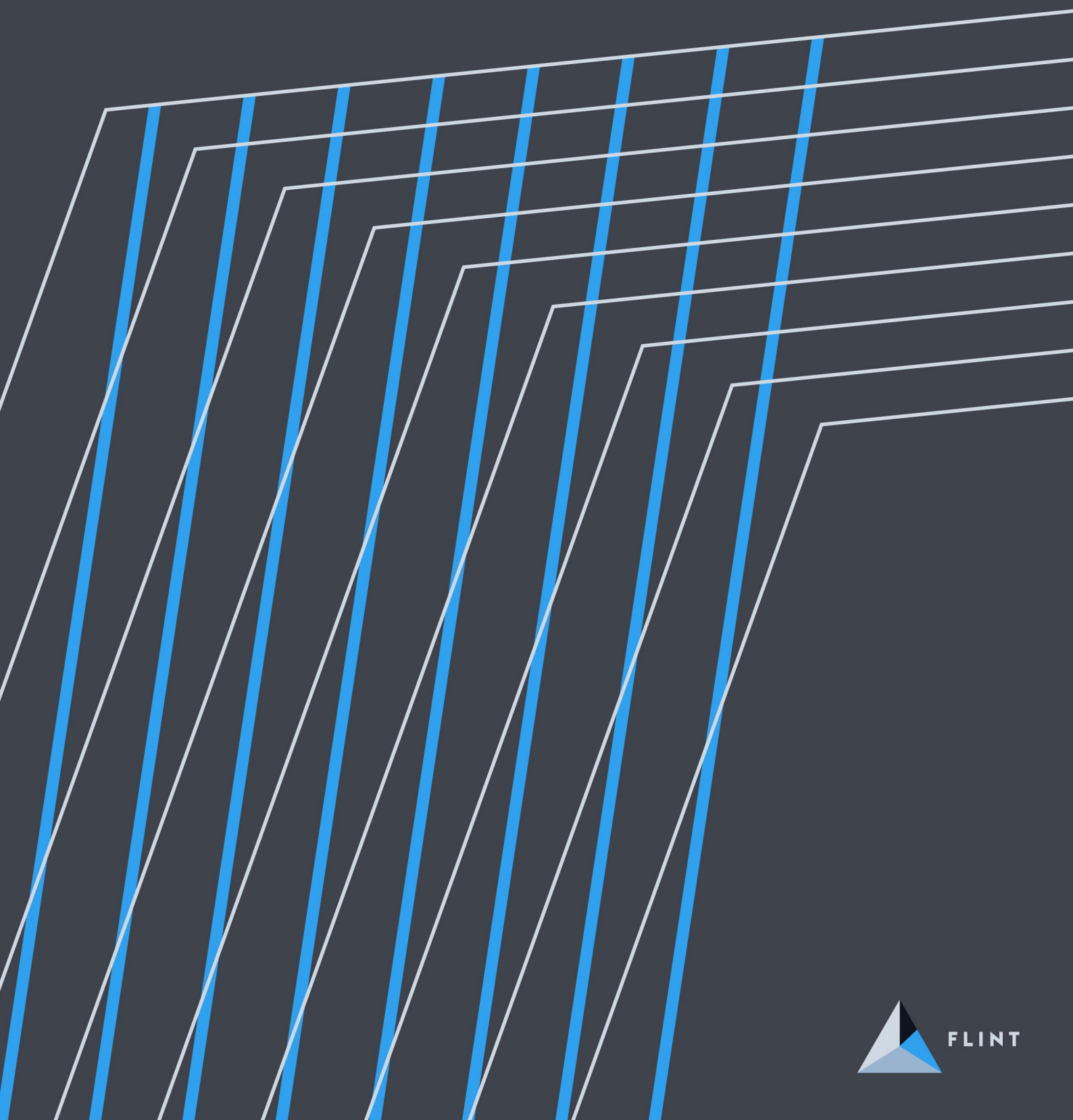
Support to the Civil Aviation Authority:
Business as Usual WACC for H7



FLINT

Executive Summary

Flint was commissioned by the Civil Aviation Authority (CAA) to assess the weighted average cost of capital (WACC) for Heathrow Airport Limited (HAL), for the H7 control period. Our assessment focuses on "Business as Usual" (BAU) mode – ignoring plans for expansion.

The WACC is important – a 1% change in the WACC prompts a 6% change in allowed revenues for HAL.

Since 2017, the CAA has commissioned analysis from PwC and HAL has provided inputs to the CAA, with support from its advisor, NERA. There have been significant differences of view in key areas. In addition, in March 2020 the Competition and Markets Authority (CMA) issued provisional findings on the price control for NERL, including a WACC assessment which has significant read-across implications for HAL.

In this report, we provide our views on the WACC and the key underpinning assumptions. We set out our assessment of the areas of disagreement between PwC and HAL and consider the implications of the CMA's provisional findings for NERL.

Importantly, our assessment is based on the evidence available at the end of February 2020. This predated the major COVID-19 outbreak, which has significantly affected the aviation sector, and the economy more broadly. This should be the subject of extensive further review and analysis as it will directly affect the WACC.

Our central case recommendations are set out in Table 1:

TABLE 1: FLINT'S ESTIMATES OF KEY PARAMETERS

	Lower Bound	Upper Bound	Central Case
Risk-free Rate	-2.10%	-2.10%	-2.10%
Equity Risk Premium	7.10%	8.10%	7.60%
Equity beta	0.96	1.35	1.14
CoE (post tax)	**4.7%**	**8.8%**	**6.5%**
Cost of embedded debt	1.48%	1.80%	1.64%
Cost of new debt	-0.48%	0.12%	-0.18%
Real CoD (pre-tax)	**1.6%**	**1.7%**	**1.6%**
Gearing	**52.50%**	**60.00%**	**56.25%**
Vanilla WACC	3.1%	4.6%	3.8%

Source: Flint estimates with cost of equity, cost of debt and WACC rounded to the nearest decimal point.
Note: The cost of debt estimate includes issuance and liquidity costs.

We would emphasise certain key aspects of our recommendations:

- On the cost of equity, we align closely with the CMA in all methodological regards. This leads us closer to the recommendations of PwC on market parameters, but aligns us more closely with HAL in relation to asset and equity beta estimation.

- On the cost of debt, we recommend an approach based on a debt index, rather than observation of HAL's actual cost of debt. Our debt index recognises the term of HAL's debt and the expected

evolving cost of both new and embedded debt up to and through H7, based on analysis of predicted yields.

- We undertake a detailed analysis of a change in notional gearing on the WACC – consistent with emphasis given to this by the CMA in the NERL provisional findings. The CMA noted that, in the case of NERL, higher gearing gave rise to an increasing WACC in a way that it thought undermined the CAA's proposed assumption for NERL's notional gearing.

- In light of our analysis of gearing and associated effects, we adopt a range for notional gearing of 52.5% to 60%. Our central case is based on the mid-point of this range. This recognises the considerations raised by the CMA and points to a reduction relative to the notional gearing previously assumed by the CAA.

  – However, we are mindful of the need to review this in light of the CMA's final determinations for NERL and for the water companies in the price control redetermination processes currently underway.

1 Introduction

Flint was commissioned by the Civil Aviation Authority (CAA) to provide an independent evaluation of the weighted average cost of capital (WACC) for Heathrow Airport, ahead of consultation on prices for the H7 control period.

Specifically, we were asked to focus on the assessment of the WACC for Heathrow in "Business as Usual" (BAU) mode – as though there were no plans for significant expansion of Heathrow, through the construction of a third runway. Consideration of the implications of expansion for the WACC are subject to separate assessment by the CAA.

Since 2017 there have been several reports produced by PwC for the CAA on BAU WACC estimation for H7, and following publication these have prompted inputs from key stakeholders, most notably Heathrow Airport Limited (HAL) and its advisor, NERA. These reports indicate significant disagreement in key areas.

Also, in March 2020, as part of an appeal process, the Competition and Markets Authority (CMA) issued provisional findings of its review of the price control for NERL. This included the CMA's estimation of the WACC for NERL, and underlying assumptions.

In this report, we provide a view on the WACC and the key underpinning assumptions, focusing in particular, on those parameters that generated disagreement between PwC and HAL (supported by its advisor, NERA) – and in light of the implications of the CMA's provisional findings for NERL.

Importantly, we were asked by the CAA to provide estimates based on the evidence available at end of February 2020. This predated the major COVID-19 outbreak, which has significantly affected the aviation sector, the economy more broadly and, hence, current WACC estimates.

The implication of COVID-19 will potentially be significant for regulation of HAL in the future, including the basis of allowed returns and prices. Nonetheless, consistent with the CMA's provisional assessment of the WACC for NERL, we evaluate the evidence based on a cut-off date as at the end of February 2020.

There are three key components to the WACC: cost of equity, cost of debt and gearing, which interact through the formula below:[1]

$$WACC = Cost\ of\ Equity_{post-tax} * (1 - gearing) + Cost\ of\ Debt_{pre-tax} * gearing$$

The structure of the report is anchored around the WACC formulation, as follows:

- Section 2 provides our views on the cost of equity. This is divided in two subsections:
  - Section 2.1 CAPM (market) parameters – Total Market Returns (TMR), Risk-free Rate (RfR), and Equity Risk Premium (ERP).

[1] Regulators typically define the WACC in "vanilla" form, with respect to tax. The cost of debt is considered a "pre-tax" cost of debt (because debt interest is paid from earnings before corporation tax). The cost of equity is considered a "post-tax" cost of equity, because payments to equity investors (dividends) are made from earnings after corporate tax.

  - Section 2.2 Beta estimation for HAL.
- Section 3 provides our view on the cost of debt. This section is divided in five subsections:
  - Section 3.1 Cost of embedded debt.
  - Section 3.2 Cost of new debt.
  - Section 3.3 Weighting of new debt.
  - Section 3.4 Issuance costs.
  - Section 3.5 Inflation
- Section 4 explains our view on gearing, and the impact of changes in gearing.
- Section 5 provides a summary of our recommendations and conclusions.

In the sections where we discuss the main WACC parameters, we provide a brief explanation of each parameter, a description of the approaches adopted to estimation, and evidence relied upon by PwC, HAL, and the CMA, respectively. We then set out our own view on the appropriate basis for evidencing and deriving the appropriate parameter values.

2 Cost of Equity

The cost of equity (CoE) is the return required by equity holders. In this context, it is the notional return that would be required by equity holders, in line with the notional capital structure assumed by the CAA for HAL.

Our estimates for the cost of equity are based on the Capital Asset Pricing Model (CAPM). The CAPM is widely used in corporate finance to capture the relationship between systematic risk and the expected return of assets. It is also commonly used across regulated sectors, and by the CMA, for the estimation of the required equity returns. Both PwC and HAL proposed a CAPM based approach for estimating the cost of equity.

The CAPM formula requires three key input parameters:

- The Risk-free Rate (RfR): the return available on a risk-free asset.
- The Equity Risk Premium (ERP): the premium required to remunerate investors for the additional risk of investing in equities in general:
  - To estimate the ERP, PwC, HAL and the CMA relied on a total market return (TMR) approach, which requires estimating the TMR directly, then deconstructing it into RfR and ERP; and
- The equity beta: which measures the systematic risk of (notional) equity relative to with reference to the market portfolio. The equity beta for HAL reflects the risk associated with investing in HAL's (notional) equity that cannot be eliminated through diversification.

The CAPM formula is as shown below:

$$Cost\ of\ Equity = Risk\ free\ Rate + \beta eta_{Equity} * Equity\ Risk\ Premium$$

Although both HAL and PwC make use of the CAPM to estimate the cost of equity, each proposed different estimates for all three parameter values. These are summarised in Table 2 below, alongside the CMA assumption set out in the provisional findings for NERL:

TABLE 2: COMPARISON OF PWC, HAL AND CMA COST OF EQUITY PARAMETERS

	PwC (Aug 2019)		HAL		CMA at RP3 (NERL)	
	Lower Bound	**Upper Bound**	**Lower Bound**	**Upper Bound**	**Lower Bound**	**Upper Bound**
RfR	-1.50%	-1.00%	-1.71%	-1.20%	-2.25%	-2.25%
ERP	6.60%	6.60%	7.71%	7.70%	7.25%	8.25%
TMR	5.10%	5.60%	6.00%	6.50%	5.00%	6.00%
Equity beta	0.90	1.15	1.20	1.40	0.71	0.86
CoE (post tax)	**4.44%**	**6.59%**	**7.54%**	**9.58%**	**2.93%**	**4.82%**

Source: PwC (Aug 2019), Estimating the cost of capital for H7 and RP3 – Response to stakeholder views on total market return and debt beta, p.9. HAL (Dec 2019), Heathrow's Initial Business Plan Detailed Plan, pp. 304. CMA (Mar 2020), NATS (En Route) Plc / CAA Regulatory Appeal, Provisional findings report, p.202.

The differences between the parties, and the reasons for these are covered in the sections below.

1 The CAPM Market Parameters: Total Market Return, Risk-free Rate and Equity Risk Premium

The TMR, RfR, and ERP estimates relate to the equity market as a whole, and describe the relationship between the returns on equities in general, and the returns on risk free assets (commonly taken to mean very low risk securities, such as government bonds).

Regulatory practice and pure corporate finance principles

In a pure corporate finance sense, the market parameters are intended to be forward-looking, describing the expected returns required by today's equity investors.

The assumed values for these parameters are often based on observed long-term historical evidence of the relationship between returns in equity markets and returns on very low risk securities, such as government bonds. This assumption is made on the basis that the "long-run" past is a useful indicator of future expectations.

However, interpretations of current or forecast market behaviours can also be used to infer values for prospective future equity returns – for example, surveys of analyst forecasts or dividend growth / discount models (DGM/DDM).

PwC and HAL considered both historic and forward-looking evidence. The CMA, on the other hand, largely disregarded any forward-looking evidence on the basis that:

"*[...] forward-looking approaches are largely assumption-driven, with little evidence to support the use of one set of assumptions over others, and they produce a wide range of estimates.*"[2]

In summary, the differences between PwC and HAL are:

- The interpretation of historic evidence – including, significantly, the approach adopted to convert observed nominal equity market returns (i.e. the TMR) into real returns with respect to CPI and RPI.
- The consideration of forward-looking evidence, in particular the prospect for dividend growth in UK equity markets, and the implications of this for implied future equity returns.

Collectively, these differences in approach drive a significant "wedge" between the PwC and HAL views of the market parameters – the TMR proposed by HAL was 6.0% to 6.5%, which was 0.9% greater than the number of 5.1% to 5.6% put forward by PwC.

Historical v. Forward-looking estimates

A critical point of disagreement between PwC and HAL is the reliance on historical and forward-looking TMR estimates:

[2] CMA (Mar 2020), NATS (En Route) Plc / CAA Regulatory Appeal, Provisional findings report, p.173.

- HAL disagreed with PwC's approach to the assessment of the effects of inflation on the TMR; and

- While PwC placed some weight on its in-house DDM, NERA, HAL's advisor, argued that the Bank of England DDM was more reliable. However, NERA also challenged the dividend growth assumption adopted by PwC.

We have reviewed the differences between PwC and HAL's approach to estimate the TMR, and concluded that:

- The approach adopted by PwC in deflating historic returns is reasonable, on the basis that it had done so using the best available independently sourced data on historic inflation.

- HAL's view, supported by NERA, is that the appropriate basis for dividend growth forecasts for UK equity should be a weighting of long-term GDP forecasts for the different regions present in the FTSE All-share index. We consider, in principle, that this is also reasonable.

- However, this approach has important caveats – notably that such evidence is potentially not representative of the long term. Widely available GDP forecasts, often used in such models, typically refer to a relatively short-term horizon. This is a general problem of populating models – such as the DDM/DGM – that require forecast information over an infinite horizon. Our general view is that forward-looking evidence should be given very limited weight due to its high sensitivity to largely speculative assumptions.

Most importantly, since the PwC reports were published and the HAL evidence submitted to the CAA, the CMA has published its provisional findings on NERL. In summary, the views adopted by the CMA on the CAPM market parameters are:

- A RfR derived from 10-year index-linked gilt (ILG) rates averaged over 3 and 6-months, and cross checked against the 15-year and 20-year ILG rates:

  "*We consider that current ILG rates continue to provide the most appropriate basis for the measurement of a notional investors' achievable risk-free returns.*"[3]

- A TMR based on Dimson, Marsh and Staunton (2020) (DMS) and the Barclays Equity Gilt Study dataset (2018):

  – The DMS data underpinned an ex-post assessment of observed returns, considering a range of assumptions regarding – for example – holding periods averaging methods, and inflation.

  – An ex-ante approach that decomposed observed returns into average dividend yields and average rate of dividend growth using the Barclays dataset.

  "*Taking this evidence in the round, our provisional view is that the TMR estimates produced under both the historic ex-post and historic ex-ante approaches are consistent with a figure of between 5 and 6% on an RPI-real basis.*"[4]

[3] CMA (Mar 2020), NATS (En Route) Plc / CAA Regulatory Appeal, Provisional findings report, p.194.
[4] CMA (Mar 2020), NATS (En Route) Plc / CAA Regulatory Appeal, Provisional findings report, p.190.

- An ERP was then adopted, consistent with the observed RfR and the assumed TMR.

The CMA acts as an anchor point for UK regulatory WACC assessment, in particular in regard to the values assumed for the market parameters. Regardless of this, we consider that the values proposed for the generic CAPM parameters, at the NERL/CAA appeal provisional findings, are reasonable for the following reasons:

- The CMA placed significant weight on the recent returns observed in the market for the RfR. This is without doubt the most appropriate reference point for equity investors, as the "risk-free" alternative location for their funds. The (relatively short) averaging period avoids undue volatility.

- The CMA estimates are consistent with the expected TMR remaining more stable in absolute value than the RfR, albeit exhibiting slight decline. This suggests an increasing "price" of risk, – or ERP – and is reflective of the apparent consensus view amongst academics that the TMR remains broadly stable, despite the currently low level of, and changes in, the RfR:

  "[…] we do not see any obvious evidence in the history of returns themselves to cast doubt on the key evidential basis for the treatment of the EMR: that long-run stock returns are stable in real terms."[5]

Conclusion

As set out above, we consider the values proposed by the CMA for the CAPM market parameters are reasonable. For that reason, we have, in principle, adopted the CMA's approach for the estimation of TMR, RfR, and ERP.[6]

We have made a minor adjustment in arriving at our values for the market parameters, but these are consistent with the CMA methodology. Our assumptions adopt a forward adjustment to the RfR – derived consistently with the CMA method – to match the timing of the middle of H7. In its provisional findings, the CMA had estimated an RfR forward adjustment for the middle of RP3, NERL's regulatory period.

Specifically, we have estimated the RfR at the midpoint of H7, deriving forward yields in line with the approach used by the CMA. The impact of this is a +0.15% increase to the CMA estimate of the RfR, and a RfR of –2.10%.[7]

- We have therefore adapted the CMA's provisional view of the ERP range in line with this, to give a range of 7.10% to 8.10%. Our range holds the TMR consistent with the CMA provisional approach.

Our overall central case recommendations for the CAPM market parameters are shown in Table 3:

[5] Wright et al. (2018), Estimating the cost of capital for implementation of price controls by UK Regulators, p.38.
[6] CMA (Mar 2020), NATS (En Route) Plc/CAA Regulatory Appeal, Provisional findings report, pp.179-190 and pp.194-197.
[7] We note that our forward adjustment to the RfR is based on a 3-month and 12-month average of ILG. While this is a slightly longer averaging period than that used by the CMA, 6-months of end-of-month yields, it is consistent with our approach to the rest of the WACC parameters. CMA (Mar 2020), NATS (En Route) Plc / CAA Regulatory Appeal, Provisional findings report, p.196.

TABLE 3: COMPARISON OF CMA AND FLINT CAPM MARKET PARAMETERS

	CMA			Flint		
	Lower Bound	**Upper Bound**	**Central Case**	**Lower Bound**	**Upper Bound**	**Central Case**
Risk-free Rate	-2.25%	-2.25%	-2.25%	-2.10%	-2.10%	-2.10%
Total Market Return	5.00%	6.00%	5.50%	5.00%	6.00%	5.50%
Equity Risk Premium	**7.25%**	**8.25%**	**7.75%**	**7.10%**	**8.10%**	**7.60%**

Source: Flint analysis as of 28 February 2020. CMA (Mar 2020), NATS (En Route) Plc / CAA Regulatory Appeal, Provisional findings report, p.202.

In the following section, we discuss our views and estimate for HAL's beta.

2 Asset and Equity Beta

Beta reflects systematic risk. This type of risk cannot be eliminated by diversification. It therefore commands a price – reflected within the market parameters by the ERP. If systematic risk is in line with the equity market as a whole (reflected in an equity beta equal to one), then the required returns on equity will align with the required return on the market as a whole (the TMR).

The beta is company – in fact, project – specific. It reflects the particular risks associated with a particular set of activities.

Regulatory practice and pure corporate finance principles

Estimation of betas can be challenging, as is the case here.

If a company is quoted on the stock exchange, its share price movements can be used to derive a (historic) equity beta directly. Even if the company itself is not quoted, very similar comparator businesses can sometimes be observed and evaluated.

If the company is focused on a very specific business or set of activities, the equity beta reflects a combination of the relative (systematic) risk of those activities. However, the observed equity is also affected by debt, or gearing.

If the company has debt (is "geared") then the observed equity beta is higher than the beta of the underlying assets. This is because the beta of debt is always lower than the beta of equity and, at typical debt levels, is generally taken to be low, or zero. This reflects the fact that debt holders have a priority claim on the cash-flows of the business. The corollary of this is that debt has the effect of "amplifying" the equity beta.

This effect can undermine the direct comparison of equity beta between companies.

The amplification effect of gearing on equity beta can be neutralised through the process of "de-gearing" to infer a beta that reflects the underlying systematic risk of the assets or activities of the business. This is referred to as the asset beta. The equity beta would be equal to the asset beta if the company had no debt. Comparison between companies is best undertaken at the asset beta level.

An assessment of underlying asset beta can then be "re-geared" to infer an equity beta – and hence a required return on equity – that would prevail at a different level of gearing. Such a re-gearing exercise also requires assumptions to be made about how the debt beta might behave as gearing changes, particularly at higher debt levels. Specifically, the de-gearing and re-gearing process might need to reflect a different debt beta, if they involve a change in gearing between companies (as in this case, between the moderately geared comparator businesses and a higher geared HAL).

In estimating a required return, the equity beta we need is, in principle, forward-looking. It should reflect the expected relationship between equity returns, and the returns on the market as a whole. Whilst it is common to base equity beta estimates for the future on such historical analysis, caution should be exercised in doing so.

Similarly, caution must be exercised when using asset betas of comparator businesses traded in a different stock market. The equity betas of these comparators, underpinning the asset beta estimates, may be affected by the constituency of the specific stock markets and may not reflect the risk of the business under assessment. This must be considered in the context of the CAPM parameters being used, which are, in this instance, derived for application in the UK equity market.

These historical estimates of equity beta will also be representative of all the activities undertaken within a company. If an equity beta is required for a particular subset of these activities, then judgement may be required.

Having established these general observations, it is important to put them in the context of equity beta estimation for HAL:

- "Pure play" equity in HAL was never traded. The last point in time at which equity of any form in HAL was traded was as a part of the BAA Group. BAA also owned other UK airports, including Gatwick, which represented a non-trivial part of its overall value.
- BAA was delisted from the London Stock Exchange in 2006. So, the last available share price data for HAL – which in itself was not representative of a pure play equity beta – will be over 20 years old by the end of H7.
- Heathrow operates in the UK, under a specific, tailored, regulatory regime, and within a UK aviation market that exhibits characteristics that – whilst potentially similar to other markets – are likely to have some unique features.

In light of this – notably the absence of robust recent share price data for HAL – both PwC and HAL reviewed the evidence for comparator airport groups. In order to make for appropriate comparison, both parties focused on asset betas, as did the CMA in its review of the comparator betas for NERL.

Asset beta

The asset beta reflects the systematic risk of an existing asset – the exposure to risk that is shared with the broader market.

Comparator evidence has played an important part in the estimation of asset beta for HAL.

PwC based its asset beta approach on determining whether "*there is [...] reason to make a fundamental change [...]*"[8] to the Q6 asset beta range adopted by the CAA – the Q6 asset beta remained unchanged from the Q5 asset beta, which was based on BAA's actual share price. However, PwC also placed weight on asset beta estimates for two international comparator businesses, Fraport and Groupe ADP, at Q6 – however, PwC's approach to estimate comparators asset beta differed from that of HAL.

For H7, PwC's initial recommendation in April 2017 was that comparator asset betas provided support for the continued adoption of the Q6 asset beta range for HAL (originally estimated from the BAA stock price).[9] Observed comparator asset betas had declined since 2011. In its February 2019 report, PwC reiterated the conclusion that comparator asset betas were within HAL's range adopted at Q6.[10]

HAL's advisor, NERA, instead suggested that the appropriate asset beta estimate for HAL should be made by reference to comparators only, disregarding the Q6 historical range. The upper bound of the NERA range is based on an up to date spot estimate of the 2-year, daily, asset beta for ADP, using the European (STOXX 600) index, and gives no weight to asset beta data from earlier time periods.

Although HAL and PwC placed different relative emphasis on the comparator evidence to estimate HAL's asset beta, the dataset that underpinned their analyses exhibited significant overlap:

- PwC considered the asset beta values for a set of comparator airport groups. PwC gave weight to the observed asset betas for these companies based on analysis against national and regional (international) market returns, and considered differing observation periods (two years and five years) and frequency of observations (daily and monthly).[11]

- PwC also gave weight to the asset beta range previously adopted by the CAA at Q6 and Q5, and, as mentioned above, its overall recommendation was that the CAA adopts an asset beta range consistent with the existing historical range for Q5 and Q6.[12]

- HAL, on the other hand, argued for a higher asset beta. Its view was consistent with current spot estimates of comparator airports' asset beta, Fraport and ADP, estimated only against the regional STOXX 600 index (rejecting the use of national indices). HAL's asset beta estimates placed strong emphasis on a specific time period and frequency (2-year, daily data).[13]

In light of the discrepancies between PwC and HAL estimates, we set out our preferred approach below.

1. Methodological assumptions

1.1. Frequency of data and estimation window

[8] PwC (Nov 2017), Estimating the cost of capital for H7, p.48.
[9] PwC (Nov 2017), Estimating the cost of capital for H7, p.51.
[10] PwC (Feb 2019), Estimating the cost of capital for H7 – Response to stakeholder views, p.71.
[11] PwC (Feb 2019), Estimating the cost of capital for H7 – Response to stakeholder views, p.61.
[12] PwC (Feb 2019), Estimating the cost of capital for H7 – Response to stakeholder views, p.71.
[13] HAL (Dec 2019), Heathrow's Initial Business Plan Detailed Plan, p.300

In estimating equity and asset betas, it is common for regulators and companies to consider daily, weekly and monthly estimates over a range of horizons (e.g. 1-year, 2-year, 5-year and 10-year).

- NERA advocated that *"[...] the choice of the estimation window should be sufficiently long to produce robust statistical estimates and should also consider the impact of wider market conditions on beta estimates and to what extent these factors are expected to prevail over the next regulatory period."*[14]

- However, NERA's preferred asset beta estimate and central case WACC proposal was essentially based on the spot value of the 2-year daily asset beta.

- A UKRN commissioned study supported the "long-run" view "*If regulators are concerned with long-horizon risks, then they should ideally be attempting to estimate long-run, rather than short-run values of beta [...]*"[15]

We also note that confidence levels associated with more frequent data observations are superior, leading us to the view that daily observations provide the most robust asset beta estimates. We therefore recommend caution on the interpretation of asset betas based on less frequent data, due to lower statistical confidence levels. We would also note the apparent instability of beta estimates based on lower frequency observations – for example, the potential for choice of a day of the week / month to materially impact the estimates – with no apparent reason.

Given the periodic nature of the regulatory regime that is applied to Heathrow (the 5-year term of the price control), we also advocate giving weight to the observed asset beta statistics over the full regulatory period (i.e. the period since the last price control determination) – this would imply that all asset beta observations are, broadly, equally recognised over a cycle of regulatory periods.

We would depart from this approach only if there is clear and unambiguous evidence that systematic risks have materially changed. We would not, therefore, support using asset beta estimates based only on the most recent 2-year daily spot rates in this instance – because we are not aware of evidence to this effect for HAL's business as usual operations. In summary, we would place greatest emphasis on 2-year, daily, asset beta statistics, and look at the 5-year history of these numbers. Alternatively, a 5-year, daily, asset beta statistic can also provide a useful view of the asset beta over the full price control period, though we recognise that there is a close statistical relationship between both these numbers. Our analysis later in this section examines these and other beta estimates for the comparator group.

We do not consider that reliance on a spot, 2-year daily, estimate is a robust basis for asset beta estimation. The 2-year estimate would implicitly disregard three years' worth of share price data entirely, at each 5-year periodic price control review, potentially without good reason. It would also potentially give rise to less stable regulatory outcomes. Given the inherent uncertainty in asset beta estimates, and the limited statistical certainty of spot rates, we give weight to all information from the recent period in which there is no *a priori* reason to believe the asset beta to have fundamentally changed.

[14] NERA (Apr 2019), Cost of Equity for HAL at H7, p.19.
[15] Wright et al. (2018), Estimating the cost of capital for implementation of price controls by UK Regulators, p.52.

Our view is consistent with the CMA's approach in its provisional findings in the NERL/CAA appeal, where the CMA adopted an approach to estimate NERL's asset beta based on comparator aviation businesses. For its proposed range, the CMA considered 2-year daily, 5-year daily and 5-year weekly asset beta estimates:

"*Daily data is often used because it has the lowest standard error. However, there is also a body of evidence that daily data may understate betas. [...] We found that there was sufficient liquidity for daily betas to be accurate, and we found no evidence of autocorrelation in the daily prices.*

However, the daily data did in some examples result in a significantly lower beta [...] Given that the choice of beta is ultimately a matter of judgement, we have included both two-year and five-year weekly betas in the analysis below. When using weekly data we gave greatest weight to the five-year weekly betas, because the standard error around two-year weekly betas was high, and also because in practice some of [these two year][16] weekly betas appeared to be outliers."[17]

Our own observations are that, whilst weekly betas are an interesting potential cross check, they exhibit significantly lower statistical confidence levels than daily data and should therefore be regarded with caution. Only in the presence of know liquidity issues would we place meaningful weight on betas estimated using weekly or less frequent observations.

1.2 Choice of market index

The choice of index (against which an asset beta is properly measured) should reflect the fundamental basis of portfolio theory on which the CAPM is anchored, that (marginal) investors rationally hold a "fully diversified" portfolio of stocks, so as to optimise the trade-off between risk and expected return.

PwC and HAL disagreed in selecting the relevant index benchmark against which to estimate the asset beta: PwC preferred local large cap indices while HAL advocated for the use of a regional index.

We recognise HAL's arguments and consider the STOXX 600 is a more relevant index against which pure asset beta measurement is made, recognising the perspective of the marginal investor: [18]

- Local indices are (by definition) not geographically diversified, and do not faithfully reflect marginal investor diversification.
- CAC 40 and DAX, domestic large cap indices, do not include the local comparator companies' stocks, ADP and Fraport, and are highly concentrated indices which do not reflect appropriate levels of diversification.
- Whilst there remains evidence of home bias in equity investment, there is evidential support for a decline in European home bias over time,[19] particularly across the most developed countries within the Eurozone:

[16] Corrected for inferred typing error.
[17] CMA (Mar 2020), NATS (En Route) Plc / CAA Regulatory Appeal, Provisional findings report, p.148.
[18] NERA (Apr 2019), Cost of Equity for HAL at H7, pp.9-13.
[19] See, for example, Darvas, Z., and Schoenmaker, D., Institutional investors and home bias in Europe's Capital Markets Union.

  - The absence of barriers to diversification (notably tax and currency risk) allow effective diversification on the part of investors.

  - The observed diversification trend is entirely in line with greater European market integration in general, and may also be more strongly driven by the behaviour of marginal investor (than the average).

- HAL's assessment of the relevant market index is consistent with the CMA provisional findings:

"*The theoretical benefits of using an international index need to be balanced in practice against a number of challenges in defining a suitable international index [...] In the case of the four firms in our sample, we found a consistent pattern that international betas relative to the Eurostoxx 600 index were higher than domestic betas. This suggested that the effect of systematic risk on 'shocks' to the share prices were more highly correlated to the European indices than to the domestic indices, and this in turn indicates that these are likely to be more relevant indices.*"[20]

In relation to the comparators selected, we support the regional asset beta estimates using the closest available index to an "All-share" index within the Eurozone. In consideration of the index against which the comparator statistics should be measured, we recognise the arguments made by NERA. [21] We consider NERA's arguments that the STOXX Europe 600 may be a more relevant index against which pure beta measurement is made, recognising the perspective of the marginal investor, are robust. We therefore give significant weight to the STOXX 600 based asset beta calculations.

Similarly important, however, is the requirement for internal consistency of the CAPM model. Asset beta values should be derived by reference to an index that properly reflects the diversification of investors. The CAPM model must also reflect these assumptions in other parameters – such as the RfR and ERP. Consistency is important, regardless of how the "imported" benchmark is defined.

This embodies the principle that similar companies should exhibit a similar WACC, regardless of where their equity trades, and regardless of how the WACC calculation is undertaken (barring, for example, different tax and gearing effects, or other international corporate financing constraints). Otherwise, international capital markets would not be working efficiently. Thus, one needs to be careful in taking an asset beta statistic calculated against one index and applying it to a CAPM that has been designed around a different index, if the different indices exhibit different features (such as volatility, and/or expected returns).

Any consideration of the likely effect of using the non-UK national asset beta statistics, or a diversified European Index as a basis for asset beta calculation must be based on the likely outcome for the WACC, not the asset beta alone. This would, in principle, require similar analysis of the European market to that undertaken in relation to the UK TMR. Such an exercise is beyond the scope of our review. However, we note the potential for further uncertainty that results.

1.3 Use of spot values and trailing averages

[20] CMA (Mar 2020), NATS (En Route) Plc / CAA Regulatory Appeal, Provisional findings report, pp.149-150.
[21] NERA (Apr 2019), Cost of Equity for HAL at H7, pp.9-13.

Many parameter inputs to the CAPM can exhibit volatility over time and considerable estimation error. As suggested above, asset beta estimation, in particular, is highly challenging and, even using recent directly relevant share price data, the reliability of the estimates can be low.

In light of the volatility of asset beta observations over time and considerable estimation error, we caution against the use of overly precise methodologies. Instead, we considered different options to test the robustness of our estimates – this is aligned with the CMA provisional findings at the CAA/NERL appeal:

"*Where data is available, we have also considered both current betas and 'rolling betas' over a 1-year, 2-year and 5-year period. Given the uncertainty over measuring beta, this reduces in our view the risk of error, and allows us to take into account whether betas have been stable when interpreting the current beta estimates.*"[22]

1.4 De-gearing and re-gearing

To estimate the asset beta, regulators usually use the formula:

$$\beta eta_{Asset} = \beta eta_{Equity} * (1 - gearing) + \beta eta_{Debt} * gearing$$

This requires an assumption of notional gearing for HAL, so that a cost of equity (and hence WACC) can be estimated for the notional efficient entity.

In its provisional findings for NERL, the CMA highlighted the issue of notional gearing. Specifically, the CMA noted that WACC was significantly affected by the assumption for notional gearing, under the formula used by the CAA. Using the CAA formula, the WACC could be observed to rise materially as the assumption of notional gearing was increased.

The CMA suggested that this did not align with accepted principles of corporate finance – that the WACC should essentially be stable with gearing:

"*According to standard finance theory, the cost of capital (WACC) does not, at least in a theoretical model, vary with gearing, other than for tax reasons.*"[23]

This led the CMA to change the CAA's assumption for NERL's notional gearing.

We will expand on the issue of gearing on the WACC in Section 4. This will explain our proposed approach to notional gearing, along with our proposed assumptions regarding debt beta at different levels of (notional) gearing for HAL, and for the comparator airports.

However, for the purposes of the WACC calculation we assume the following as our central case – and as the basis for our de-gearing and re-gearing calculations:

- Notional gearing for HAL of 56.25%.
- HAL's debt beta at this notional gearing level is assumed to be 0.09.

[22] CMA (Mar 2020), NATS (En Route) Plc / CAA Regulatory Appeal, Provisional findings report, pp.150-151.
[23] CMA (Mar 2020), NATS (En Route) Plc / CAA Regulatory Appeal, Appendices and glossary, p.D2.

- The debt beta of the comparator airports at their observed gearing levels is 0.05.

We consider the sensitivity of the resulting WACC to these assumptions in Section 4.

Both PwC and HAL assumed a debt beta for the purposes of de-gearing the comparator airports equity betas that matched their debt beta assumption for HAL:

- PwC assumed a debt beta for the comparators of 0.10.
- HAL assumed a debt beta for the comparators of 0.05.

We do not agree that the same debt beta should be assumed for both steps of the de-gearing and re-gearing process. The gearing level assumed for Fraport, ADP and AENA, around 30%, is significantly below our proposed notional gearing for HAL.

In line with the CMA approach, and given that the actual gearing of comparator airports is significantly below that of HAL, we use a debt beta of 0.05 to de-gear comparators equity beta estimates. A debt beta of 0.05 for comparator airports is the same as the assumption adopted within the CMA provisional findings in the NERL/CAA appeal.[24]

2. Flint's estimates

We consider Fraport, ADP and AENA the most relevant comparators to HAL.

There is some disagreement between PwC and HAL over the relative systematic risk of HAL and the comparators. HAL argues its higher systematic risk justifies a higher asset beta than the comparators.[25]

We understand that, in practice, a precise assessment of HAL's systematic risk in comparison to other airports is challenging:

- Different market context, and regulatory regimes, may both have a material bearing on risk and asset beta levels. Operational choices around, for example, tariffs and cost structure may also have an effect.
- Fraport and ADP are not entirely dominated by their main respective airports – so the contribution of Frankfurt and Charles de Gaulle (CDG) airports to the observed group systematic risk may be blurred by the risk of other group activities. Therefore, even if Frankfurt and CDG have lower systematic risk than HAL, the groups asset beta may be polluted by other activities with different systematic risk.

Following discussion with the CAA, we have not considered the assessment of relative systematic risk between HAL and its comparators in detail – there is already material uncertainty over asset beta estimates, and the lack of clear evidence of materially different risk presented either by PwC or HAL.

[24] We note CMA's asset beta range seems to have been updated from 0.50 to 0.60 in p.161, to 0.52 to 0.62 in Table 12-17, p.202. This updated range is consistent with the use of a 0.05 debt beta for comparators.
[25] NERA (Apr 2019), Cost of Equity for HAL at H7, p.17.

We therefore base our view of HAL's asset beta on the beta estimates for comparators. To estimate the comparator asset betas, we have followed the principles set out in the methodological assumptions, above, and we have used:

- Daily observations and an estimation horizon of 2-years and 5-years.
- STOXX 600 as the relevant market index.
- Spot values and 2-years / 5-years rolling averages.
- Specific levels of gearing at comparator companies to de-gear the equity beta.
- Debt beta of comparators: 0.05, in line with the CMA provisional findings at the NERL/CAA appeal for the same airport comparators.

We have used the same cut-off date as the CMA in its provisional findings, with the purpose of estimating an asset beta prior to the COVID-19 pandemic outbreak. Our asset beta estimates are in Table 4 below.

TABLE 4: ASSET BETA ESTIMATES

	Fraport	ADP	AENA
2-years, daily frequency			
Spot	0.58	0.59	0.57
2-years average	0.56	0.56	0.60
5-years average	0.49	0.54	
5-years, daily frequency			
Spot	0.50	0.56	0.52
2-years average	0.47	0.53	
5-years Average	0.48	0.53	

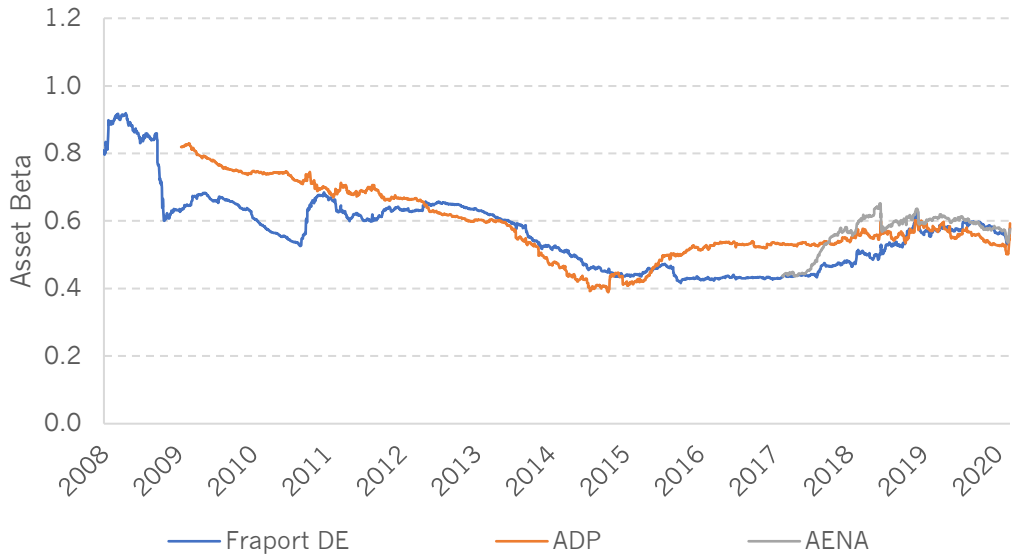
Source: Flint analysis of Thomson Reuters data as of 28 February 2020.

Based on Table 4 above, our estimates might suggest an overall range of 0.47 to 0.60, based on the individual comparators range of:

- 0.47 to 0.58 for Fraport;
- 0.53 to 0.59 for ADP; and
- 0.52 to 0.60 for AENA.

In our view, this suggests that the previous range adopted by the CAA – of 0.42 to 0.52 – is no longer supportable. The latest estimates appear to show a meaningful increase in asset betas during Q6, as can be seen in Figure 1 below. We would also observe some apparent convergence of beta values for the different airport comparators.

FIGURE 1: 2-YEAR ASSET BETA OVER TIME



Source: Flint analysis of Thomson Reuters data as of 28 February 2020.

In addition to our own estimates, we have also considered the values and reasoning adopted by the CMA in its provisional findings from the NERL appeal. Using broadly the same approach (although the CMA added 5-year weekly asset beta observations), the CMA concluded a range of 0.52 to 0.62 for NERL, based on the same airport comparators that we are using for HAL.

We note the following differences between our calculated values and the CMA's provisionally assumed ranges for individual comparators:[26]

- CMA's Fraport range, 0.47 to 0.57, is similar to our range of 0.47 to 0.58;
- CMA's ADP range, 0.52 to 0.62, is slightly above our range of 0.53 to 0.59; and
- CMA's AENA range, 0.56 to 0.66, is above our AENA range of 0.52 to 0.60.
- These ranges for the individual comparator airports differ for several reasons:
  - The CMA placed some weight on 5-year weekly estimates, while we rely primarily on daily estimates.
  - Our calculations make slightly different assumptions to the CMA in relation to gearing – specifically, we de-gear the comparator betas based on average gearing over the estimation window, while the CMA estimates appear to use gearing at the end of the estimation window.
  - The CMA applied judgement, to reflect the clustering of values under different calculation methods and remove outliers.

[26] We infer the CMA estimates based on a consistent debt beta assumption of 0.05.

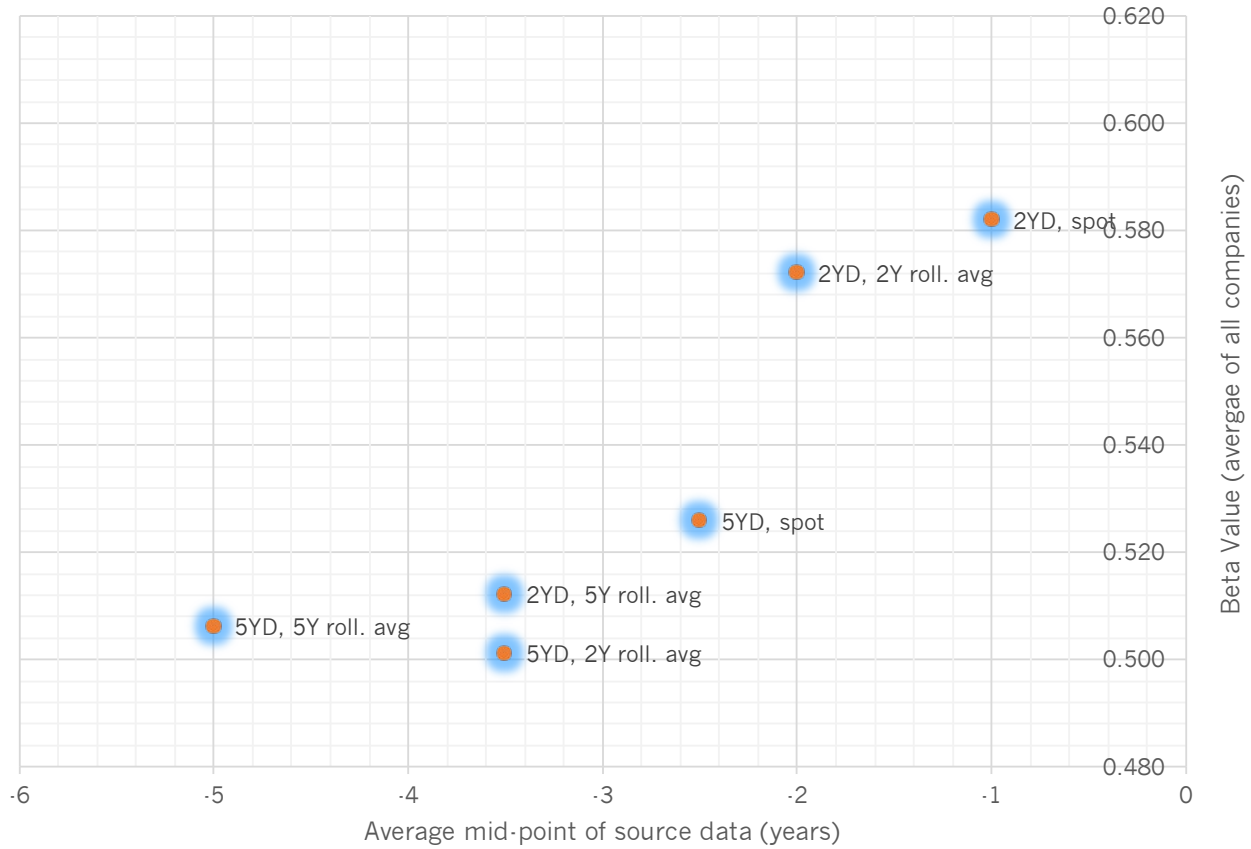
Notwithstanding these differences, the combined effect of the CMA's analysis is to point to ranges fairly similar to our own, for each of the individual airport comparators.

The CMA then considered – based on this combined comparator set – that an asset beta range for NERL should reflect a range of 0.52 to 0.62. This was a broad judgement in light of the overall evidence and the relative risk of the different airports.

To bring our analysis together and support our proposed range for HAL, we examine the estimates for the different comparators, using different beta formulations (observation frequency, estimation window, trailing averaging period) and consider the average beta estimates across the comparator group. We observe the resulting beta estimates against the "average age" of the share price data from which they are drawn. For example, a 2-year spot beta estimate is based on data observations with an average age of one year (half-way through the 2-year estimation window). A 5-year trailing average of a 5-year beta is based on data observations with an average age of five years, etc.

The results of this analysis are shown in Figure 2 – which plots the observed average comparator beta against the age of the data from which it was drawn. It shows that all data points drawn on data with a mid-point within the last five years are in the range 0.50 to 0.58. It suggests a trend of increasing betas, based on the more recent data.

FIGURE 2: AVERAGE BETA OF ALL COMPARATORS



Source: Flint analysis of Thomson Reuters data as of 28 February 2020.

In line with our overall approach set out earlier, our preference for beta estimates is using the 2-year estimation window, averaged over time, and cross checked against 5-year data. We use this

analysis to underpin a proposed range of 0.50 to 0.60, which we note is close to (but slightly lower than) the CMA's range. Our range reflects that the recent 2-year daily beta analysis would perhaps point to a value in the upper half of this range, and also that the statistical confidence levels on observations based on data with more recent mid-points may be slightly lower.

Debt beta

The debt beta, in principle, reflects the (systematic) risk of holding debt. However, the debt beta is generally more difficult to measure than the equity beta, as bonds are less well traded than equities.

Both HAL and PwC converted the asset beta estimates of comparator airports to an equity beta for HAL using assumptions about debt beta. HAL and PwC also appear to have assumed the same debt beta for the de-gearing of comparators equity beta into an asset beta, and the re-gearing of this asset beta into an estimate of HAL's equity beta.

However, PwC and HAL disagreed on the estimate of debt betas that are appropriate for de-gearing and re-gearing:

- HAL's advisor, NERA, used a debt beta of 0.05 for both de-gearing and re-gearing. However, we note HAL used an equivalent assumption of 0.10 debt beta in its Initial Business Plan (IBP).[27]

- PwC initially supported a debt beta of 0.05, but later proposed an increase in debt beta to 0.10.[28]

Contrary to PwC and HAL, we support a debt beta for each company consistent with its gearing level, instead of using the same debt beta for de-gearing of comparators equity beta and re-gearing of HAL's asset beta. This is consistent with the CMA's view at its provisional findings for the NERL/CAA appeal.

We describe our approach below.

The equity beta for comparators

In de-gearing the comparators' equity beta into an asset beta, to be imported into HAL's estimates, we follow the CMA view that a 0.05 debt beta is consistent with a 30% gearing. This is appropriate because the comparator airports used in the CMA provisional findings (Fraport, ADP and AENA), are the same as those we use in our analysis for HAL.

We recognise, however, that, in our analysis, a different debt beta may be warranted for each comparator, since our estimates for the comparators actual levels of gearing range from 20% to 40%:

- We estimate Fraport's gearing at c.38%.

[27] HAL (Dec 2019), Heathrow's Initial Business Plan Detailed Plan, p.303.
[28] According to PwC, a 0.10 debt beta "*better reflects the upward movement in market data and aligns better to other recent regulatory determinations which are also targeting an investment grade rating on corporate debt.*" PwC (Feb 2019), Estimating the cost of capital for H7 – Response to stakeholder views, p.74.

- We estimate both ADP's and AENA's gearing at c.22%.

We also recognise that there is uncertainty in the estimation of debt betas – and even the CMA suggested that existing evidence on debt beta is speculative. We agree with the CMA's assessment and, in the interest of simplicity, we have made the assumption of a debt beta of 0.05 for all of the comparators, despite the actual differences in the levels of gearing.

We then use these asset beta estimates, as an approximation for HAL's asset beta.

Re-gearing the asset beta for HAL

To estimate HAL's equity beta, we re-gear the asset beta estimated above. In doing so, we need to use a debt beta consistent with HAL's notional financial structure.

Both PwC and HAL assumed the same debt beta for the de-gearing and re-gearing steps. However, de-gearing and re-gearing, in principle, require the use of different debt beta assumptions.

Debt beta is primarily a function of asset beta (underlying systematic risk of the business) and gearing – which influences how the risk is shared between equity and debt investors. The comparators (by design) are considered to have fundamentally similar underlying business risk. However, they exhibit very different levels of gearing to HAL, both in reality and under the potential notional financing structure.

In our later section on gearing, we establish a proposed range for HAL's notional gearing of between 52.5% to 60%. This is materially higher than – approximately double – the gearing of the comparators, and therefore an assumed notional HAL debt beta above 0.05 is needed, for consistency.

Notwithstanding the aforementioned uncertainties associated with debt beta estimation, our view is that a 0.10 assumption for HAL's debt beta is reasonable and consistent with a 60% notional gearing assumption. A 0.1 debt beta seems consistent with values adopted by the CMA's in price determinations in other sectors where higher gearing is observed and assumed, and is broadly in line with the debt betas assumed by other regulators in industries where gearing assumptions more in line with HAL's are typically made (gas, electricity, water). In addition, this assumption is not obviously inconsistent with a debt beta of 0.05 at 30% gearing.

For the purpose of further consistency within our model, we also assume a small impact on the debt beta in line with the gearing level assumed in our lower bound.

Conclusions on Equity Beta

We estimate HAL's equity beta based on the above assumptions, as shown in Table 5 below. We adopt the midpoint of the range as our central case scenario.

TABLE 5: COMPARISON OF PWC, HAL AND FLINT BETA PARAMETERS

	PwC (Aug 2019)		HAL		Flint	
	Lower Bound	**Upper Bound**	**Lower Bound**	**Upper Bound**	**Lower Bound**	**Upper Bound**
Gearing	*60.0%*	*60.0%*	*60.0%*	*60.0%*	*52.5%*	*60.0%*
Asset beta	0.42	0.52	0.54	0.62	0.50	0.60
Debt beta	0.10	0.10	0.10	0.10	0.09	0.10
Equity beta	**0.90**	**1.15**	**1.20**	**1.40**	**0.96**	**1.35**

Source: Flint analysis. HAL (Dec 2019), Heathrow's Initial Business Plan Detailed Plan, pp. 304.

We note that our proposed mid-point equity beta for HAL is greater than one, and materially so at the upper bound, although lower than the values proposed by HAL.

The CMA noted in its provisional findings for the NERL/CAA appeal that "*[...] the CAA told us that it considered that the equity beta for a regulated business such as NERL should not be higher than one, as it did not accept that NERL, with the protection of regulation and as a monopoly should be more risky than the overall market.*"[29]

However, although the CMA noted that "*[...] if NERL were to gear up to 60% its shareholders would have relatively high volatility of returns, given its low operational margins*"[30], CMA's view is that NERL's ability to gear up to 60% while maintaining a strong credit rating was plausible.

Therefore, the CMA concluded that "*[...] it does not seem to us to be implausible that NERL could have a cost of equity at 60% gearing consistent with a beta of one or higher.*"[31]

We note this CMA conclusion, and do not therefore consider the implied equity beta to be unreasonable. That said, we consider the implications of a change in gearing for the notional equity beta in Section 4.

3 Conclusions on post-tax cost of equity

We provide our real cost of equity estimates in Table 6 below. We propose a central case cost of equity estimated through the midpoint of all parameters.

[29] CMA (Mar 2020), NATS (En Route) Plc / CAA Regulatory Appeal, Provisional findings report, p.155.
[30] CMA (Mar 2020), NATS (En Route) Plc / CAA Regulatory Appeal, Provisional findings report, p.155.
[31] CMA (Mar 2020), NATS (En Route) Plc / CAA Regulatory Appeal, Provisional findings report, pp.155-156.

TABLE 6: COST OF EQUITY ESTIMATES

Parameter	Lower Bound	Upper Bound
Gearing	*52.5%*	*60%*
Risk-free Rate	-2.10%	-2.10%
Total Market Return	*5.00%*	*6.00%*
Equity Risk Premium	7.10%	8.10%
Asset beta	*0.50*	*0.60*
Debt beta	*0.09*	*0.10*
Equity beta	0.96	1.35
Cost of equity, post-tax	**4.69%**	**8.84%**

Source: Flint calculations.

3 Cost of Debt

The cost of debt (CoD) measures the returns debt investors require for putting their money into a business, or project.

Debt investors face less risk than equity investors. This is because debt investors have primary claim over cash-flows – equity investors only receive a return once debt liabilities have been met. Because of this, equity is often considered and described as a "call option" on the value of assets.

As set out earlier, the WACC calculation gives weight to the cost of debt and cost of equity according to the proportion of each in the capital structure of the business.

This raises important questions regarding the level of assumed gearing, and the implications for the WACC, which are considered further in Section 4.

In line with other regulators, the CAA has previously adopted a notional gearing assumption. The notional gearing that the CAA assumed for HAL – in the past – has been established at 60%, and the CAA adopted this value consistently since before Q5.

The assumption is intended to reflect an efficiently financed notional entity, recognising that there are benefits (for example tax relief) to debt financing, and that an efficient company would at least partly fund itself through debt.

The assumption is also reflective, to some extent, of the observed reality – HAL does indeed finance itself largely through debt. In fact, an assessment of HAL's gearing indicates that its debt levels exceed those that would be implied by the notional 60% gearing assumption. Moreover, other regulated entities (such as water, energy networks) typically operate with similar capital structures.

Of course, the impact of recent events (COVID-19) and the exposure of HAL to hitherto unanticipated risks has perhaps raised a question over HAL's gearing and the risks this creates – but these are beyond the scope of our report.

We therefore conduct our analysis in this section around an assessment of the costs of debt that would be aligned with a continued assumption of a 60% gearing level at the upper bound, and an assumption of 52.5% at the lower bound. The basis of our 52.5% lower bound assumption is explained in Section 4 – in short, it reflects the minimum notional gearing level we consider HAL can feasibly achieve during H7 without having to embark on an implicit (and explicit) debt buy-back program.[32] We then consider the impact and implications of departure from this gearing assumption in a separate section.

We address these and other considerations in estimating HAL's cost of debt, below.

Regulatory practice and pure corporate finance principles

"Pure" corporate finance principles would suggest that appraisal and valuation, for example of a new project, is undertaken on the basis of a forward-looking WACC. This would require that, to the

[32] A 52.5% notional gearing assumes HAL does not issue new debt at H7, under the notional structure.

extent debt financing is to be used, and integrated into the WACC calculation, the cost of debt is entirely forward looking.

However, in providing for an allowed return on assets, regulators typically look at the cost of debt in a way that departs from this purist principle. In the face of a duty to finance, and to ensure that the regulated company has appropriate access to the capital markets, regulators have tended to adopt a different approach – one that recognises the cost of debt that was (notionally or actually) raised in the past.

Were they not to do so, then the regulated company might face a greater mismatch of cash inflow (based on regulated prices) and cash outflow (based on debt issued in the past, at different rates of interest than those payable on debt issued today).

There are of course drawbacks to this. Allocative inefficiencies might result, through regulated prices failing to reflect the true "forward-looking" level of costs of consumption (including the cost of capital). Similarly, investment might not face the correct incentives, and may be higher or lower than the efficient level as a result.

Nonetheless, the approach adopted by many regulators, including the CAA, and endorsed by the CMA in its NERL provisional findings and earlier CMA price control appeals, maintains this approach, for good reason. We therefore adopt a similar approach in our own assessment.

For the reasons described above, our estimate of the cost of debt includes both the cost of embedded debt, and the forecast cost of new debt. We then weight the cost of new and embedded debt according to the implied proportions of each.

Nonetheless, we would note two further considerations in relation to the cost of debt, and how it is typically recognised in the regulatory WACC calculation.

The first of these is the difference between "promised yields" and "expected yields".

The promised yield, or return, on debt will be delivered to a debt holder only if coupon payments and principal repayment are made in full. The expected yield on debt is different. The expected yield on debt reflects the expected yield (ex-ante) that will accrue to the debt holder, allowing for the risk and impact of default with regard to these payments. Put simply, there is a probability that the company will fail to meet debt repayments (e.g. go bankrupt), and, in the event that it does so, the value of actual payments made will be lower.

The difference between the (higher) promised yield and (lower) expected yield is referred to as the expected loss premium (ELP). The expected yield is a matter of speculation, while the promised yield can be observed with mathematical clarity. For this reason, published yields are always reflective of the promised yield. UK regulators, including the CMA, have generally allowed for the promised yield in full in the WACC calculation (ignoring the expected yield and the ELP). To do anything different would, in essence, create an unusual conflict with the financeability duty.

This creates an inconsistency between the cost of equity calculation and the cost of debt calculation. Put simply, the cost of equity is faithfully based on an expected, or required, equity return (because it fully recognises the risks of financial distress and default, averaged across the equity market as a whole, through the ERP assumption). The cost of debt, on the other hand, is an overestimate of the expected, or required return.

The second, and related, consideration is to do with the liquidity premium on debt.

As the CMA noted in its provisional findings for NERL, the observed cost of debt in corporate bond markets in recent years has increased relative to theoretically reasonable expectations. If the CAPM model operated consistently across debt and equity markets, the required return on debt would provide remuneration only for systematic risk (i.e. $\beta eta_{Debt} * ERP$), and a plausible premium for expected losses based on observed default rates and impact (i.e. the ELP). In fact, promised debt yields trade at a significant premium to this. The premium is seen – in the main – to reflect the lower liquidity, or tradeability, of corporate bonds relative to other securities like equity. At present, this liquidity premium is estimated to be more significant than in the past. Nonetheless, like the ELP, the liquidity premium has always been included in full in previous UK regulatory assessments of the WACC.

We consider these issues further, including their potential impact, in Section 4 on gearing.

The weighted average cost of debt

Having established the basis of the calculation, the formula for the cost of debt becomes straightforward. The costs of embedded and new debt are weighted according to the proportion of each, as set out in the formula below. Regulators usually also grant an additional allowance for issuance/liquidity costs, and we also consider this in our cost of debt estimate.

$$Cost\ of\ Debt = Cost\ of\ Embedded\ Debt * (1 - proportion\ of\ new\ debt) +$$

$$+ Cost\ of\ New\ Debt * proportion\ of\ new\ debt\ + Issuance\ and\ Liquidity\ Costs$$

Notional v. Actual cost of debt

The cost of embedded debt is based on backward-looking evidence, while the cost of new debt reflects a forward-look. There are two common approaches to estimate the cost of both types of debt:

- A "top-down" approach: under which the cost of debt uses the notional construct – adopting benchmarks to establish an efficient cost of debt for HAL.
- A "bottom-up" approach: which relies on actual (HAL-specific) costs of debt.

We adopt a "top-down" approach for both types of debt. Our reasoning is as follows.

So long as an appropriate benchmark can be established, the notional approach should reflect efficient financing costs, by benchmarking the cost of debt to observed market evidence (which should represent an efficient cost of debt).

This retains clear, good incentive properties – if HAL is able to outperform the cost of debt, then it retains the immediate benefits of this, though these will then potentially flow through to customers in subsequent regulatory price determinations.

Where the regulated company has a very simple balance sheet with a limited number of debt issues (on which the issuance yields can be readily observed) and actual gearing is close to the notional regulatory assumption, the "bottom-up" approach may be reasonably explored.

This is not the case for HAL. HAL's borrowings are complex, and involve multiple debt issues, through different holding company structures, and in different currencies. HAL makes extensive use of derivatives and adopts a mix of real and nominal borrowing.

The top-down approach avoids the challenges associated with these complexities.

Our preference for the top-down approach also benefits from consistency over time – it has been adopted to some extent by the CAA and the CMA in the past.

In terms of representations:

- The proposed approach of PwC for H7 was also based on a top-down assessment.[33]
- The HAL proposal set out in its IBP was defined by reference to actual debt costs. However, HAL also provided an alternative approach in line with the top-down methodology, aiming to propose a different view from PwC as to how the backward-looking assessment of embedded debt costs should be undertaken.[34]
- Specifically, PwC and HAL expressed a different view as to the historical time frame from which the average embedded debt cost should be derived.

We consider this below.

Real v. Nominal cost of debt

In line with the approach adopted for the cost of equity, we estimate the cost of debt in real terms, with reference to the Retail Price Index (RPI).

Our approach to estimating the cost of debt in real terms involves two steps:

- First, we derive an estimate of the nominal cost of debt, aligned to the price control period.
- Second, we deflate this by a view of RPI, defined to align in the same way.

We consider this to be the simplest and most readily evidenced method – because the evidence on real terms bond yields is more limited, particularly in regard to corporate debt. We also observe that most of HAL's debt issuance is in nominal terms.

1 Cost of embedded debt

Under the top-down approach, the cost of embedded debt should be based on the observed costs of efficiently incurred debt that would have been incurred by the notional entity – a business similar to HAL, with a similar level of (notional) gearing.

This assessment requires further assumptions to be made regarding two main drivers of the cost of debt:

[33] PwC (Feb 2019), Estimating the cost of capital for H7 – Response to stakeholder views, p.27.
[34] HAL (Dec 2019), Heathrow's Initial Business Plan Detailed Plan, p.313.

- First, the term, or "tenor" of the debt issued; and
- Second, the credit rating that would prevail for such debt.

These two drivers are then used to decide the averaging period and weighting on the embedded debt calculation.

Tenor of HAL's debt

We understand the average tenor at issue of actual HAL debt to be 17 years. This is based on a calculation of Heathrow Funding Limited's outstanding debt, weighted for the sterling equivalent amount issued, and includes all debt issues, regardless of the nature of the issue.[35] Whilst many of these bond issues cannot be directly compared to the benchmark index that we subsequently use, we believe it offers the most useful proxy for the overall term structure of HAL's debt.

In its IBP, HAL provides a calculation of the tenor at issuance of 20 years, based, as we understand, on estimates made for HAL by NERA, which includes bonds that predate the breakup of BAA.

PwC considered a 15-year trailing average matched HAL's tenor at the beginning of H7.[36]

We consider the 20-years tenor is a reasonable basis for the assumed notional tenor of debt. There is no reason to suppose that HAL has issued debt at a frequency or of a mix that is inappropriate or inefficient, and we do not believe that this assumption is likely to have a particularly material bearing on the WACC estimate over the long term.

We therefore assume a tenor of debt of approximately 20 years.

Credit rating and benchmark yields for the notional entity

We have reviewed the evidence on observed issuance yields of HAL's bonds. The relevant measure of the cost of debt incurred by the borrowing entity is the yield at issuance.

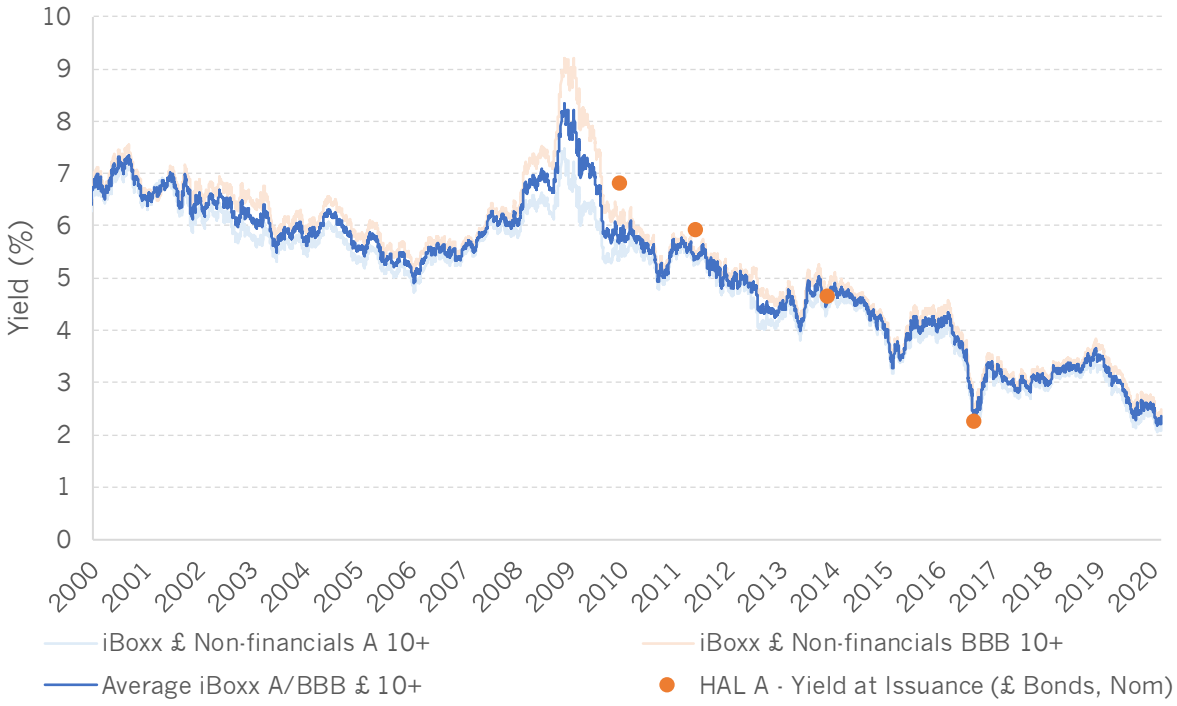
In doing so we have focused on HAL's A rated bonds, which, based on advice received from Centrus, the CAA's appointed corporate finance advisor, are considered to provide the best proxy for HAL's cost of debt under the notional capital structure. We understand that HAL's A rated bonds most closely map onto the ring-fenced regulated entity, under the whole business securitisation (WBS) structure.[37]

We also note from Centrus' analysis that the core WBS entity in this structure has gearing of just under 70% - higher than the notional gearing assumption of 60%. This is the gearing statistic that partly underpins the credit rating of the bonds and should be used as the reference point for consideration of how yields might change at different gearing levels.

[35] Information available on HAL's website: https://www.heathrow.com/company/investor-centre/debt-information/heathrow-bonds.
[36] PwC (Feb 2019), Estimating the cost of capital for H7 – Response to stakeholder views, p.29.
[37] Information provided by Centrus.

We compare the issuance yields on these bonds, with the observed benchmarks for A/BBB bond yields in Figure 3 below. These benchmarks (the iBoxx indices) capture bonds with remaining term of more than 10 years, and an average term of 19 years.

FIGURE 3: YIELD AT ISSUANCE OF HAL £ ISSUANCES V. IBOXX INDICES YIELDS



Source: Flint analysis of HAL's website and Thomson Reuters data as of 28 February 2020.

In evaluating this evidence on yields, we make the following observations:

- The yields on the most relevant and recent HAL bond issues have been closely in line with the indices. The first two bonds issued by HAL, and shown in the graph, appear to have been issued at a small premium to the indices.
- The yields on HAL's bonds are likely to be upwardly biased by the actual gearing of HAL, which is higher than that of the notional entity.
- PwC also noted that "*[...] the two most recent issuances were close to the benchmark despite having time-to-maturity greater than the benchmark average.*"[38]

In light of this, we consider that the average of the A and BBB iBoxx 10+ index forms a reasonable basis for the calculation of the costs of debt of the notional entity, both for the embedded debt cost calculation, and for the cost of new debt at a notional gearing level of 52.5% to 60%.[39]

This is in line with the practice of other regulators, who typically make an assumption of notional credit rating (and gearing) in line with medium to lower investment grade status.

[38] PwC (Nov 2017), Estimating the cost of capital for H7, p.29.
[39] Furthermore, Ofwat and Ofgem also support the use of an iBoxx index.

It is also the approach adopted (at least in part) by the CAA and the Competition Commission (CC, now CMA) in relation to previous price controls for HAL.[40]

Averaging period and weighting for the embedded debt calculation

We now turn to how the average cost of embedded debt should be calculated. This involves assumptions about averaging period and weighting:

- Averaging period is the date range over which the observed debt yield index is to be observed, and
- Weighting describes how this data is synthesised into an appropriate average for the cost of embedded debt.

As in previous areas, we are evaluating both the averaging period and the weighting from the perspective of the notional entity.

Averaging period

In principle, from an "expected value" point of view, the averaging period will not bias the average level of the regulator's WACC estimate over time. From a theoretical perspective, over a very long horizon, a 5-year trailing average or a 20-year trailing average of the same debt index will drive the same average value for the WACC. This is because each year's observed index value is given equal weighting when this is evaluated over a long sequence of regulatory settlements.

However, the choice of the averaging period is not only about the expected value of the WACC over time. The financing duty requires that consideration is also given to the likely cash-flows associated with debt liabilities and attempt to create a similar pattern of cash-flows through the WACC mechanism. This points, in broad terms, to the averaging period matching the average tenor at issuance of notional company's debt.

There are also considerations of consistency over time. A change to the backward-looking averaging period (between one regulatory settlement and the next) will give rise to certain periods of historic observed yields being given greater weight than others. This may align with intention – perhaps to recognise an understood pattern of (efficient, notional) debt issuance – but, if so, we would recommend that it should be reflected in explicit weightings adopted in the averaging calculation, covered below.

We believe this consistency point to be of great importance, to avoid bias in the WACC estimate. Consistency is particularly important in the context of a notional calculation.

In our view, a notional calculation maintains incentives to acquire debt in an efficient manner and is less open to gaming than an approach based on the cost of company's actual debt (and it also seems sensible given HAL's complex debt structure). Under the notional approach, the trailing period is a key component – it should be broadly reflective of the period for which finance is

[40] CC (2007), Cost of Capital Appendix F, p.F10-F11. At Q5, the CAA considered "*[...] there was no case for adjusting the Commission's proposed cost of debt in either direction.*" CAA (Mar 2008), Economic Regulation of Heathrow and Gatwick Airports 2008-2013, p.127.
CAA (2013), Estimating the cost of capital: a technical appendix to the CAA's Final Proposal for economic regulation of Heathrow and Gatwick after April 2014, p.39.

obtained in benchmark companies and would not be expected to deviate greatly from the tenor of the actual debt of the firm

In deciding the trailing period to be used, a key concern is to keep a consistent approach through price controls over time to avoid double counting or under counting certain periods.

In the past, the CAA has not made clear any preference for a notional approach or a specific trailing average period:

- At Q5, the CAA adopted the CC's recommendation to use the cost of new debt as proxy for the cost of embedded debt, suggesting this was broadly in line with BAA's embedded costs.[41]
- At Q6, the CAA followed the recommendation of its' advisors, PwC, which proposed that the average yield to maturity of Heathrow bonds at issuance since January 2008 was lower than the 5-year trailing average of the A/BBB 10-15 years indices.[42] PwC concluded that Heathrow was able to issue debt below average benchmark yields, and used the actual cost of debt as proxy for the cost of embedded debt.[43]

Since previous price controls do not provide a strong preference towards a certain trailing average period, and in light of CAA's financeability duty and the potentially better cash-flow matching properties, a 20-year trailing average period, consistent with HAL's existing debt tenor, seems appropriate.

We consider a simple average, which gives equal weight to all data points in the period, is appropriate in light of the distribution of HAL issuances over time – i.e. HAL debt issuance are not concentrated at a single point in time, as show in Figure 4 below.

Weighting for the embedded debt calculation

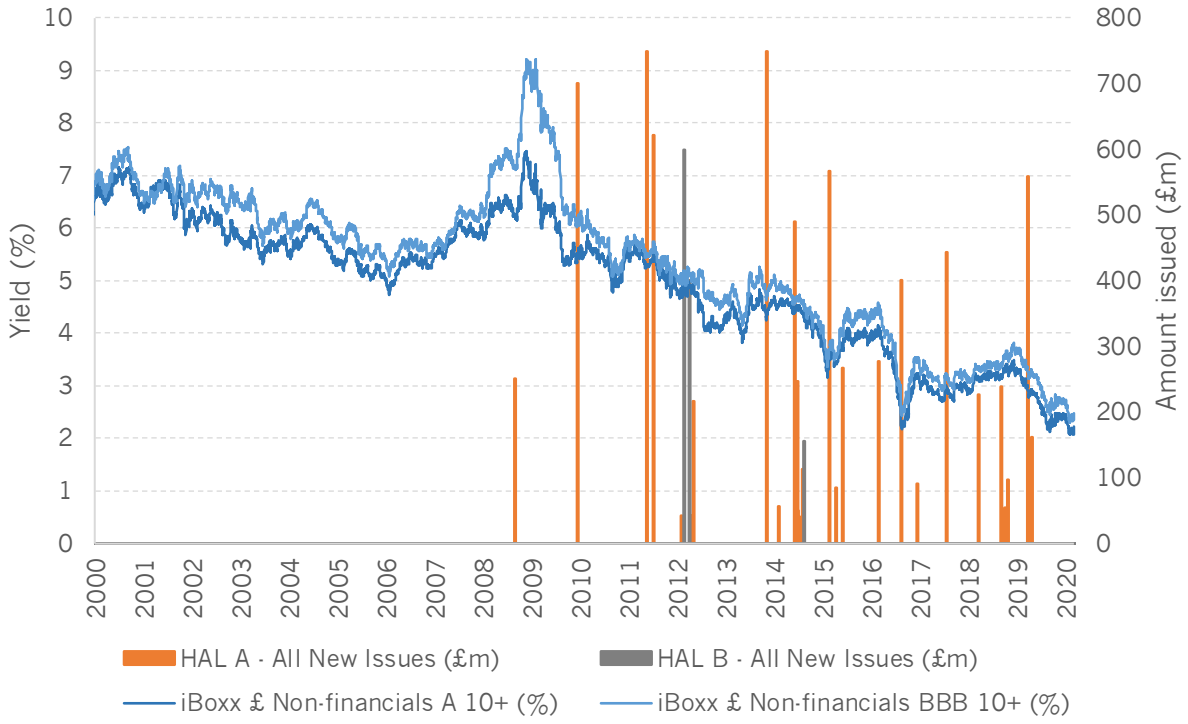
PwC did not explicitly address the question of weighting within the calculation of the historical average of the debt yield index.

HAL, on the other hand, advocated the recognition of actual embedded costs, thus implicitly adopting weighting in line with the pattern of actual debt issuance.

Figure 4 shows the issuance of HAL bonds over time, alongside the yields on the iBoxx index.

[41] CC (2007), Cost of capital, Appendix F, p.F11.
[42] We note the blended average of spot yields across Heathrow's bonds was below the comparable estimate for Gatwick.
[43] PwC (Apr 2013), Estimating the cost of capital in Q6 for Heathrow, Gatwick and Stansted, p.36.

FIGURE 4: HAL ISSUANCES V. IBOXX YIELD



Source: Flint analysis of HAL's issuances, available in HAL's website, and Thomson Reuters data as of 28 February 2020.

We are cautious about inferring a strong pattern in HAL's debt issuance from this. The evidence on recent debt issuance appears to suggest that HAL's debt capital was raised in different amounts, across multiple issues, in a fairly uneven profile over time. Of course, debt issuance is necessarily lumpy. However, we do not see an obvious pattern that would suggest significant additional weight be given to yields from a particular period in the past (for example, a dominant handful of large bond issues from a small number of particular dates).

We do observe that, in the last five years, debt issues have been more frequent, but smaller, whereas in the earlier part of the last decade, issues were less frequent but typically bigger.

The specifics of HAL's actual debt issuance profile are one consideration, but the consideration of the notional entity, and a more theoretically optimal debt issuance pattern, is also relevant. We note that the observed pattern in corporate debt issuance might exhibit trends over time. For example, periods of high interest rates may be correlated with lower levels of borrowing, or vice versa. This might point to periods of higher or lower yields being "de-weighted" or "over-weighted" in the cost of debt calculation.

However, we do not explore this in detail. HAL has a series of financing needs that perhaps is less adaptable than that of the generality of corporate borrowers. We therefore consider that HAL's financing needs are perhaps more stable over time than for most companies.

Thus, we are of the view that complex weighting should not be applied to the observed historical average values of the bond yield index. We would recommend adopting a simple average. This is in line with the suggested approach of both PwC and HAL.

Conclusion on Flint's estimate

In summary, our recommended approach, regarding the main considerations on the cost of embedded debt, is to use a 20-years simple average of iBoxx A/BBB £ Non-financial 10+ indices, matching HAL's tenor proposed by NERA.

Turning to the suggested approaches of PwC and HAL:

- PwC initially recommended a notional approach based on a 15-year trailing average of historical A/BBB benchmark yields.[44] In its follow up report (February 2019), PwC adopted CEPA's suggestion that a rolling, trailing average, approach be adopted – reflecting the amount of outstanding debt that will mature during H7 (i.e. when a year passes over H7, the first year of the trailing average is removed from the calculation).[45]

- HAL advocated using the actual costs of embedded debt, a more accurate reflection of HAL's actual debt costs. HAL argued that if a notional approach was adopted, it should reflect a 20-year averaging period, consistent with HAL's actual portfolio and average debt tenor at issue.[46]

With regard to our own assessment, and the elements of these proposed approaches, our views are as follows:

- We support the use of a top-down approach, using a debt index. This is largely due to the incentive properties of such an approach, combined with the difficulties of inferring a reasonable notional cost of debt from HAL's actual financing structure and the significant departure of HAL's capital structure from the notional gearing level.

- We consider the use of the average of the iBoxx A/BBB £ Non-financial 10+ indices to be reasonable and align with the observed evidence on HAL debt.

- We do not have strong view regarding the choice of averaging period from a methodological standpoint, but tend towards the use of a 20-year trailing average given the match to HAL's tenor, which we have no reason to assume is inefficient.

- We advocate most strongly that, once chosen, this averaging period should remain in place. If changed, an appropriate mechanism should be implemented to ensure that a particular period of interest rates is not given undue weight, so as to bias the WACC calculation, and create a windfall loss or gain.

- Whilst not covered in our earlier sections, we do not, in principle, disagree with the revised PwC/CEPA proposal to adopt a trailing average for embedded debt that recognises how the mix of notional embedded debt will evolve over the course of the new control period to reflect notional refinancing. In principle, this might bring the WACC estimate more in line with the "pure" corporate finance value, and more faithfully reflect the 20-year tenor of HAL's debt.

[44] PwC (Nov 2017), Estimating the cost of capital for H7, p.30
[45] PwC (Feb 2019), Estimating the cost of capital for H7 – Response to stakeholder views, p.30.
[46] HAL (Dec 2019), Heathrow's Initial Business Plan Detailed Plan, p.313.

- This introduces a layer of complexity into the calculation of the embedded debt cost. We would generally avoid undue complexity in such calculations, but – so long as the principle is reflected consistently over time – we do not feel strongly that in this situation it is unwarranted.

- Our reasoning is that it brings the WACC materially more closely in line with the "true" WACC, at the present time, and reflects the substantially changes to capital market conditions observed in recent years.

- We therefore adopt an approach that reflects a dynamic trailing average for embedded debt over H7. We describe below the steps in our calculation.

Using the simple 20-year trailing average of the iBoxx index values described earlier, we estimate HAL's nominal cost of notional embedded debt at 5.13% as of 28 February 2020. We then adapt this approach to reflect HAL's likely position at the beginning of H7, on 1st January 2022. The steps are:

- We first calculate the trailing average from 1 January 2002 to 28 February 2020 – we "lose" the (~2 year) data at the start of the series which will no longer be part of the notional embedded debt mix at the beginning of H7.

- This data is then replaced by a projected average cost of new debt issued over the remainder of iH7 (i.e. prior to the beginning of H7), aiming to reflect new issuance prior to 1st January 2022.

- We estimate the projected cost of this "pre-H7" new debt at the beginning of H7, based on forward yields and consistent with the approach set out in Section 3.2.[47] We estimate the cost of new debt issued during the remainder of iH7 to be 2.46%, the midpoint of an estimated range 2.33% to 2.59%.

- We then weight this cost of notional new (pre-H7) debt with the (known) embedded debt index values for the earlier period, to give an estimate of the 20-year trailing average cost of embedded debt of 4.74% at the beginning of H7.

- We repeat the same approach to estimate the cost of remaining embedded debt at each year of the H7 regulatory period. At the beginning of each year, the earliest year is dropped from the historical trailing average data series and the calculation re-weighted. Thus, by the beginning of the final year of H7 (1st January 2026), the statistic reflects only a 16-year trailing average of the index, but properly captures the historic values of the iBoxx derived consistent with the above.

- Our estimates are shown in Table 7 below.

[47] We first estimate the forward adjustment to the beginning of H7 using a 3-months and 12-months average of the implied forward adjustment in 1.5/2.5-year and 2/3-year government bonds, -0.12% to -0.11%. We then halve the forward adjustment range to -0.06% to -0.05% to reflect the average adjustment applied to the cost of new debt issued over the remainder of iH7.

TABLE 7: DYNAMIC COST OF EMBEDDED DEBT OVER H7

Year	2022	2023	2024	2025	2026	H7 Average
Term of the trailing average	20 yrs	19 yrs	18 yrs	17 yrs	16 yrs	
Start of historical trailing average	Jan 2002	Jan 2003	Jan 2004	Jan 2005	Jan 2006	
Relevant iBoxx A/BBB 10+ trailing average	4.97%	4.89%	4.82%	4.75%	4.70%	
Assumed cost of new debt for remainder of iH7	2.46%	2.46%	2.46%	2.46%	2.46%	
Weighting of new debt issued prior to H7 start	9.21%	9.70%	10.24%	10.84%	11.52%	
Cost of Embedded Debt	**4.74%**	**4.65%**	**4.58%**	**4.50%**	**4.44%**	**4.58%**

Source: Flint analysis of Thomson Reuters and Bank of England data as of 28 February 2020.
Note: New debt issued during the remainder of iH7 will represent debt issuance over a period of 1 year and 10 months. The weighting of this new debt issued during the remainder of iH7 increases over time because the term of the trailing average calculation reduces from 20 years at the start of H7, to 16 years by the final year of H7 – i.e. 2026. Similarly, the debt issued prior to January 2006 is given progressively lower weighting as it "disappears" from the trailing average dataset – hence the value of the relevant iBoxx trailing average debt yield declines.

We recognise that the allowed return that will be given to HAL at H7 will be expressed in real terms. We set out later (in Section 3.5) our proposed approach for the translation of these into real yields, to adjust for the forecast level of RPI. The approach we propose involves a range of RPI forecast values based on consensus forecasts, and also from the implied RPI forecast from government bond yields (real and nominal) – ensuring consistency of cost of (new) debt approach with this basis of forward government bond yield estimation.

2 Cost of new debt

In the previous section we explained our approach to the estimation of the cost of embedded debt for the notional entity. In this section we extend this approach to the treatment of new debt – that is, debt that the notional entity might expect to issue during H7.

We discuss later the weighting that should be given to the cost of new debt. Essentially, this requires a consistent approach to be given with the level of forecast notional gearing, and the relationship, of future gearing, to today's (notional) gearing. For now, we focus only on the expected cost of new debt.

In essence, we forecast the cost of new debt on an assumption that it is similarly related to the iBoxx index values in future. So, we rely on a blend of iBoxx A/BBB, pound sterling denominated, non-financial, indices with an expected remaining life aligned with HAL's debt profile, 10+ years.

We do not consider the additional adjustments to the cost of new debt advocated by HAL (i.e. additional cost at issuance over iBoxx, spread relative to iBoxx, new issue premium, and spread to index-linked and fixed debt) are warranted:

- The sample of HAL's nominal, pound sterling denominated, bonds that we have examined provide robust evidence that HAL debt does not warrant a premium to the iBoxx index, in the notional efficient cost of capital calculation.
- We do not consider that a premium is warranted to reflect different types of debt issuance that HAL claims is potentially more costly – such as index-linked, or debt denominated in other

currencies. The evaluation of differences and implications for the cost of debt are not straightforward (e.g. currency translation issues). Nonetheless, a basic point of principle drives our view – if HAL is choosing to issue these different types of debt in preference to nominal sterling denominated debt then we would assume that it does so only because it is cheaper, or there are offsetting benefits elsewhere to its higher cost.

- This assumption may be challenged – for example, in the event that HAL was entering a period where a very significant amount of debt was to be issued that might "dry up" a particular source of borrowing. However, under the "business as usual" circumstances assumed in this estimation exercise, we do not consider this likely.

- We therefore think that the nominal, pound sterling denominated, debt yield, based on the blended iBoxx indices, represents a fair proxy for the efficient cost of all debt raised in the context of a "business as usual" H7

To forecast the iBoxx yield at H7, we make use of government forward yields. We calculate these based on observed government bond prices over a recent short-term period.

We use nominal forward yields to forecast a nominal iBoxx yield because, being based on the most widely traded government bonds, these are most reliably observed. Over the short forecast horizon that we are applying (~5 years), forward yields are unlikely to be distorted by, for example, inflation, or liquidity risk premia.

As for the cost of embedded debt, we recognise that the allowed return that will be given to HAL at H7 will be expressed in real terms. We set out later (Section 3.5) our proposed approach for the translation of these into real yields, to adjust for the forecast level of RPI.

In summary our approach to estimate the cost of new debt uses estimates based on the spot values of government bond yields for different maturities. We take an average of values over the past 3-months and 12-months. Both PwC and HAL used an average of three months, and the CMA uses a 6-month average in its NERL/CAA appeal provisional findings.[48]

- We infer a forward 20-year yield on government bonds to match the tenor of HAL's existing debt, and broadly aligned with the iBoxx index blend.

- We infer this rate for a date at the midpoint of H7.

- We define a range for this yield based on the spot 20-year government nominal bond, average over 3-months and 12-months, 1.18% to 1.32%. We then adjust for the middle of H7 based on the implied forward adjustment in 4/5-year and 24/25-year government bonds, 0.23% to 0.26%.[49]

---

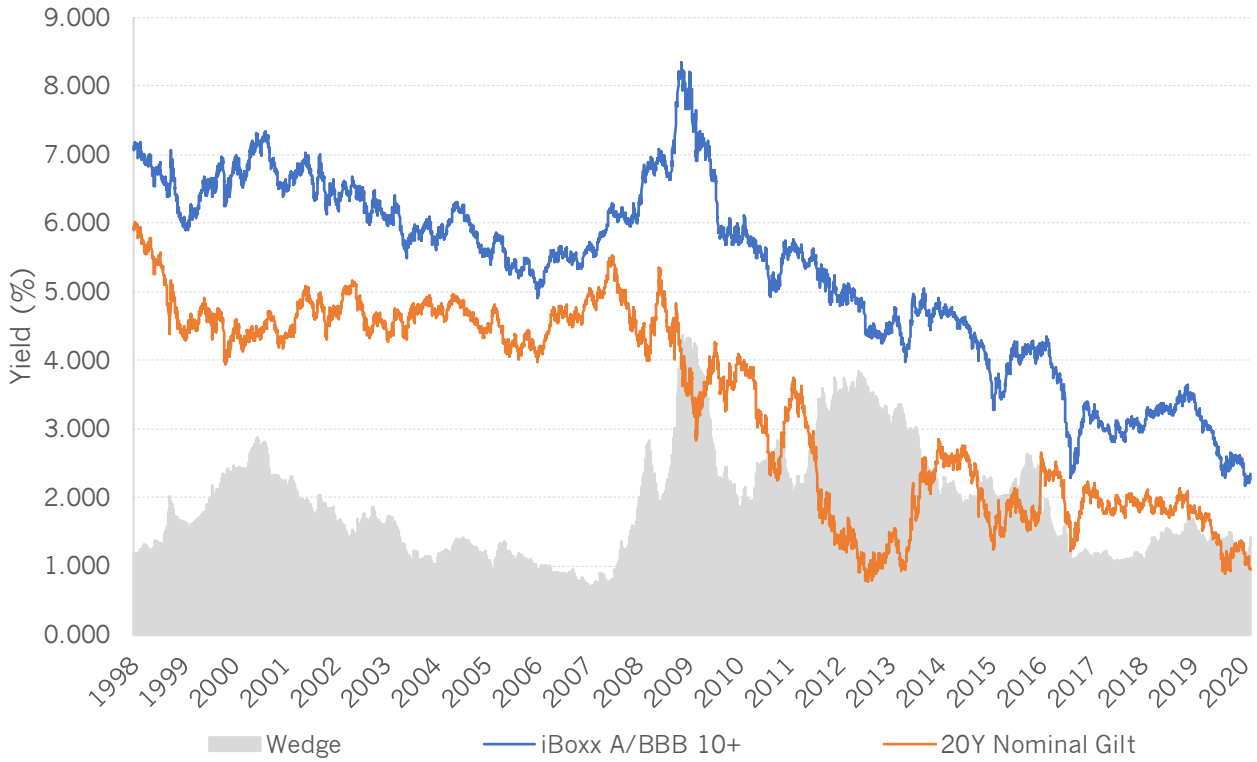
[48] PwC (Feb 2019), Estimating the cost of capital for H7 – Response to stakeholder views, p.25.
HAL (Dec 2019), Heathrow's Initial Business Plan Detailed Plan, p.307.
CMA (Mar 2020), NATS (En Route) Plc / CAA Regulatory Appeal, Provisional findings report, p.170.

[49] We have estimated this adjustment by observing the implied annual return in nominal government yields with 4/5 years to maturity to 24/25 years to maturity, and the difference between this implied return and the return on 20-year gilts as at 28 February 2020 – the use of 20-year gilts is consistent with HAL's debt tenor of 20 years. We note that the reliance on 20-year nominal gilts for the cost of new debt forward

We then assume that the relationship between the iBoxx index and the 20-year government bond yield will remain consistent over time. That is to say, we infer a "wedge" that is observed between relevant iBoxx estimate and the 20-year UK government bond yield.

As shown in Figure 5 below, the wedge has been volatile over time. That said, it has generally been in the range 1.0% to 1.5% since 2017. Moreover, we are not aware of a more robust basis on which to estimate future corporate bond yields, and none of the parties have (to our understanding) recommended an alternative.

FIGURE 5: WEDGE BETWEEN IBOXX A/BBB INDICES AND UK GILTS



Source: Flint analysis of Thomson Reuters and Bank of England data as of 28 February 2020.

We therefore adopt a range for the wedge, with an upper and lower bound based on the 3-months and 12-months average values for the difference between the iBoxx v. 20-year government yields. This gives a range of 1.21% to 1.33% for the historical wedge, which we assume to remain similar in the future.

We show the resulting estimates for each cost of new debt parameter in Table 8 below.

adjustment is at odds with the reliance on 10-year ILG for the RfR forward adjustment. However, the use of 10-year ILG for the RfR forward adjustment is in line with the CMA emphasis on 10-year ILG for the RfR estimate, and recognises the potential of bigger distortions from liquidity premia at the longer dated end of the ILG curve.

TABLE 8: COST OF DEBT ESTIMATES

	Low Bound	Upper bound
20-year Gilts	1.18%	1.32%
Wedge between Gilts and iBoxx A/BBB	1.21%	1.33%
Forward adjustment	0.23%	0.26%
Cost of new debt	**2.62%**	**2.90%**

Source: Flint analysis of Bank of England gilts and Thomson Reuters data as of 28 February 2020.

We note that our approach is consistent with the CMA's top-down provisional approach at the NERL/CAA appeal, but yields slightly different results due to:

- Use of a different debt-index calibrated to NERL's observed tenor, credit rating, and yield at issuance. We use the iBoxx, calibrated similarly, and consistent with Ofgem, Ofwat, and CAA precedent.
- The CMA estimated a forward adjustment to the middle of RP3 based on ILG, and we estimate a forward adjustment to the middle of H7 based on nominal gilts. It is our view that the use of nominal gilts to estimate the forward adjustment is consistent with the use of nominal indices such as iBoxx, and a consistent approach to inflation.

3 Proportion of new debt

In practice, the required amount of new debt for a firm is driven by future gearing, combined with the maturity profile of existing embedded debt.

If gearing is to hold constant (assuming no systematic expectation of a change in market value of the enterprise) then new debt will need to be issued to "replace" the debt that reaches maturity.

Our upper bound notional gearing assumption holds the level at the 60% previously assumed by the CAA for HAL.

On the basis of a tenor of 20 years, then over the 5-year price control period, 25% of debt would mature, and need to be replaced with new debt.

Under our assumption of consistent issuance of debt over time, this would mean that the average level of new debt during H7 would be 12.5%.

We therefore attach a weighting of 12.5% to the cost of new debt at the upper end of our cost of debt calculation.

We note that this is consistent with the assumption proposed by PwC and HAL, both of whom supported a continued notional gearing assumption of 60% and a new debt weighting of 12.5%.

We also note that this is potentially in conflict with the approach to notional gearing and new debt weighting adopted by the CMA in relation to NERL.

Essentially the CMA's provisional approach for NERL attempted to anchor the WACC estimate in a way that was more clearly aligned with the comparator businesses from which the asset beta estimates were drawn.

This led the CMA to adopt a lower notional gearing level for NERL than the CAA had assumed, and more in line with the companies from whom asset beta estimates had been derived.

In doing so the CMA aimed to avoid what was perceived to be an observed idiosyncrasy in the WACC calculation; that the calculated WACC value rose, as notional gearing was increased.

The CMA was of the view that this increase was inconsistent with key principles of corporate finance, that the WACC is unchanged by gearing:

"*This effect of the WACC strictly increasing with gearing is unexpected, since the approach followed in this formula is ultimately derived from the Modigliani-Miller theorems, which describe a scenario under which the cost of capital is independent of (and therefore broadly constant with) gearing.*"[50]

We consider the implications of this and evaluate how the adoption of an approach more closely aligned with the CMA provisional decision for NERL might influence the WACC calculation in this instance. This is set out in Section 4.

For the lower end of our range, we assume a proportion of new debt consistent with a gearing assumption of 52.5%, on average, during H7. This would reflect a significant notional de-gearing of HAL, to 45%, by the end of H7. In effect, this would involve the issuance of no debt during H7, hence a proportion of new debt of zero.

4 Issuance and liquidity costs

Issuance costs are costs incurred by the company related to the issuing of debt (e.g. legal costs and bank fees), that are not faithfully captured in observed yields, which tend to be calculated on the basis of gross proceeds or gross coupon and principal. So long as these costs are efficiently incurred, it is reasonable that they are recognised in the WACC calculation.

These costs are in some degree fixed in nature (e.g. legal and administrative costs) and therefore might be expected to exhibit scale economy.

PwC and HAL both suggested that the allowance for issuance costs should be 0.10%.

HAL also suggested that an additional allowance of 0.05% be made for liquidity costs *"[...] need[ed] to maintain a liquidity facility to ensure that [HAL] has sufficient funds to meet its investment and debt repayment requirements over a reasonable future horizon."*[51]

There is significant regulatory precedent in estimation of these costs that may be relevant in HAL's context:

[50] CMA (Mar 2020), NATS (En Route) Plc / CAA Regulatory Appeal, Provisional findings report, p.158.
[51] HAL (Dec 2019), Heathrow's Initial Business Plan Detailed Plan, p.318.

- At PR19, Ofwat made an allowance for the cost of issuance and liquidity (combined) at 10bps.[52]
- At RIIO-2 and RIIO-1, Ofgem did not provide an allowance for these costs due to the "halo effect" – companies being able to issue debt below the iBoxx benchmark consistently:[53]
  - At RIIO-1, Ofgem considered the halo effect was large enough to offset issuance and liquidity costs (estimated at 20bps). Ofgem considered a separate transaction and liquidity cost allowance was therefore not required.
  - At RIIO-2, Ofgem found a halo effect of 7 bps to 14bps, and proposed a recalibration of the index to cover transaction and liquidity costs may be appropriate.
- At the NIE appeal (2014), the CMA allowed 20bps to cover issuance costs and fees (including for interest rate hedges).[54]
- At the Bristol Water appeal (2015), the CMA allowed 10bps for issuance costs and 10 to 20bps for cash holding costs based on regulatory precedent and Bristol specific evidence.[55]

The CMA has indicated, in the provisional findings of the NERL/CAA appeal, that it may grant NERL 0.10% issuance costs and 0.05% liquidity costs considering that:

"*[...] as a smaller entity with fewer interactions with banking institutions and the financial markets, NERL may face slightly higher-than-average issuance costs when compared to regulated companies in other sectors.*"[56]

We also note the previous CAA determinations for HAL:

- At Q5 (2008), the CC recommended, and the CAA adopted, a 15bps allowance to cover fees paid by borrowers similar to BAA.[57]
- At Q6 (2014), PwC recommended, and the CAA adopted, a 10bps allowance in the cost of debt for debt arrangements and commitment fees.[58]

In our view, an allowance of 0.10% for these combined costs (including both issuance and liquidity costs) is reasonable. In reaching this conclusion, we primarily consider scale and associated economies of debt issuance.

HAL's Regulated Asset Base (RAB), and hence the typical scale of notional debt issuance, is much more aligned with the larger companies in the water (WASCs) and energy sectors than with the other precedents referred to above. HAL's regulatory asset value is £16.6bn.[59] The WASCs have

[52] Ofwat (Dec 2019), PR19 final determinations, p.5.
[53] Ofgem (May 2019), RIIO-2 Sector Specific Methodology Decision – Finance, pp.20-21.
[54] CC (Mar 2014), Northern Ireland Electricity Limited price determination, p.13-15.
[55] CMA (Oct 2015), Bristol Water plc, p.316.
[56] CMA (Mar 2020), NATS (En Route) Plc / CAA Regulatory Appeal, Provisional findings report, p.169.
[57] CAA (Mar 2008), Economic Regulation of Heathrow and Gatwick Airports 2008-2013, p.124
[58] CAA (2013), Estimating the cost of capital: a technical appendix to the CAA's Final Proposal for economic regulation of Heathrow and Gatwick after April 2014, p.42
[59] Heathrow (SP), Annual Report and Financial Statements 2019, p.8.

assets in the range £3bn to £14bn, with most in the £3bn to £8bn range,[60] and the main energy companies have assets in the range £1bn to £13bn.[61]

The other companies for whom CMA referral precedents are observed (NIE, Bristol Water, NERL) are much smaller. We would expect issuance and other debt related costs to be proportionately bigger – potentially significantly so.

We also note that this is consistent with the assessment of the WACC at Q6.

We next describe our inflation assumptions to deflate the nominal cost of debt parameters.

5 Inflation

Our cost of debt calculation is expressed (based on the method outlined above) in nominal terms. The cost of capital will be applied by the CAA in real terms, with respect to RPI. This is because the nominal WACC is "delivered" to HAL investors in two parts:

- First, the RAB is indexed by RPI, providing a nominal holding gain on the value of assets.
- Second, the "real" WACC is delivered as profit (effectively in cash) to investors.
- The combination of the two delivers the nominal WACC, each year.

Because the cost of equity is already properly derived in real terms with respect to RPI, no further adjustment is required for inflation. However, the cost of debt has been observed in nominal terms and needs to be adjusted.

We adopt a "simple addition" approach to this calculation – it does not require adoption of a compounding formula (the "Fisher" equation).

Compounding formulae are relevant when considering the relationship between inflation and interest rates over time. It is not required in this case, where we are considering how to deliver a defined nominal return at a specified point in time through two different mechanisms. In any case, the difference this makes is small.

Therefore, we need to provide a robust and neutral forecast of inflation and remove this from the nominal cost of debt.

To forecast inflation, we give consideration to a wider range of available evidence, including both the CMA's provisional approach and alternatives. These alternatives include consideration of "implied inflation" derived from the from observed differences between the forward yields on real and nominal gilts, and the latest views of the Office of Budgetary Responsibility (OBR).:

- The CMA's approach is based on HM Treasury's average of independent forecasts for the RPI deflator, resulting in a 2.78% inflation forecast.

[60] Ofwat (May 2019), Regulatory capital values 2019.
[61] Ofgem (Nov 2019), RIIO-1 Price Control Financial Model.

- Government break-even inflation can be estimated using the implied inflation in nominal and index-linked gilts. We estimate the difference between the implied forward rate in gilts with maturity to align with H7, as shown in Table 9 below:

TABLE 9: IMPLIED INFLATION FORECAST

Base Gilts (maturity)	4Y to 5Y	5Y to 6Y
3-month average	3.17%	3.24%
12-month average	3.17%	3.24%

Source: Flint analysis of Bank of England data as of 28 February 2020.

Ideally, we would estimate the implied forward inflation adjustment to the middle of H7:

- 3-month average of the annual forward implied inflation between the gilts with 2-years and 7-years to maturity
- 12-month average of the annual forward implied inflation between the gilts with 3-years and 8-years to maturity

However, ILG data below 4-years to maturity is not available for the relevant averaging period. We therefore use the 4 to 5-year to maturity, and 5 to 6-year to maturity, as an approximation.

Our estimates suggest an implied forward inflation of 3.21%, based on the implied inflation curve published by the Bank of England, is a reasonable approximation to inflation in the middle of the H7 period.

However, we note that the Bank of England implied inflation estimates may have an inflation risk premium.[62] We therefore make an adjustment to the inflation rate and adopt a value of 3.10% - we note that this is also broadly consistent with OBR RPI forecasts towards the middle of H7.[63]

We adopt an inflation range which makes use of broader available information than the one used by the CMA:

- At the lower bound, we adopt CMA's inflation assumption, based on the HMT publication, of 2.78%
- At the upper bound, we adopt our adjusted estimates from the Bank of England implied inflation curve, cross-checked against the OBR forecasts, of 3.10%. It is our view that the additional existing evidence from the Bank of England and OBR should also be considered in estimating inflation forecasts.

6 Conclusions on pre-tax cost of debt

We provide our real cost of debt estimates in Table 10 below.

[62] Bank of England, Notes on the Bank of England UK Yield Curves, p.5.
[63] OBR (Apr 2019), RPI Inflation.

TABLE 10: COST OF DEBT ESTIMATES

Parameter	Lower Bound	Upper Bound
Cost of embedded debt, nominal	*4.58%*	*4.58%*
Cost of new debt, nominal	*2.62%*	*2.90%*
Inflation	*3.10%*	*2.78%*
Cost of embedded debt, real	1.48%	1.80%
Cost of new debt, real	-0.48%	0.12%
Proportion of new debt	0.00%	12.5%
Issuance and liquidity costs	0.10%	0.10%
Cost of debt	**1.58%**	**1.69%**

Source: Flint calculations.
Note: to estimate the real cost of debt, we use $nominal - inflation$ *adjustment instead of the Fisher equation as explained in Section 3.5.*

If anything, we believe this may slightly overestimate HAL's cost of debt, for the reasons outlined above:

- The potential upward bias in HAL's observed debt yields relative to the notional BAU entity.
- The possibility that undue weight is given to older debt index values.

We do not propose an adjustment for these factors, however, given the aforementioned difficulties associated with interpretation of the evidence, the likelihood that any adjustment is not likely to be material, and the desire to avoid undue regulatory complexity.

4 Gearing

In this section we consider the question of gearing. First, we evaluate the approach adopted by the CMA in the provisional findings for NERL. Second, we provide our view on the implications of the CMA's provisional findings to HAL's notional gearing.

CMA provisional findings on notional gearing for the NERL/CAA appeal

The assumption regarding notional gearing was subject to material change in the CMA's provisional findings for NERL:

- The CAA had assumed a notional gearing level of 60%.[64]
- The CMA proposed changing this to a notional gearing of 30%, in line with the comparator group used for the estimation of asset beta.[65]

The CMA's reasons for making this change were essentially rooted in the belief (from corporate finance theory) that increased gearing in the WACC formula should not drive material change to the resultant WACC.

Instead, the CMA observed that the WACC formula and parameter values adopted by the CAA (and the adjusted equivalent proposed by the CMA) gave rise to an increase in the WACC, as the assumption of gearing increased.

The CMA's view is that this effect results from a problem with the de-gearing and re-gearing of the equity beta comparators, as undertaken by the CAA. Under this process, as gearing in the notional model is assumed to increase, debt replaces equity in the capital structure, but the cost of the new debt exhibits a significant premium to a "CAPM implied" value for the cost of debt.

- The cost of debt in both the CAA's and CMA's models for NERL were more than 1% above the cost of debt that would be warranted by debt beta alone.
- The difference was mainly attributed by the CMA to the liquidity premium on corporate debt, which is less readily traded than equity, and is therefore introduced into the WACC through the substitution of equity with debt.
- Therefore, as debt was added to the notional entity, the observed vanilla WACC increased.

The increase in the WACC for NERL was material. The CMA observed that the move from 30% gearing (consistent with the comparators) and the 60% gearing assumed by the CAA resulted in a boost to the WACC of ~0.5%, which it considered to be inappropriate:

[64] CMA (Mar 2020), NATS (En Route) Plc / CAA Regulatory Appeal, Provisional findings report, p.156.
[65] CMA (Mar 2020), NATS (En Route) Plc / CAA Regulatory Appeal, Provisional findings report, pp.158-159.

"[...] the cost of capital increases by around 0.5% as a result of the assumed higher gearing of NERL (60%) relative to gearing assumption based on the gearing of comparators (30%), which is not consistent with either finance theory or with our understanding of how actual financing models work."[66]

Flint's views on the principles of the relationship between gearing and the WACC

In light of the CMA's provisional findings in the NERL/CAA appeal, similar analysis is conducted here.

Before setting out our analysis of the impact of notional gearing, we make some observations on the CMA's analysis, as follows:

- We agree in principle that the notional gearing level, and the WACC calculation, should be based at the optimal level of gearing, although in the broader context of the regulatory settlement.
- We agree that the WACC should hold broadly constant in the face of gearing, and that this is consistent with corporate finance theory (the "MM assumption").
- We believe that this relationship should hold at the post-tax WACC level, rather than the "vanilla" level, assumed by the CMA. Because the tax system works in nominal terms, this requires that calculations are undertaken against the nominal cost of debt. This makes a significant difference to the observed impact of gearing on the WACC.
- The traditional corporate finance theory also points to wider implications of increased debt levels. For example, it is frequently suggested in the academic literature that there can be operational consequences of higher debt levels – such as improved operational efficiency.
- Thus, it is possible that whilst the WACC (in the "vanilla" form calculated) might increase, there may be offsetting impacts elsewhere in the cash-flows of a business, beyond the simple tax effects described above, that drive a net benefit. Under the CAA's regulatory regime these benefits should find their way through to customers (for example through allowances for operating costs) and offset the observed WACC effect.
- The "stable WACC" assumption holds true for the "pure" value of the WACC. We have discussed in earlier sections how the regulatory WACC assumption diverges from theoretically pure corporate finance principles in various ways. For example:
  - The CMA attributed a significant element of the "increasing WACC effect" to a potentially large liquidity premium in the cost of debt. This liquidity premium is not considered to be diversifiable by bond investors and – to the extent that notional debt levels are not out of line with observed market behaviour for typical companies – might be considered to form a legitimate part of an efficient WACC, given the wider implications of debt financing described above. As the CMA notes, it appears likely that this liquidity premium has increased in recent years.
  - The regulatory WACC calculation is also, as explained earlier in this document, based on "promised" rather than "expected" yields. There are good reasons for this, but the effect is

[66] CMA (Mar 2020), NATS (En Route) Plc / CAA Regulatory Appeal, Appendices and glossary, p.D1.

that the cost of debt included in the WACC calculation is – in effect – already overstated. Other things equal, this would be expected to drive an increase in the observed WACC from the regulatory WACC formula, as gearing increases – thus already contravening the MM assumption. The difference between promised and expected yields is referred to as the "expected loss premium" (ELP).

For these reasons, we do not entirely discount the idea that the regulatory WACC should exhibit a small increase with gearing as an unreasonable outcome. We do not consider that this necessarily contravenes the principles of corporate finance, nor that it amounts to a flaw in regulation. However, we recognise the importance of understanding these effects. In this regard, we note that the combination of these two sources of debt premium could have significant impact on the observed WACC:

- The ELP may be significant. Whilst the likelihood of default may be low, the impact is typically large. Values of perhaps 10 to 30 bps are thought to prevail for medium dated (10-years) A/BBB bonds[67]. ELP values on longer dated bonds are higher, thus a number at the upper end of this range may perhaps prevail for HAL.

- Recent data appears to imply a liquidity premium of more than 50bps on the cost of debt. This is higher than values previously observed (for example at the time of the 2007 CC report).

Recent regulatory assessments support these statistics:

- In Ofwat's PR19 final determinations for the water companies, the combined ELP and liquidity premium is observed to be ~1.0% on the cost of debt.

- In the CMA provisional findings for NERL, the combined effect is ~1.3%.

- Our parameter values for HAL imply a combined ELP / liquidity premium of ~1.5%. However, the effect of this on the WACC is moderated through the way we adapt debt beta in line with gearing, in common with the previous CC (2007) approach.

We note that these observed premia – and hence the impact of gearing on the WACC – are very sensitive to the underlying market parameters used in the CAPM model. The above premia are calculated by reference to a "CAPM derived" cost of debt that is closely linked to the CMA's (and our own) assumption for the RfR in particular. We evaluate the impact of this further below.

However, overall, like the CMA, we are firmly of the view that it is important that the effect of gearing is evaluated and properly understood.

[67] For example, Cooper (2003) "Using Yield Spreads to Estimate Expected Returns on Debt and Equity". The mid-point of this ELP range can be usefully thought of as the required loss premium on a 10-year bond, at issue, with an expected loss on default (or "haircut") of 20% and an annual likelihood of default of 1%.

The impact of gearing within our proposed model

As explained earlier in this document, our model approaches the "de-gearing and re-gearing" process by assuming a lower prevailing debt beta for the comparators (0.05) than is assumed for HAL at the notional 60% gearing level (0.10).

If we were to estimate the WACC for HAL at a notional gearing of 30%, we would assume a debt beta consistent with the comparators, and also adjust the equity beta consistently. We recognise that, in principle, we would also have to estimate a cost of new debt at gearing of 30%. However, this is a non-trivial exercise. We therefore conduct a simple impact assessment using the assumption that the cost of new debt holds constant, and then consider the likely impact of this simplifying assumption.

This translates into the WACC estimates in Table 11 below:

TABLE 11: SENSITIVITY ANALYSIS TO CHANGE IN GEARING LEVELS

Parameters	Central Case with 60% gearing	Sensitivity to 30% gearing
Gearing	**60%**	**30%**
Risk-free Rate	-2.10%	-2.10%
Equity Risk Premium	7.60%	7.60%
Total Market Return	5.50%	5.50%
Asset beta	0.55	0.55
Debt beta	0.10	0.05
Equity beta	***1.23***	***0.76***
CoE (post tax)	**7.21%**	**3.71%**
Cost of embedded debt	1.64%	1.64%
Cost of new debt	-0.18%	-0.18%
Weighting on new debt *	***12.5%***	***-75.00%***
Issuance and liquidity costs	0.10%	0.10%
Real CoD (pre-tax)	**1.51%**	**3.11%**
Vanilla WACC	**3.79%**	**3.53%**

Source: Flint analysis.
Note: This sensitivity includes a simplifying assumption that cost of new debt is constant at different gearing levels, and the analysis may therefore not capture the full effects of gearing on the WACC.
** The unusual – and apparently absurd – weighting of new debt implied by the low gearing scenario results from recognition of the starting point of 60% for notional gearing (at the beginning of H7). If gearing starts at 60% and only the natural maturity of embedded debt is taken into account, but no further action is taken, then gearing reduces only to 52.5%, on average, during H7. The only way to achieve an average notional gearing of 30% over H7, having started with notional gearing at 60%, is for HAL to "notionally" issue equity and buy back all of its existing debt over H7. This "notional buy back" effectively represents negative debt issuance – hence negative weighting on new debt in the above calculations. The alternative, to ignore the 60% notional "start point" for gearing, would in our view fail give due weight to HAL's embedded debt and the need for consistency with previous regulatory decisions.*

As can be seen above, the WACC in our suggested central case (at 60% notional gearing) is approximately 0.3% higher than the WACC calculated at notional gearing of 30% (with

appropriately changed assumptions regarding debt beta). Thus, under our simplifying assumptions, the vanilla WACC would increase by 0.1% for every 10% change in gearing.[68]

This impact of the gearing assumption in our own model is therefore potentially significant. By way of reminder, a 1% increase in the WACC would prompt approximately a 6% increase in required revenues for HAL. Therefore, if the adoption of a 60% gearing assumption, rather than the 30% observed for the comparator group, might be expected to increase the WACC by 0.3%, then this might increase required revenues by around 2%. Moreover, through the "single till" regulatory approach, this effect would be amplified to drive a bigger increase in landing charges. It is therefore important that it is understood, considered appropriate, and reflective of (notionally) efficient financing.

In its provisional findings for NERL, the CMA notes that the CC identified a similar problem in 2007, addressed in part through the use of a debt beta. In effect, our approach is similar to that adopted by the CC in 2007, which slightly muffles the impact of changing gearing, through the use of a material debt beta. Our approach also recognises the likely increase of the debt beta as gearing rises.

We also note that the impact on the post-tax WACC is lower. The post-tax WACC estimate in our model (not shown above) increases by only 0.2% between gearing of 30% and 60% (though similarly understated because of the simplified cost of debt assumption). Tax considerations mean that the impact on the post-tax WACC are lower by approximately one third. The effect of tax relief (which has to be calculated based on the nominal cost of debt) is material in offsetting the observed increase in the vanilla WACC.

Overall, the WACC effect we see in our model is potentially similar to the effect observed by the CMA for NERL – though we would take into account the impact of tax, and therefore suggest that it should properly be viewed as having a smaller impact on the WACC than the CMA assessment suggests. However, it is certainly not trivial, and therefore prompts serious consideration of the gearing assumption.

Sensitivity of the analysis to underlying CAPM assumptions

We have also undertaken a similar analysis, leaving other parameters (including the TMR) the same, but evaluating the impact of gearing in the context of an illustrative RfR of -1.0%. We do so based on an approximate assessment of the approach adopted by the CMA in three decisions over the last decade (notably Bristol Water 2010, NIE 2014 and Bristol Water 2015).[69]

[68] The above analysis is in fact only slightly changed by an assumption of a lower cost of new debt at lower gearing levels. If the liquidity premium is thought to remain broadly constant within the cost of new debt, the effect on our analysis of the gearing effect on the WACC is very small, and (somewhat counterintuitively, but due to the implied weighting of new debt within the WACC) slightly reduces the impact of gearing on the WACC. Importantly though, within the range of gearing that we go on to propose, the effect is trivial.

[69] CC (Aug 2010), Bristol Water plc, p.65.
CC (Mar 2014), Northern Ireland Electricity Limited price determination, p.13-25.
CMA (Oct 2015), Bristol Water plc, pp.329-330.

Here, in defining the appropriate RfR rate for use within the CAPM, the CMA adopted values more than 1% above the prevailing ILG yields. We therefore considered how reflection of this alternative CMA approach might have changed our own analysis.

This change of assumption dramatically reduces the impact of gearing. In a model with this different RfR, the change in gearing from 30% to 60% increases the WACC by less than 0.1%. Interestingly, under the same assumptions, the post-tax WACC goes down as gearing moves from 30% to 60%, by a similar magnitude ~0.1%.

Put simply, the approach adopted by the CMA to estimating the RfR in other recent decisions would have resulted in a higher RfR estimate now. A similar assumption here would mean that the gearing assumption within the WACC calculation would have a very small effect on the WACC and, when adjusted to recognise tax effects, would potentially have an overall effect of reducing prices in the regulatory settlement – perhaps more in line with corporate finance theory.

We do not suggest that the CMA's previous approach was superior, nor that it should lead to the adoption of a different RfR in our (or its) proposed model today. We consider that the approach to estimation of the RfR rate adopted by the CMA in the NERL provisional findings is reasonable, and reflect this in our own model.

Instead, we use this alternative analysis to highlight the sensitivity of the WACC and associated financing relationships to the underlying model assumptions. We emphasise that this should be seen in the context of the significant uncertainty associated with estimation of the WACC and the underlying parameter values. In light of both, we would be cautious in placing too much weight on the observed consequence of such a recent change, and making significant alterations to established regulatory precedents (such as the basis for assumed notional gearing level) as a result.

HAL's actual debt levels

We also consider gearing in light of HAL's actual debt levels.

HAL has a gearing level which is in excess of our proposed notional level. Whilst the structure of HAL's debt liabilities is complex, the notional gearing assumption is below the gearing estimated (by Centrus) for the whole business securitised (WBS) entity, which is close to 70%.[70] Taking into account the holding company structure of HAL, actual gearing of HAL might be considered higher still.

- Reasons for this are speculative, but we believe it is quite feasible that it includes the aforementioned issues of tax, and positive impact on operational efficiency, amongst other things.

- We understand that – in principle at least – such benefits accrue to customers directly through the regulatory framework (for example, through direct allowances for actual tax costs, and assumptions regarding operational expenditure).

[70] Information provided by Centrus.

- We also note that it is the actual gearing level that drives the HAL bond yields we have observed to develop our views of the cost of debt, both embedded and new.

- So, the cost of debt that we adopt in our notional structure is, in our view, a faithful reflection of the cost of debt for HAL, that would align closely with the 60% notional gearing level rather than a lower notional gearing level aligned to the comparators.

We do not consider that there is obvious evidence to point to the fact that HAL's gearing is inefficient – it is not obviously out of line with other regulated sectors. Whilst very recent events may shine a different light, we think this observation should not be disregarded, in that perceived historic risks for Heathrow were low, and high gearing not considered inappropriate.

The CAA's previous approach and implications for consistency

Our views about appropriate notional gearing for HAL in H7 are also informed by the previous regulatory treatment.

The CAA has, since before Q5, always assumed a 60% gearing:

- At Q5, the CC cost of capital calculations assumed a gearing of 60%:

  "*Overall, our judgment is that our cost of capital calculations should be based on a gearing figure of 60 per cent. In practice, this may well turn out to be lower than the debt-to-RAB ratio that the airports are able to achieve when they implement their refinancing plans. We nevertheless consider the choice of a relatively conservative figure to be prudent given the uncertainties that surround the rating process and is a step towards ensuring that airports maintaining our assumed gearing will find our package of price control recommendations to be financeable.*"[71]

  The CAA adopted the 60% notional gearing level at Q5:

  "*The CAA has also maintained its assumption of a notional gearing level of 60 per cent, which it considers represents a reasonable balance for users between the lower costs of debt financing, on the one hand, and the risks to investment and service from more highly geared structures, on the other.*"[72]

- At Q6, the CAA also adopted a notional gearing assumption of 60%:

  "*The CAA proposes to use gearing of 60% [...] for HAL*"[73]

If we were to advocate a change to the notional gearing assumption, we do not believe it is consistent, or reasonable, to ignore assumptions adopted in the past. We would consider it reasonable that any change to notional gearing should be cognitive of this, and a plausible level of change between price controls.

[71] CC (2007), Cost of Capital Appendix, p.F8.
[72] CAA (Mar 2008), Economic Regulation of Heathrow and Gatwick Airports 2008-2013, p. viii.
[73] CAA (2013), Estimating the cost of capital: a technical appendix to the CAA's Final Proposal for economic regulation of Heathrow and Gatwick after April 2014, p.37.

Specifically, we would take the view that any assessment of future notional gearing would at least be "notionally" deliverable under some form of conventional refinancing plan, from a start point in line with the previously adopted view of notional gearing.

In simple terms, this imposes a lower bound on notional gearing, in line with natural refinancing, and the observed tenor of debt. With an average debt tenor of 20 years, approximately 25% of HAL's debt will mature over a 5-year period.

Assuming a start point of assumed gearing in line with the previous notional assumption, then *in extremis*, if this were entirely refinanced with equity, HALs notional gearing could reduce by 15%, to 45% at the end of H7.

This extreme assumption would prompt an average notional gearing for HAL over the 5-year period of 52.5%, and a weighting on the cost of new debt of zero. In our view, this might be an appropriate extreme lower bound for gearing – driven by a reasonable continuity of regulatory behaviour, and an extreme assumption about the refinancing of all debt that matures with new equity.

A reduction in gearing bigger than this would (by implication) effectively require the notional HAL entity to be embarking on a programme of debt buy back, and major equity issuance over H7. Such an approach would seem odd in principle, and costly in (notional) practice – giving rise to potentially significant refinancing transactions costs, in the notional model.

In effect, we believe that this imposes a lower bound of 52.5% on HAL's notional gearing – which would reduce our central case for the vanilla WACC by around 0.1%. This estimate of the WACC reduction that results from this gearing assumption is also independent of the assumption regarding the cost of new debt. This is because at a notional gearing of 52.5%, in our calculation, the weighting on the cost of new debt (and thus the new debt premium) is zero.

As previously explained, the impact on the post-tax WACC is smaller.

Conclusions and recommended approach to gearing

Given the wider considerations that we view as relevant in relation to notional gearing, set out above, we consider that an assumption of 60% – consistent with the assumption made in the past by the CAA – remains a relevant point in our range for HAL's notional gearing. We therefore define this as an upper bound.

However, we recognise and consider the issues raised by the CMA's provisional findings on NERL in relation to gearing. These point to consideration of potentially lower values for notional gearing:

- The impact of gearing in the WACC estimation is significant in our model, in a similar vein to the CAA/CMA/NERL models.
- We do believe that wider consideration is warranted than that undertaken by the CMA – recognising that impact on the post-tax WACC, and the potential operational benefits of gearing are relevant. The tax effect is relatively clear and slightly moderates the view put forward by the CMA. Operational effects are hard to establish with confidence, but may not be insignificant.

- We also note the high sensitivity of the observed relationship between WACC and gearing to the CAPM assumptions – particularly the RfR. We are cautious about making any fundamental change to the WACC assumptions in light of conclusions that are very sensitive to underlying assumptions that have been subject to significant recent change by the CMA.

- The previously adopted CAA notional gearing assumption of 60%, and the implications of refinancing, should also not be ignored – despite these existing only within the notional model. We are of the view that this imposes a lower bound on gearing that represents a small reduction. We believe the lower bound should, at most, reduce notional gearing to 52.5%.

- Other things equal, this reduces our lower bound vanilla WACC by around 0.1%.

We therefore recommend a lower bound notional gearing of 52.5%. We do recommend, however, that the CAA is mindful of the final NERL decision in this regard, and may need to adapt our range, or bear this in mind in the selection of a point value within the range, accordingly.

5 Conclusion and Recommendations

We propose a central WACC estimate of 3.77%. Our proposed parameters and WACC estimates are shown in below Table 12.

TABLE 12: FLINT ESTIMATES

	Lower Bound	Upper Bound	Central Case
Gearing	**52.5%**	**60%**	**56.25%**
Risk Free Rate	-2.10%	-2.10%	-2.10%
Equity Risk Premium	7.10%	8.10%	7.60%
Total Market Return	5.00%	6.00%	5.50%
Asset beta	0.50	0.60	0.55
Debt beta	0.09	0.10	0.09
Equity beta	*0.96*	*1.35*	*1.14*
CoE (post tax)	**4.69%**	**8.84%**	**6.54%**
Cost of embedded debt	1.48%	1.80%	1.64%
Cost of new debt	-0.48%	0.12%	-0.18%
Weighting on new debt	0.00%	12.5%	6.67%
Issuance and liquidity costs	0.10%	0.10%	0.10%
Real CoD (pre-tax)	**1.58%**	**1.69%**	**1.62%**
Vanilla WACC	**3.06%**	**4.55%**	**3.77%**

Source: Flint estimates.

Our analysis provides general support to the approach adopted by the CMA in its provisional findings for the NERL/CAA appeal, in particular for the cost of equity:

- The CAPM market parameters (RfR, ERP and TMR) are based on the CMA estimates, albeit subject to specific small adjustments to match the anticipated timing of the H7 price control.
- We adopt a range for the asset beta of comparators of 0.50 to 0.60, following an approach consistent with the CMA provisional findings – and close to the CMA provisional findings range for NERL. We recommend reliance on estimates of the asset betas of international comparators rather than the range previously adopted by the CAA at Q5 and Q6.
- Our range for asset beta is underpinned by estimates of the equity betas for ADP, Fraport and AENA. We consider a variety of measurement methods, but prefer the use of daily data, and observation of both spot value and averages for asset betas over time.
- The comparator equity betas are de-geared into asset betas using a debt beta assumption of 0.05.
- This leads us to our range of 0.50 to 0.60, consistent with the CMA.

- We translate this asset beta range into an equity beta range through a re-gearing process, assuming that the notional debt beta for HAL is within the range of 0.09 to 0.10.

For the cost of debt, we adopt an index-based approach – for both cost of new debt and cost of embedded debt:

- We estimate HAL's cost of embedded debt using a dynamic 20-year notional trailing average of the combined historical iBoxx A/BBB index and the cost of new debt issued from 28 February 2020 to the beginning of H7. A 20-year notional average is consistent with the average tenor of HAL's debt. Our trailing average reflects a notional assumption of even debt issuance over time.

- We estimate HAL's cost of new debt using the 3-month and 12-month average of the iBoxx A/BBB index, adjusted for the (forward curve implied) change in yields between now and the middle of H7, consistent with the approach to estimation of the future RfR.

- We consider 10bps to be a good reflection of HAL's issuance and liquidity costs considering the scale of HAL's issuances and in light of regulatory precedent.

- We assume a proportion of new debt in line with the notional gearing assumption, and the likely maturity of existing debt under the notional assumptions.

- We translate the cost of debt from nominal into real based on a range of forecasts, including those adopted by the CMA, and break-even inflation forecasts derived from the relative yields on real and nominal government bonds.

Regarding gearing, we assume 56.25%, notional, in our central case. We have considered the issue raised by the CMA concern in its provisional findings, regarding the strictly increasing effect of the gearing on the WACC. Our view is that, although a valid concern, the impact for HAL is more limited than that for NERL. However, we recommended the CAA is mindful of the CMA final decision for the NERL/CAA appeal and adapts its range accordingly.

We summarise our overall position for all parameters in Table 13, on the following page.

TABLE 13: KEY PARAMETER VALUES AND REASONING

Parameter	Lower Bound	Upper Bound	Central Case	Reasoning
TMR	5.0%	6.0%	5.5%	Consistent with CMA's provisional findings in the NERL/CAA appeal.
RfR	-2.1%	-2.1%	-2.1%	Consistent with CMA's provisional findings in the NERL/CAA appeal, adjusted to reflect forward ILG yield curve at mid-point of H7.
ERP	7.1%	8.1%	7.6%	Derived consistently with TMR and RfR estimates.
Asset beta	0.50	0.60	0.55	Flint's approach consistent with the CMA approach: • Based on Stoxx 600 Market Index • 2Y and 5Y daily data • Spot and 2Y/5Y trailing averages • De-gearing comparators based on assumed debt beta of 0.05 Consistent with CMA's provisional findings in the NERL/CAA appeal.
Debt beta	0.09	0.10	0.09	0.10 debt beta at 60% gearing aligns with regulatory precedent and not inconsistent with the CMA's provisional findings in the NERL/CAA appeal. Lower bound debt beta consistent with assumption for comparator debt betas.
Equity beta	0.96	1.35	1.14	Derived.
Post-tax cost of equity	**4.7%**	**8.8%**	**6.5%**	
Cost of embedded debt	1.5%	1.8%	1.6%	Use of dynamic average debt index-based approach, consistent with HAL's debt tenor, adjusted for the changes over H7.
Cost of new debt	-0.5%	0.1%	-0.2%	Use of debt index-based approach. Index aligned to observed HAL Whole Business Securitisation debt yields. Cost of new debt reflects forward nominal yield curve at mid-point of H7.
Weighting on new debt	0.0%	12.5%	6.7%	Proportion of new debt consistent with 60% notional debt and balanced financing profile.
Issuance and liquidity costs	0.1%	0.1%	0.1%	0.1% considered reasonable based on regulatory precedent and for scale of HAL's debt issuance.
Pre-tax cost of debt	**1.6%**	**1.7%**	**1.6%**	
Gearing	52.5%	60.0%	56.3%	Consistent with precedent, and CMA/NERL, in light of HAL's actual gearing.
Vanilla WACC	**3.1%**	**4.5%**	**3.8%**	
Forecast Inflation	3.1%	2.8%	2.9%	Upper bound for WACC consistent with CMA's provisional findings in the NERL/CAA appeal. Lower bound based on implied break-even inflation from nominal /index-linked gilts during H7.

Source: Flint analysis

6 Appendices

1 Estimates of Flint, PwC, HAL and CMA

TABLE 14: COMPARISON OF PWC, HAL AND FLINT CENTRAL CASE ESTIMATES

Central Case	PwC	HAL	Flint
Gearing	**60.00%**	**60.00%**	**56.25%**
Risk Free Rate	-1.25%	-1.52%	-2.10%
Equity Risk Premium	6.60%	7.71%	7.60%
Total Market Return	5.35%	6.19%	5.50%
Asset beta	0.47	0.57	0.55
Debt beta	0.10	0.10	0.09
Equity beta	1.03	1.27	1.14
CoE (post tax)	**5.52%**	**8.30%**	**6.54%**
Cost of embedded debt	1.20%	1.98%	1.64%
Cost of new debt	0.40%	0.05%	-0.18%
Weighting on new debt	12.5%	12.5%	6.67%
Issuance costs	0.10%	0.10%	0.10%
Liquidity costs	0.00%	0.10%	
Real CoD (pre-tax)	**1.20%**	**1.94%**	**1.62%**
Vanilla WACC	**2.93%**	**4.48%**	**3.77%**

Source: PwC (Aug 2019), Estimating the cost of capital for H7 and RP3 – Response to stakeholder views on total market return and debt beta, p.9. HAL (Dec 2019), Heathrow's Initial Business Plan Detailed Plan, pp. 304, 319, 320, 328.

TABLE 15: PWC PROPOSAL AT AUGUST 2019

	Lower Bound	Upper Bound	Central Case *
Gearing	60.0%	60.0%	60.0%
Risk Free Rate	-1.50%	-1.00%	-1.25%
Equity Risk Premium	6.60%	6.60%	6.60%
Total Market Return	5.10%	5.60%	5.35%
Asset beta	0.42	0.52	0.47
Debt beta	0.10	0.10	0.10
Equity beta	0.90	1.15	1.03
CoE (post tax)	**4.44%**	**6.59%**	**5.52%**
Cost of embedded debt	1.20%	1.20%	1.20%
Cost of new debt	0.15%	0.65%	0.40%
Weighting on new debt	12.5%	12.5%	12.5%
Issuance costs	0.10%	0.10%	0.10%
Liquidity costs	0.00%	0.00%	0.00%
Real CoD (pre-tax)	**1.17%**	**1.23%**	**1.20%**
Vanilla WACC	**2.48%**	**3.37%**	**2.93%**

Source: PwC (Aug 2019), Estimating the cost of capital for H7 and RP3 – Response to stakeholder views on total market return and debt beta, p.9.
*Notes: * We assume a point at the middle of the range for each parameter.*

TABLE 16: HAL PROPOSAL IN ITS INITIAL BUSINESS PLAN

	Lower Bound	Upper Bound	Inferred Central Case *
Gearing	60.0%	60.0%	60.0%
Risk Free Rate	-1.71%	-1.20%	-1.52%
Equity Risk Premium	7.71%	7.70%	7.71%
Total Market Return	6.00%	6.50%	6.19%
Asset beta	0.54	0.62	0.57
Debt beta	0.10	0.10	0.10
Equity beta	1.20	1.40	1.27
CoE (post tax)	**7.54%**	**9.58%**	**8.30%**
Cost of embedded debt	1.98%	1.98%	1.98%
Cost of new debt	0.05%	0.05%	0.05%
Weighting on new debt	12.5%	12.5%	12.5%
Issuance costs	0.10%	0.10%	0.10%
Liquidity costs	0.10%	0.10%	0.10%
Real CoD (pre-tax)	**1.94%**	**1.94%**	**1.94%**
Vanilla WACC	**4.18%**	**5.00%**	**4.48%**

Source: HAL (Dec 2019), Heathrow's Initial Business Plan Detailed Plan, pp. 304, 319, 320, 328.
*Notes: * We infer parameter values that would be consistent with HAL's declared position on the cost of equity*

TABLE 17: CMA PROVISIONAL FINDINGS AT THE NERL/CAA APPEAL

	Lower Bound	Upper Bound	Central Case *
Gearing	30.0%	30.0%	30.0%
Risk Free Rate	-2.25%	-2.25%	-2.25%
Equity Risk Premium	7.25%	8.25%	7.75%
Total Market Return	5.00%	6.00%	5.50%
Asset beta	0.52	0.62	0.57
Debt beta	0.05	0.05	0.05
Equity beta	*0.71*	*0.86*	*0.79*
CoE (post tax)	**2.93%**	**4.82%**	**3.89%**
Cost of embedded debt	2.55%	2.55%	2.55%
Cost of new debt	-0.68%	-0.68%	-0.68%
Weighting on new debt	46%	46%	46%
Issuance and liquidity costs	0.15%	0.15%	0.15%
Real CoD (pre-tax)	**1.21%**	**1.21%**	**1.21%**
Vanilla WACC	**2.41%**	**3.74%**	**3.09%**

Source: CMA (Mar 2020), NATS (En Route) Plc / CAA Regulatory Appeal, Provisional findings report, p.202.
*Notes: * We assume a point at the middle of the range for each parameter.*