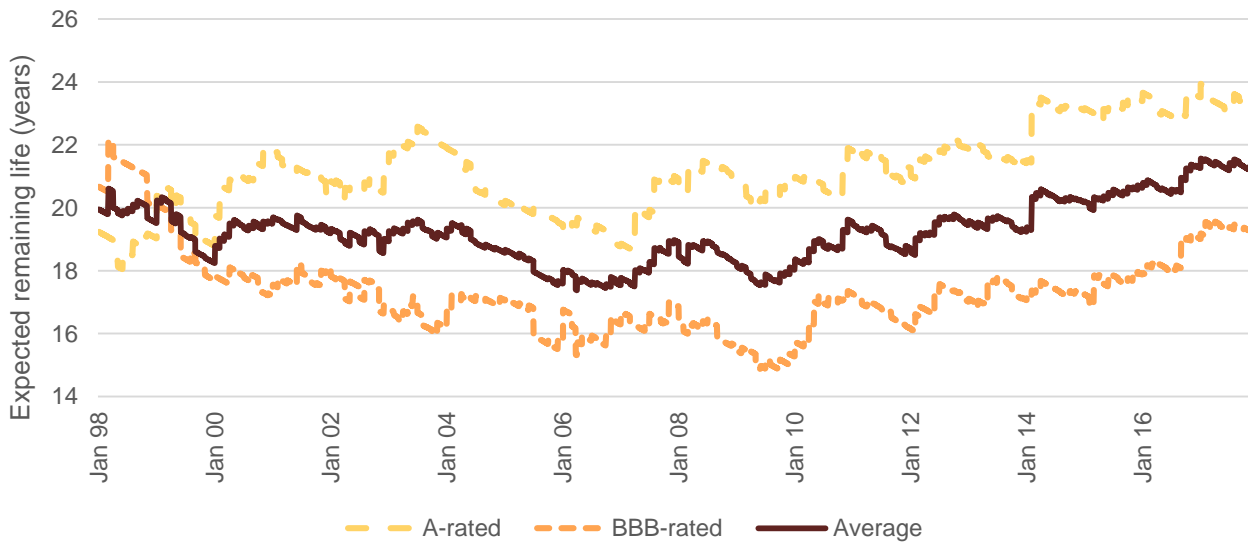
Source: Thomson Reuters, Heathrow debt information

Note: August 16 to March 2017 time period chosen as the issuance of the 2.75%, August 2049 bond impacted the average spread

- 4.9 The second piece of evidence is to contrast the ‘remaining life’ of the iBoxx benchmark to years to maturity on HAL’s bond issuances. This is to test for any material maturity mismatches between the benchmark and HAL’s actual financing. Figure 4.2 below shows the expected remaining life of the benchmark index, which changes over time as the constituents in the index evolve. As shown, the expected remaining life in years of the benchmark has averaged approximately 19 years since 1998, and has fluctuated within the range 17 years to 22 years.
- 4.10 This compares to an average years to maturity at issuance of 18 years on the outstanding bonds of HAL (as at October 2017).<sup>42</sup> We therefore find consistency between the bonds used in our benchmark analysis.

<sup>42</sup> Based on 29 HAL senior debt ISINs available at October 2017 (source: Heathrow, Thomson Reuters).

Figure 4.2 Expected remaining life of iBoxx corporate bond index (A and BBB, 10Y+)

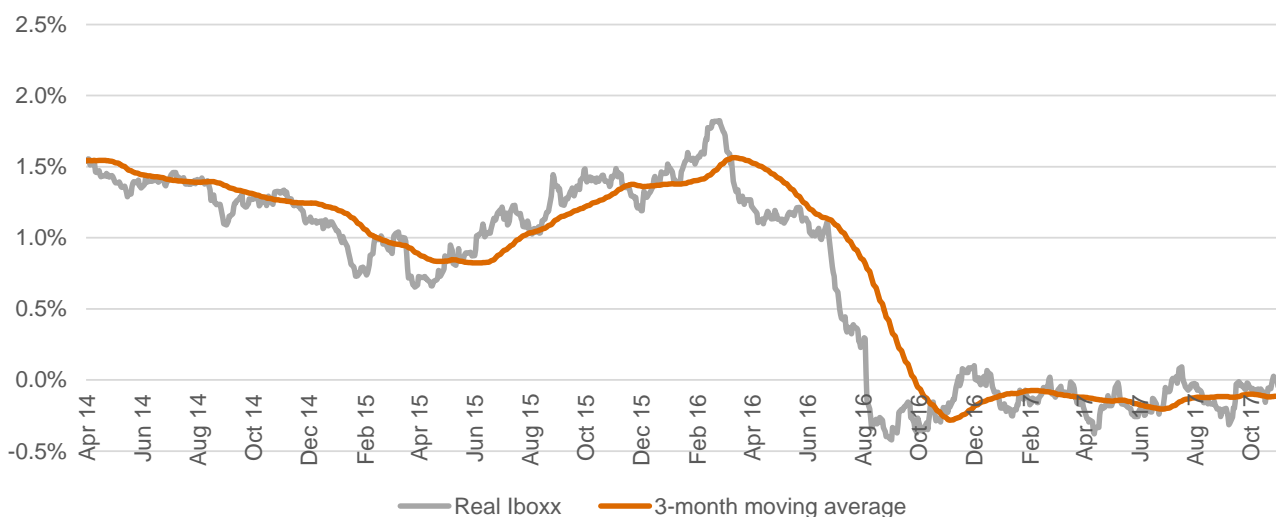


Source: Thomson Reuters

### Spot corporate bond yields

- 4.11 From the analysis above, we conclude that the selected iBoxx benchmark is suitable for application to the notional financing structure for HAL. Therefore, we now focus on selecting a suitable spot yield and forward-looking adjustment with reference to this benchmark.
- 4.12 Figure 4.3 shows how real iBoxx yields have evolved over Q6. As shown, real yields have persistently been below the approximate 2.5% real cost of new debt allowance since April 2014, and since March 2016 have sharply declined.<sup>43</sup> This decline reflects the embedding of investor expectations of interest rates remaining lower for longer.

Figure 4.3 Real iBoxx yields over Q6



Source: Thomson Reuters, Bank of England, CAA Q6 final decision

Note: Real nominal iBoxx yields deflated to real-terms using Bank of England 10-year breakeven inflation

<sup>43</sup> Approximate allowance inferred from final view point estimate.

### *Forward-looking adjustment*

- 4.13 As yields are unlikely to persist at their current levels through H7. It is appropriate to consider a forward-looking adjustment to current market yields in order to account for expectations of future interest rate changes. One source of evidence which can be used to inform the magnitude and direction of an adjustment is forward-yields from gilts.<sup>44</sup> We consider evidence from both nominal gilts and index-linked gilts below.
- 4.14 Table 4.2 below shows that the forward-looking adjustment implied by forward yields around the centre of the H7 control period (October 2022).

Table 4.2 Forward-looking adjustment implied by gilts

Gilt type	Date	Yield	Forward-looking adj.
Nominal	Spot (Oct 2017)	1.39%	
	Forward (Oct 2022)	2.30%	+0.91 percentage points
Index-linked	Spot (Oct 2017)	-1.76%	
	Forward (Oct 2022)	-1.37%	+0.39 percentage points

Source: PwC calculations

### *Discussion and conclusion*

- 4.15 Based on the 3-month moving average (smoothing out day-to-day fluctuations) of iBoxx yields shown in Figure 4.3 above, recent figures have tracked close to 0%. In terms of forward-looking adjustment to this figure, we apply a market based view with a degree of uncertainty factored in.
- 4.16 In terms of the forward-looking market view, we prefer to use the adjustment implied from real gilt yields directly – reflecting changes to the underlying real cost of debt - which is approximately +0.4 percentage points.
- 4.17 Based on the evidence above, and factoring some degree of inaccuracy (25bps above and below our central projection) from forward-looking adjustments based on forward yields, we conclude that the cost of new debt during H7 could be 0.4% +/-0.25%. Producing a range for the real cost of new debt of **0.15% to 0.65%**.
- 4.18 We note at this stage, the CAA's cost of debt methodology for H7 has not been confirmed. For the purposes of this report we therefore consider this forward-looking market based approach an appropriate holding assumption for the cost of new debt.
- 4.19 While there is uncertainty over the degree to which current market yields are being driven by temporary or permanent factors, evidence from the future direction of long-term interest rates supports the view that long-term equilibrium interest rates may have declined. However, as there is a risk that current rates used for the purposes of our analysis are being distorted by shorter-term market uncertainty, market movements should be monitored between now and the final determination of the H7 controls.

### *Cost of embedded debt*

- 4.20 The cost of embedded debt reflects the cost of servicing debt which has been issued historically. This requires an analysis of historic bond yields and issuances in order to reach an estimate.

<sup>44</sup> The application of a forward-looking adjustment to spot corporate bond yields based on gilts may not be appropriate where corporate bond spreads are unusually elevated or suppressed. As at October 2017 the spread of iBoxx investment-grade yields to gilts was not unusually elevated or suppressed but was below the longer-run average spread. Some unwinding towards long-run spreads could therefore be considered in addition to the gilt based forward-looking uplift.

## Approach

- 4.21 Consistent with the approach to assessing both gearing and the cost of new debt, we assess embedded debt costs for a notionally financed airport. One advantage in adopting this approach is its transparency; attempting to estimate the cost of embedded debt on an actual basis is complex due to the nature of HAL's debt e.g. multiple currencies, different coupon types, presence of embedded options and swap positions.
- 4.22 To estimate the cost of embedded debt we use historical averages of benchmark yields, but prior to this, as above, we test the suitability of the benchmark relative to a sample of HAL's actual bonds.

## Evidence

### Suitability of an iBoxx notional benchmark

- 4.23 To test whether the iBoxx notional benchmark is suitable for providing a notional cost of embedded debt estimate for HAL we review how yields at issuance on selected HAL bonds have compared to prevailing iBoxx yields. This is shown in Figure 4.4 and Table 4.3 below.<sup>45</sup> The data shows that HAL's yields at issuance have tracked broad movements in the iBoxx curve over the period 2008 to 2016.
- 4.24 While the 2009 and 2011 issuances were above the benchmark yield, the two more recent issuances were close to the benchmark despite having time-to-maturity greater than the benchmark average. On balance, we therefore find that the iBoxx benchmark is suitable for estimating a notional cost of embedded debt.

Figure 4.4 Nominal iBoxx bond yields compared to selected HAL bond yields at issuance

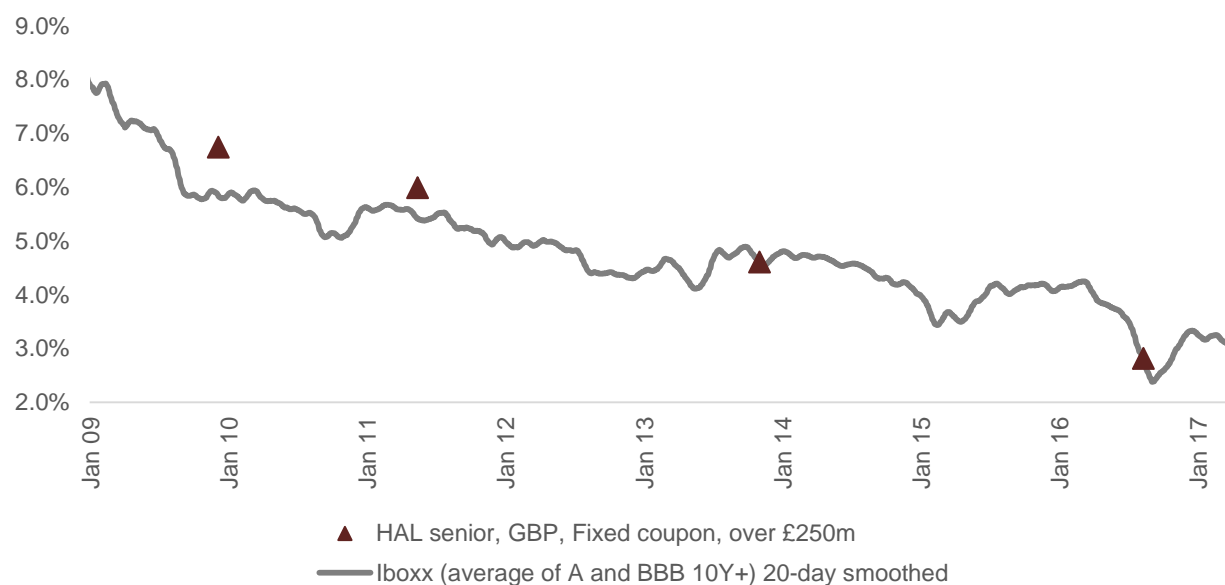


Table 4.3 Spread of HAL bond yields to iBoxx at issuance

	<b>Dec-09</b>	<b>May-11</b>	<b>Oct-13</b>	<b>Aug-16</b>
Spread to smoothed iBoxx	+91 bps	+59 bps	+1 bps	+3 bps
Longer maturity than iBoxx?	Yes	Yes	Yes	Yes

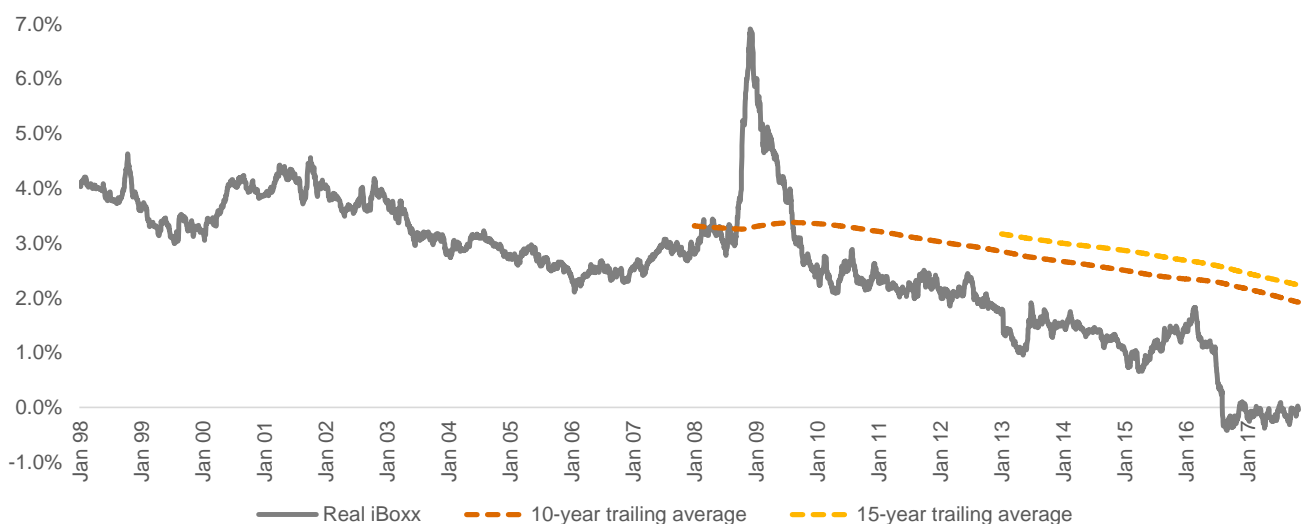
Source: Thomson Reuters

<sup>45</sup> The same sample bonds from the cost of new debt analysis were used.

### Historic yield averages

- 4.25 Using the iBoxx benchmark to estimate the cost of embedded debt, a key choice is then over the selection of averaging period. Specifically, we consider 10yr and 15yr historic averages. We do not consider any averaging periods longer than this as, by the time H7 begins, the proportion of HAL's outstanding funding associated with their August 2008 corporate securitization will be a small percentage of total embedded debt.
- 4.26 Figure 4.5 below sets out trends in real iBoxx yields since 1998 and plots the 10yr and 15yr moving averages. The current 10yr moving average is approximately 1.9% while the 15yr moving average is approximately 2.2%.
- 4.27 Given that current yields are below these averages, these historic average figures are likely to move downwards in the near-term. Consistent with the view on the cost of new debt set out above, towards the end of 2019, these figures could be approximately 1.1% and 1.8%, for 10yr and 15yr respectively.<sup>46</sup>

Figure 4.5 Real iBoxx yields and long-term moving averages



Source: Thomson Reuters

### Discussion and conclusion

- 4.28 Based on available evidence from benchmarks, the cost of embedded debt immediately prior to the H7 control period could potentially lie in the range 1.1% to 1.8%. The upper end of this range, as informed by the longer-term 15-year average, represents a more cautious estimate of embedded debt. Furthermore, a 15-year may better reflect the past trends in HAL's issuances. For example, there was a cluster of issuances in the period 2008-2009, dates which would not be covered using a 10-year average immediately prior to the H7 start date. For the purposes of this report, we therefore recommend a real cost of embedded debt of **1.8%**.<sup>47</sup>

<sup>46</sup> These averages are rolled forward on the assumption that observed yields increase linearly from October 2017 spot yields through the yields forecast for October 2022 for the real cost of new debt. However, it should be noted that forward curves suggest a larger proportion of increases could occur in early time periods (rather than being linear as assumed). The large decline in the forward-looking 10-year average is caused by higher yields from 2008 dropping out of the sample as the averaging window rolls forward to 2019.

<sup>47</sup> This figure is consistent with a cost of new debt of 0.40%.

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## *Weighting and overall cost of debt*

- 4.29 In summary, our initial estimate for the cost of new debt is 0.15% to 0.65%, while our estimate for the cost of embedded debt is 1.8%.
- 4.30 In order to combine these figures into an overall cost of debt, a weighting factor between embedded and new debt is required. Consistent with an average years to maturity on the iBoxx of approximately 20 years, refinancing total debt of 25% in each control period would match the notional approach adopted. On a smoothed basis over the period - assuming not all new debt is issued immediately - the appropriate weighting on the cost of new debt is therefore 12.5%.<sup>48</sup>
- 4.31 We estimate the overall cost of debt is therefore in the range **1.6% to 1.7%** (before issuance costs).

### *Issuance costs*

- 4.32 Consistent with the view in Q6, we suggest an allowance for debt issuance costs of **10bps**.<sup>49</sup> This level of issuance cost allowance is consistent with the long-term bond financing of the notional company. For example, evidence from long-term bond issuances - approximately 30 years to maturity at issuance - by water companies shows that amortized issuance costs are approximately 6bps. For 20-year bonds, 10bps should therefore be sufficient.<sup>50</sup>

### *Overall cost of debt*

- 4.33 Based on the 10bps allowance for issuance costs set out above, our view on the overall real cost of debt (pre-tax) range is **1.7% to 1.8%**.<sup>51</sup>

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<sup>48</sup> A higher proportion of new debt can be justified where embedded debt has a floating interest rate (and therefore re-prices in response to changing interest rates, more like new debt).

<sup>49</sup> Including issuance costs as an addition to the cost of debt is a useful way of amortising costs over the life of borrowings. This approach requires such financing costs to be excluded from operational costs.

<sup>50</sup> PwC (2014), 'Company specific adjustments to the WACC: A report prepared for Ofwat'.

<sup>51</sup> This is a narrow range as we have focused specifically on an average of A and BBB credit ratings and also on a specific average length. Considering credit ratings separately along with different average lengths would generate a wider range.



## 5. Cost of equity

- 5.1 Our approach to estimating the cost of equity is to apply the Capital Asset Pricing Model (CAPM). This is consistent with standard regulatory practice. CAPM assumes that equity investors require their investment to yield the return available on a risk-free asset plus the product of an equity market risk premium (EMRP) and a company specific equity beta. It can be expressed as follows:

$$K_e = R_f + \beta(EMRP)$$

Where:

$K_e$  is the cost of equity,  $R_f$  is the risk-free rate,  $\beta$  is the equity beta, and,  $EMRP$  is the equity market risk premium.

- 5.2 In calculating the cost of equity we focus on calculating two parameters (1) the total market return, which is the sum of the RFR and the EMRP (2) the equity beta for HAL 'as is' in H7. We begin by setting out our view of total market returns in the subsection below.

### Total market returns

- 5.3 As shown by the CAPM formula above, distinct values for the RFR and EMRP are required for estimation of the cost of equity. The sum of these two parameters where equity beta is one (i.e. the cost of equity for the equity market portfolio) is referred to the total market return (TMR).

### Approach

- 5.4 Broadly speaking, there are two approaches that can be used when estimating the cost of equity:
- Build-up to a cost of equity through individually estimating RFR and EMRP.
  - Estimate the TMR and then deconstruct into RFR and EMRP.
- 5.5 Our preferred approach is to estimate the TMR and then deconstruct. This is for two reasons, firstly, the TMR and RFR are more observable than the EMRP. Secondly, the TMR is a more stable parameter than government bond yields.<sup>52 53</sup>
- 5.6 When estimating a value for TMR there are two key sources of evidence that can be reviewed. The first is long-term historical equity returns (ex-post sources) and second is forward-looking evidence from current market expectations of TMR using techniques such as dividend discount modelling, market valuation and investor surveys (ex-ante sources). We review these sources below. An important consideration when evaluating both sources is the wider economic and market context within which investors are forming return expectations. In particular, how those expectations are impacted by a longer period of low interest rates.
- 5.7 Where a current market based approach is employed, the estimates of TMR are likely to be more volatile compared to a long-term historical approach. Where we set out current market based estimates there is therefore greater potential for those numbers to evolve between now and the beginning of the H7 period.
- 5.8 Furthermore, adopting a current market based approach rather than a long-term historical approach involves a trade-off between applying a TMR figure which is more reflective of prevailing market

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<sup>52</sup> Dividend discount model outputs show that there exists a negative relationship between government bond yields and the equity market risk premium, this means that when the RFR falls, the EMRP rises to partially offset this decline – leading to a smoother TMR.

<sup>53</sup> We also note that for companies with an equity beta close to 1 – as is the case for HAL in past price reviews - the precise breakdown of TMR into RFR and EMRP only change the cost of equity by a small amount.

conditions and a TMR assumption which is more stable between reviews. A current market based approach, has the potential for greater charge volatility, however, it helps to avoid overly generous or challenging regulatory targets in the short to medium term that may occur with the application of a flat long-term return figure. This, in turn, helps to prevent intergenerational transfers between airlines and airports.

## Evidence

5.9 In this subsection we review the evidence for setting the TMR assumption. It is set out in four parts:

- Regulatory developments;
- Evolution in the market outlook;
- Current market evidence; and
- Long-run historical evidence.

### Regulatory developments

5.10 In past determinations, up until around 2013, UK regulators have tended to anchor their estimates of TMR to long-run historical equity return evidence. The justification of regulators for this approach has typically been that short-term market figures represent ‘temporary’ or ‘cyclical’ market conditions that will reverse as return expectations converge to longer-term mean values. A key source of evidence in support of a TMR of approximately 7.0% used by regulators was Smithers & Co. (2003).

5.11 Evidence of regulators using this figure a focal point for TMR is shown in Table 5.1 below.

Table 5.1 Regulatory TMR estimates 2009 - 2013

Regulator	Applied to:	Year	Real TMR point estimate <sup>54</sup>
CAA	Airports	2008	7.0%
CAA	Airports	2009	6.6%
Ofcom	Telecoms	2009	7.0%
Ofwat	Water	2009	7.4%
Ofgem	Electricity Distribution	2009	6.0%
CC	Bristol Water	2010	7.0%
CAA	NATS	2010	7.0%
Ofcom	WBA	2011	6.4%
UREGNI	NIE	2012	7.0%
Ofgem	Gas Distribution and Transmission	2012	7.25%
UREGNI	NI Water	2012	7.0%
ORR	Network Rail	2013	6.75%
<b>Average TMR</b>			<b>6.9%</b>

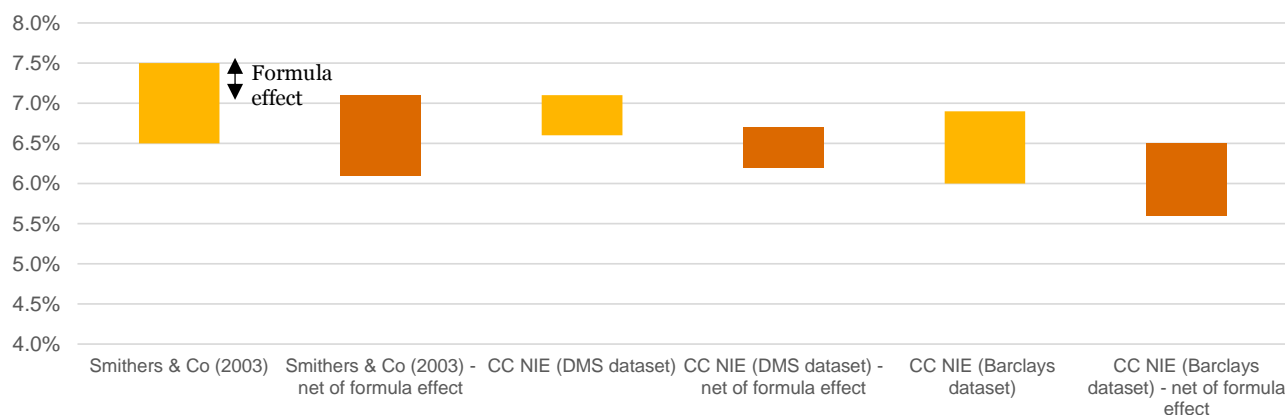
Source: final determinations by UK regulators

5.12 Since these determinations, there are three factors that have led to downward revisions in TMR, these are:

<sup>54</sup> The TMR is a component of the cost of equity. Each regulator has combined the TMR with activity specific betas in order to calculate the appropriate cost of equity.

- The RPI formula effect – this refers to the differences in the CPI and RPI driven by the different formulae used to construct the indices. Figure 5.1 shows that while 7.0% is in the middle of the range in the Smithers & Co TMR range pre RPI formula effect change, once the effect is taken into account the whole range is shown downwards. This suggests that a lower TMR estimate should be used.<sup>55</sup>

Figure 5.1 Historical TMR estimates



Source: Smithers & Co, CC

- Equity returns that have been achieved historically may have been caused by factors which are unlikely to be repeated. Future expected returns are therefore likely to be lower than historical returns. This view is expressed by Dimson, Marsh and Staunton (2011) who noted a number of factors in the second half of the 20<sup>th</sup> century which lead to greater than anticipated premiums:

*“no third world war, the Cuban missile crisis was defused, the Berlin Wall fell, the Cold War ended, productivity and efficiency accelerated, technology progressed, economic development spread from a few industrial countries to most of the world, and governance became stockholder driven”.*<sup>56</sup>

- Increased attention on ex-ante evidence sources for TMR. In particular, the CC’s determination of NIE specifically set out that:

*“The CC said in recent regulatory inquiries that 7 per cent is an upper limit for the expected market return, based on the approximate historical average realized return for short holding periods. We think that it is now appropriate to move away from this upper limit based on historical ex post realized returns and place greater reliance on ex ante estimates derived from historical data which tend to support an upper limit of 6.5 per cent.”*<sup>57</sup>

This decision from the CC prompted Ofgem to launch a consultation into its methodology for setting equity returns and, more widely, re-orientated the evidence base used by regulators in determining TMR.

5.13 The impact of these three factors is captured in Table 5.2 below, which shows that more recent estimates of TMR, since 2013, by regulators have been below 7.0%, and have averaged 6.5%.

<sup>55</sup> The formula effect refers to the differences in the CPI and RPI driven by the different formulae used to construct the indices. The formula effect increased in 2010 due to methodological changes made by the ONS, and as such we adjust figures from historical studies to reflect this change. Due to the timing of this change it is particularly relevant for the earlier determinations set out.

<sup>56</sup> Dimson, E, Marsh, P and Staunton, M (2011), ‘Equity premiums around the World’, London Business School

<sup>57</sup> CC (2014) ‘Northern Ireland Electricity Limited price determination’, A reference under article 15 of the Electricity (Northern Ireland) Order 1992, para 13.146

Table 5.2 Regulatory TMR estimates 2014 - 2016

Regulator	Applied to:	Year	Real TMR point estimate <sup>7</sup>
CC	NIE	2014	6.5%
CAA	Designated airports	2014	6.25%
Ofcom	Telecoms	2014	6.3%
UREGNI	NI Water	2014	6.5%
Ofgem	Electricity distribution	2014	6.5%
Ofwat	Water	2014	6.75%
Ofcom	Business connectivity	2015	6.3%
CMA	Bristol Water	2015	6.5%
UREGNI	NI Gas distribution	2016	6.5%
<b>Average TMR</b>			<b>6.5%</b>

Source: Final determinations by UK regulator.

- 5.14 However, despite this downward movement, the 6.5% estimates were still largely influenced by long-term averages and the expectation of normalisation of interest rates and financial market conditions. This normalisation in financial market conditions has thus far failed to materialise, and the opposite has occurred – with further reductions in long-term interest rates during this period. This raises the question of whether long-term historical benchmarks are still relevant in the current period of ultra-low interest rates.
- 5.15 Most recently of all, Ofcom set out an updated view of the cost of equity for BT in their March 2017 Wholesale Local Access Market Review documentation (annex 16). Specifically, Ofcom used a real risk-free rate of 0.5% and a real ERP of 5.5%, producing a real TMR of 6.0%. This was similar to the 6.1% real TMR they set out in their 2016 Business Connectivity Market Review – where a real RFR of 1.0% and a real ERP of 5.1% was applied. Ofcom noted that this reduction on TMR associated with a lower RFR reflected their consideration that the relationship between the TMR and ERP may not be one-for-one. The view on the TMR was informed by both ex-post and ex-ante evidence.
- 5.16 In the next sub-section, we consider the evolution of the market outlook more recently, in particular the embedding of lower interest rate expectations for the medium term, and consider how these may impact on future estimates of TMR.

#### *Evidence of the evolution in market outlook*

- 5.17 A key development since many of the regulatory determinations, which used TMR assumption of around 6.5%, has been an embedding of expectations of a ‘lower for longer’ interest rate environment. This is captured by the marked step change in lower expectations of long-term interest rates.
- 5.18 Figure 5.2 below presents the evolution of the 10 year forward 10 year gilt rate. This represents the current market expectation of 10 year gilt yields in 10 years’ time, and therefore provides a guide to expectations of future long-term interest rates (but is also influenced by demand and supply conditions for Gilts, including the Bank of England’s quantitative easing programme). As shown, market expectations of long-term interest rates remained stable over the period 2000 to 2011 despite significant movement in short-term interest rates over the period. However, from 2011 through to mid-2014, expectations of lower long-term interest rates declined before stabilising at around 4-4.5% (nominal). Since 2014, there have been further significant declines in expectations of the future 10-year gilt yield, down to below 2% before stabilising at around 2.6%.

Figure 5.2 Evolution of the 10 year forward 10 year gilt rate (“10x10”)



Source: Bank of England and PwC analysis

- 5.19 This expectation of lower for longer long-run interest rates is mirrored by forecasts for short-term rates. For example, in the November 2017 Economic and Fiscal Outlook, the OBR forecast that the base rate will be just 1.2% in Q1 2023 (in the box below we discuss the implications of recent monetary policy decisions on these expectations).

**Box 1: The impact of recent monetary policy decisions**

Following from the evidence set out above, caution needs to be applied when assessing the implications of the increase in the Bank of England base rate, and in the implications of very modest changes to interest rate expectations. Such changes in expectations need to be considered in the context of the scale of interest rate reductions, which characterise the low interest rate environment (Bank of England base rates falling from 5.75% in July 2007 to 0.25% in August 2016 and 20-year nominal government bond yields falling from above 4% in 2011 to below 2% in 2017).

Following the interest rate rise on 2 November 2017, gradual and limited future interest rate movements have been signalled. Specifically, the MPC dropped their guidance that the Bank Rate may need to rise more than markets imply, and Governor Mark Carney said two additional 25bp rate hikes over three years “are consistent with” inflation falling back towards target by the end of the forecasting horizon.

The Bank of England November Inflation Report concludes that “all members agree that any prospective increases in bank rate would be expected to be at a gradual pace and to a limited extent”, and sees “considerable risks to the outlook, which include the response from households, businesses and financial markets to developments related to the process of EU withdrawal”.

The impact of Quantitative Easing (QE) on long-term interest rates and other non-conventional monetary policies is difficult to assess definitively, but the policies themselves clear and bond markets would be expected to incorporate expectations as to their effect. The Bank of England has not provided any timetable for unwinding of QE, stating only this would start after interest rates had been risen a few times. This, therefore, places any unwinding of Quantitative Easing well into and probably beyond the H7 period.

- 5.20 In terms of implications for TMR, these expectations of lower long-term interest rates are likely to underpin low returns across all asset classes.
- 5.21 This view is consistent with much market commentary, which has focussed on both low interest rates, but also low returns across all asset classes. This sentiment is captured in the 2016 Credit Suisse Global Investment Returns Yearbook, a McKinsey report on the outlook for investment returns, recent Blackrock advice to its clients and valuation expert Professor Aswath Damodaran:

*“As we continue to live in a low-return world, bond returns are likely to be much lower and there is no reason to believe that the equity risk premium is unusually*

elevated. Consequently, the real returns on bonds, equities and risk assets in general seem likely to be relatively low.”<sup>58</sup>

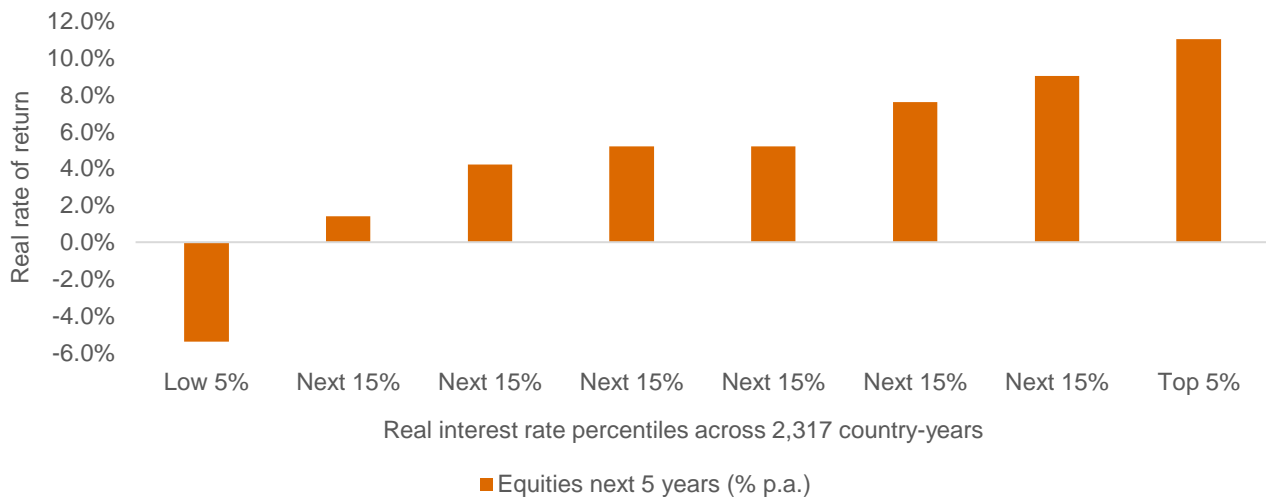
“Our analysis suggests that over the next 20 years, total returns including dividends and capital appreciation could be considerably lower than they were in the past three decades. This would have important repercussions for investors and other stakeholders, many of whom have grown used to these high returns”<sup>59</sup>

“The prospect of an extended period of low returns – and its potential effect on retirement – is an emerging challenge. BlackRock is one of 35 financial industry firms included in a consensus capital markets forecast compiled by Horizon Actuarial Services that suggests average annual returns for U.S. equities and bonds may be more than 3% lower than their averages for recent decades.”<sup>60</sup>

“For investors in the US and Europe who yearn for the normality of decades past, I am afraid that normal is not returning. We have to recalibrate our assumptions about what is normal (for interest rates, risk premiums, inflation and economic growth) and pay less heed to rules of thumb that were developed for another market (US in the 1900s) and another time.”<sup>61</sup>

- 5.22 The view that low real interest rates underpin lower real returns across equities is also supported by the analysis of Dimson, Marsh and Staunton in the latest 2017 Credit Suisse Yearbook. Their research on a dataset containing 2,317 country years shows that when real interest rates have been towards lower historical percentiles, the real return on equities in the following five year period is also lower. This relationship is set out in Figure 5.3 below.

Figure 5.3 Relationship between real equity returns and real interest rates



Source: Credit Suisse, Global Investment Returns Yearbook 2017 – Slide Deck

- 5.23 The evolution of the market outlook therefore points towards a further decline in TMR since mid-2014. This provides further evidence that current market evidence has become detached from long-run average trends.
- 5.24 In summary, where a relationship exists between interest rates and required equity returns – as all the above evidence suggests – then this presents a problem with using a long-term historical averages approach for estimating the total market returns assumption. In this situation, the balance of weight

<sup>58</sup> Credit Suisse Research Institute, “Credit Suisse Global Investment Returns Yearbook 2016”.

<sup>59</sup> McKinsey Global Institute (2016), “Diminishing returns: Why investors may need to lower their expectations”, May 2016

<sup>60</sup> Blackrock (2016), “Long-term thinking in a low return world” October 2016

<sup>61</sup> aswathdamodaran.blogspot.co.uk/2015/04/dealing-with-low-interest-rates.html

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placed on the use of historical averages should be reduced in favour of more contemporaneous market techniques. In the subsection below we review the TMR range suggested by current market evidence.

- 5.25 However, we recognise historical estimates still provide a useful benchmark, as contemporaneous market estimate should evolve around historical averages.<sup>62</sup> In addition, we acknowledge that there is uncertainty over how the market outlook will change between now and H7, and that contemporaneous market based techniques require greater judgement in terms of input assumptions (and set out some of the policy trade-offs in this report). We therefore follow our review of current market evidence with a review of long-term historical based measures of TMR – where long-run data on returns is adjusted for some of the factors discussed under the ‘regulatory developments in TMR’ above.

#### *Current market evidence on TMR*

- 5.26 Ex-ante, or current market evidence of TMR indicates that TMR has been falling as interest rates - and expectations for their future path – have declined. This can be seen from three sources of current market evidence: dividend discount model (DDM) outputs, investor survey results and transaction premiums in regulated sectors.

#### DDM outputs

- 5.27 A DDM approach can be used to estimate a market implied TMR figure. DDM is a long established technique and is undertaken by a range of market analysts as well as the Bank of England – for example the CC’s 2014 determination for NIE sourced the Bank of England’s DDM analysis for the UK when arriving at their estimate for TMR.<sup>63</sup> A multi-stage DDM model has the advantage of capturing both short-term expectations of future dividend growth as well as long-term expectations of future dividend growth, making it suited to the dynamics of a lower for longer scenario.<sup>64</sup> The full details of our DDM are set out in appendix D.
- 5.28 The outputs from our monthly DDM analysis are shown in Figure 5.4 below. The TMR spot rate for December 2016 is 8.4% (in nominal terms), while the 5-year average of DDM outputs has been 8.7%.

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<sup>62</sup> Historical return estimates should also consider structural (as opposed to cyclical) factors, which suggest forward looking returns may not be the same as historical averages.

<sup>63</sup> See Figure 13.6 of the CC’s final determination for NIE. The analysis shown by the CC was conducted in real terms and we note that it exhibited a similar profile to our own analysis set out above.

<sup>64</sup> The expected short-term and long-term growth rates used in our DDM analysis represent nominal growth rates from forecast real GDP growth and forecast inflation. Our rationale for using GDP growth as our assumption is threefold. Firstly, if part of the reason that dividend growth has been kept low is due to investment (i.e. deferred dividends), then we expect dividend growth to return to typical rates of GDP growth in the future. Secondly, if dividend growth has been low because dividends have been falling as a share of national income, then this trend is unlikely to continue and dividends should find an equilibrium share of national income, and then grow in line with national income. Thirdly, the GDP measure of growth provides stability in the DDM model. Our assumption for GDP growth draws on forecasts of real GDP and inflation from Consensus Economics, which is a widely sourced provider of consensus forecast macroeconomic data. This avoids large swings in analyst dividend growth forecasts overly influencing the DDM results.

Figure 5.4 Monthly DDM outputs, 2000 to 2016



Source: PwC analysis, Datastream, Consensus Economics, Bank of England

- 5.29 The outputs of this analysis show that the TMR has declined to some extent with the falling RFR. For example, in 2013 the TMR was consistently above 9%, but more recently has been closer to 8%. In our work for Ofwat we provided analysis which investigated the relationship between the RFR and the TMR. We found that reductions in the RFR were partially offset by increases in the EMRP but in overall terms the TMR has still fallen.<sup>65</sup> The correlation factor between the RFR and EMRP was -0.67 over the 2000 to 2017 period.<sup>66</sup>
- 5.30 As captured in Figure 5.2 above, the largest declines in the long-run RFR expectations have taken place since 2014. We therefore consider it is helpful to calculate an average DDM figure from January 2014. This period marked the beginning of a structural decline in long-term interest rate expectations, so is more aligned to the low interest rate environment. From the start of 2014 through to October 2017 the DDM output has averaged 8.4%.

#### Investor survey results

- 5.31 Evidence from investor surveys can provide a useful cross-check on outputs of analysis such as DDM (where the outputs can be sensitive to specific input assumptions). A 2017 survey of discount rates (TMR) applied by practitioners, investors and academics in the UK found that the mean value of TMR was very similar to the spot TMR estimates from the DDM analysis above. This is set out in Table 5.3 below.

Table 5.3 Survey evidence of investor TMRs

Parameter	Average value	Standard deviation
Nominal TMR (United Kingdom)	8.1%	1.1%

Source: Fernandez (2017)

- 5.32 A slightly different form of survey data is provided by surveys of investment consultants. An example is Horizon Actuarial Services who survey 35 investment advisors.<sup>67</sup> This particular survey covers the US market with a full spectrum of return assumptions, so the most instructive insight to take from this is the rate of change in those assumptions. The mean assumption for large cap long-term equity returns

<sup>65</sup> PwC (2017), "Updated analysis on cost of equity for PR19"

<sup>66</sup> The -0.67 figure was calculated using nominal parameters but a similar result was obtained using real parameters.

<sup>67</sup> Horizon Actuarial Services (2016). "Survey of Capital Market Assumptions"

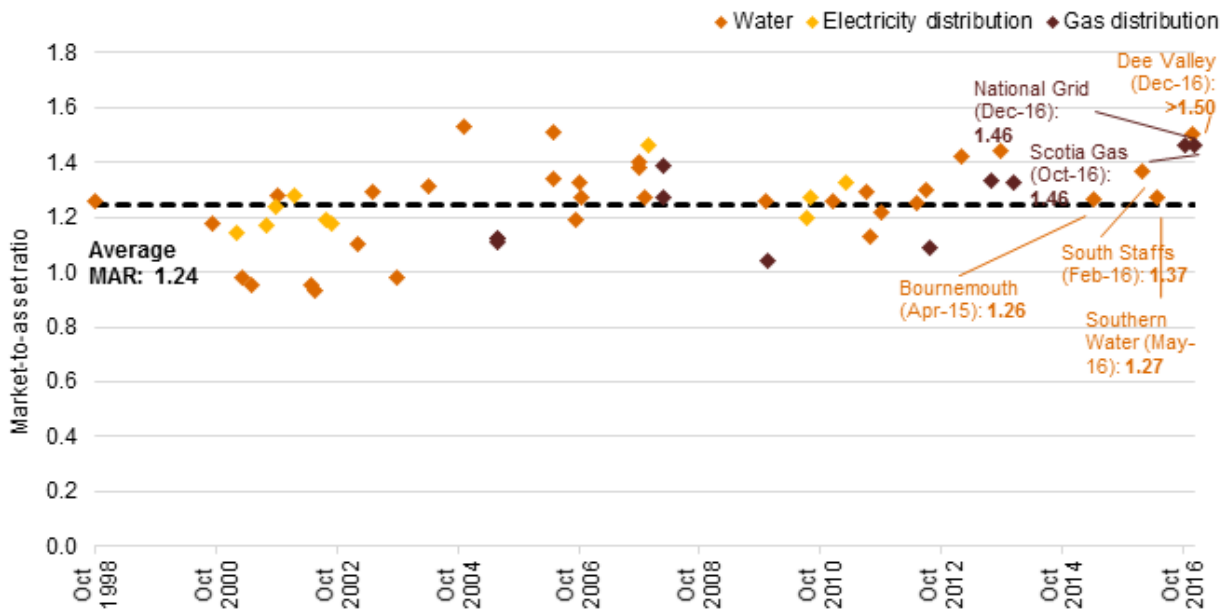


was 8.9% (nominal) in 2012, and by 2016 this had fallen to 8.1% (nominal). A trend that is consistent with the DDM analysis for the UK market set out above.

Transaction premiums in regulated sectors.

5.33 A further observation is provided by evidence of RAB<sup>68</sup> premia (otherwise referred to as market-to-asset ratios or MARs). We have collected data from transactions of UK regulated utilities for the period 1998 – 2016 and calculated an average MAR of 1.24. Moreover, we find that for more recent transactions, the MARs have been above the long-term average, for example the RCV premia for two recent gas distribution transactions have been approximately 1.46.

Figure 5.5 Market-to-asset ratios on regulated energy and water <sup>69 70</sup>



Source: PwC

Note: Average MAR shown excludes multiples for South Staffordshire and Dee Valley for which there is greater uncertainty over the ratio value.

5.34 There could be two key factors driving the magnitude of recent RCV premia.<sup>71</sup> The first is an expectation of outperformance relative to regulatory allowances e.g. cost or financing outperformance. The second is that the cost of equity allowed by the regulator is regarded by investors as being in excess of the required return of investors. In the absence of adequate assumptions regarding outperformance of regulatory allowances embedded in these private transactions we cannot accurately disentangle the individual impact of these two factors. However, given the magnitude of the recent RCV premia, we find that outperformance of regulatory cost targets alone is unlikely to explain the full extent of the premia. Therefore, this appears to imply that current levels of cost of equity allowed by regulators could be above the current requirements of investors.

5.35 In our updated analysis for Ofwat of water sector RCV premia for publicly listed water companies, we were able to make assumptions on market expectations for outperformance and thereby infer the water

<sup>68</sup> RCV and/or RAB premia depending on the sector naming convention.

<sup>69</sup> Note on South Staffordshire Group ratio: global investment firm KKR sold its 25% stake in South Staffordshire Group – parent company of South Staffs and Cambridge Water – to Mitsubishi Corporation (“MC”) for £103.5m. Based on publically information available we have estimated a transaction implied EV/RCV multiple range of 1.22-1.52 (with centre point of 1.37 shown). This multiple range was derived based on the segmental analysis we performed in order to estimate the value of South Staffordshire non-regulated business valuation (estimated to be c. 35%-50% of EV).

<sup>70</sup> Dee Valley multiple is sourced from Macquarie’s January 2017 report: “UK Utilities – The re-inflation trade: what public equity doesn’t get, private equity does”.

<sup>71</sup> Other more minor factors include non-regulated income, optimism bias, valuation of potential future opportunities and flight to safety effect.

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sector cost of equity. Using these figures to back out the TMR, we calculated a potential TMR range of 7.5% to 8.2% (in nominal terms).<sup>72</sup>

### *Long-run historical evidence on TMR*

- 5.36 The application of current market techniques for estimating TMR is not without drawbacks. As mentioned above, there is typically increased levels of judgement involved and the outputs can be more volatile. As there is also some uncertainty regarding changes in the economic and market outlook between now and the H7 period, long-run historical evidence on TMR can provide a useful reference point to judge the size of any cyclical variation in TMR assumptions.
- 5.37 Two key data sources for long-run equity returns in the UK are provided by Dimson, Marsh and Staunton and Barclays.<sup>73</sup> Both datasets provide real terms equity return series from 1899.
- 5.38 A well-documented adjustment to long-run return series relates to the RPI formula effect.<sup>74</sup> This structural change requires a downward adjustment to observed long-run real return series as the majority of observations pre-date the formula effect change. In terms of quantifying the formula effect adjustment, Ofgem's 2014 consultation on equity returns highlighted that an adjustment of 25bps could be considered "cautious" and concluded that 40bps was a reasonable estimate for the enduring effect of the changes to data collection routines. The ONS prepared an analysis of the size of the increase of the formula effect and concluded that the formula effect had increased by 0.32% as a result of the methodology change. We adopt an adjustment of 30bps.
- 5.39 Furthermore, as cautioned by both Dimson, Marsh and Staunton (2017) and Fama and French (2002), using long-run averages of these real equity return series to infer expected future return figures can lead to an overstatement of expected returns. This should be considered when estimating a forward-looking returns assumption using historical data.<sup>75</sup>
- 5.40 In order to produce a forward-looking expected equity return assumption, there are two further sources of adjustment to historical observations we consider most relevant:<sup>76</sup>
- i) Adjustments to historical dividend growth;
  - ii) Adjustments relating to price to dividend ratio expansion; and
- 5.41 Dimson, Marsh and Staunton deduct at least half of the long-run observed global real dividend growth when looking to estimate future global equity return expectations (an adjustment of at least 0.25 percentage points). This is to account for past "good fortune" that is embedded in the long-run observed equity returns data. They also note that some countries have performed much better than others over the 1900 to 2016 period. Logically, this means that the deduction from historic performance should be greater from those higher performing countries. The UK is ranked 7<sup>th</sup> out of the 21 developed economies in the study, with real dividend growth rate of 0.34 percentage points above the world average.<sup>77</sup> Therefore, forward-looking estimates of UK equity market returns should logically be adjusted by a

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<sup>72</sup> PwC (2017), "Updated analysis on cost of equity for PR19"

<sup>73</sup> As set out in the Credit Suisse Global Investment Returns Yearbook, and the Equity Gilt Study, respectively.

<sup>74</sup> The formula effect refers to the differences in the CPI and RPI driven by the different formulae used to construct the indices. The formula effect increased in 2010 due to methodological changes made by the ONS.

<sup>75</sup> The 2017 Credit Suisse Global Investment Returns Yearbook states that, "While forward-looking estimates obviously cannot be precise, a long-term projection of the annualized equity premium might, at the very least, involve adjusting the historical record for components of performance that cannot be regarded as persistent". Meanwhile Fama and French (2002), also find issues with using observed historical stock returns directly as the expected returns on equity, highlighting that, "An expected stock return that exceeds the expected income return on book equity implies that the typical corporate investment has a negative net present value. This is difficult to reconcile with an average book-to-market ratio substantially less than one."

<sup>76</sup> When reviewing the application of a historical EMRP to the future, DMS consider the four components the EMRP can be divided into. These are the mean dividend yield, the real growth in dividends, the annualized expansion of the price to dividend ratio and the annualised change in the real exchange rate (to convert to USD). In terms of forward-looking adjustments to these components, in line with DMS we focus on the real dividend growth and price to dividend ratio components. However, as we are interested in a sterling based figure for the WACC we do not require any consideration of the exchange rate component.

<sup>77</sup> See Credit Suisse Global Investment Returns Yearbook (2017), Table 11 and Chart 13.

greater amount than the world average deduction of at least 0.25 percentage points. Based on this assessment we consider an approximate adjustment of around 0.4 percentage points to the nominal TMR.

- 5.42 Secondly, regarding the expansion of the price to dividend ratio, where historical returns have been attributable to this source, and this expansion cannot be expected to continue indefinitely, an adjustment for the observed long-run equity return is required. Data from Dimson, Marsh and Staunton (2017) suggests that for the UK market this adjustment only accounts for -0.01% in the long-run. We therefore consider this adjustment as negligible.
- 5.43 These adjustments are shown in the table below. The starting point used is the long-run average historical real equity return based on overlapping 20yr holding periods. The figures shown are updates to the analysis conducted by the CMA for the 2014 Northern Ireland Electricity Final Determination. We focus on these longer-run holding periods and these are consistent with the long-run investment horizons applied when estimating the cost of debt.

**Table 5.4 TMR based on adjusted long-run historical evidence**

<b>Real total market return %</b>	<b>DMS dataset</b>	<b>Barclays dataset</b>
20yr holding period *	7.0%	6.3%
Formula effect adjustment	-0.3%	-0.3%
<b>TMR adjusted for formula effect</b>	<b>6.7%</b>	<b>6.0%</b>
Forward looking returns adjustment	-0.4%	-0.4%
<b>TMR adjusted for formula effect &amp; returns</b>	<b>6.3%</b>	<b>5.6%</b>

\* For overlapping holding periods  
Source: DMS (2017), Barclays (2016)

- 5.44 In summary, unadjusted long-run historical evidence produces a real TMR range from 6.3% to 7.0%. Adjusting for the RPI formula effect lowers this range to 6.0% to 6.7%. Depending on views regarding the sustainability of long-run historical dividend growth, further downward adjustments can be applied. Consistent with Dimson, Marsh and Staunton (2017) we consider an adjustment equal to half of long-run real dividend growth. This lowers the range further to 5.6% to 6.3%.

## *Discussion and conclusion*

- 5.45 In summary, we find that regulatory estimates of TMR have shifted downward as a result of factors such as:
- One-off historical impacts elevating historical returns above expected levels of return;
  - The impact of the formula effect change in the calculation of RPI; and
  - A re-orientation of the evidence base towards ex-ante sources.
- 5.46 These changes led to a clustering of regulatory TMR assumptions around the 6.5% mark. However, the wider economic and market context has evolved since these estimates were made, in particular interest rates are expected to remain ultra-low for a prolonged period of time.
- 5.47 We find that the ‘search for yield’ created by a prolonged period of negative real returns on the safest assets has led to a decline in required equity market returns. This is supported by evidence from DDM outputs, investor surveys and recent transaction premiums in regulated sectors.
- 5.48 Based on current market evidence (ex-ante sources) we find that a nominal TMR could be approximately in the range 8.0% to 8.6%. Expressing this in real terms we calculate a TMR of

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approximately **5.1%** to **5.6%**.<sup>78</sup> The lower end of the current market evidence range (ex-ante sources) is consistent with more weight being placed on evidence from MARs analysis and investor surveys, and extends below DDM spot and average outputs. The upper end of this range is consistent with more weight being placed on DDM outputs.

- 5.49 Focusing on ex-post sources of evidence, which factor in both the one-off historical impacts and the impact of the formula effect change, we estimate a real TMR range of **5.6% to 6.3%**. This shows that our current market approach is resulting in a negative adjustment to long-term (adjusted) historical returns of around 0.5% to 0.6%.
- 5.50 Drawing upon evidence that there is a less than perfect negative correlation between the RFR and EMRP, for the purposes of this report we use the TMR range from current market evidence.

## *Risk-free rate*

- 5.51 Once a range for TMR has been estimated, it can be deconstructed into two parts, the risk-free rate and the equity market risk premium. In calculating the cost of equity using CAPM, we first estimate the RFR and then estimate the EMRP as the residual from the TMR and RFR estimates. Where the equity beta is close to unity – as is the case for HAL<sup>79</sup> – the impact of deconstructing the TMR in different proportions has little impact on the overall cost of equity. However, it is a necessary step in transparently calculating the cost of equity. In this subsection we set out an estimate of the RFR for H7.

## *Approach*

- 5.52 Our approach to estimating the risk-free rate centres on gilt market data. For sterling denominated assets, we find that gilts are sufficiently low risk to act as an appropriate proxy for the risk-free rate. There are two types of gilt that can be used to inform estimates of the risk-free rate:
- Nominal gilts – these are conventional government bonds with fixed nominal payments. These are considered a direct proxy for the nominal RFR.
  - Index-linked gilts – the return on these government bonds is linked to retail price index (RPI) inflation. These are therefore considered a direct proxy for the real RFR.

- 5.53 For both types of gilt we consider spot market evidence as well as forward-looking evidence.

## *Evidence*

- 5.54 Over the past few years, there has been widespread recognition of the global nature of lower interest rates. Evidence in recent periods shows the sustained decline of real interest rates into negative territory. As we go on to highlight, market expectations suggest this environment of negative real interest rates is likely to persist for the foreseeable future.

### *Spot market evidence*

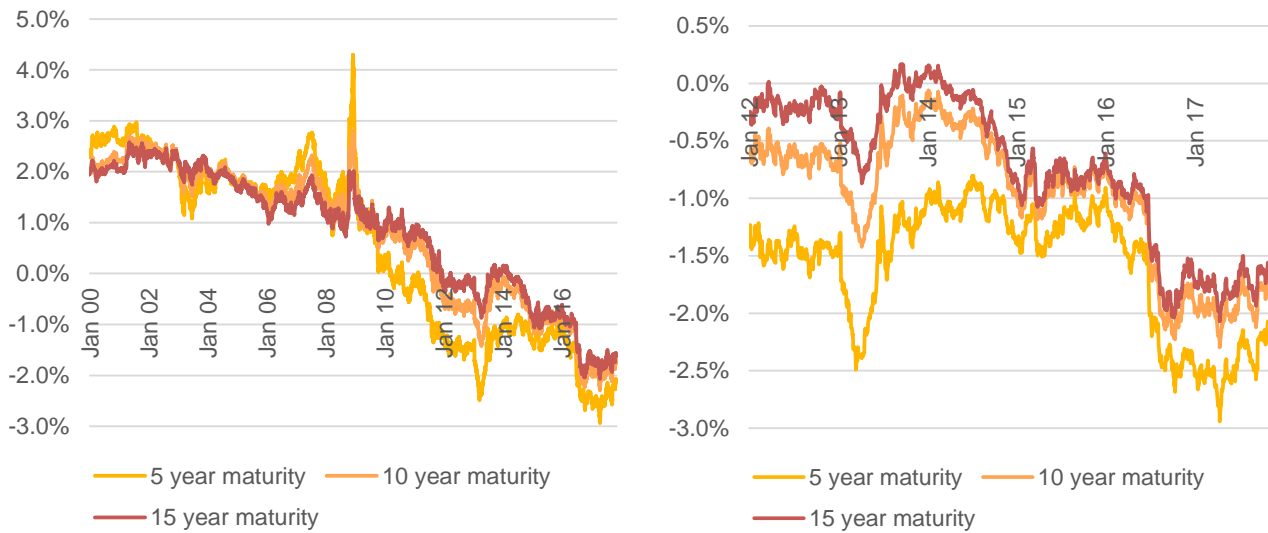
- 5.55 The yields on gilts have declined substantially since early 2014. Having declined gradually through 2014, they then dropped sharply in 2016 as expectations of lower interest rates became prolonged. This is shown in both panels of Figure 5.6 below. Whereas the yield on 10-year gilts was close to zero in early 2014, current yields are close to -2% in real terms.

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<sup>78</sup> We note that this is within the TMR range set out by the CC in their 2014 determination for NIE – which considered the appropriate upper limit to be 6.5% and considered that 5.0% could be an approximate lower bound figure.

<sup>79</sup> The Q6 final proposals range for the equity beta from the CAA ranged from 0.9 to 1.15.

Figures 5.6 Index-linked gilt yields



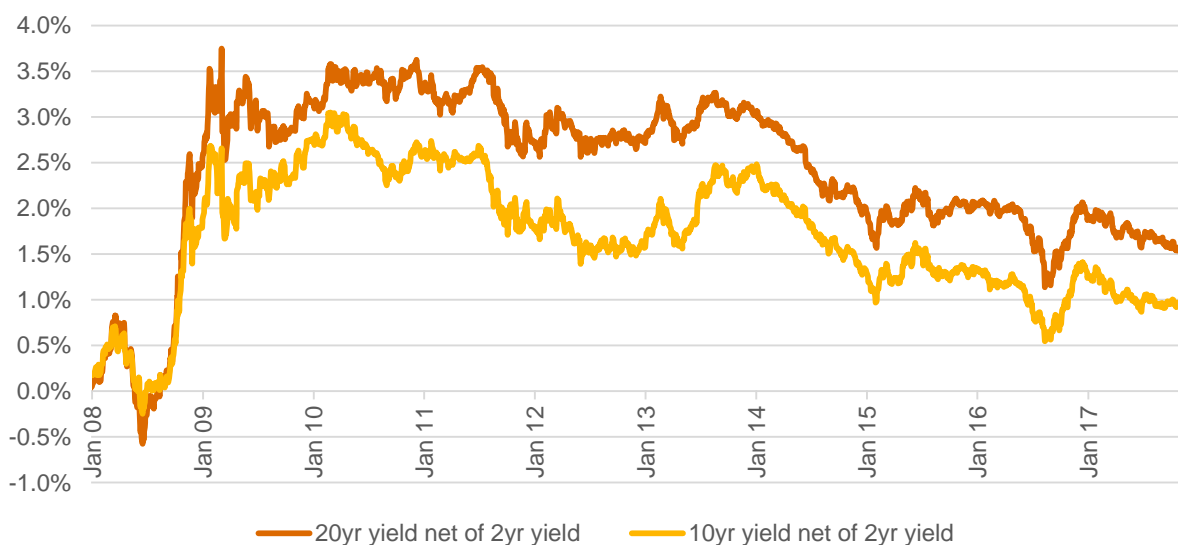
Source: Bank of England

5.56 Data on spot yields also shows that the real yield curve is also substantially flatter than it was in the build-up to the Q6 determination. For example see the change in spread between the 5-year maturity and the 15-year maturity in the figure above.

*Forward-looking evidence*

5.57 From a forward-looking perspective, the spread between long-term gilts and short-term gilts is a proxy for understanding expectations of future interest rate changes. In Figure 5.7 below we plot the spread between 10-year gilts and 2-year gilts as well as the spread between 20-year gilts and 2-year gilts. The larger the spread, the steeper the expected path for future rate rises. As shown, expectations of future rate rises have considerably softened over the last three years.

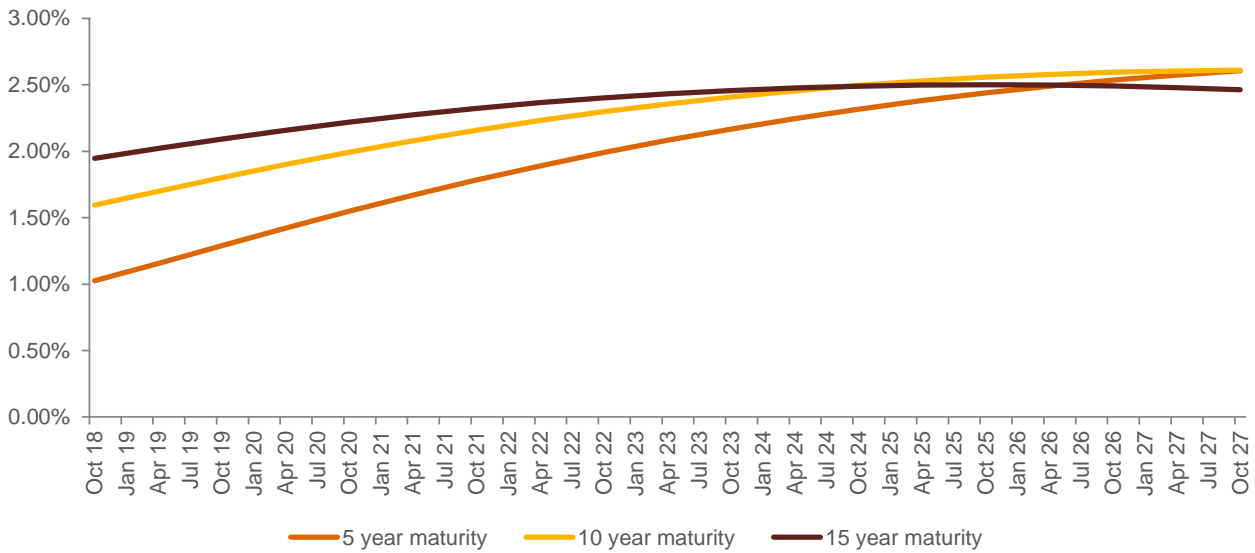
Figure 5.7 Yield curve proxy for rate change expectations



Source: Bank of England

5.58 Spot market data can also be used to produce implied forward-gilt yields; that is, the implied yield on a gilt of a given maturity at some future date. Figure 5.8 sets out the implied forward gilt yields from nominal gilts (using data from the end of October 2017). This evidence shows that there were market expectation for yields on nominal gilts to be higher than recent market values (e.g. 1.4% on 10 year nominal gilts). In the first half of the H7 period the yields on nominal 10yr gilts are expected to surpass 2%.

Figure 5.8 Implied nominal forward gilt yields (end of October 2017)

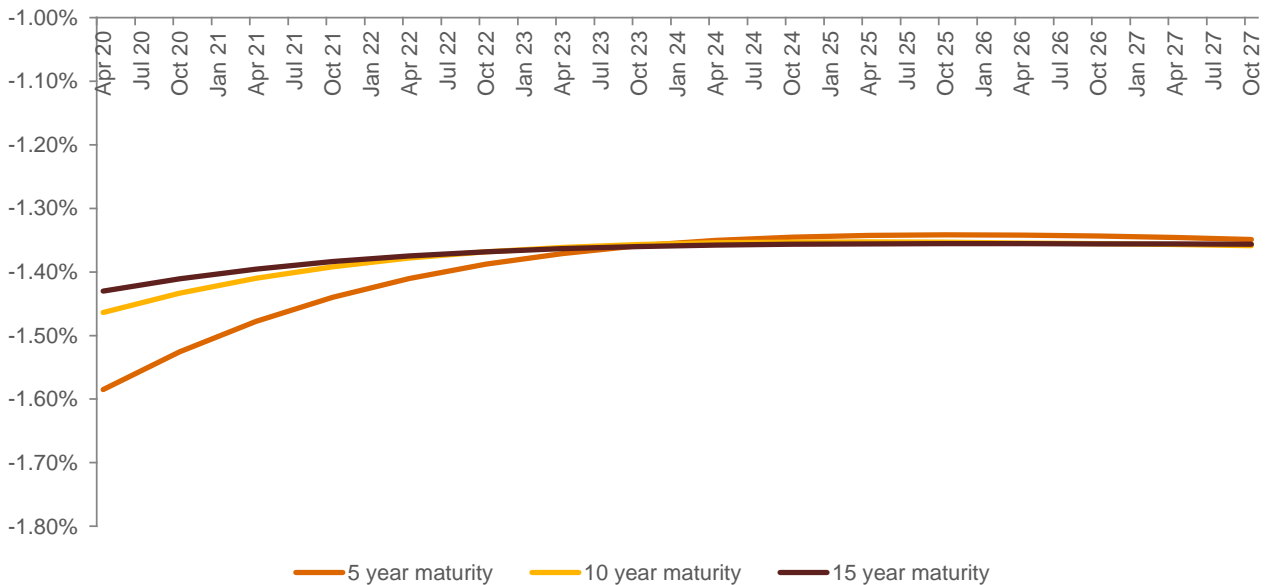


Source: Bank of England

5.59 The same analysis can be conducted using index-linked gilt yields. Figure 5.9 sets out the implied forward gilt yields from index-linked gilts (using spot from the end of October 2017). This evidence shows that market expectations for yields on index-linked gilts will be higher than recent market values (e.g. -1.76% on 10-year index-linked gilts). Over the H7 period yields are expected to remain relatively flat, at around -1.4%; this finding holds across all maturities shown.

5.60 For comparison, four years earlier (October 2013), spot yields on 10-year index-linked gilts were around -0.4% and were expected to rise to around +0.6% by the start of H7.<sup>80</sup>

Figure 5.9 Implied index-linked forward gilt yields (end of October 2017)



Source: Bank of England

<sup>80</sup> As implied by forward yields.

### Recent regulatory decisions

5.61 In Table 5.5 below we set out the real RFR point estimate from recent regulatory decisions. The CAA's Q6 point estimate remains the lowest of recent decisions. All other decisions have varied between 1.0% and 1.5%.

Table 5.5 Recent regulatory decisions on RFR

Regulator	Applied to:	Year	Real RFR point estimate <sup>7</sup>
CC	NIE	2014	1.25%
CAA	Designated airports	2014	0.5%
Ofcom	Telecoms	2014	1.3%
UREGNI	NI Water	2014	1.5%
Ofgem	Electricity distribution	2014	1.5%
Ofwat	Water	2014	1.25%
Ofcom	Business connectivity	2015	1.0%
CMA	Bristol Water	2015	1.25%
UREGNI	NI Gas distribution	2016	1.25%

Source: Regulatory final determinations

### Discussion and conclusions

- 5.62 The evidence set out above shows that as well as spot yields for gilts declining since the Q6 decision, future expectations of rates rises have also softened since the Q6 decision. Taken together these suggest that the risk-free rate should be lower than the 0.5% figure the CAA previously adopted.
- 5.63 Our recommendation is to use inputs into the cost of capital calculation which are broadly market aligned. This is clearly done for the cost of debt assumption. If the risk-free rate assumption is not based upon market observations, then this would lead to an inconsistency in the credit spread between the risk-free rate and the cost of debt.
- 5.64 Market forward yields from index-linked gilts show that a forward-looking adjustment to current spot yields could be relatively small e.g. +0.4 percentage points from spot yields. This would suggest a real RFR estimate of -1.4%. Comparing this figure to recent regulatory decisions on RFR, an estimate as low as this would depart significantly from other regulatory decisions.<sup>81</sup> Taking account of this, and factoring in a degree of uncertainty, we recommend an upper end figure of -1.0% for the risk-free rate. Our recommended range is therefore **-1.4% to -1.0%**.<sup>82</sup> Across the range, this implies an EMRP of **6.5% to 6.6%**.<sup>83</sup> This level of EMRP is markedly higher than assumptions typically used by regulators before the current era of low interest rates.

### Asset beta

- 5.65 The TMR represents the returns required by investors on equities of average risk. The actual returns needed for a particular equity investment vary with the degree of risk to which it exposes the investor. Using the CAPM framework investors only require compensation for bearing systematic risk. The asset beta captures the systematic risk of an equity on an unlevered basis. The higher the asset beta, the larger compensation equity investors require for bearing additional systematic risk.

<sup>81</sup> While a negative real RFR has not been used by UK sector regulators in previous determinations, a negative real risk-free rate was suggested by the Ministry of Justice's March 2017 discount rate update for personal injury claims.

<sup>82</sup> See Appendix C for a comparison to Ofcom's Wholesale Local Access Market Review view.

<sup>83</sup> A lower figure for the RFR is paired with a lower figure for TMR (and vice versa) – reflecting whether there is a higher or lower general returns environment.

## Approach

### Past approaches

- 5.66 Following the break-up of BAA, in the Q5 determination the CAA estimated the equity beta for HAL, GAL and the rest of BAA by using the beta for BAA (before it was de-listed) and disaggregating into estimates for the specific segments. This disaggregation reflected a logic ranking of the risks present in each part of the BAA business.
- 5.67 For the Q6 determination the CAA considered the movement in asset betas for comparators airports as well as reviewing key risk drivers (quantitatively and qualitatively) to see if there had been a demonstrable change in systematic risk. The outcome of the Q6 review was that the range for the HAL asset beta had not changed. This is summarised in Table 5.6 below.

Table 5.6 Past CAA decision on HAL asset beta

CAA determination	Range for HAL asset beta	Point estimate
Q5	0.42 to 0.52	0.47
Q6	0.42 to 0.52	0.50

Source: CAA determinations

### Our approach

- 5.68 Our approach is similar to that of Q6. Firstly, we review key systematic risk drivers at HAL, to take an initial view on whether there has been a fundamental movement in the systematic risk effecting the airport. Secondly, we review evidence from comparator airport asset betas, contrasting their exposure to systematic risk to HAL.

## Evidence

### HAL specific evidence

- 5.69 Over Q6 to date HAL has outperformed the CAA's assumptions in all years. This robust performance has been achieved against an economic backdrop of relatively stable and positive economic growth and a continuation of loose monetary policy.
- 5.70 HAL's performance is captured in Table 5.6 below. As shown, HAL on average has achieved a return on average RAB on average 0.8 percentage points above that assumed in the Q6 determination. The level of outperformance it has achieved has also been stable between years.

Table 5.7 Measures of financial performance

Performance measure	FY2014 performance*	Variance to CAA assumption*	FY2015 performance	Variance to CAA assumption	FY2016 performance	Variance to CAA assumption
Total revenue	£2,094m*	+£118m*	£2,745m	+£156m	£2,786m	+£145m
Regulatory operating profit	£710m*	+£112m*	£881m	+£116m	£925	+£106m
Return on average RAB	4.79%*	+0.77%*	5.92%	+0.84%	6.13%	+0.80%

Source: Heathrow regulatory accounts

\* Performance summary for the 9 months ending 31<sup>st</sup> December 2014

- 5.71 When using historical performance to assess risk, we are cognisant that recent years are merely a snapshot. They show HAL's performance in relatively benign economic conditions and do not show whether HAL has become more or less risky in more challenging economic conditions.
- 5.72 Given this Q6 context, considering asset beta of HAL in the 'as is' H7 case, there is little reason to believe the asset beta range applied in Q6 should be amended. This is for three reasons:



- Firstly, there is no reason to consider that HAL is any differently exposed to demand risk, as the airport can be expected to continue to operate in an environment of excess demand and capacity constraints.
- Secondly, there is no expectation of a fundamental change in HAL's cost structure compared to Q6. Therefore, in terms of the impacts of input price risk, operational leverage and capex risk in beta, there is no reason to anticipate a change.
- Thirdly, there is no anticipated material change to regulatory protections or incentives that drive systematic risk e.g. no step change in the protections against capex risk provided by the CAA. Were the regulatory regime to change incentives significantly, then there would be grounds for revisiting the Q6 asset beta range.

5.73 In summary, for HAL 'as is' there is no reason to make a fundamental change to the Q6 beta range of **0.42 to 0.52**. This range also sits comfortably next to other regulatory benchmarks. For example the asset beta used by Ofgem for energy regulation varies from 0.34 (gas transmission) to 0.43 (Scottish electricity transmission). Given that electricity regulation is based upon a revenue control mechanism without exposure to air travel risk, it is appropriate that the bottom end of the HAL range does not extend too far into the range of asset betas used for energy regulation.

#### *Comparator airport evidence*

5.74 As a cross-check against the 'as is' beta range 0.42 to 0.52 we also review beta evidence from a range of international comparator airports.

5.75 The details underlying our methodology are set out in Appendix B of this report.

5.76 Table 5.7 below sets out the asset beta outputs for both daily and monthly beta regressions. The average across all international airports in the sample is 0.43 for both daily and monthly data. However, within the sample there is a wide range of dispersion.

**Table 5.8 asset beta of comparator airports (2-year average of spot rates)**

<b>Company Name</b>	<b>2 Year average (Daily)</b>	<b>2 Year average (Monthly)</b>
Fraport	0.37	0.58
AdP	0.51	0.50
Kobenhavns Lufthavne	0.31	0.41
Flughafen Zurich	0.46	0.41
Flughafen Wien	0.20	0.34
Auckland Intl. Airport	0.71	0.56
Sydney Airport	0.43	0.24
<b>International airport average</b>	<b>0.43</b>	<b>0.43</b>

Source: Thomson Reuters, Capital IQ, PwC analysis

5.77 Within the group of airports above, based on the criteria of comparable size, geography, hub status and similar mix of traffic types, we consider that Fraport (Frankfurt) and ADP (Charles de Gaulle) are the closest comparators for HAL.

5.78 Focusing on these two comparators in more detail, Figure 5.10 below sets out the asset beta outputs for both daily and monthly regressions in recent years.<sup>84</sup> In both instances we present the outputs using a local stock market index and a European wide stock market index to show the sensitivity of outputs.<sup>85</sup> Using daily data the outputs for ADP are close to 0.5 more recently, while for Fraport the outputs more

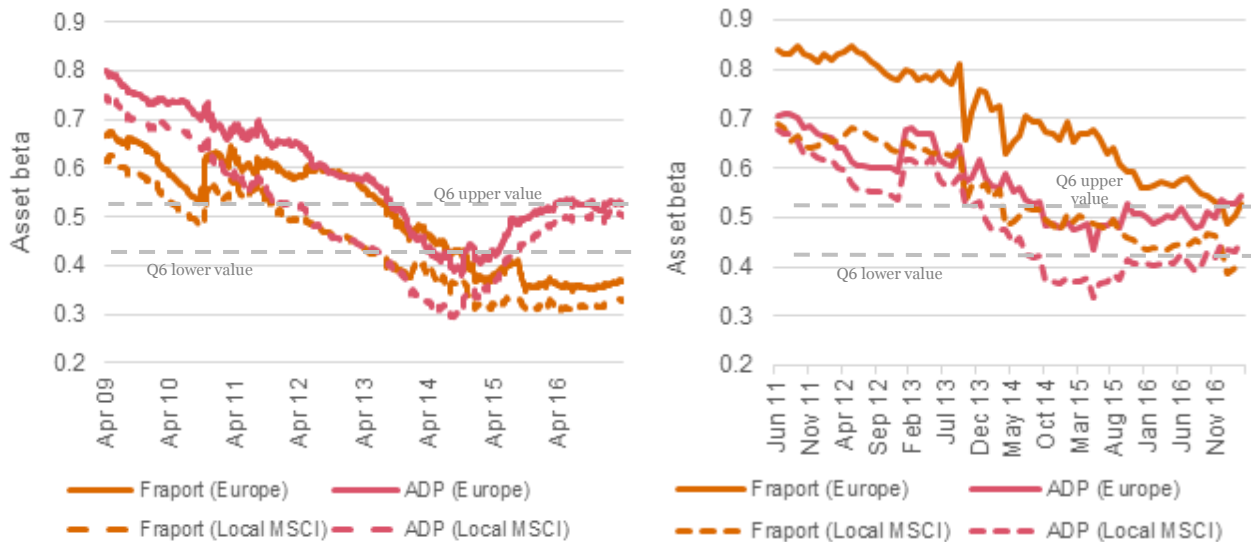
<sup>84</sup> The 5-year monthly analysis ceases at mid-2011 due to data availability for ADP.

<sup>85</sup> Further sensitivity analysis is set out in Appendix B

recently are between 0.3 and 0.4. Using monthly data the recent outputs for ADP are broadly between 0.4 and 0.5 while for Fraport they are closer to a 0.45 to 0.55 range.

- 5.79 The changes in asset beta since April 2014 for Fraport are: -0.11 (daily) and -0.10 (monthly) and for ADP: +0.06 (daily) and -0.04 (monthly).<sup>86</sup> Both airports now have asset betas which are largely within the HAL Q6 range. What is more difficult to ascertain is whether these reductions represent broader market movements (suggesting HAL's risk profile may have changed), or whether Fraport and ADP have become less risky and moved close to HAL (suggesting HAL's risk profile may not necessarily have changed).

Figure 5.10 comparator airport asset beta outputs (Fraport and ADP), LHS – 2yr daily, RHS – 5yr monthly



Source: Thomson Reuters, Capital IQ

Note: De-levered using net debt as a percentage of enterprise value, and debt beta of 0.05. No Blume adjustment.

- 5.80 Given the evidence on the asset beta estimates for Fraport and ADP set out above, it is important to understand the relative systematic risk exposure of HAL relative to these benchmarks. A key area of comparison is differences in exposure to demand risk.<sup>87</sup> In order to review exposure to demand risk we consider three areas of comparison: impact on passenger volumes from the 2009 economic downturn, the relationship between economic growth and passengers, and historical revenue variability.

#### *Impact on passenger volumes from 2009 economic downturn*

- 5.81 In terms of impact on passenger volumes from the 2009 economic downturn, we would expect that airports that were more significantly affected to have higher exposure to systematic risk. In order to capture this impact, we review peak to trough annual passenger change (as given by a rolling 12-month sum of passengers) associated with the economic downturn. This is shown in Table 5.8 below. The evidence shows that peak to trough passenger declines were smallest at HAL in both absolute and percentage terms. In percentage terms, the impact at Frankfurt was over double the size than that of HAL.

<sup>86</sup> Based on European market index values.

<sup>87</sup> Differences in cost risk exposure is another key driver.

Table 5.9 peak to trough passenger numbers associated with 2009 economic downturn

	Heathrow	Frankfurt	Charles de Gaulle
Peak passengers (m)	67.99 (Feb-08)	54.76 (May-08)	61.16 (Oct-08)
Trough passengers (m)	65.67 (Jun-09)	50.85 (Nov-09)	57.91 (Dec-09)
Difference (m)	-2.32	-3.91	-3.26
Difference (%)	-3.4%	-7.1%	-5.3%

Source: Airport traffic statistics

Note: Figures shown are rolling 12-month sums of total passengers

#### *Relationship between economic growth and passengers*

- 5.82 In terms of the relationship between economic growth and passenger growth at each airport, we would expect that airports with a greater degree of systematic risk exposure would exhibit greater passenger sensitivity to the economic cycle. In Table 5.9 below we contrast PAX growth to both domestic GDP and EU GDP growth. We focus on EU GDP growth as Europe is by far the largest market for all of the airports, based on recent traffic statistics we estimates for Europe (including domestic traffic) accounts for approximately 50% of traffic at HAL and approximately 60% at Fraport and ADP.<sup>88</sup>
- 5.83 Under both categories, for this relationship HAL shows the least sensitivity to GDP growth.

Table 5.10 Relationship between GDP growth and passenger growth

Airport	% change in PAX from % change in domestic GDP	% change in PAX from % change in EU GDP
HAL	0.60	0.46
Frankfurt	0.91	1.09
CDG	1.87	1.30

Source: Airport traffic statistics, PwC analysis

Note: Based on quarterly passenger data and GDP from 2003 to 2017 (dummies used for quarters associated with volcanic ash disruption).

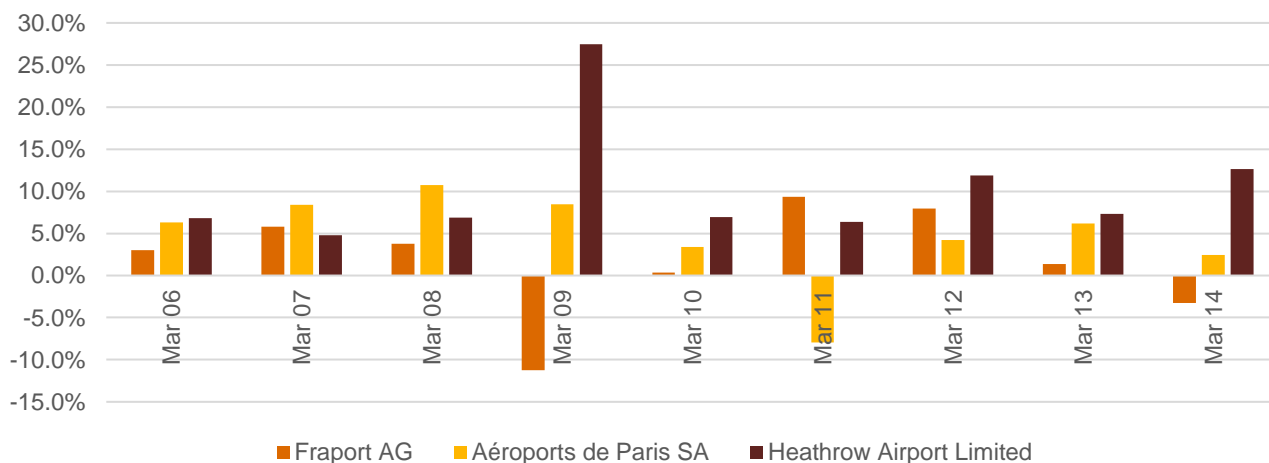
#### *Historical revenue variability*

- 5.84 In terms of historical revenue variability, Figure 5.11 sets out annual revenue growth (to March end each year) over the period 2006 to 2014.<sup>89</sup> The Figure shows that HAL has experienced positive revenue growth in every single year over the period, and has a significantly higher average revenue growth than the other airports. The most notable observation for HAL is the growth to March 2009, which is explained by a step-change in allowed yield per PAX. Across the entire period - including 2009 - all airports have a broadly similar standard deviation in revenue growth. Excluding 2009 - where HAL experienced a step-change in charges – HAL has the lowest standard deviation in revenue growth.

<sup>88</sup> Comparisons to global GDP as not as relevant as global GDP at market exchange rates is largely compromised by the USA, China and Japan (accounting for 45.3% of global GDP accounting to PwC's June 2017 Global Economy Watch) – and these countries compromise only a minor component of traffic at each airport.

<sup>89</sup> We end this analysis in 2014 as HAL changed their accounting year end to December from March from this point onwards.

Figure 5.11 revenue growth by airport



Source: Company accounts, PwC analysis

### Discussion and conclusion

5.85 For HAL ‘as is’ in H7 we have four broad findings:

- We have not identified any fundamental reasons why HAL ‘as is’ will be exposed to a different level of systematic risk relative to Q6.
- Asset betas for international comparators have reduced and are now predominantly within HAL’s Q6 asset beta range.
- On three measures of relative risk, HAL appears to be lower systematic risk than both Fraport and CDG.
- This suggests that the Q6 range for asset beta remains valid, but that a reasonable point estimate could be drawn from the lower end of this range.

## Conclusion on the cost of equity and 'as is' WACC for H7

5.86 Applying our estimates for the RFR, asset beta and TMR we estimate a cost of equity range (real, post-tax) for HAL 'as is' in H7 of 4.9% to 7.1%. Combining this with our estimates for the cost of debt and gearing, Table 5.10 sets out a vanilla H7 WACC for HAL 'as is'.<sup>90</sup>

Table 5.11 H7 vanilla WACC for HAL 'as is'

	Q6 final views		H7 'as is'	
	Low	High	Low	High
Gearing	60%	60%	60%	60%
RFR	0.50%	1.00%	-1.4%	-1.0%
TMR	6.25%	6.75%	5.1%	5.6%
Asset Beta	0.42	0.52	0.42	0.52
Debt beta	0.1	0.1	0.05	0.05
Equity beta	0.90	1.15	0.98	1.23
<b>Real Cost of equity (post-tax)</b>	<b>5.7%</b>	<b>7.6%</b>	<b>4.9%</b>	<b>7.1%</b>
Cost of embedded debt	3.15%	3.65%	1.8%	1.8%
Cost of new debt	2.20%	2.65%	0.15%	0.65%
Weighting of new debt	50.0%	30.0%	12.5%	12.5%
Issuance costs	0.10%	0.10%	0.10%	0.10%
<b>Real Cost of debt (pre-tax)</b>	<b>2.8%</b>	<b>3.5%</b>	<b>1.7%</b>	<b>1.8%</b>
<b>Vanilla WACC</b>	<b>3.9%</b>	<b>5.1%</b>	<b>3.0%</b>	<b>3.9%</b>

Source: PwC analysis

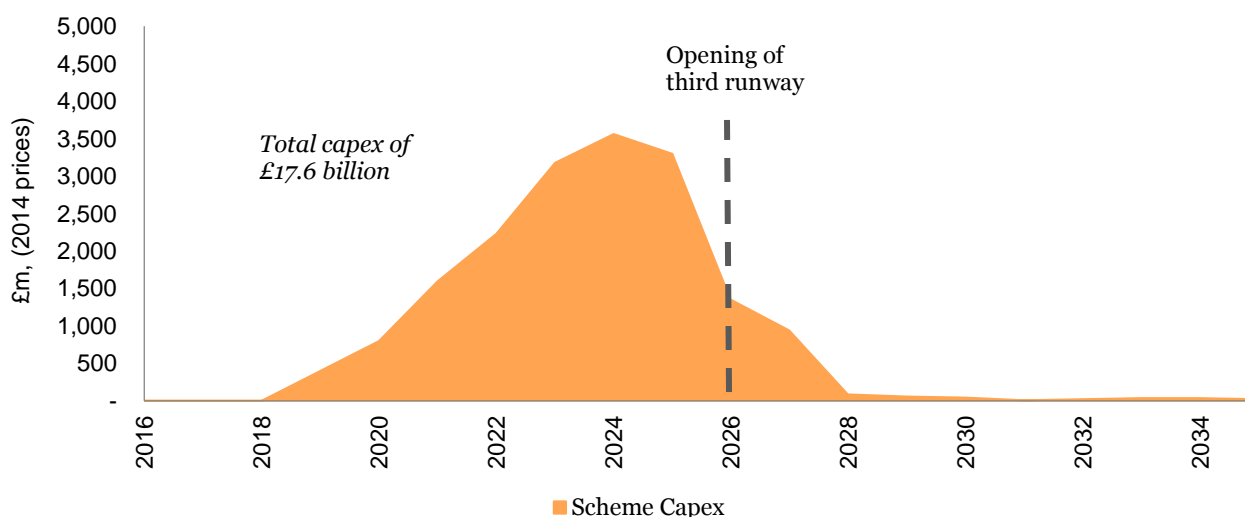
<sup>90</sup> A detailed discussion of asset beta and debt beta is set out in Appendix B.

## 6. Third runway impacts

### Context

- 6.1 In October 2016, the UK government announced its support for a new northwest runway at Heathrow. The scheme is still going through parliamentary and planning processes and is subject to revision. The planned third runway at Heathrow represents a major long-term investment with an estimated overall cost of the scheme of £17.6bn (2014 prices) – see figure 6.1 below.<sup>91</sup> HAL’s financing proposal for the third runway was that the scheme could be financed predominantly by the airport itself.<sup>92</sup> This financing is likely to require a mixture of both new debt and new equity.

Figure 6.1 Third runway scheme capex



Source: PwC report for the Airports Commission - cost and commercial viability

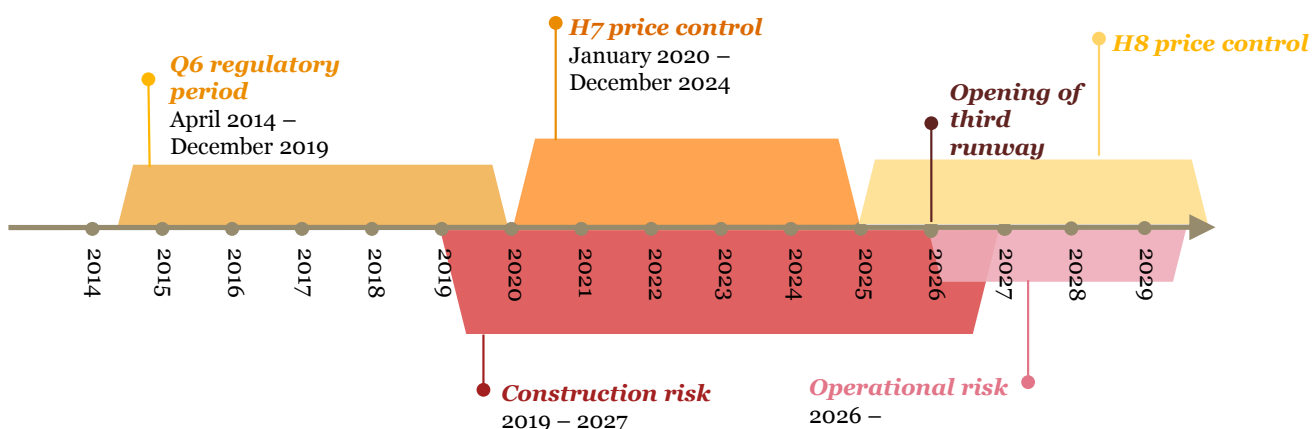
- 6.2 In absolute terms, the scheme will be the largest capital project undertaken by HAL since privatisation. The scheme has been developed over a number of years, through numerous variants. Indeed HAL is continuing to develop variants to manage the costs and benefits of the scheme. We have restricted our analysis to the scheme which was used by the Airports Commission in its review.
- 6.3 The current regulatory regime allows for the recovery of costs associated with seeking to obtain planning permission for the new runway. These are termed Category B costs and are subject to a risk sharing mechanism.<sup>93</sup> The timing of the end of the current price control is currently broadly aligned to the end of the planning stages of the scheme.
- 6.4 In terms of the scheme’s implementation, the construction phase is expected to predominantly take place over the years 2019 to 2025. Under the proposed scheme, the third runway is expected to be open by 2026 – overlapping with some residual construction risk. This is shown in Figure 6.2 below. In terms of the regulatory cycle, this means that the period of construction risk associated with the scheme lies mostly in H7, with operational risk associated with the opening of the third runway concentrated in the subsequent regulatory period (H8).

<sup>91</sup> This section of the report has been prepared using 2015 costs estimates from the Airports Commission for the Heathrow Airport Northwest Runway (LHR NWR). Where an alternative set of data is used e.g. a “quicker and cheaper” option for construction, then some of the analysis in this section would need to be revisited.

<sup>92</sup> Airports Commission - Funding and financing

<sup>93</sup> CAA (2016), “The recovery of costs associated with obtaining planning permission for a new northwest runway at Heathrow Airport: final proposals.” CAP 1469

Figure 6.2 Regulatory and scheme timelines



Source: CAA and Airports Commission

### Treatment of capex risk in H7

- 6.5 As the H7 policy for capex risk is still in the early stages of development, to illustrate the potential capex risk that could occur in H7 we draw upon the treatment of capex risk in Q6 as a point of reference.
- 6.6 The Q6 approach adopted by the CAA splits capex into core and development components. The core component is for projects which have been through HALs internal development process prior to the CAA’s final proposals, whilst the development component covers projects which have been planned but not committed by this point in the regulatory cycle.

#### Core Capex

- 6.7 For core capex, there are fixed-price allowances whereby the CAA allocates risk by waiting to control period end before adjusting the RAB and price-cap to reflect the true costs HAL incurs. This lag ensures that the effects of any under- or over-spend are absorbed by HAL for the remainder of the period before being passed on to passengers through charges.
- 6.8 At the end of the regulatory period, the CAA adjusts the RAB equally for over and under-spending, and additionally requires that HAL is not able to recover costs from airlines that arise through waste and inefficiency. The CAA considers the divergence between actual and projected spend at an aggregate level such that under-spend on some projects offsets overspend on others. When adjusting RAB, the CAA compares actual and allowed capex spend in each individual year and all under- and over-spends are deducted/added to the RAB at the start of the new regulatory period.
- 6.9 As an example of this, if HAL were to overspend by £100 million in year 2 of a regulatory period, it would have to absorb the short-term costs of this, as the RAB would not be adjusted until the end of year 5 (assuming a five year control period).

#### Development Capex

- 6.10 For development capex, the CAA’s allowance is by nature indicative, and therefore there are mechanisms in place that ensure flexibility. The CAA allows development capex to vary in real-time over the course of the regulatory period, such that when capex is realised charges are adjusted to equal what they would have been, had the realised outcome been known at the start of the regulatory period.

*“As an illustrative example of this approach, if the CAA were to provide originally for £200 million of development capex in year 2 of Q6, but HAL made new fixed price commitments for new capex totalling only £100 million by 31 August 2014, there would be a downward adjustment to the originally determined value of the year 2 price cap. The scale of the adjustment would be of the magnitude required to put charges at the level that they would have been had the CAA known the correct year 2*

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*amount from the outset. The same process would operate again before the start of years 3 to 5.”<sup>94</sup>*

- 6.11 We note that under normal circumstances there would not be a specific adjustment made to the WACC for capex, the size of the investment for the third runway and the short time frame in which it will take place suggests the possibility of elevated risk during this period.

### *Summary*

- 6.12 Therefore, were the Q6 approach to be broadly adopted in H7, the current regulatory regime mitigates much of HAL’s risks in relation to third runway capex. HAL’s residual risks relate to:
- i) inefficient and wasteful expenditure (both core and development capex), where HAL is unable to demonstrate that capex was efficiently incurred;
  - ii) scheme failure, which would likely result in unrecoverable costs. Such failure risk reduces as the scheme evolves, but could be driven by technical or wider political factors which are outside the control of HAL;
  - iii) spill-over risks, where the construction activities relating to the new runway impact the performance of the existing airport; and
  - iv) for runway capex treated as core capex - short-term deviation between assumed capex and outturn capex. Where capex has been efficiently incurred it will be compensated at the following price control.

## ***Relationship of high capex with the WACC***

- 6.13 When considering the impact of the third runway on the WACC we have assumed that there will be a single WACC figure applied to a single RAB (as set out in Section 1). This covers all of HAL’s activities – both existing and those related to the third runway.
- 6.14 As set out above, the bulk of the construction phase associated with the scheme will lie within the H7 period. We assume that any construction risks of the scheme in H7 will be accounted for through a premium to the WACC - accounting for both equity financing and debt financing risks.
- 6.15 We are therefore considering the change to the WACC for the integrated business during the period of construction of the third runway. Following the completion of construction, HAL will be a larger airport with three runways and will be exposed to potentially different demand and operational risks, but this will be an issue for consideration in the next (H8) price control.
- 6.16 The academic literature is not clear-cut on the impact of a large capital project on a company. Up-front investment costs are usually treated as the investment itself, rather than impacting the rate of return on investment. Viewed this way, a large capital project is merely an increase in the size of the business, rather than a change in risk profile.
- 6.17 Viewed, alternatively, as a series of large investment expenditures, in comparison to a situation where such investment are not made, then the company is bearing additional risk whilst these investments are being incurred. These risks impact future rates of return, as a cost overrun on a capital investment (with no change to capacity) will depress future returns in relation to investment.
- 6.18 The degree to which these risks are systematic will depend on the nature and mix of the costs involved. Some costs (e.g. raw materials, wages) may vary with broader economic conditions, and therefore would be expected to incorporate systematic elements. However, cost risks can be negatively correlated with market risks (as a strong market and economic environment (a positive value effect) can drive up

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<sup>94</sup> CAA (2014) *Economic regulation at Heathrow from April 2014: initial proposals*, Chapter 12: Regulatory Incentives – Capital Efficiency, pp. 217



costs (a negative value effect)). So, the directional impact of large capital programmes on betas is conceptually unclear.

- 6.19 Observation of the risk registers of large projects suggest that overall project risks are highest during the early stages of construction and gradually fall away as uncertainties become better understood and managed. However, such risks are typically very specific to the project and not influenced by broader economic and market factors. This means they are important to manage, but as long as the project can both outperform and underperform in equal measure, then this should have limited impact on the required rate of return.
- 6.20 From an empirical perspective, highly capex intensive activities can contain more systematic risk, such as property developers who typically have higher betas than property landlords,<sup>95</sup> but regulated businesses typically have greater regulatory protections around their capital investment (e.g. RAB-based regulation), so observations from non-regulated sectors need to be treated carefully.
- 6.21 As a consequence of ambiguous directional impacts from academic perspectives, in order to assess the impact of the scheme on HAL's WACC we review case studies of other cost of capital adjustments which have been made to capture the impact of additional risks in the construction phase of a project. We then logically benchmark the third runway scheme against these case studies. We set out six key case studies below:
- i) HAL – Terminal 5;
  - ii) Ofgem RIIO;
  - iii) Thames Tideway Tunnel (TTT);
  - iv) Offshore wind projects;
  - v) OFTOs; and
  - vi) Hinkley Point C.
- 6.22 We then review the impact of the third runway on HAL's overall gearing and mix of embedded and new debt financing. Lastly we consider the requirement to allow HAL to recover additional efficient issuance costs in relation to new equity finance.

## Case studies of construction phase risk

### HAL - Terminal 5

- 6.23 The construction of Terminal 5 is an example of a large capital programme that HAL has previously delivered. Constructed over the period 2003 to 2007, Terminal 5 led to a CAA forecast of HAL incurring a Capex to average RAB ratio over 15.8% over the Q4 regulatory period. The forecasts for Q4 are captured in Table 6.1 below.

Table 6.1 Q4 Capex to RAB ratio

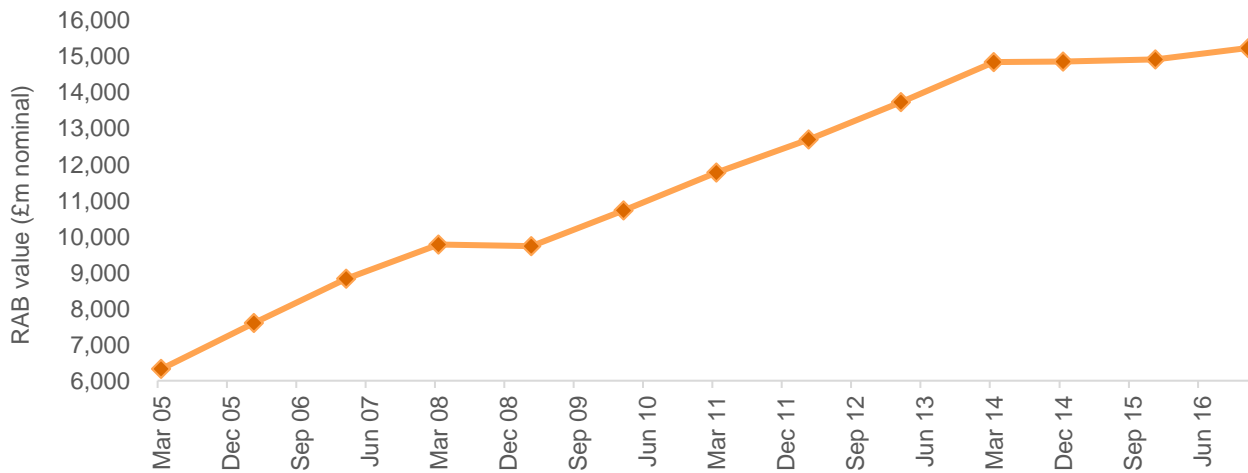
	2003/4	2004/5	2005/6	2006/7	2007/8	Average
CAPEX (£m)	792	817	948	796	801	
Opening RAB (£m)	4026	4530	5074	5777	6341	
Closing RAB (£m)	4530	5074	5777	6341	6919	
<b>Capex to average RAB (%)</b>	<b>18.5%</b>	<b>17.0%</b>	<b>17.5%</b>	<b>13.1%</b>	<b>12.1%</b>	<b>15.6%</b>

Source: CAA Q4 decision

<sup>95</sup> For example, the asset beta for Barratt Developments plc (a large housebuilder) is approximately 0.9, while the asset beta for Grainger plc (a large UK residential property manager) is approximately 0.3.

6.24 More broadly, HAL's RAB has expanded significantly since 2005, approximately doubling over the period 2005 to 2012 as Terminal 5 (T5) was completed and other enhancements were made. This is shown in Figure 6.3 below.

Figure 6.3 HAL actual RAB (nominal terms)



Source: HAL regulatory accounts

6.25 Comparing previous levels of capex incurred at HAL to the third runway scheme, we find that it is comparable in terms of its proportion to the existing asset base. Based on proposed scheme data from 2015, we find that the average capex to average RAB ratio over H7 (including core capex and asset replacement) is similar to the past period.<sup>96</sup> This is shown in Table 6.2 below.

Table 6.2 H7 capex to average RAB

	2020	2021	2022	2023	2024	Average
Scheme capex (£m)	797.6	1,595.1	2,228.6	3,178.8	3,560.2	
Asset replacement (£m)	294.7	294.9	294.5	302.1	305.0	
Core capex (£m)	225.7	460.7	588.5	737.0	1,162.9	
Average RAB (£m)	14,635.2	15,633.2	17,453.0	20,124.3	23,651.5	
<b>Capex to average RAB (%)</b>	<b>9.0%</b>	<b>15.0%</b>	<b>17.8%</b>	<b>21.0%</b>	<b>21.3%</b>	<b>16.8%</b>

Source: Airports Commission

6.26 Given the similarities that exist in terms of proportional scale to the existing business, we review the treatment of the WACC during the Q4 period.

#### Q4 WACC

6.27 At the time when T5 was proposed, BAA operated Heathrow, Gatwick and Stansted airports. As part of the Q4 price review, the CC assessed the potential impact of the construction and operation of T5. As part of this review into the WACC, the CC identified four risks associated with T5:

- Delays – for which BAA would suffer substantial financial penalties even if they were outside of their control;
- Early initiation of construction – BAA gave up its option to delay construction;
- Increased borrowing increasing BAA's gearing which would increase both debt premiums and equity beta reflecting the greater risk faced by shareholders; and

<sup>96</sup> Surface access costs associated with the scheme have been excluded.

- The potential for BAA to outperform the price control during the course of construction was limited but there was potential for BAA to fail to meet the expectations incorporated in the price control which would financially disadvantage BAA.

6.28 As a result of these factors, the CC recommended to the CAA that the overall WACC be increased by 0.25 percentage points.<sup>97</sup>

6.29 Following this recommendation from the CC, in the CAA decision for the WACC at HAL in Q4 (made February 2003), stated that,

*“the scale of a project like Terminal 5 clearly involves accessing the capital markets as it is unlikely to be possible to fully finance such a project from internally generated cash flow...”*

*Large investment projects tend to be risky in a number of ways. The scale of Terminal 5 will increase BAA’s risks, not only with respect to construction risk but also risks of uncertain demand and risks associated with the Terminal 5 triggers as pointed out by the Competition Commission. Regulatory commitment is another issue influencing risk. The degree to which these risks are diversifiable will differ...*

*a beta close to one seems appropriate for Heathrow, given the specific circumstances as discussed above, most notably the option to raise new equity...*

*This results in a cost of equity figure above the mid-point of the range as determined by the Competition Commission. This therefore results in a pre-tax real cost of capital figure also above the mid-point of the range. In the view of the CAA a point estimate of 7.75% pre-tax real for Heathrow’s cost of capital is appropriate and reasonable. This figure reflects the uncertainty surrounding the cost of equity, and especially the cost of new equity, and the importance of enabling BAA to finance Terminal 5 on a commercial basis given the risks involved.”<sup>98</sup> [emphasis added]*

6.30 As set out above, in light of the construction risk, demand risk and considerations of the CC, the CAA opted for an equity beta figure close to one (from a range of 0.8 to 1.0). A figure towards the top end of the plausible WACC range was therefore considered appropriate coverage for the risks associated with T5 (rather than an explicit adjustment being made).

## Ofgem – RIIO

6.31 Ofgem’s determinations under the RIIO framework have considered a standard set of measures when assessing relative risk between regulated companies. Of these measures, the two that are most relevant here are the scale of investment and the complexity of investment.

6.32 Ofgem has previously stated that:

*“We regard the scale of investment as the most significant differentiator of risk affecting both the asset beta (and, therefore, the cost of equity) and the appropriate level of notional gearing.”<sup>99</sup>*

6.33 In considering the scale of investment, Ofgem uses the ratio of capex to regulatory assets as their core measure. The impact of the scale of investment can be demonstrated by setting out the gearing and asset beta selected for different regulated companies alongside the scale of their investment (as inferred from the figures published in the final proposals for RIIO-T1). This is shown in Table 6.3 and Table 6.4 below.

<sup>97</sup> This uplift was applied to all three designated airports, of which HAL’s RAB comprised 75% of the total (based on Q4 closing RAB). Therefore, if this uplift had been concentrated on HAL’s RAB only, it could be adjusted by a factor equal to (1/0.75). Providing a WACC increase specific to HAL of 0.33%.

<sup>98</sup> CAA (2003), ‘Economic Regulation of BAA London Airports (Heathrow, Gatwick and Stansted), 2003-2008

<sup>99</sup> Ofgem (2012), ‘RIIO-GD1: Final proposals – Finance and uncertainty supporting document’, para 3.14

Table 6.3 RIIO-T1 gearing asset betas

	Scottish Power Transmission Limited (SPTL)	Scottish Hydro Electric Transmission limited (SHETL)	National Grid Electricity Transmission (NGET)	National Grid Gas Transmission (NGGT)
Gearing	55.0%	55.0%	60.0%	62.5%
Asset beta	0.43	0.43	0.38	0.34

Source: Ofgem, RIIO-T1

Table 6.4 Relative risk of firms to NGET

	Risk of each firm relative to NGET		
	SHETL	SPTL	NGGT
Scale of investment	Higher	Similar	Lower
Totex variability	Higher	Higher	Lower
Complexity of investment	Similar	Similar	Lower
Totex incentive rate	Higher	Higher	Lower
Totex approach	Similar	Similar	Similar
Focus on outputs	Similar	Similar	Similar
Uncertainty mechanisms	Similar	Similar	Higher
Incentives	Similar	Higher	Higher
Pension costs	Similar	Similar	Higher
Cost of debt approach	Lower	Similar	Similar
Length of price control	Similar	Similar	Similar
Timing of revenue adjustments	Similar	Similar	Similar
<b>Overall</b>	<b>Higher</b>	<b>Higher</b>	<b>Lower</b>

Source: Ofgem, RIIO-T1

- 6.34 As set out in the tables above, there is a difference between SHETL and NGET of 0.05 in asset beta assumption.<sup>100</sup> SHETL also has a regulatory gearing assumption 5% below that of NGET. A key risk differentiator driving the differences in these point estimates between the two is the scale of investment, for example, SHETL was projected to have capex of around 27% to RAV over T1, while NGET was projected to have capex of around 13% to RAV.<sup>101</sup>
- 6.35 However, not all of this difference is attributable to the scale of investment alone. As shown in Table 6.4 above, there are risk differences between the two firms in terms of both totex variability and the totex incentive rate – with SHETL facing higher risk on both relative to NGET.
- 6.36 Assuming that attributing the full WACC difference between SHETL and NGET presents an upper bound impact for the scale of investment, this upper bound estimate can be expressed as shown in Table 6.5 below. By assuming the same illustrative cost of debt of 2.5% for both SHETL and NGET, and given that they both had a cost of equity of 7.0%, the maximum difference in WACC attributable to the scale of investment is 0.23 percentage points.

<sup>100</sup> Inferred from the available figures on cost of equity and gearing.

<sup>101</sup> Including base capex, volume driver capex and Strategic wider works capex.

Table 6.5 Upper bound impact of scale of investment on WACC

	SHETL	NGET
Cost of equity	7.0%	7.0%
Cost of debt (illustrative)	2.5%	2.5%
Gearing	55%	60%
Illustrative WACC	4.53%	4.30%
<b>Difference</b>		<b>0.23%</b>

Source: PwC analysis, Ofgem RIIO-T1

6.37 More generally, in developing the cost of equity range for the initial RIIO controls, Ofgem noted that:

*“The figures show that our indicative range offers attractive returns on equity compared to European and US regulated utilities. We think that this is appropriate given the need to attract investment into the sector during RIIO-T1 and GD1 in order to finance investment that will facilitate achieving the UK’s low carbon objectives.”<sup>102</sup>*

6.38 This view is consistent with the view of the CAA set out above, which is that cost of equity allowances towards the upper end of a plausible range can be sufficient to encourage equity investment.

### Thames Tideway Tunnel (TTT)

6.39 Regulated projects, such as the Thames Tideway Tunnel (TTT), can also provide an indication for the cost of equity required by investors on large capital intensive projects as compared to the cost of equity set for the wider regulated wholesale water and wastewater business. This can be done by comparing the implied cost of equity from the regulated project to the cost of equity used for the regulated wholesale business.

6.40 For TTT, the weighted average cost of capital (WACC) was determined through a bidding process (of which the bid WACC was a part), in which private companies wishing to be appointed the infrastructure provider for the project submitted bids for their expected WACC. The outcome of this was a bid WACC of 2.497%.

6.41 Depending on the cost of debt and gearing assumption assumed, this bid WACC can be used to infer a cost of equity for the project. However, this inferred cost of equity may not be directly comparable to the wider industry cost of equity due to being a large stand-alone construction project (involving building a tunnel under London) with a government support package for the project (and other bespoke regulatory mechanisms in place for the TTT).

6.42 Attempting to take these into account, Oxera calculated an implied cost of equity of 5.5%, close to the Ofwat PR14 estimate of 5.65%. Their calculation involved making an adjustment by adding 50 basis points to the bid WACC to account for the liquidity allowance that TTT received as part of the revenue building blocks, and assumed a gearing of 62.5% with a cost of debt of 1.5%.<sup>103</sup>

6.43 TTT therefore indicates that an uplift to the underlying cost of equity of the wider regulated business may not be required. However, estimates regarding TTT are subject to uncertainty regarding the value of the government support received.

### Offshore wind

6.44 In 2012, the Crown Estate produced a study ‘The Crown Estate’s Offshore Wind Cost Reduction Pathway Study’ which sought to provide evidence of options for cost reduction. One stream of this study was a finance work stream which aimed to assess the role of finance and insurance in contributing to

<sup>102</sup> Ofgem (2011), ‘Decision on strategy for the next transmission and gas distribution price controls – RIIO-T1 and GD1 financial issues.’

<sup>103</sup> Oxera (2015) ‘Agenda: The Thames Tideway Tunnel: returns underwater?’, September 2016

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alternative potential cost reduction pathways towards £100/MWh by 2020. As a part of this study, PwC assessed the demand for and availability of funding for UK offshore wind over the period 2011-20, and found that total funding requirements ranged from £36bn under a slow progression, to £68bn under the assumption of rapid growth.

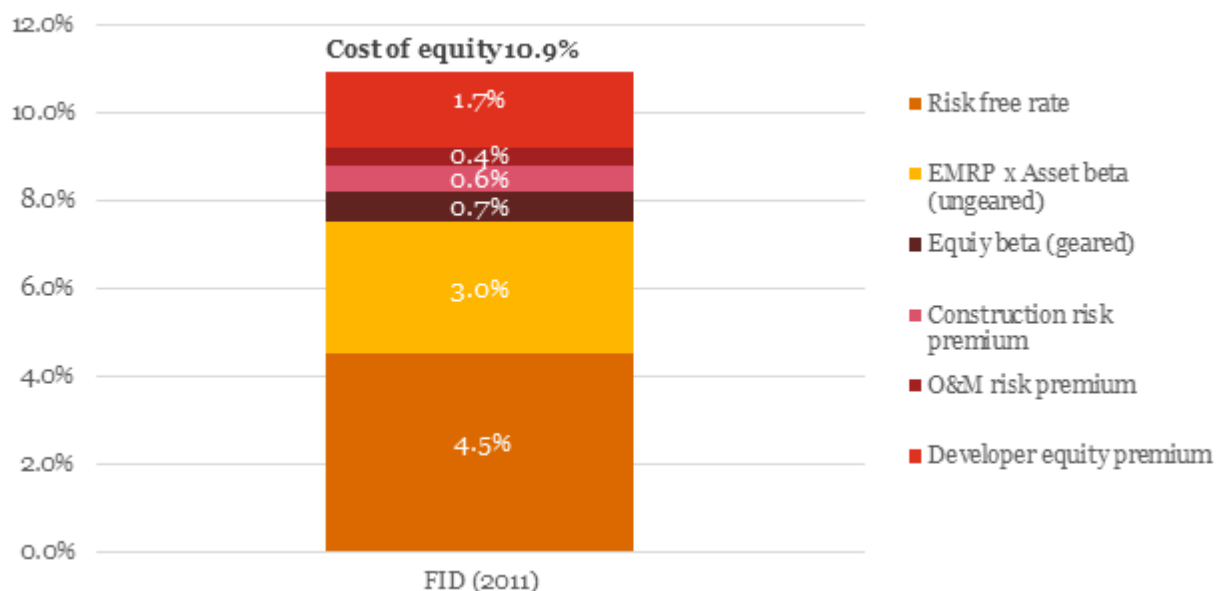
- 6.45 Within the sector a shortfall in funding was expected. Drivers of this shortfall included:
- limited debt funding reflecting the challenges of finding a structure that allows utilities to use project debt;
  - the need to retain relatively conservative gearing levels in order to attract project bond investors (relevant only at the end of the decade); and
  - limited appetite from financial investors to invest in the sector due to the perceived risks it presents (both at market and project level).
- 6.46 Given this context, developers require a higher return on equity investment to compensate for the risk associated with the wind sector given its relative immaturity.
- 6.47 The study assumed that construction would be financed entirely by equity, and debt funding would be introduced after a year of operations, with a maximum gearing of 40%.
- 6.48 Meanwhile, risks that reside within the supply chain were expected to be reflected in the pricing of supply chain elements. So, if a supply chain contractor was required to bear materials costs or disruption impacts, it would include this risk in its price.
- 6.49 The risks which remained at a developer level then therefore needed to be captured through:
- Cost estimates;
  - Contingencies; and/or
  - Appropriate risk premia.
- 6.50 The complexities and relative inexperience in the construction of offshore wind projects had previously resulted in severe project cost overruns in some instances, and it was noted that delays to completion could have a material impact on both the overall construction cost and the value of lost revenue that might result from any subsequent delays in commissioning the site.
- 6.51 To incorporate the cash flow risk PwC adjusted cash flows to include a contingency of the level typically in offshore wind projects. For the 2011 base line offshore wind project, PwC assumed a contingency of 10% of capital costs. This uplift was included on all construction phase capex costs, and was expected to cover some small cost overruns.
- 6.52 Outside of these contingencies, additional downside risk was captured by adjusting the cost of equity. This was done as follows:
- Firstly, holding all other inputs constant, an increase in expected costs due to uncertainty will cause the levelised cost of energy (LCoE) to increase.<sup>104</sup>
  - Provided with this, the same increase in the LCoE can be replicated by adjusting the cost of equity and holding the costs at their original input levels.
  - The increase in the cost of energy that generates this increase in the cost of equity then represents the increase in investment returns that investors require for being exposed to this potential increase in installation and operational costs.

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<sup>104</sup> The levelised cost of energy (LCoE) is a metric used within the utility industry for the cost of energy and is the net present value of building and operating a power plant over its estimated lifetime

- 6.53 Feedback from industry stakeholders within the offshore wind sector was used to inform the findings. The feedback collected suggested that developers typically target a post-tax nominal equity return of between 9-11%, with some, but not substantial gearing.
- 6.54 Those developers who sought to adjust for risks in their cash flow projections typically used a cost of capital towards the bottom end of this range, whereas those developers who used the cost of capital to capture risks which have not been explicitly modelled used figures towards the upper end of this range.
- 6.55 PwC selected a figure of 10.9% for the lifetime cost of equity, which incorporated an additional risk uplift of 1.7 percentage points. The weighted average-post tax, nominal cost of capital for a UK offshore wind project reaching FID in 2011, was estimated to be 10.1% (7.5% post-tax, real). This is shown in Figure 6.4 below.

Figure 6.4 Crown estate cost of equity (post tax nominal, FID 2011)



Source: PwC (2012), *Offshore wind cost reduction pathways study: Finance work stream*, Figure 32, pp. 82

- 6.56 Consistent with the risks occurring in the H7 period for HAL, we focus on the construction phase. The appropriate benchmark is therefore a 0.6 percentage point premium to the cost of equity. Given that the construction phase gearing was assumed to be 0%<sup>105</sup> in the baseline cost of capital assumptions, we treat the cost of equity uplift here as being equivalent to a WACC uplift.

## OFTOs

- 6.57 During the planning and construction phase of the construction of generator build offshore transmission and interconnector assets, developers invest with no returns on investment until project completion. To determine the final asset values developers receive on assets when Offshore Transmission Owners take ownership of the assets, Ofgem include the efficient cost of capital for construction through Interest During Construction (IDC). The IDC is the weighted sum of:
- the cost of debt,
  - cost of equity,
  - a factor to allow for construction phase risk (determined using estimates of the lower returns investors require during the operation phase), and for interconnector projects,

<sup>105</sup> PwC (2012), *Offshore wind cost reduction pathways study: Finance work stream*, Table 20, pp. 82

- a factor to allow for development phase risk (economic and efficient offshore transmission development costs are reimbursed therefore there is no development risk for these projects).

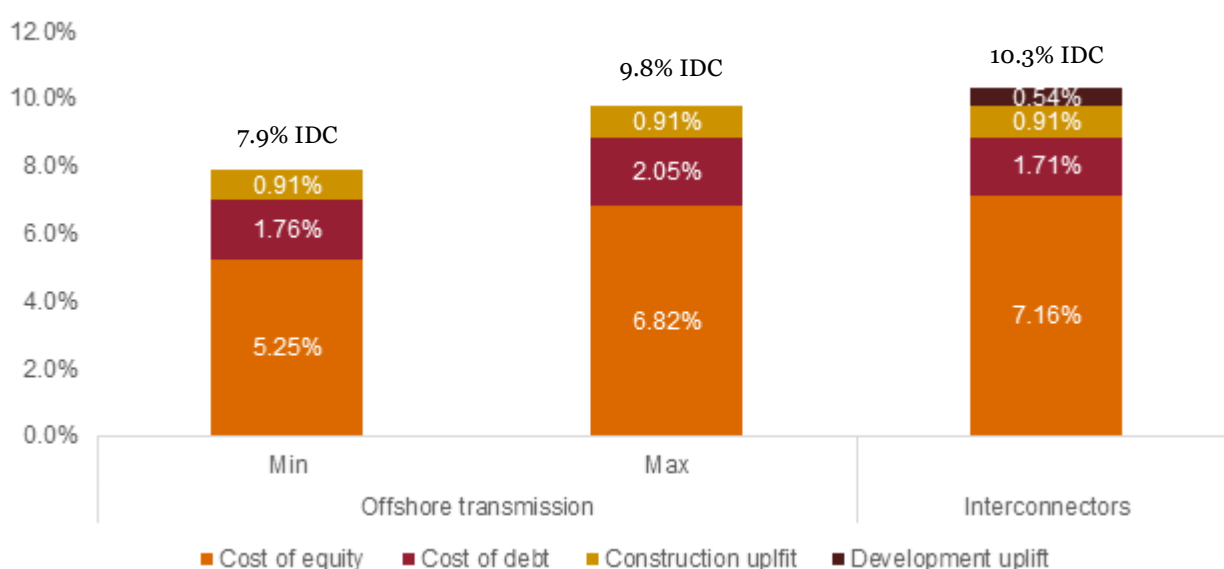
6.58 To determine the efficient cost of capital for construction, Ofgem allows for the application of a cap for IDC. In 2016, Ofgem published a consultation document which proposed an updated capped rate of IDC and set out their methodology for calculating the IDC. The parameters used to calculate the IDC are shown in Table 6.6 and Figure 6.5 below.

Table 6.6 IDC illustration, nominal terms

	Offshore Transmission	Interconnectors
Tax rate	23%	23%
Equity beta	0.88	1.07
Cost of equity (post-tax)	6.75%-8.77%	8.63%
Cost of debt (post-tax)	3.37%-3.93%	3.65%
Development premium uplift	-	0.54%
Construction premium uplift	+0.91%	+0.91%
Post-tax WACC	5.4%-6.8%	6.8%
Pre-tax WACC	7%-8.9%	8.9%
Vanilla IDC	6.71% - 8.21%	8.68%

Source: Grant Thornton (2013) *A review of IDC for generator build offshore transmission projects and Project NEMO – Stage 2 report*, Table 12 pp. 34

Figure 6.5 Offshore transmission and interconnector, pre-tax IDC



Source: Grant Thornton (2013) *A review of IDC for generator build offshore transmission projects and Project NEMO – Stage 2 report*, Figure 9 pp. 33

6.59 Ofgem has a responsibility to allow for a return that is proportional to the risks of the investment, and as such the risks are factored into the determination of the IDC. Six fundamental risk types are considered in relation to offshore transmission investments:

- Development risk – the risk associated with project activity until the final investment decision i.e. the feasibility of work (both technical and financial), and the process of gaining the permissions and consent that the project can progress. The development risk for OFTO is linked to the generating asset as investors only proceed with the offshore transmission link if the whole wind farm is viable. The IDC mechanism reimburses the costs of developing the offshore transmission link. A development risk premium uplift is included in the IDC of 0.54 percentage points.



- Construction risk – the risk that occurs during the construction phase of the project e.g. cost overruns, delays, failure to achieve the quality benchmarks etc. The more established a project is, the more easily the construction risk can be transferred to contractors on a value-for-money basis because a model can be used where the contractor is responsible for overall risk across the range of construction activities. Contractors can less easily price the construction risk for offshore transmission projects because they are bespoke and complex assets, therefore developers are responsible for part of the construction risk. A construction risk premium uplift is included in the IDC of 0.91 percentage points.
- Capex regulation – when costs are not considered to be economic and efficient by Ofgem, they are not reimbursed and developers may be uncertain about the extent to which costs will be reimbursed given they may be uncertain about what is considered by Ofgem economic and efficient.
- Technology risk – the risk introduced by the use of technologies e.g. due to risk of failure, lack of experience with technology.
- Financing risk – the risk brought about by the impact of challenging market conditions on financing offshore; Transmission Owners may experience difficulty refinancing once interconnectors are operational. Developers of offshore transmission assets have pre-determined exit options whereby the capital can be recycled, however for interconnectors, investors depend on the operational revenues and refinancing to bring return on investment and therefore financial risk is higher.
- Investment risk – changing capex will bring varying impacts on total project return.

6.60 The premium that is relevant to HAL in this context is the construction uplift of 0.91 percentage points. The development uplift is of less relevance given that HAL will have completed the development phase by H7.

### *Hinkley Point C*

6.61 In the National Audit Office (NAO) June 2017 report on Hinkley Point C, the NAO consider the relationship between deal type, investor return and strike price (see Appendix 4 of the NAO report). Namely, of most relevance to the third runway context is the ‘Hybrid regulated asset base model’ as this is the closest proxy to the current regulatory model applied at HAL.

6.62 This deal type is described as:

*“The government agrees to provide investors with a return during construction. Consumers’ energy bills would increase during the construction period.”*

6.63 The NAO then consider two scenarios under this deal type. These are:

1. Consumers are reimbursed if the project is not complete. Investors bear similar construction and operational risk as the current HPC deal.<sup>106</sup> In essence, there is no construction risk sharing meaning this risk is fully borne by the developer. For this scenario the NAO assume a 9% nominal equity return for investors.
2. Consumers share the construction risk with investors and do not get compensated for failure to complete or costs overruns. This scenario therefore offers a much greater degree of protection for the developer. For this scenario the NAO assume a 7% nominal equity return for investors.

6.64 From these two scenarios, we find that for a project with the following characteristics:

- (i) a standalone construction project,

<sup>106</sup> The construction risks under the current HPC deal is considerable. For example, similar construction projects – which apply complex technology – have experienced very substantial cost overruns and delays.

- (ii) where there is a material step-change in construction risk from sharing to zero risk sharing; and
- (iii) there is a history of substantial cost overruns and delays associated with the technology being applied.

6.65 The risk premium to the WACC associated with construction could therefore be as high as 2 percentage points. This is captured in Table 6.7 below which sets out an extract from Figure 19 in the NAO report.

Table 6.7 Extract from Figure 19 of NAO Hinkley Point C report

Deal type	Description	Private investor return	Risk sharing		
			Construction	Operational	Financial
Hybrid regulated asset base model	Consumers are reimbursed if the project is not completed. Investors bear similar construction and operational risk as the current HPC deal. We assume a 9% return	9% (post-tax, nominal)	No	Shared	No
	Consumers share the construction risk with investors and do not get compensated for failure to complete or costs overrun. We assume a 7% return.	7% (post-tax, nominal)	Shared	Shared	Shared

Source: NAO

6.66 While this 2 percentage point differential between the two scenarios is an assumption of the NAO it provides another reference point in guiding the magnitude of a potential construction risk uplift to the WACC.

## Conclusion on construction phase risks

6.67 Having set out six case studies on the relationship between construction risk and the WACC we find that the weight of evidence is towards the provision of an upward adjustment to the WACC and that the range of uplifts varies from 0 to 2.0 percentage points.

Translating this into a setting where the adjustment is being applied to a ‘single WACC for a single RAB’ case, we apply an adjustment to some of the case studies set out above. These adjustments are shown in the table below.<sup>107</sup> The range of scaled adjustments produced is 0 to 1.1 percentage points.

<sup>107</sup> Where a WACC adjustment is associated with a standalone project we weight the adjustment by a factor of 55%, this corresponds to the relative weights of HAL’s ‘as is’ RAB and the scheme capex associated with capacity expansion – which are approximately £14.5bn and £17.6bn respectively. For the T5 adjustment an 133% scaling factor reflects the relative proportion of HAL’s RAB to BAA’s RAB. For Ofgem RIIO the uplift is already applied within a single WACC / single RAB setting – so no scaling is required.

Table 6.7 Scaled WACC adjustments from case studies (in ascending order)

Case study	WACC uplift (pps)	Scaling factor (%)	Scaled WACC uplift (pps)
TTT	0	100%	0.00
Ofgem RIIO	0.23	100%	0.23
CC/CAA T5	0.25	133%	0.33
Crown Estate Offshore Wind	0.6	55%	0.33
Ofgem OFTOs	0.9	55%	0.50
Hinkley Point C	2.0	55%	1.10

Source: PwC analysis

6.68 Of the case studies discussed above some are more relevant to likely H7 risks than others. In Table 6.8 we summarise the findings of each of the case studies above. We then place HAL logically against these benchmarks to reach a view on the uplift to account for third runway scheme risks.

Table 6.8 Relevance of case studies

Case study	Notes	Relevance for H7
CC/CAA T5	The T5 WACC uplift was for specific to HAL where the a large terminal capital programme was occurring alongside the existing regulated business. The uplift factored in aspects such as construction risks, some element of demand risk, potential increases in financing premiums and considered asymmetric risks arising from the limited ability to outperform. The CCMA applied a 0.25 percentage point uplift to the entire BAA group, which is equivalent to 0.33 percentage points if applied only to Heathrow.	<b>High</b> – HAL specific case study.
Ofgem RIIO-T1	The WACC uplift (calculated) associated with the scale of investment represents an upper bound estimate. Other relative risk factors associated with totex mean that a central uplift for scale of investment alone is likely to be lower than this. Specifically, the figure of 0.23 percentage points is commensurate with approximately a 14% increase in the Capex:RAB ratio.	<b>Medium</b> – related to scale of investment.
Thames Tideway Tunnel	The Thames Tideway Tunnel is largely a standalone project – delivered through an infrastructure provider distinct from Thames Water. The project also received some governmental assistance. It is though, regulated on a RAB basis.	<b>Low</b> – similar regulation but a distinct project with additional government support.
Crown Estate Offshore Wind	Developer risk has been driven by the complexities and relative inexperience in the construction of offshore wind projects, which has previously resulted in some severe project cost overruns.	<b>Low</b> – bearing significant long-term project risk.
Ofgem OFTOs	Offshore transmission projects are bespoke and complex assets and involve bearing construction risk. Technology risk specific to OFTOs are potentially less relevant.	<b>Low</b> – additional risks not relevant to HAL.
Hinkley Point C	The NAO report specifically considered the level of return required under a ‘hybrid’ RAB model. However, there is a history of considerable cost overruns and delays associated with the technology being applied.	<b>Low</b> – could become more relevant where construction capex risk was entirely borne by investors.

Source: PwC

6.69 As shown by the case studies above, there is support for the provision of an uplift for construction phase impacts. Within the set of case studies reviewed the similarities between T5 and the third runway scheme, and the uplift implied from benchmarking against Ofgem’s RIIO-T1 determination, suggest that a logical positioning against precedents supports a WACC uplift towards the lower end of the range

set out above. However, a case could also be made for the uplifts towards the upper end of the range, particularly in a scenario where capex incentives exposed HAL's investors to a greater degree of risk – especially if such risk was asymmetric. In terms of forming a plausible range for this uplift, we propose an indicative range of **+0.25% to +1.0%**; this relatively wide range reflects the developmental stage of the H7 price control.

- 6.70 This WACC uplift range should be reviewed as the risk profile surrounding the construction of the third runway becomes better understood and the CAA's regulatory regime evolves.

## **Financing structure and weighting new and embedded debt**

- 6.71 For the purposes of this report, we assume our notional gearing level is sustained by HAL throughout the construction of the third runway. This requires that the additional capex is funded in the same proportions as the notional capital structure. So for every £100 of capex, £60 is funded through debt and £40 through equity, either by way of retained earnings or through issuance of new equity.
- 6.72 The impact on HAL's credit metrics will depend upon the regulatory approach adopted and the associated charging profile. Where a revenues start recovering capital expenditure in the year it is incurred then there is likely to be little impact on credit metrics, rating and cost of debt. Where charging for the investment in the new runway is not allowed prior to its operational launch, then credit metrics will likely deteriorate, and maintaining the notional capital structure may suggest a higher cost of debt is warranted.
- 6.73 Assuming a constant 60% notional capital structure, we can estimate the proportion of new debt relative to total debt in H7. As a result of the scheme capex, significant new debt issuance will be required relative to the 'as is' case for HAL in H7. The viability of this notional funding structure will require testing through financeability analysis and will also depend on the regulatory approach implemented by the CAA for H7.
- 6.74 As shown in Table 6.9 below, this notional assumption results in a new debt percentage of 60% for the integrated HAL business of H7.

**Table 6.9 Proportion of new debt**

<b>Item</b>	<b>Value</b>
Scheme cost (2014 prices) (£bn)	17.6
Assumed illustrative 'as is' RAB (2014 prices) (£bn)	14.5
Notional Gearing (%)	60%
Notional debt stock (£bn)	8.7
As is' new debt (%)	13%
As is' new debt (£bn)	1.09
New scheme related debt (£bn)	10.6
New debt required H7 (£bn)	11.6
Embedded debt H7 (£bn)	7.6
<b>Proportion of new debt</b>	<b>60%</b>

Source: PwC, Airports Commission

## Equity issuance Costs

- 6.75 In recognition of the need for equity issuance in the upcoming price controls Ofgem provided an allowance for equity issuance costs. This was also allowed by Ofwat in PR09.
- 6.76 Some network companies may need to increase equity to maintain their credit metrics at a ‘comfortable investment grade’, given that the investment expected during RIIO-T1 is large. Ofgem therefore makes an *ex ante* allowance, on an annual basis, to account for the cost of raising equity which is set equal to 5% of the amount of notional new equity required to be issued during the price control period.
- 6.77 To determine the level of equity issuance required, Ofgem analyses the credit metrics used in financeability analysis. A simplified example of the process, which only considers gearing, is provided by Ofgem:
- *“Step 1 – The model is run with forecast RAV changes over the price control period (forecasts for totex, depreciation, tax, incentive revenue, inflation, etc.), with gearing assumed at the notional level at the start of the price control.*
  - *Step 2 – In every year of the price control, the gearing level on nominal RAV is calculated based on the outcome of step 1.*
  - *Step 3 – When the difference exceeds a hurdle rate (for example gearing of 70%), the model assumes an equity issuance such that calculated gearing is brought back to the notional gearing level. 55*
  - *Step 4 – In the years in which new equity needs to be issued according to the model, an allowance for issuance costs is calculated as 5 per cent of the assumed amount of equity issued.*
  - *Step 5 – The model is re-run annually with actual numbers replacing forecasts for the financial year just passed. This will give a “corrected” level of equity issuance, if any.*
  - *Step 6 – An adjustment to revenues is made to reflect any differences between the equity issuance cost allowance calculated in step 4 and the corrected level.”<sup>108</sup>*
- 6.78 We recommend a similar approach where new equity issuance costs are incorporated into the allowed revenues as part of the H7 financial modelling. The dividend assumption in the model will allow the CAA to flex the amount of equity which is internally sourced as opposed to raised externally.
- 6.79 While this is a different approach to the incorporation of issuance costs into debt finance, this reflects the specific circumstances and quantum of financing required during H7.

## Debt market depth

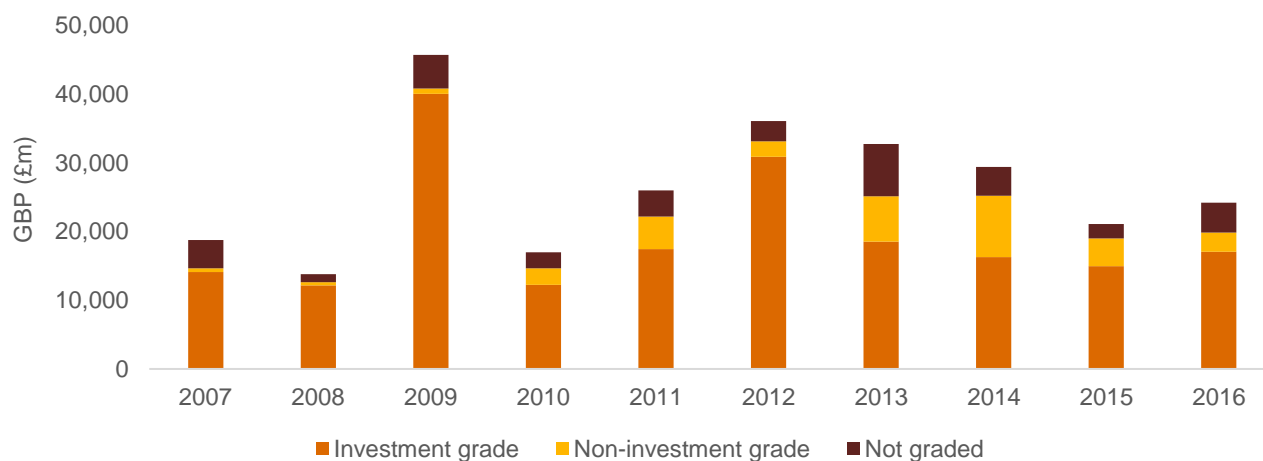
- 6.80 As set out in Section 4 above, the ‘as is’ WACC for HAL is based on a relatively low weighting on the percentage of new debt, and assumes a broadly stable RAB. In recognition of the need for a much higher quantity of debt issuance over the H7 period, additional costs on-top of the ‘as is’ cost of debt may be required. This is most relevant where the GBP corporate bond market does not have sufficient depth to absorb the large issuance associated with the third runway scheme.
- 6.81 To test the market depth for GBP deals, we set out in Figure 6.6 below the total GBP deal value over the period 2007 to 2016.<sup>109</sup>

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<sup>108</sup> Source: Ofgem (2011) Decision on strategy for the next transmission and gas distribution price controls – RIIO-T1 and GD1 Financial Issues, Appendix 3, pp. 83

<sup>109</sup> Includes investment grade and high-yield bonds, preference shares and medium-term notes.

Figure 6.6 GBP deal value



Source: Dealogic, PwC analysis

6.82 As shown in the figure above, the year-on-year changes to deal value (in the order of several billion, split over dozens of transactions) shows that the market could have sufficient depth to absorb several large GBP debt issuances associated with funding the third runway scheme – particularly where they were spread over several years – however the degree to which the market has sufficient depth to absorb all third runway debt could be investigated further.

## Conclusion

6.83 In conclusion we consider an indicative range of **+0.25% to +1.0%** is sufficient to capture third runway impacts at this early stage. We also consider that a WACC uplift associated with the third runway is more likely to be towards the bottom of the range set out in Table 6.7 above (subject to the development of the H7 methodology). The rationale for this is threefold.

- Firstly, cost overruns, where incurred efficiently – through factors outside of management control – are likely to be recoverable under the current capex incentive mechanisms in place. This protects HAL from some of the large downside risks that are built into the top-end of the range in Table 6.7 above; for example, offshore wind does not benefit from the same regulatory protections.
- Secondly, the benchmarks for CAA T5 and Ofgem RIIO are more comparable to HAL as they are calibrated to a setting a single WACC for a whole business, where a large capital programme is taking place alongside an existing regulated business. Furthermore, in each instance, the regulated companies have an established track-record in delivering capex programmes on familiar assets.
- Lastly, T5 had a similar proportion of capex relative to the existing size of the business. It therefore represents the most relevant benchmark as it is specific to both HAL and airport expansion.

6.84 The indicative range we apply for third runway impacts should be sufficient to compensate debt and equity holders for the additional risks associated with the third runway scheme.<sup>110</sup>

6.85 The financing of the third runway substantially alters the mix of new and existing debt; it increases new debt financing from representing 12.5% of total debt financing to 60% of total debt financing. This is

<sup>110</sup> While the uplift proposed is to the entire WACC, we note that the majority of the uplift may be concentrated in the cost of equity component of the WACC. This is for two reasons. Firstly, credit rating methodologies for privately managed airports place little weight on capex schemes such as this, while the methodologies for regulated utilities more widely only place a relatively small weighting on size and complexity of capital programme. Secondly, even were, for instance, a one-notch rating downgrade to occur due to the scale and complexity of the capex scheme – one notch is typically worth around 15-20bps on the cost of new debt, meaning the cost of equity increase implied by this range would be larger.

consistent with the assumption that the scheme is financed at a ratio consistent with the notional capital structure of 60% gearing.

- 6.86 The viability of this notional funding structure will require testing through future financeability analysis and will also depend on the regulatory approach implemented by the CAA for H7.
- 6.87 Furthermore, as set out in Section 4 above, the estimate for the cost of new debt is based on current market yields plus a forward-looking uplift. However, projections of future yields based on forward curves are not always accurate predictors of outturn yields. Given the significantly higher proportion of new debt (associated with the capital required to fund the third runway scheme) expected in H7, the risk associated with forecast error on the cost of new debt is magnified. While this report doesn't review the approach to the cost of new debt in H7, we note that any cost of new debt projection is susceptible to forecasting error, particularly over long time periods.<sup>111</sup> Therefore, although we have factored in a small margin of uncertainty around the cost of new debt projection, the range of possible outcomes may be much wider than this in practice.
- 6.88 We leave the debt issuance costs unchanged and recommend allowing for new equity issuance costs within the allowed revenues (and not as an uplift the WACC). Applying this uplift, the WACC including the risks associated with the third runway scheme is set out in Table 6.10 below.

**Table 6.10 WACC for HAL including construction of new runway**

	H7 'as is'		H7 with third runway	
	Low	High	Low	High
Gearing	60%	60%	60%	60%
RFR	-1.4%	-1.0%	-1.4%	-1.0%
TMR	5.1%	5.6%	5.1%	5.6%
Asset Beta	0.42	0.52	0.42	0.52
Debt beta	0.05	0.05	0.05	0.05
Equity beta	0.98	1.23	0.98	1.23
<b>Real cost of equity (post-tax)</b>	<b>4.9%</b>	<b>7.1%</b>	<b>4.9%</b>	<b>7.1%</b>
Cost of embedded debt	1.8%	1.8%	1.8%	1.8%
Cost of new debt	0.15%	0.65%	0.15%	0.65%
Weighting of new debt	12.5%	12.5%	60.0%	60.0%
Issuance costs	0.10%	0.10%	0.10%	0.10%
<b>Real cost of debt (pre-tax)</b>	<b>1.7%</b>	<b>1.8%</b>	<b>0.9%</b>	<b>1.2%</b>
WACC Uplift			+0.25%	+1.0%
<b>Vanilla WACC</b>	<b>3.0%</b>	<b>3.9%</b>	<b>2.8%</b>	<b>4.6%</b>

<sup>111</sup> The CAA commissioned CEPA to consider indexation of the cost of debt in CEPA (2016), "Alternative approaches to setting the cost of debt for PR19 and H7"

## 7. Tax

- 7.1 When setting aeronautical charges an allowance for tax needs to be reflected either in the WACC or it can be treated as a separate allowance. Historically, when setting charges for HAL, the CAA has opted for a pre-tax WACC approach rather than using a separate allowance. The pre-tax WACC is expressed as follows:

$$WACC_{pre-tax} = (g \times CoD) + \frac{(1 - g) \times CoE}{(1 - t)}$$

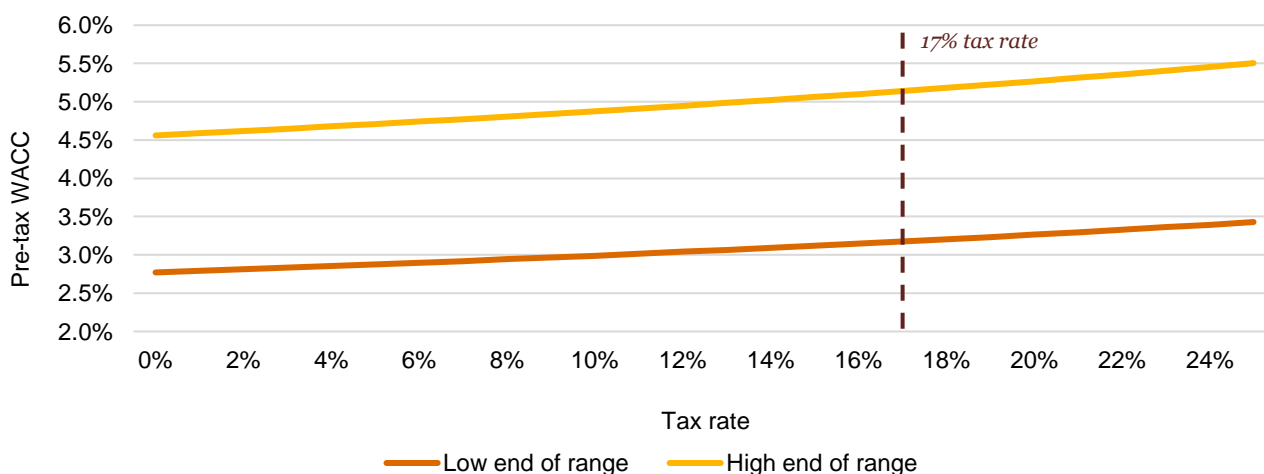
- 7.2 Where  $g$  is the gearing of the operator,  $CoD$  is the pre-tax cost of debt,  $CoE$  is the post-tax cost of equity and  $t$  is the tax rate applied.
- 7.3 In Q6, the tax rate applied was the expected average statutory corporation tax rate, which was 20.2%. The equivalent figure based on the latest information for H7 would be 17%. This incorporates the UK Government's signalled reductions in the headline rate of corporation tax from the current figure of 19% to 17% from 2020.
- 7.4 Given the size of the third runway capex scheme in H7, an approach that applies an effective tax may be preferred by the CAA. This approach would take account of the projected notional tax payments over the course of the price control period, considering capital allowances as well as other tax credits. It then assesses an effective tax rate for the price control period to estimate the required pre-tax WACC (still based upon a notional capital structure). In order to inform the calculation of the effective tax rate, data from the H7 financial model could be applied.
- 7.5 An alternative approach, is to separate the WACC and the treatment of tax, by applying a vanilla WACC. There is then a separate assessment of the cost allowances required to cover projected actual tax payments that are expected to be incurred over H7 – this approach can take account of actual capital structure, as currently done by Ofwat.



## 8. Conclusion and overall WACC

- 8.1 Since the Q6 determination for HAL, the available evidence suggests that market required returns have fallen. Meanwhile, HAL has outperformed its regulatory targets – suggesting little change to the risk profile of the ‘as is’ business. Together this suggests a lower WACC in H7 is appropriate for the ‘as is’ case.
- 8.2 Delivery of the large third runway expansion over the H7 period will require two key changes to the WACC estimate for H7 in order to transition from an ‘as is’ figure. The first is to adjust the proportion of debt that will be new compared to embedded. On a notional basis we calculate the proportion of new debt will be around 60%. The second is to account for change in risk profile arising predominantly from construction risk. Benchmarking against existing precedents, we find that an uplift of around 0.25% to 1.0% would account for this change in risk profile. The most appropriate point estimate in this range will depend upon other aspects of the CAA’s H7 methodology. The viability of this notional funding structure will also require testing through financeability analysis.
- 8.3 Combining all the evidence set out above, and focusing on the **lower end of the third runway impacts** adjustment of +0.25%, we derive a **real vanilla WACC of 2.8% to 3.8%**. This is broadly similar to the ‘as is’ real vanilla WACC range for H7 because the third runway uplift to the WACC is counterbalanced by more weight in the capital structure being placed on relatively low cost new debt. Where a statutory corporation tax rate assumption of 17% is applied, this equates to a H7 pre-tax WACC of 3.2% to 4.4%.
- 8.4 Focusing on the **upper end of the third runway impacts** adjustment of +1.0%, we derive a **real vanilla WACC of 3.5% to 4.6%**. In this instance, the effect of the third runway adjustment is larger than the downward pressure on the WACC arising from more weighting on relatively low cost new debt. Where a statutory corporation tax rate assumption of 17% is applied, this equates to a H7 pre-tax WACC of 3.9% to 5.1%.
- 8.5 Given the uncertainty over the most suitable tax-rate to apply in the H7 period e.g. given large capital allowances and effective tax-rate could be below the statutory tax-rate, we set out the sensitivity of the pre-tax WACC range to the tax-rate in Figure 8.1 below.

Figure 8.1 Pre-tax WACC over different tax-rates



Source: PwC analysis

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# *Appendix A – Notional capital structures for private companies*

## *Context*

Following privatisations in the late 1980s and 1990s, UK utilities were transferred into public companies with listed equity and a broad shareholder base. But over the past three decades a number of alternative structures have emerged. Infrastructure funds and private equity investors have converted publicly listed companies into privately held entities. Sovereign wealth funds and actively-managed pension funds have purchased equity stakes in such privately held institutions, further broadening the investor base of UK utilities. Lastly, some UK utilities have public, or customer ownership with Welsh Water being a good example.

This diversity in ownership and legal structure should be welcomed, as a broad investor base is likely to support a lower cost of capital across UK utilities. However, it does question whether the ‘one-size-fits-all’ notional capital structure approach frequently used by UK utility regulators remains fit for purpose.

## *The notional capital structure approach*

The notional capital approach imposes a hypothetical capital structure on the calculation of the WACC. It is purposely ‘high-level’ and only prescribes a split of debt financing relative to equity financing. Generally the benchmarks for assessing the reasonable proportions of debt and equity, and their respective costs, are taken from publicly listed firms and public capital markets. So benchmarks for gearing are taken from listed firms (such as Severn Trent Water and National Grid etc.), the cost of equity is determined from betas estimated from publicly traded equity and the cost of debt is estimated from publicly traded debt.

Such an approach avoids regulators making detailed assessments of the efficiency of the financing of regulated activities. This means companies are responsible for the financing of their regulated activities and bear the risk of financing costs being more or less than regulatory benchmarks. Where companies choose different financing structures, they also bear the risk of associated financing gains and losses.

Such an approach is also suitable when regulating a range of companies across an industry sector. Here the regulator should use a notional capital structure approach which allows companies to use a range of financing structures, and provides incentives to eliminate inefficient financing structures. For this reason, the gearing assumption in the notional capital structure is not typically set at the upper limit of where some financing structures have been set. Rather, it has been set at the lower end of where publicly held entities have set their financing structure and thereby can be used for regulating companies using a range of ownership types and financing structures.

## *CAA approach*

The CAA’s regulatory remit has evolved over recent years. From undertaking regular price controls for Heathrow, Gatwick and Stanstead, the economic regulation of Stanstead and Gatwick has been rolled back, so that ex-ante price controls are now only required for HAL. This means there is a potential lack of alignment between the notional capital structure assumption in the WACC and HAL’s own capital structure. While such inconsistency lack of alignment was inevitable when regulating a number of airports, now that the CAA is only setting price caps for HAL, then it could use a notional capital approach which is more aligned to HAL’s actual financing decisions.

To be clear, such an approach is not intended to remove the incentive benefits of the notional approach, and we do not suggest the CAA base its financing cost allowances on HAL’s actual financing. But we do recommend investigating whether a more tightly specified notional capital structure assumption can be used in HAL’s case. The rest of the appendix investigates whether an alternative notional capital structure can be specified for HAL and what impact this may have on the regulatory WACC.

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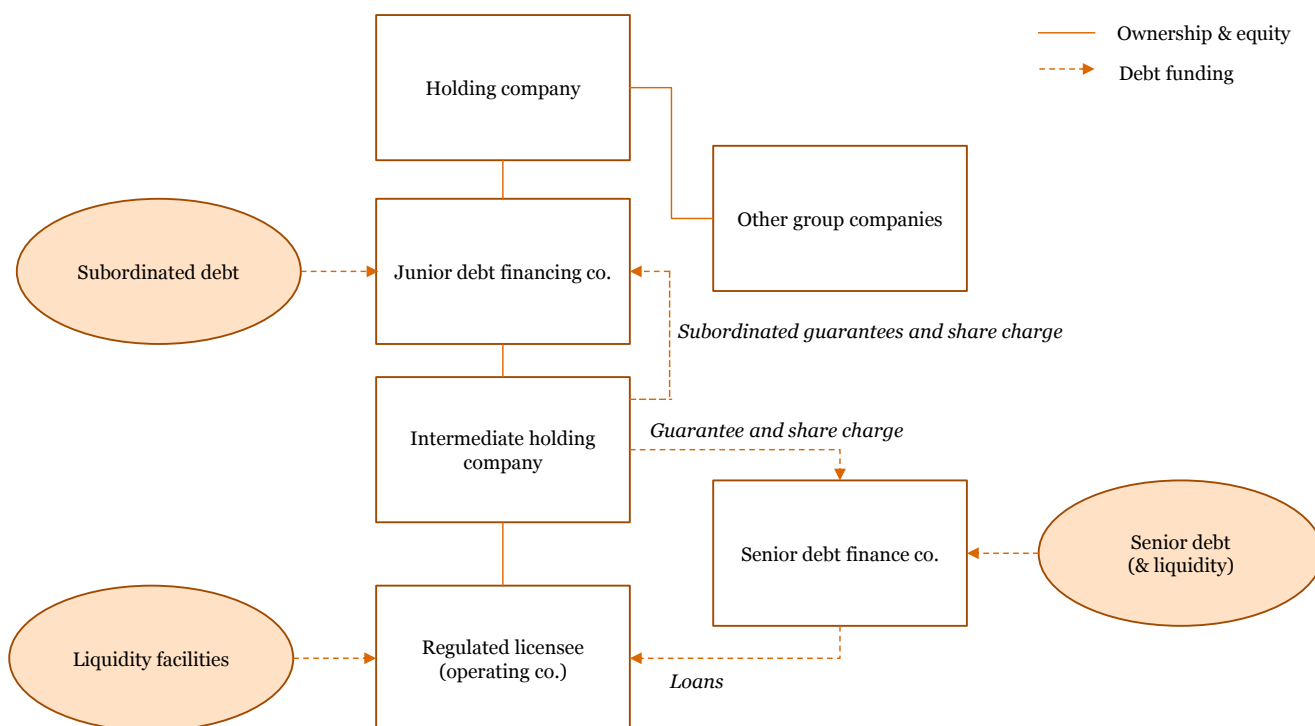
## *Whole Business Securitisation structures*

HAL converted into private ownership following the acquisition of BAA by Ferrovial in 2006. It also put in place a Whole Business Securitisation (“WBS”), a financing structure which has been used by a number of UK utilities and corporates in various sectors. While the individual structures vary, in general, they consist of a number of mechanisms. Some of these are used in other financing agreements, others are unique to WBS structures, but collectively they make package which provides considerable lender protection:

- A bankruptcy remote, special purpose borrowing vehicle which raises distinct financing in the public and/or private debt markets, often with an investment credit rating on one or more of the debt tranches;
- Protections on the way the ring-fenced regulated entity can operate and trade with other group entities;
- Limits on the ability of the ring-fenced regulated entity to borrow and to lend to other group companies;
- Restrictions on acquiring or forming new companies and on disposing of assets (except as permitted in the documentation);
- Debt covenants which limit gearing (for certain entities in the structure) and allow for earlier intervention by creditors and/or the regulator to minimise loss or restructure;
- Limits on dividends in the event of financial stress e.g. debt service ratios below a given level or leverage in excess of a certain level;
- Liquidity facilities sufficient to cover a period of debt service payments and in some cases a percentage of operating & maintenance costs;
- Payment priority in the cash waterfall;
- Senior creditors and/or their trustees have first ranking security over the ring-fenced entity. However, in certain infrastructure sectors, this is within the limiting context of various special administration regimes;
- Principal and interest for the financing group’s obligations are serviced through various revenue sources, but primarily through regulated charges and/or other relatively stable revenue sources. A WBS differs from other securitisations in that debt service comes from the operating revenue of an entire business (as opposed to specific assets e.g. a pool of mortgages); and
- As a result of the above noted covenants, additional financing tends to be raised outside the ring fence i.e. further up the corporate structure and transferred down to the regulated entity. This is subordinate to the senior debt financing which is used for the ring-fenced entity.

A generic WBS structure is set out below. This contains the core elements of a WBS structure, but does not show additional finance-raising companies and additional holding companies, which are often used in practice.

Figure A.1 Simplified WBS structure



Source: PwC, based upon UK utility WBS structures.

A WBS structure can enhance the creditworthiness of ring-fenced entity due to the additional creditor protections and enables it to raise finance at lower rates than finance raised outside a WBS, although this depends on the covenant package of the non-WBS financing<sup>112</sup>. The ring-fence also preserves the credit quality of the regulated business during crisis events in the rest of the group. The WBS structure generally enables a higher level of overall gearing, as seen in HAL’s actual gearing in Section 3 and Table A.1 below.<sup>113</sup>

Table A1.1 Gearing (Net Debt/RAB) of companies that have undergone WBS

	FY 2013/14	FY 2014/15	FY 2015/16
Anglian Water <sup>114</sup>	79.6%	79.2%	82.2%
Thames Water <sup>115</sup>	77.6%	81.1%	82.9%
Yorkshire Water <sup>116</sup>	77.7%	75.8%	76.7%
Affinity Water <sup>117</sup>	80.5%	81.7%	75.4%

Source: Company regulatory accounts

Typically such WBS’ can achieve capital structures with 60% to 65% of senior debt, 15% to 20% of subordinated debt and the remainder in equity.

### Cost of capital for WBS structures

In this section we assess the cost of capital for WBS structures, which we compare to the cost of capital using the 60% notional gearing assumption. Assessing the cost of capital for WBS structured entities requires

<sup>112</sup> <https://www.yorkshirewater.com/sites/default/files/Yorkshire%20Water%20Annual%20Report%202014.pdf>

<sup>113</sup> The gearing level of publicly listed water companies is much closer to Ofwat’s 62.5% notional gearing assumption.

<sup>114</sup> Anglian Water Group Limited (2014), (2015), (2016) respectively *Annual report and consolidated financial statements*

<sup>115</sup> Thames Water (2014), (2015), (2016) respectively *Annual performance report*

<sup>116</sup> Yorkshire Water Services Limited (2014), (2015), and (2016) respectively *Annual Report and Financial Statements*

<sup>117</sup> Affinity Water (2014), (2015), and (2016) respectively *Annual Report and Financial Statements* ‘Table 4H: Financial Metrics for the 12 months ended 31 March 2016’ in 2016 report, ‘Table 9: Analysis of net debt, gearing and interest costs’ in 2014, 2015 reports

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estimating the cost of equity and cost of different portions of debt in the structure and then weighting using the proportions within the capital structure. We estimate the cost of debt and cost of equity from market observations and by using economic relationships (particularly the relationship between leverage and the cost of equity). An alternative approach would be a more detailed corporate finance approach which would seek to develop the WBS structure in line with prevailing market appetite for different financing tranches and how different structuring options can be used to optimise financing costs.

As a simplification, we incorporate just senior and subordinated debt and equity:

- Senior debt – which may be similarly priced to ordinary utility debt, but may be lower cost reflecting the additional creditor protections from the WBS structure;
- Subordinated debt – which costs more than the senior debt because of its ranking in the debt structure; and
- Equity – which is more leveraged and therefore higher cost due to both senior and subordinated debt. This can be calculated using the same formulae for leveraging the asset beta within the cost of equity calculations.

In the table below, we set out our assessment of a hypothetical WBS cost of capital for HAL. This is compared to our cost of capital using the traditional approach in Sections 5,7 and 8 (so all other cost of capital parameters remain constant).

Table A1.2: Comparison of cost of capital in public and WBS structures

	H7 'as is'		H7 WBS		Comment/assumption
	Low	High	Low	High	
Gearing	60%	60%	80%	80%	
Of which senior WBS debt			60%	60%	
Of which junior WBS debt			20%	20%	
RFR	-1.4%	-1.0%	-1.4%	-1.0%	Uniform across WBS/non-WBS
TMR	5.1%	5.6%	5.1%	5.6%	Uniform across WBS/non-WBS
Asset Beta	0.42	0.52	0.42	0.52	Uniform across WBS/non-WBS
Debt beta	0.05	0.05	0.15	0.15	WBS debt beta based upon top end of investment grade debt beta range
Equity beta	0.98	1.23	1.50	2.00	Higher equity betas in WBS using leverage formula
<b>Cost of equity (post-tax)</b>	<b>4.9%</b>	<b>7.1%</b>	<b>8.4%</b>	<b>12.2%</b>	
Cost of embedded debt	1.8%	1.8%			
Cost of new debt	0.15%	0.65%			
Weighting of new debt	12.5%	12.5%			
Cost of embedded senior WBS debt			1.65%	1.65%	A- rating, 1 notch above A/BBB average
Cost of new senior WBS debt			0.00%	0.50%	A- rating, 1 notch above A/BBB average
Weighting of new senior debt			12.5%	12.5%	
Cost of embedded junior WBS debt			2.25%	2.25%	BBB- rating, 3 notches below A/BBB average
Cost of new junior WBS debt			0.60%	1.10%	BBB- rating, 3 notches below A/BBB average
Weighting of new junior WBS debt	12.5%	12.5%	12.5%	12.5%	
Issuance costs	0.10%	0.10%	0.15%	0.15%	Higher issuance costs for more complex WBS structure
<b>Real Cost of debt (pre-tax)</b>	<b>1.7%</b>	<b>1.8%</b>	<b>1.6%</b>	<b>1.7%</b>	
<b>Vanilla WACC</b>	<b>3.0%</b>	<b>3.9%</b>	<b>2.9%</b>	<b>3.8%</b>	
<b>Pre-tax WACC</b>	<b>3.4%</b>	<b>4.5%</b>	<b>3.3%</b>	<b>4.3%</b>	
<b>Post-tax WACC</b>	<b>2.8%</b>	<b>3.7%</b>	<b>2.7%</b>	<b>3.5%</b>	

Source: PwC analysis. One notch is assumed to translate into 15basis points of differential borrowing costs

Table A.2 illustrates the potential impact of a notional WBS structure on the cost of capital, with 80% overall gearing. It is sensitive to the assumptions around the cost of debt, debt betas and form of leverage expressions used.

Strikingly the higher leverage does not increase the cost of debt significantly, as the more expensive junior debt is partially offset by the cheaper senior debt. It is possible that the cost of debt could be pushed lower with

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additional guarantees from investors, but this merely transfers risk from one finance source to another, so should have little impact on the overall WACC.

The more geared structure does increase the cost of equity markedly. This increase is dependent upon the size of the debt beta and the form of leveraging expressions used. As more debt is introduced into the capital structure, debt itself starts to bear more systematic risk, particularly the subordinated debt. This means that in extreme downside scenario, the equity becomes worthless and debt starts bearing loss. This therefore needs to be reflected in a higher debt beta assumption in our WACC calculations.<sup>118</sup> We have therefore used a debt beta of 0.15 in order to gear equity in the WBS WACC, which can be supported by the empirical analysis of debt betas from the lower end of investment grade bonds.

The leverage expressions we have used result in a particularly high value for the equity beta - 2 in our high case. This is significantly above the normal values of equity betas for public companies, but then again, the WBS structure is not constrained in the same way as public equity.

We have used the standard leverage expressions<sup>119</sup>, but alternative expressions have been suggested by Hamada (1969)<sup>120</sup> and Miles and Ezzell (1985)<sup>121</sup>. Both assume interest tax shields are risk-free. Hamada assumes this indefinitely, whereas Miles and Ezzell assume this in the first year only. Hamada assumes the amount of debt is fixed, whereas the standard leverage expression assumed gearing is maintained as a fixed proportion. These alternative expressions suggest that the cost of equity could not be as high as suggested by the standard leverage expressions and could suggest a lower cost of equity in the WBS structure. However, our preference is to use the standard leverage expressions which assume that interest tax shield are risky and constant gearing is maintained as this better accords with how utilities finance themselves.

The resulting 12% cost of equity in the WBS high case may be higher than the expected returns required by investors, particularly where equity risks can be managed within the WBS structure, or where equity risks from higher leverage can be transferred (e.g. to regulators or to customers). This means that a more detailed corporate finance approach may deliver lower an overall lower cost of capital using the WBS approach.

## Conclusion

While the equity return is significantly higher, on a smaller equity investment, our economic analysis suggests modest reductions to the overall cost of capital for WBS structured entities<sup>122</sup>. This is consistent with finance theory which suggests that movements in gearing should have limited impact on the overall cost of capital.

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<sup>118</sup> The CMA concluded the “debt beta is assumed to increase with gearing” in its final determination for NIE. CC NIE (2014), para 13.175(c)

<sup>119</sup> Harris, R.S. and J.J. Pringle, 1985, “Risk-adjusted Discount Rates – Extensions from the Average-risk Case”, *Journal of Financial Research*, vol. 8(3), pp. 237-44.

<sup>120</sup> Hamada, R.S., 1969, “The Effect of the Firm’s Capital Structure on the Systematic Risk of Common Stocks”, *Journal of Finance*, vol. 27, pp. 435-52

<sup>121</sup> Miles, J.A. and J.R. Ezzell, 1985, “Reformulating Tax Shield Valuation: A Note”, *Journal of Finance*, vol. 40(5), pp. 1485-92.

<sup>122</sup> A more geared equity return may suit certain equity investors who don’t want to commit as much investment to one entity or have a preference for a higher expected return investment with higher risk.

# Appendix B – Asset beta estimation

To help inform our view on the appropriate range for HAL's asset beta, we have analysed asset beta outputs from comparator airports. The need to look at comparator airports arises as HAL is not a listed entity. Furthermore, as none of the other UK airports are listed, we have relied on international comparisons to form our view on an appropriate asset beta for HAL.

Beta estimation involves some element of subjectivity, and there are a number of different ways of calculating beta. This appendix discusses the methodological assumptions and decisions we have taken in order to calculate the asset betas for the comparator airports used in our analysis. It also outlines a number of sensitivity analyses to demonstrate the impact of making alternative methodological assumptions.

## Calculating the Equity Beta

Equity betas measure the systematic risk (i.e. the risk that is not diversifiable) of an investment by estimating the extent to which the investment's returns move in line with the market index. The stronger the relationship, and the greater the amplitude of any movement in the investment's returns relative to the markets' returns, the higher the systematic risk associated with an investment.

The equity beta for a particular company can be estimated by regressing the actual returns for that company against the returns on a relevant stock market as a whole:

$$r_{airport,t} = \alpha + \beta r_{Market\ Index,t} + \epsilon$$

Here  $\beta$  represents the equity beta for a given company. In order to calculate the equity beta for a given company, a number of methodological a need to be taken. These are discussed below.

### Data Frequency and estimation window

Beta regressions can be run using different data frequencies. Lower frequency data can be more reflective of underlying risk, but risk not capturing shorter-term changes in risk profile. On the other hand higher frequency data benefits from a large number of observations, but can lead to more volatile estimates.

Where we report estimations based on daily data, we use a 2 year estimation window. Where we base our calculations on monthly data, we use a 5 year estimation window.

### Market Index

Beta regressions require a market index upon which the company specific returns are regressed. This index needs to be sufficiently liquid and not overly distorted by unbalanced sector compositions. World indices can be used in some circumstances, however this introduces complications as a result of mismatches between the company and the index. It is, therefore, more common to use local indices. In some circumstances there is a choice to be made between a local (or economy specific) index and a regional index. For example, the returns to Fraport could be assessed against a Germany specific index, or a European wide index.

The choice of index can be made with reference to the portfolio of a marginal investor. It may be considered, for example, that an investor in European airport stocks will diversify their portfolio across the European market.

### Adjusting raw equity betas

In some circumstances, an adjustment is made to the 'raw' equity beta to account for a tendency for equity betas to approach a beta of one over time (i.e. the market beta). This is known as the Blume adjustment. The standard approach to the weighting of the 'raw' equity beta is to use the Blume adjustment as outlined below:

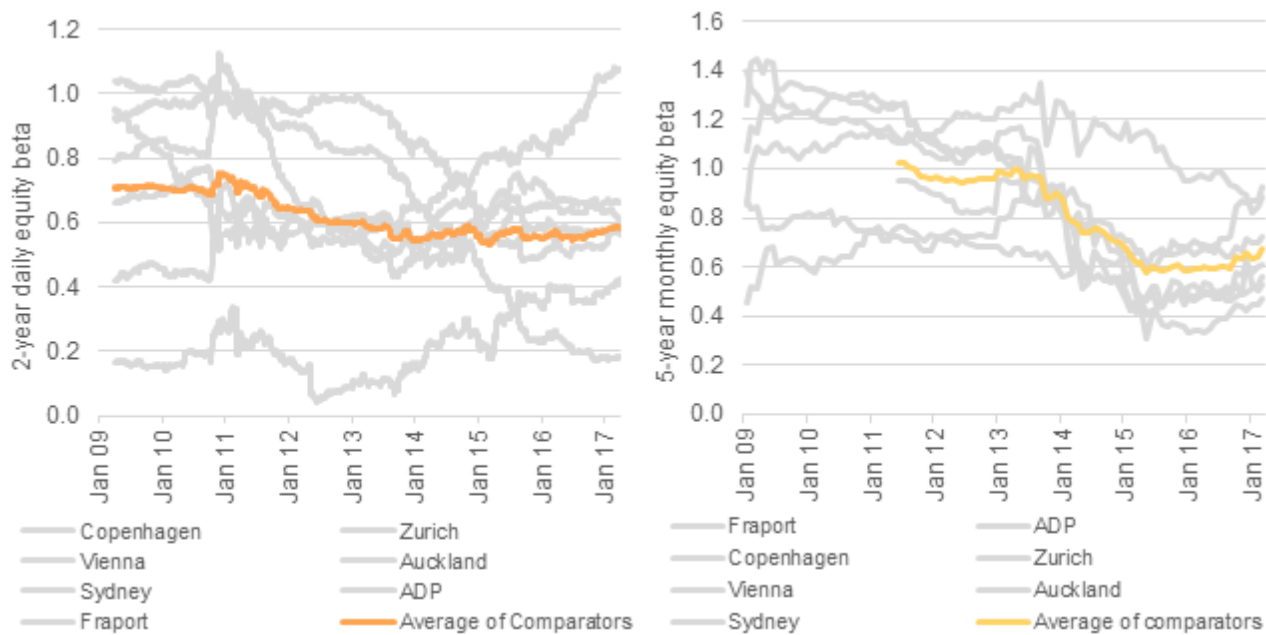
$$\beta_{blume} = \left(\frac{2}{3}\right)\beta_{raw} + \frac{1}{3}$$

Recent evidence on airport equity betas, as presented in Figure A2.1 below, indicates that equity betas of comparator airports do not exhibit a strong tendency converge to one. Moreover, as noted by the CMA



(2015)<sup>123</sup>, it is not the case that one would necessarily expect such convergence for regulated companies. The application of a Blume adjustment may therefore not be appropriate.

Figure A2.1 Raw equity Betas for a range of comparator airports <sup>124</sup>



Source: Thomson Reuters, Capital IQ, PwC analysis

### Calculating the Asset Beta

Asset Betas (or unlevered betas) remove the effects of financial risk from the equity beta. Asset betas therefore allow us to compare the risk of different firms which have different levels of leverage.

A company's asset beta is not directly observable and therefore needs to be calculated. Such a calculation requires a number of methodological assumptions which are discussed below.

#### De-leveraging

We use the Harris-Pringle un-levering formula to calculate the asset beta for comparator airports:

$$\beta_a = \beta_e(1 - G) + \beta_d(G)$$

where  $\beta_a$  is the company asset beta,  $\beta_e$  is the equity beta,  $\beta_d$  is the debt beta, and G is a measure of gearing.

Alternative formulae include the Miller formula and the Miles and Ezzel formula. Providing one uses the same formula for un-levering and re-levering, the exact un-levering formula used results in little impact on the final equity beta calculation.

#### Gearing

We calculate comparator airports' gearing using market data. Our measure divides the net debt of the airport by its total enterprise value. The value for gearing we use in the un-levering formula to calculate comparator airports' asset betas is an average of an airport's spot gearing over time. For asset betas based on daily data, we use a 2 year average gearing figure. For asset betas based on monthly data, we use a 5 year average gearing figure.

<sup>123</sup> CMA Bristol Water Determination paragraph 86

<sup>124</sup> Equity Betas calculated using daily data with a two year estimation window, and European market indices for airports based on Europe, and local market indices elsewhere.

## Debt Beta

The debt beta represents the exposure of a company's debt to systematic risk. In its Q6 determination, the CAA used a debt beta of 0.10, justified by placing more weight on historical academic studies of asset beta. Empirical estimates reviewed tended to produce lower results.

More recent determinations, particularly those published by the CC/CMA, have used lower values for the debt beta. In the 2015 Bristol Water appeal, the CMA assumed a debt beta of zero and in the 2014 NIE appeal used a debt beta of 0.05. This lower value for the debt beta is consistent with recent empirical estimations that we have conducted. We therefore use a debt beta of 0.05 in our de-levering calculations.

## Summary of results

Table A2.1 below presents the spot value of daily asset betas (31st March 2017), the one year average value, and the two year average values calculated using our base-case methodology.<sup>125</sup> Sensitivities to this base-case are then discussed below.

Table A2.1 Company specific asset betas (daily data)

Company Name	Spot	1 Year Average	2 Year Average
Fraport	0.37	0.36	0.37
AdP	0.53	0.53	0.51
Kobenhavns Lufthavne	0.36	0.33	0.31
Flughafen Zurich	0.52	0.48	0.46
Flughafen Wien	0.16	0.17	0.20
Auckland Intl. Airport	0.86	0.77	0.71
Sydney Airport	0.40	0.42	0.43
<b>International airport average</b>	<b>0.46</b>	<b>0.44</b>	<b>0.43</b>

Source: Thomson Reuters, Capital IQ, PwC analysis

Table A2.2 Company specific asset betas (monthly data)

Company Name	Spot	1 Year Average	2 Year Average
Fraport	0.53	0.54	0.58
AdP	0.54	0.51	0.50
Kobenhavns Lufthavne	0.45	0.43	0.41
Flughafen Zurich	0.51	0.44	0.41
Flughafen Wien	0.41	0.36	0.34
Auckland Intl. Airport	0.73	0.62	0.56
Sydney Airport	0.30	0.26	0.24
<b>International airport average</b>	<b>0.50</b>	<b>0.45</b>	<b>0.43</b>

Source: Thomson Reuters, Capital IQ, PwC analysis

In previous CAA reviews, Fraport and ADP have been identified as closer comparators for HAL than other international airports. For this reason in Figure A2.2 below we show a time series of daily and monthly asset beta estimates for both using the same methodology as in the tables above.

<sup>125</sup> Asset beta calculated using raw equity betas regressed on a European Index for airports based on Europe, and a local index for airports based outside of Europe, de-levered using a debt beta of 0.05.

Figure A2.2 Asset Betas for Fraport and ADP



Source: Thomson Reuters, Capital IQ, PwC analysis

### Sensitivity Analysis

In the detailed tables below we present sensitivity analysis as to the results of altering the methodological assumptions discussed in this appendix. We hold our gearing assumption and debt beta constant while conducting the sensitivities. We conduct this analysis for Fraport and AdP, given their particular relevance to HAL.

Table A2.3 Asset Betas for key HAL comparators calculated using daily data under a variety of assumptions

Company	Index	Spot		2 Year Average	
		Raw	Blume	Raw	Blume
Fraport	Local	0.33	0.43	0.32	0.41
	European	0.37	0.45	0.37	0.44
AdP	Local	0.50	0.60	0.47	0.57
	European	0.53	0.61	0.51	0.60

Source: Thomson Reuters, Capital IQ, PwC analysis

Table A2.4 Asset Betas for key HAL comparators calculated using monthly data under a variety of assumptions

Company	Index	Spot		5 Year Average	
		Raw	Blume	Raw	Blume
Fraport	Local	0.41	0.47	0.53	0.56
	European	0.53	0.55	0.68	0.65
AdP	Local	0.45	0.55	0.47	0.55
	European	0.54	0.61	0.55	0.61

Source: Thomson Reuters, Capital IQ, PwC analysis

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The sensitivity analysis presented in Tables A2.3 and A2.4 above suggests the following general conclusions for Fraport and AdP:

- Daily data (assuming a 2 year estimation window) tends to result in lower asset betas than monthly data (assuming a 5 year estimation window);
- Using a European Index as opposed to a local index tends to increase the asset beta calculated; and
- Using a Blume adjustment on the equity beta tends to increase the asset beta calculated.

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# Appendix C – Risk-free rate comparisons

In Section 5 we set out a real RFR range of -1.4% to -1.0%. In this appendix we compare this estimate to the real RFR proposed by Ofcom in their March 2017 Wholesale Local Access Market review and also compare this estimate to the indicative nominal RFR range set out in our ‘Refining the Balance of Incentives for PR19’ report for Ofwat (published in July 2017).

## *Comparison to Ofcom*

In their March 2017 Wholesale Local Access Market Review documentation (annex 16). Ofcom selected a figure for the real RFR of +0.5%.

There is, however, a key methodological difference between the approach we adopt for the purposes of this report and the approach employed by Ofcom. In particular, Ofcom uses a debt premium approach to setting the cost of debt allowance (i.e. RFR plus a margin). Under Ofcom’s chosen methodology, this cost of debt allowance needs to provide for both embedded and new debt (rather than a separate allowance being made for each), as such, the RFR applied is typically a longer-run historical average.

Nevertheless, for comparability, Ofcom’s consultation also provides a set of figures for a ‘separate allowance’ approach on the cost of debt (i.e. separate estimates for the cost of new debt and the cost of embedded debt). This approach is comparable to the approach taken in this report, and importantly, can be used to infer a real RFR figure that is comparable to the figures in this report. This inference is set out below:

- Under a ‘separate allowance’ approach, Ofcom’s cost of new debt (nominal) was estimated to be 3.0% to 3.5%.
- Applying the RPI assumption of 3.2% provided by Ofcom therefore implies a real cost of new debt close to 0%.
- From this 0% real cost of debt figure, if a corporate debt risk premium is deducted, we find that a negative real RFR is implied.

This means that once differences in methodology are appropriately accounted for, there is broad consistency between the estimates presented here and the negative estimate of the real RFR inferred from Ofcom’s review.

## *Comparison to Refining the Balance of Incentives for PR19*

In our Refining the Balance of Incentives for PR19’ report for Ofwat (published in July 2017) we set out an illustrative nominal RFR range of +1.5% to + 3.0%. This lower end of this range (+1.5% nominal) is consistent with the range set out in this report (-1.4% real to -1.0% real); both data points were market evidence based and can be approximately reconciled through the addition and subtraction of RPI.<sup>126</sup>

The top end of the nominal RFR range of +3.0% (approximately 0% in real terms) set out our July 2017 work was for the purposes of demonstrating the sensitivity of the cost of equity to different combinations of RFR and EMRP. It was broadly calibrated to a more historically focused RFR estimate. As we are not interested in demonstrating a similar sensitivity between RFR and EMRP in this report, our selection of an RFR assumption remains market evidence based. Furthermore, where the equity beta is close to one – which it has been for HAL in Q6 – the precise selection of RFR and EMRP from a given TMR figure has only a minimal impact on the WACC.

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<sup>126</sup> There is also some updating for market movements between the two publications.

# Appendix D – Dividend discount model

The dividend discount model (DDM) is a common approach used to calculate the intrinsic value of an asset. It is a form of discounted cash flow (DCF) model and equates equity value to the present value of future dividends. In its simplest form it is expressed as follows:

$$V_0 = \sum_{t=1}^{\infty} \frac{D_t}{(1 + k_e)^t}$$

Where:

- $V_0$  is the intrinsic value
- $D_t$  is the dividend value at time  $t$
- $k_e$  is the cost of equity

Varying layers of complexity can be added or removed from the version of the model set out. For example, the model can be amended to reflect a single period (perpetuity) model, a multi-stage model with a terminal value, or a multi-stage model with no terminal value can also be used. In addition, in multi-stage models the growth rate in dividends can also be amended.

Once an appropriate model has been specified, and given a known value for the parameter  $V_0$ , one can solve for the cost of equity that is required to ensure that the present value of future dividends is equal to  $V_0$ . We can then disaggregate the cost of equity into its constituent parts. Based on a CAPM formulation of the cost of equity of:

$$k_e = R_f + \beta_e(EMRP)$$

Where:

- $R_f$  is the risk-free rate
- $\beta_e$  is the equity beta
- $EMRP$  is the equity market risk premium

Where  $R_f$  and  $\beta_e$  are known, we are able to infer a value for the EMRP. This is what is termed as the “implied EMRP” estimate. It is defined as an ex ante (forward-looking) approach because it is based on expectations of future cash flows. We use this approach to estimate an EMRP for the UK using data on the FTSE All-Share index.

In formulating our implied EMRP estimates, we use a multi-stage DDM model, in which equity value is specified as:

$$V_0 = \frac{D_0(1 + g_s)^1}{(1 + k_e)^1} + \frac{D_0(1 + g_s)^2}{(1 + k_e)^2} + \frac{D_0(1 + g_s)^3}{(1 + k_e)^3} + \frac{D_0(1 + g_s)^4}{(1 + k_e)^4} + \frac{(D_0(1 + g_s)^5 + TV)}{(1 + k_e)^5}$$

Where:

- $g_s$  is the expected short-term (5-year) growth rate
- $TV$  is a terminal value calculated as:

$$TV = \frac{D_5(1 + g_l)}{(k_e - g_l)}$$

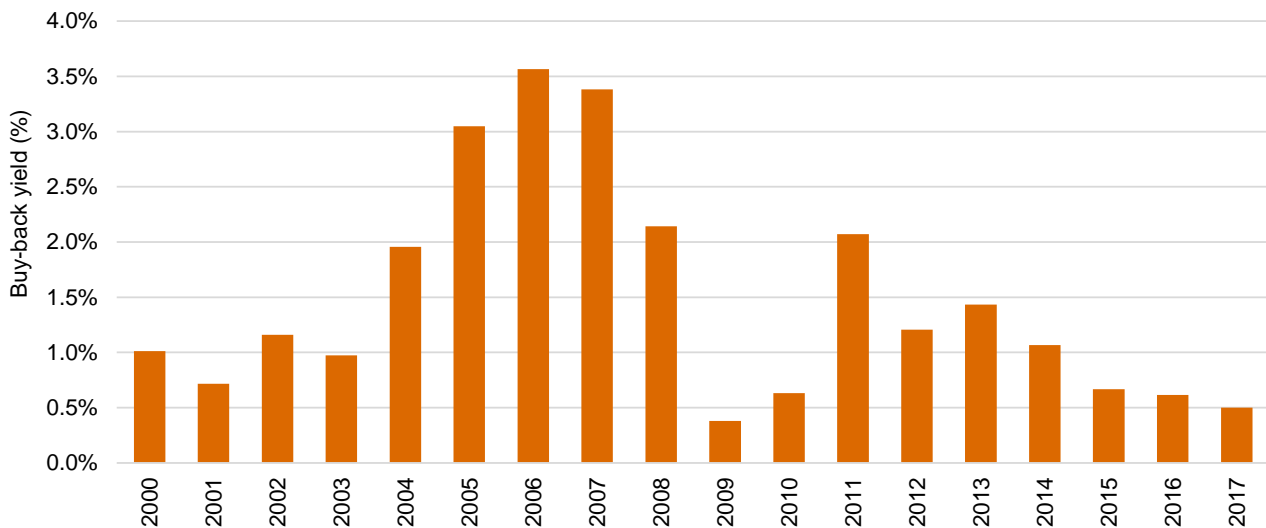
Where:

- $g_l$  is the expected long-term growth rate

The dividend ( $D_0$ ) in the formula above is calculated as the initial market value of the FTSE All-Share index multiplied by the observed “cash yield”, where the cash yield is made up of (i) a dividend yield; and (ii) a buy-back yield. The dividend yield represents the value of periodic cash dividends received by equity holder. Buy-backs are an alternative method for companies to remunerate investors, in which the company repurchases the equity from them, therefore making up another form of cash return for investors. The buy-back yield used in

our analysis is based on the value of actual buy-backs on the FTSE All-Share over time and is shown in Figure A4.1 below.

**Figure A4.1 FTSE All-Share buy-back yield, 2000 to 2017**



Source: PwC analysis, Capital IQ

The expected short-term and long-term growth rates ( $g_s$  and  $g_l$ , respectively) are nominal growth rates calculated from forecast real GDP growth rates and forecast inflation. Our GDP growth assumptions for the most recent 6-years in the model are set out below:

**Table A4.1 Nominal GDP growth assumptions**

Nominal GDP growth	Oct 2012	Oct 2013	Oct 2014	Oct 2015	Oct 2016	Oct 2017
Compounded average short-term growth	4.2%	4.8%	4.6%	3.6%	3.7%	4.3%
Long-term growth rate	4.0%	4.1%	4.2%	4.3%	4.0%	4.0%

Source: Consensus Economics

Note: October editions of Consensus Economics contain both short and long-term projections for inflation and real GDP growth.

Our rationale for using GDP growth as our assumption for dividend growth is threefold:

- If part of the reason that dividend growth has been kept low is due to investment (i.e. deferred dividends), then we expect dividend growth to return to typical rates of GDP growth in the future;
- If dividend growth has been low because dividends have been falling as a share of national income, then this trend is unlikely to continue and dividends should find an equilibrium share of national income, and then grow in line with national income;
- The GDP measure of growth provides stability in the DDM model. It draws on forecasts of real GDP and inflation from Consensus Economics, which is a widely sourced provider of consensus forecast macroeconomic data. This avoids large swings in analyst forecasts (e.g. at turning points in the economic cycle) overly influencing the DDM results.

We therefore consider the use of GDP forecasts as a reasonable proxy for dividend growth expectations. Hence, our use of GDP growth rates lies in the middle of the spectrum of options as it is not downwardly bias by omitted sources of growth (historical measures) and not upwardly biased by using analyst dividend forecasts.<sup>127</sup>

<sup>127</sup> In order to capture long-term dividend growth variations, the BoE ties its estimate to long-term GDP projections. Specifically, the BoE DDM model assumes that beyond five years, dividends are expected to grow in line with five year-ahead GDP projections. This is in line with our DDM approach for long-term DDM growth expectations.





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