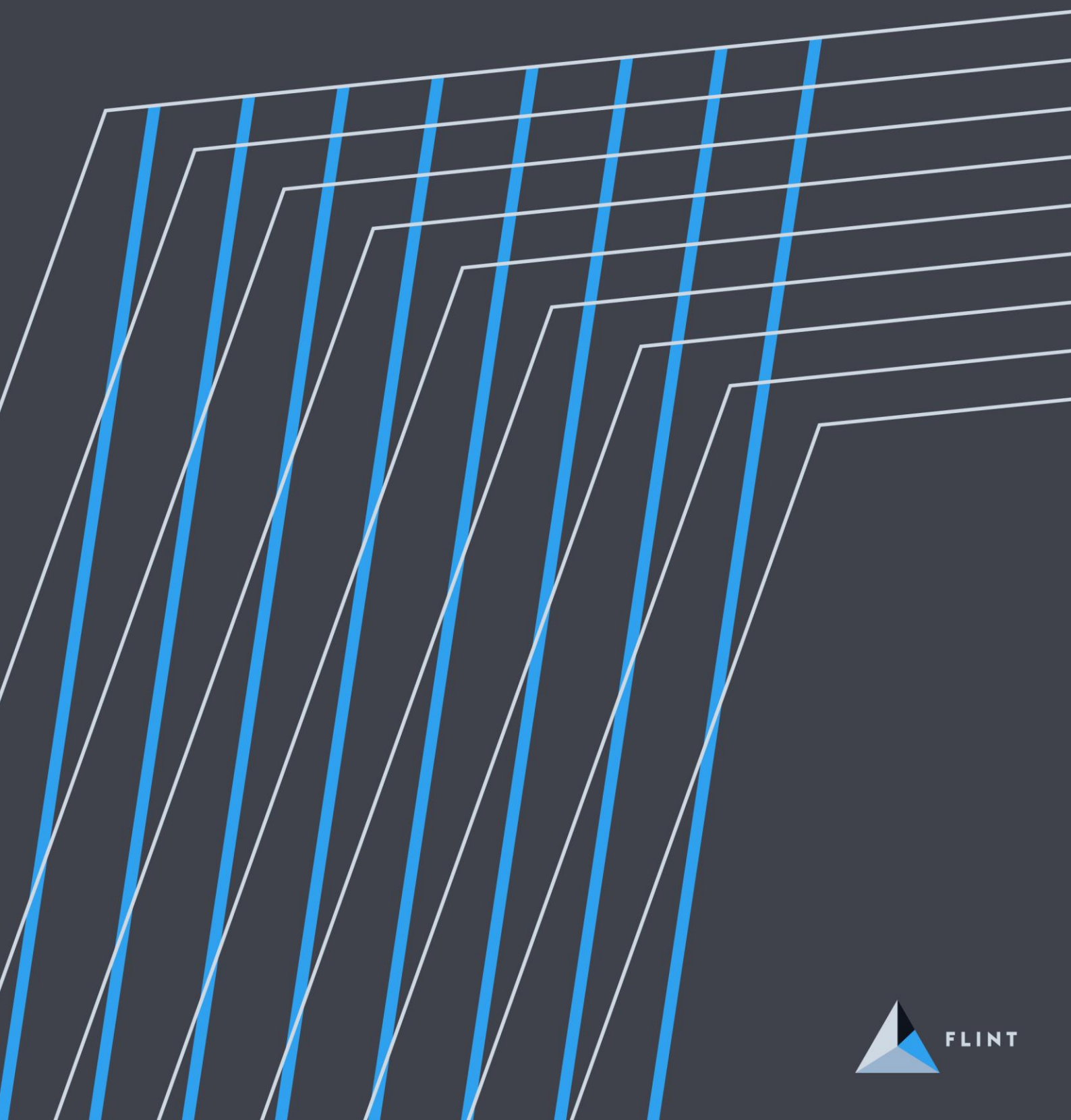
Support to the Civil Aviation Authority:
Estimating NERL's beta at NR23



FLINT

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Executive summary

Background

Flint has been commissioned by the Civil Aviation Authority (CAA) to estimate the beta for NATS (en Route) plc (NERL) for the NR23 price control.

In this report, we rely on recent historical market evidence to estimate a forward-looking beta, that captures the balance of systematic risks that NERL may face in the future.

Recent comparator evidence suggests two broad periods of very different systematic risk, before and since the COVID-19 pandemic began. In common with other stakeholders, we consider that both periods are informative for NERL's NR23 beta.

Our approach

We recommend a beta for NR23 made up of two parts:

- A baseline beta – which captures the balance of risks faced by NERL which are unrelated to COVID-19 (effectively a 'pre-COVID' beta).
- A 'COVID adjustment' – to be added to the baseline beta, reflecting the risk of events similar to COVID-19 that may occur in the future.

For our COVID adjustment, we have developed an approach which relies upon around seven years of historic daily market data, which we divide into 'pre-COVID' and 'COVID-affected' observations. We then 're-weight' the observations to generate a series of beta estimates that reflect the balance of risk that a company would face in the future if experiencing a 'COVID-like' event less frequently than implied by recent 'raw' beta calculations. For example, a raw 5-year beta observed in March 2022 implicitly reflects the occurrence of an event similar to COVID-19 exactly once every five years. Our analysis allows for lower frequencies of such events in future.

NERL itself is not and has never been listed on a stock exchange. Share price information and beta evidence cannot be directly observed for its owner, NATS. There is only one available ANSP (Air Navigation Service Provider) comparator – ENAV, based in Italy. In common with the CMA at RP3, we have also considered evidence from airport comparators. Expanding our comparator set avoids the issues associated with relying on a single comparator's data, and airports were considered by the CMA to face (and may still face) a comparable set of systematic risks to an ANSP, particularly when operating in a similar market and under similar comparative regulatory arrangements.

Prior to COVID-19, the CMA concluded that ENAV was likely to face lower systematic risks than NERL, and more comparable risks to a set of three major European airport groups, ADP, Fraport and AENA, which the CMA found had slightly higher betas than ENAV. Evidence from the airport comparators was therefore given greatest prominence in the CMA's redetermination at RP3.

During the COVID-19 pandemic, ENAV's beta appears to have increased to a greater extent than our preferred airport comparators, although we interpret this evidence with caution, due to the lower apparent stability of ENAV's beta over time (prior to-COVID-19) compared to the airports'. Nonetheless, the airport data and ENAV's data may point towards different levels of beta for NERL

in the future, both at benign times, and in response to a major demand shock with characteristics like those experienced during COVID-19.

Therefore, we have carried out sensitivity analysis around the assumptions in our model. These would suggest that a COVID adjustment estimate drawn from ENAV is particularly sensitive to our use of later data, and our assumptions about which historical data is materially affected by COVID-19. In contrast, the COVID adjustment implied by our preferred airport comparators is relatively robust to these alternative assumptions. In light of these results, we recommend the CAA interprets evidence from ENAV with caution and places primary weight on the evidence for the airport comparators.

Resulting beta estimates

The table below sets out our resulting beta estimates.

TABLE 1: FLINT NR23 ASSET BETA RECOMMENDATION

	Lower Bound	Upper Bound
Baseline beta	0.52	0.62
COVID adjustment derived from airport evidence	0.02	0.11
Combined beta for NR23	**0.54**	**0.73**

For our baseline beta, we estimate a beta of between 0.52 and 0.62, consistent with the beta the CMA estimated at the RP3 determination and based on data immediately prior to the COVID-19 pandemic.

Our recommended COVID adjustment is based on the difference between pre-COVID betas and re-weighted betas for our range of comparators, reweighted to account for the possible frequency of COVID-like events in the future. For our recommended range, we consider the future occurrence of COVID-like events (of between 17 and 39 month duration) occurring between once-every-20 and once-every-50 years. Across all comparator sets, we estimate a range for the COVID adjustment of between 0.02 and 0.17; however, as discussed above, we recommend that the CMA places primary weight on evidence derived from averages across our preferred airport comparator. As a result, we recommend a range of COVID adjustment for NERL of between 0.02 and 0.11, to be added to NERL's baseline beta.

The lower bound of our recommended COVID adjustment (0.02) is set by COVID-like events around one third less impactful than COVID-19, occurring once every 50 years. Our upper bound (0.11), meanwhile, is defined by events around 50% more impactful than COVID-19, occurring once every 20 years.

1. Introduction

NATS (en Route) plc (NERL) is the monopoly Air Navigation Service Provider (ANSP) in the UK, providing en route and certain approach air traffic services in UK airspace, as well as the Oceanic area of the North Atlantic.

The Civil Aviation Authority (CAA) is setting the weighted average cost of capital (WACC) allowance for NERL at the NR23 price control. An important determinant of the WACC allowance is the asset beta, which represents the systematic risk of the NERL business. Using the asset beta, a (notional) equity beta can be derived to form the basis of the cost of equity calculation within the WACC.

Flint has been commissioned by the Civil Aviation Authority (CAA) to estimate NERL's beta for the NR23 price control.

The estimation of a beta for NERL is ordinarily challenging, due to the lack of quoted share price evidence for the company itself. Compounding this at the present time is the challenge in interpreting recent evidence, and the impact of COVID-19.

Our report is structured as follows:

- Chapter 2 discusses our overall approach to estimating a beta for NERL for NR23;
- Chapter 3 discusses our choice and use of evidence drawn from listed comparator businesses;
- Chapter 4 discusses our approach to estimating a 'baseline beta' for NERL; while
- Chapter 5 explains our approach to estimating the effect of COVID on NERL's forward-looking beta; and
- Chapter 6 sets our conclusion and our recommendation for the CAA's assessment at NR23.

Further detail of some aspects of our analysis is set out in appendices.

2. Overall approach

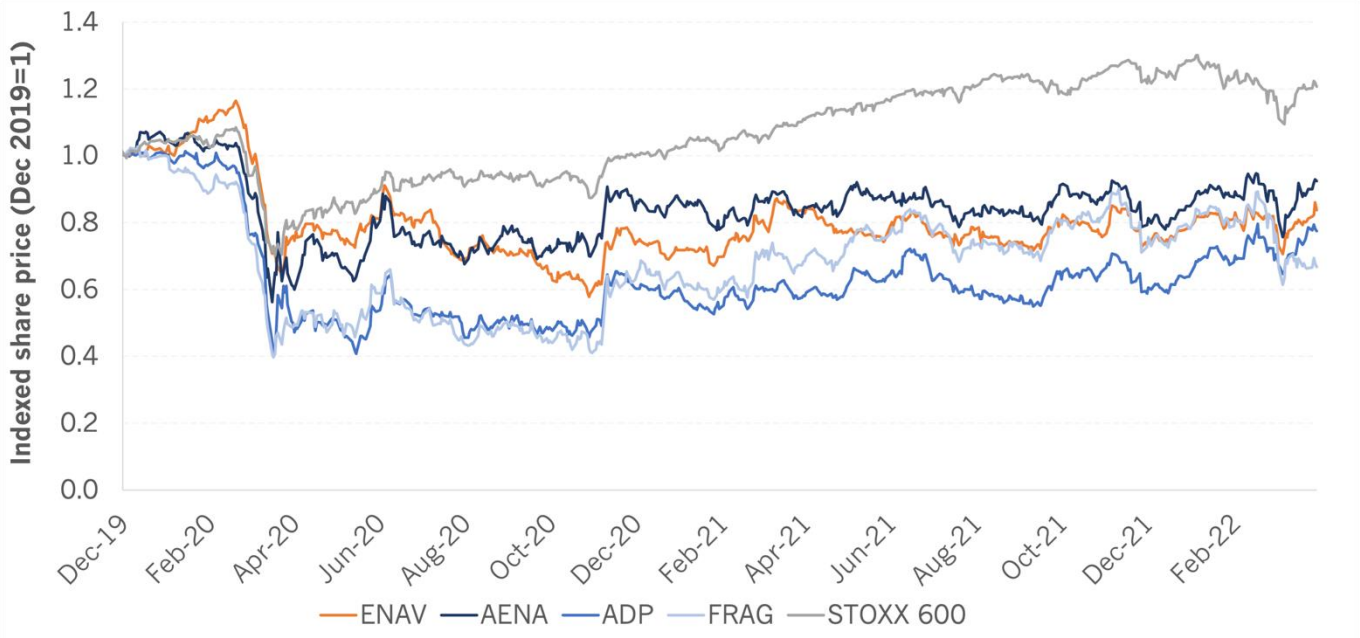
2.1 Market context

Estimating the beta (and systematic risk) for the purposes of setting regulated charges for future price control periods is challenging at the best of times – particularly for businesses such as NERL which are not publicly traded. In such cases, practitioners often rely on observed backwards-looking betas, estimated from similar – but listed – businesses (i.e. comparators), and take these to be a proxy for systematic risks of the business in question in the future.

However, since early-2020, and the onset of the COVID-19 pandemic, market valuations of some firms have exhibited significant volatility closely linked to the pandemic. The aviation sector has been one of the most prominently affected, with widespread global restrictions on travel driving significant reductions in passenger numbers and revenues.

There has also been significant volatility across equity markets in general, with day-to-day movements often driven by news and events related to COVID-19.

FIGURE 1: AVIATION INFRASTRUCTURE EQUITY PERFORMANCE SINCE DECEMBER 2019



Source: Thomson Reuters data as of 31st March 2022.

These stock market movements have materially affected observed betas for aviation infrastructure firms, as shown in Figure 2 below, and reflecting the systematic risks experienced within the sector, which were materially increased during the pandemic.

However, the figure also shows that betas observed over different estimation windows and at different points in time over the last two years would imply very different levels of systematic risk to one another. Therefore, setting a forward-looking beta for NR23 requires careful consideration

of what recently observed betas imply about the future balance of risks in relation to COVID-19 (and other similar events).

FIGURE 2: ASSET BETAS FOR 3-AIRPORT COMPARATOR SET OVER DIFFERENT ESTIMATION WINDOWS

Note: AENA was only listed in February 2015, so the 5-year rolling beta estimate prior to February 2020 excludes AENA. We note however that the inclusion of AENA from 12 February 2020 does not result in a significant change to the 5-year average.
Source: Thomson Reuters data as of 31st March 2022.

2.2 Regulatory context

In setting the beta for NR23, it is important to consider recent regulatory decisions in aviation and, where relevant, other sectors, as well as stakeholders' proposals for NR23.

The CMA redetermination for NERL at RP3

NERL rejected the CAA's RP3 final decision (for the period 2020 to 2024), leading the CMA to carry-out a re-determination of NERL's licence modification. The CMA published its final report in August 2020, i.e. relatively early in the COVID-19 pandemic.[1]

In its redetermination, the CMA estimated an asset beta for NERL of between 0.52 and 0.62, based on "the combination of the 0.5-0.6 estimate for the unlevered equity beta (or asset beta with zero debt beta) and [its] choice of debt beta", of 0.05.[2] While the CMA did not specify a point estimate of the asset beta from within this range, it set a cost of capital based on the midpoint of its range across all parameters.[3]

[1] CMA (July 2020), NATS (En Route) Plc /CAA Regulatory Appeal, Final report, hereafter "**CMA final report**".
[2] CMA final report, Table 13-17.
[3] CMA final report, para. 13.287 and 13.319.

In estimating the cost of capital at RP3, the CMA explicitly did not account for the effect of COVID-19.[4] Discussing its overall approach, the CMA described "the practical effect of this approach is that maximum charges will in effect be set as if COVID-19 had not occurred".[5]

As such, the CMA's estimate of NERL's beta could be interpreted as a 'pre-COVID' beta, since it was explicitly intended to rely only on market information up to the start of the COVID-19 pandemic, but not since.

The CMA's approach at PR19

In 2021, the CMA carried out a redetermination of the PR19 price control in the water sector. In doing so, the CMA considered for the first time the question of whether and to what extent changes in observed betas due to the pandemic represented changes in systematic risk (that should be reflected in the allowed rate of return via the assumed beta parameter), concluding:[6]

> *"While we consider that the pandemic represents a systematic event which should not be excluded from our estimates, we also recognise that this type of economic crisis is relatively rare and that it is likely to be over-weighted in our range of beta estimates, which cover the last 2-, 5- and 10-year periods."*

While the CMA's PR19 decision concerned a different sector to aviation, it is relevant to NR23. It recognises that a forward-looking estimate of the beta should reflect the effect of COVID-19 or similar events on long-run systematic risks, but that relying directly on betas calculated from recent data would likely overstate the influence of such events that are likely to occur rarely in future.

CAA's decision at H7

In June 2022, the CAA published its decision on Heathrow Airport's H7 price control, including an estimate of the cost of capital for the 2022 to 2026 period. To inform its decision, the CAA commissioned Flint to evaluate the implications of COVID-19 for Heathrow's beta.[7]

Due to the similarities between NERL and Heathrow and the timing of the regulatory decision, and particularly given the reliance on similar/overlapping listed comparators for airport and air traffic control sectors, the CAA and Flint's approach at H7 provides a useful 'starting point' for our analysis of NERL's beta for NR23.

We discuss the specific elements of our approach at H7 and the CAA's H7 decision in more detail in subsequent sections. In summary, however, the CAA's H7 asset beta consisted of:[8]

- A baseline beta of 0.50 to 0.60, which captures the balance of risks faced by Heathrow which are unrelated to COVID-19;

[4] CMA final report, para. 13.2
[5] CMA final report, para. 5.41.
[6] CMA (Mar 2021), Anglian Water Services Limited, Bristol Water plc, Northumbrian Water Limited and Yorkshire Water Services Limited price determinations, p. 870, para 9.493.
[7] Flint (May 2020), Support to the Civil Aviation Authority: H7 Updated Beta Assessment.
[8] CAA (June 2022), CAP2365, Economic regulation of Heathrow Airport Limited: H7 Final Proposals, Section 3: Financial issues and implementation.

- A 'COVID adjustment' – to be added to the baseline beta, and reflecting the risk of events similar to COVID-19 that may occur in the future, of 0.02 to 0.11; and
- A downward adjustment to the both the baseline beta and the COVID adjustment to account for the introduction of a new traffic risk sharing mechanism, reducing the beta range from 0.52-0.71, to 0.44-0.62.

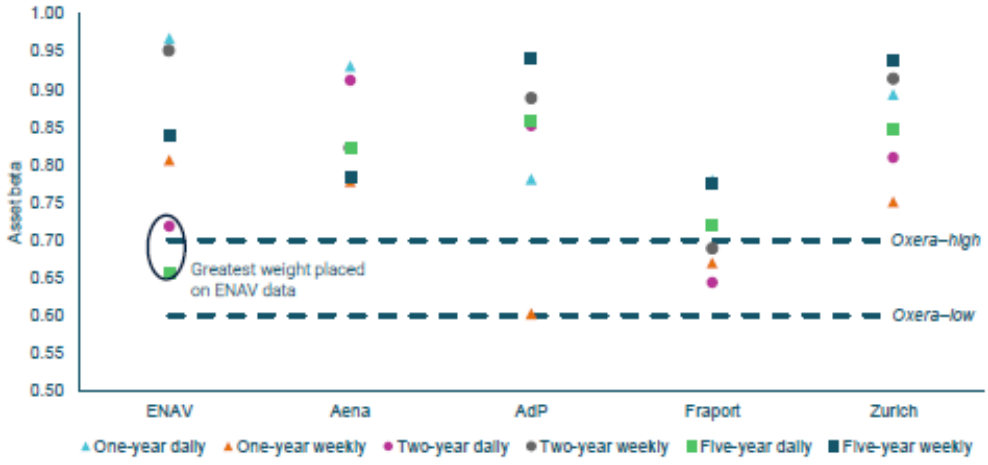
NERL's proposed beta for NR23

In its NR23 business plan, NERL proposes a beta for NR23 of 0.60 to 0.70, informed by analysis carried out by Oxera.[9]

Oxera's analysis relies on 1-year, 2-year and 5-year daily and weekly spot betas from five comparators, estimated as of September 2021. Oxera argues that COVID-19 should be viewed as a systematic risk that likely led to an "enduring reappraisal of the risk of aviation relative to the economy" and that "full reversion" of aviation betas to pre-pandemic levels is unlikely.[10]

From a wider range (between 0.60 and 0.97), Oxera recommend an asset beta for NERL for NR23 of between 0.60 and 0.70.[11] In doing so, Oxera places weight on betas which contain data from before and after the COVID-19 pandemic as well as betas based entirely on data since the pandemic. NERL argues that since Oxera's evidence "points towards a likely upward skewed distribution within the range",[12] it sets a point estimate at 0.678, i.e. slightly above the upper quartile of the 0.60 to 0.70 range.[13]

FIGURE 3:OXERA'S RECOMMENDED NR23 BETA AND RANGE OF EVIDENCE CONSIDERED



Summary of asset beta estimates and Oxera's proposed range (note, cut-off date is 30 September 2021)
Source: Oxera analysis based on Bloomberg data

[9] NERL Business Plan, Appendix M: Cost of Capital, hereafter "**NERL Cost of Capital Appendix**", p.4-5; and Oxera (28 October 2021), Cost of capital for NR23, hereafter "**Oxera report**".
[10] Oxera report, p. 33.
[11] Oxera report, p. 34.
[12] NERL Cost of Capital Appendix, p. 4.
[13] NERL Cost of Capital Appendix, p. 8.

2.3 Our overall approach to estimating a beta for NERL for NR23

It is important that the risks faced by NERL are fairly assessed and reflected in regulated prices during NR23. As such, it is important that the beta reflects the systematic risks faced by NERL's investors given uncertainty about the future state of the world, and allowing for a range of outcomes, including low probability, high impact events (such as a 'COVID-like' event).

Historical evidence splits into two broad periods of very different systematic risk

As shown in Figure 2 above, backwards looking betas for aviation infrastructure vary significantly according to the date of observation, and 'time window' used for estimation.

In particular, the evidence shows a 'step change' in observed betas in March 2020, around the onset of the COVID-19 pandemic. While short-run estimates of the beta (6-month and 1-year) show significant variation over time, the predominant difference is between data from before the pandemic and data since, suggesting that, had the COVID-19 pandemic not happened, aviation infrastructure betas would have been lower.

Like the CMA and Oxera, we consider that COVID-19 represents a systematic risk that should be reflected in forward-looking estimates of the beta. However, we also agree with the CMA that recently observed beta evidence effectively "over-weights" COVID-affected data: COVID-like events are possible in the future, but are not expected to be as prominent in future as they have been in influencing the recently observed beta statistics (e.g.. once every five years, as implied by a 5-year backwards looking beta).

We also note that Oxera, in arguing that less weight should be placed on one-year and two-year betas than on five-year betas,[14] appears to recognise that recent beta evidence (particularly when estimated over short windows) "over-weights" COVID-affected data.

We recommend a forward-looking beta comprised of a baseline beta and a COVID adjustment

We therefore choose to rely on an estimate of the beta for NR23 which relies on both COVID-affected and non-COVID affected data, but which moderates the impact of COVID-19-affected data, allowing us to estimate the effect of COVID-like events on long-run estimates of the beta.

We propose to execute this approach in a similar way to our approach for Heathrow in our H7 reports, with a forward-looking beta made-up of two components:

- A 'baseline beta', to reflect the underlying long-run systematic risk faced by NERL due to events unrelated to COVID-like events. The baseline beta would reflect an estimate of the future systematic risks faced if an event like COVID-19 were never to happen again, effectively a 'pre-COVID' beta; and
- A 'COVID adjustment', to be added to the baseline beta, which captures the effect on NERL's beta of events similar in nature to COVID-19 that may occur again in the future, but reflecting that they will do so less often than observed in recent years. For example, our approach allows us to estimate the effect (on forward looking betas) of a COVID-like event occurring once every

[14] Oxera report, p.34.

50 years, rather than, say, once every five years, as would be implied by relying on a raw 5-year beta.

We calculate the COVID adjustment by reweighting recent observed source data

To estimate the baseline beta, we rely on comparator evidence from before the COVID-19 pandemic. We discuss our choice of comparators and methodological choices in the chapters below.

To estimate the COVID adjustment, we have developed a methodology which creates a 'reweighted' beta estimate based on daily share price and index data over recent years, made up of data directly affected by COVID-19, and data from before the pandemic began. Again, we rely on evidence from comparators to NERL.

To implement our methodology, we change the weight on the COVID-affected observations in our dataset relative to the non-COVID observations. This allows us to use a dataset of recent data (e.g. from the last five to ten years) to simulate betas for longer time horizons but reflecting different frequencies with which the COVID-19 data occurs (correspondingly reflected in the reweighted dataset).

In our preferred approach (discussed in more detail in Section 5.2 below), we use pre-COVID data as a proxy for the beta that would have prevailed had COVID-19 not happened. This provides an estimate of the effect on long-run beta estimates of a sequence of simultaneous share price and market movements of the type that have been observed since the COVID-19 outbreak, alongside a (longer) period of benign share price and market movements. We also consider sensitivities which make alternative assumptions about COVID- and non-COVID-affected data.

As a simplified illustration of the approach, imagine we had five years of actual observed data. One year of the data can be identified and attributed to the full cycle of a specific event, and four years of the data were unaffected (i.e. pre-dated the event). A simple 5-year beta calculated from this raw data would be suitable for use as a forward-looking beta estimate only if it was considered likely that future similar events would occur – with the same duration and characteristics – once every five years.

But what if the expected frequency of future events was lower, say one in 10 years? Using the same data, we can simulate a beta for an event frequency of one in 10 years by increasing the weight on the 'non-event' data such that it accounts for nine years of a new 10-year dataset, while holding the weight of data affected by the event constant. A beta calculated from this constructed dataset would reflect the prospective systematic risk if events were expected to occur once every 10 years.

So, we can reformulate recent, historical data, which we know to represent an observed combination of events and time periods, to form a forward-looking beta that reflects different possible combinations of such events in the future, over the long term. We do exactly this with recent stock market data, which pre-dates, and then captures the effects of the COVID-19 'event'.

We describe our mathematical approach in more detail in section 5.2 below.

3. Comparators

In order to estimate a beta for NERL, which is not listed, we must draw upon evidence for other comparable businesses which are listed, and for which beta evidence can be observed. In this section, we discuss our consideration and selection of comparators for NERL.

3.1 Precedent and context

The CMA primarily relied on three airport comparators

In its RP3 determination, the CMA relied upon the betas of four comparators:[15]

- Three "large European airports": ADP (Paris Charles de Gaulle), Fraport (Frankfurt) and AENA (Madrid); and
- ENAV, The Air Navigation Service Provider (ANSP) in Italy (and the only traded European ANSP).

The CMA rejected the use of airline and utility comparators, arguing they respectively face higher and lower systematic risks than ANSPs such as ENAV.[16]

The CMA also rejected the use of other airports proposed by stakeholders, namely Zurich, Vienna, Copenhagen, Sydney and Auckland. The CMA rejected the three smaller European airports due to the risk that "company-specific issues or a lack of liquidity would distort the betas" and rejected the non-European airports on the grounds that it was not confident "that investors in these very geographically distinct markets could be assumed to be comparable investors with a comparable view on systematic risks".[17]

The CMA then considered whether its chosen comparators were likely to face higher or lower systematic risks than NERL. First, it concluded that ENAV was likely to be lower risk than NERL, due to its lower operating leverage and evidence that it faced lower traffic risk.[18]

We also note that the CMA had available to it a shorter window of pre-COVID data for ENAV (2.5 years) compared to around five years or more for each of the airport comparators. The CMA only showed estimates of spot betas and one-year trailing averages of ENAV's beta.

The CMA considered the evidence of the relative risk of the three candidate airports to be less consistent, with the airports exhibiting differences in their regulatory regimes, exposure to greater volume risks (although noting that these might be mitigated by capacity constraints), higher operating margins, and generally higher commercial risks.[19] It concluded "that there was

[15] CMA final report, para. 13.96.
[16] CMA final report, para. 13.49-13.51.
[17] CMA final report, para 13.75-13.76.
[18] CMA final report, para. 13.64.
[19] CMA final report, para. 13.82.

inconclusive evidence that airports were either more or less risky than NERL, and therefore we used the value of the betas of the airport comparators as a direct comparator for NERL's beta".[20]

At H7, we relied on a wider range of airport comparators for the COVID adjustment

The CAA's baseline beta used in the H7 Final Proposals relied on the same three airport comparators as the CMA's RP3 decision.

However, for the COVID adjustment, we (and the CAA) relied on a wider set of six comparator airports for estimating the change in beta due to COVID-like events. During the COVID-19 outbreak, the CAA indicated that "*reliance on an overly narrow comparator set could lead to excessive weight being placed on results that are driven by specific circumstances that may not be applicable to HAL.*"[21] Based on this approach, the CAA concluded on a set of eight potential airport comparators: AENA, ADP, Fraport, Zurich, Vienna, Copenhagen, Sydney and Auckland.

From this shortlist, we assessed the extent to which reliable estimates of the daily beta could be estimated, and, on this criterion, chose not to place weight on the betas estimated for Copenhagen or Auckland airport. For the remaining six airports, we assessed the comparability of the airports' regulatory regime and operational features with Heathrow in light of changes due to COVID-19 and concluded on three comparator sets:[22]

- AENA only, the group with the most comparable main airport, Madrid-Barajas, and overall group operational features that appear most similar to Heathrow.
- The average of the four airports that we considered most comparable to Heathrow: AENA, ADP, Fraport and Zurich.
- An average of all six retained comparators: AENA, ADP, Fraport, Zurich, Vienna and Sydney.

NERL and Oxera propose relying on four airport comparators and ENAV

NERL and Oxera draw their comparators from the CAA's set of eight airport comparators and ENAV.[23]

Oxera (and NERL) argues that ENAV is NERL's closest comparator (in a post-COVID/COVID-affected world), due to its similar exposure to traffic risk and similarities of regulatory protections.[24]

From the shortlist of eight airports, Oxera narrows down its comparator set using the following criteria:

[20] CMA final report, para. 13.83.
[21] CAA (Apr 2021), Appendices *to* Economic regulation of Heathrow Airport Limited: Consultation on the Way Forwards, p.68.
[22] Flint August 2020 report, p. 21.
[23] Oxera report, p. 7.
[24] Oxera report, p. 34.

- First, it rejects Sydney and Auckland, arguing they operate in different geographical markets, that they operate under different (lighter-touch) regulatory regimes, and that they had a different experience of the COVID-19 pandemic.[25]

- Second, it rejects Copenhagen and Vienna due to the low liquidity of their stocks, based on their lower share of free-float and higher bid-ask spreads.[26]

Therefore, Oxera and NERL retained a set of four airport comparators (ADP, Fraport, AENA and Zurich), plus ENAV.

3.2 Our approach

For the baseline beta, we propose to align with the CMA's RP3 comparators

As we discuss in more detail in section 4.2 below, we set NERL's baseline beta for NR23 based on available beta evidence prior to COVID-19. As such, our choice of comparators for the baseline beta is particularly informed by the CMA's RP3 approach.

The CMA primarily relied on three major European airport groups (Fraport, AdP and AENA), while placing some weight on ENAV. These are the same airport comparators that the CAA relied for Heathrow's baseline beta at H7, as informed by Flint's advice for the CAA.

In both cases, other potential airport comparators were rejected due to the risk of their betas being distorted by measurement error or capturing a different balance of risks compared to those experienced by major European aviation infrastructure operators.

Therefore, we retain the CMA's choice of comparators for our baseline beta.

For the COVID analysis and adjustment, we rely on the CAA's shortlist of airports and the only listed ANSP

We agree with the CAA's view at H7 that it is appropriate to draw upon evidence from a wider set of comparators when assessing the impact of COVID-19 on betas. Given the specific effect of the COVID pandemic on the aviation sector, we choose to rely on comparators from within the sector.

ENAV is the only listed ANSP. Therefore, we include it in our comparator set.

We then consider the eight airport comparators identified by the CAA at H7.

For the European comparators, and consistent with the CMA's approach, we rely on the STOXX 600 index, since there is a high degree of market integration between European stock markets. For Sydney and Auckland, we use the largest available local indices, the All Ordinaries and the NZX All, respectively.

[25] Oxera report, p. 10-11.
[26] Oxera report, p. 10.

We do not rely on betas which cannot be estimated reliably

As a first step for each of the eight airport comparators, we have reviewed the share price data for the comparators and the appropriateness of the relevant market index, and the resulting reliability of beta calculation.

From the shortlist of eight airport comparators, we consider that we do not have sufficiently reliable data on the relationship between share price and the market for two comparators:

- Only 1% of shares in Copenhagen airport are traded on the stock market. As noted by Oxera, it also has a higher bid-ask spread than any other comparator.[27] With such a low level of free float, and the associated potential for infrequent trading, its daily share price data is likely to be unreliable. In some circumstances, when estimating betas over a longer time window, it may be appropriate to retain such a comparator and rely on weekly or monthly data, which would suffer less from these problems. However, in this case we are looking at price behaviours within a shorter window and require daily data in order to capture the specific dynamics of the COVID-19 pandemic.

- Auckland airport is traded on the NZX exchange, a market which is not highly diversified. For example, Auckland airport alone makes up 6% of the NZX. Hence, movements in the market index may be driven by movements specific to Auckland airport, creating some circularity in the beta estimates for Auckland. While this issue could, in theory, be resolved by relying on an international index, we do not consider that the New Zealand market is a sufficiently integrated market to be able to consider an international index to capture the choices made by the marginal investor.

We note that Oxera shares our assessment of Copenhagen and also chooses not to rely on Auckland airport, although for further reasons.

These same criteria might also lead us to place less weight on the beta data for Sydney and Vienna. Sydney's market index – All Ordinaries – is less diversified than the STOXX 600 (even though Sydney is not a dominant constituent). Vienna airport only has 10% free float, and its beta estimate is less statistically robust than the remaining candidate airport betas. However, as we discuss below, we retain these comparators as part of our wider set and consider these factors in the round when assessing the weight to place on them for estimating NERL's COVID adjustment.

To avoid company-specific effects, we consider averages of the COVID-effect across airport comparators

Having decided to retain six airport comparators, we now consider the weight we should place on them.

As in our advice to the CAA at H7, we consider that taking an average of the COVID adjustment implied across multiple comparators is most appropriate. Even in benign times, an airport's beta will be influenced by company-specific factors related to its regulatory regime, the market it serves and environment it operates in. However, when identifying the beta response to the COVID-19

[27] Oxera report, p. 11.

pandemic, the risk of company-specific factors distorting the apparent response of the beta is potentially greater.

In establishing the relative weight placed on the different comparators and their comparability to NERL, we have considered two broad factors:

- First, the comparability of the regulatory regime with the CAA's regime for NERL, e.g. in terms of the duration of the price control and the manner and extent to which it binds the airport's ability to recover its costs; and
- Second, the comparability of operational features, such as traffic volume, capacity utilisation, and the geographic focus of their operations.

Our assessment is informed by:

- The CMA's pre-COVID assessment (of the European airports and ENAV) at the RP3 determination,
- Oxera's assessment of the airports' comparability to ENAV in light of the COVID pandemic;[28] and
- The CAA's review of the airport comparators (before and since COVID-19), which we summarised in the Flint August 2021 report, in the context of Heathrow's H7 beta.

In addition, appendix 1 sets out our updated observations on NERL and ENAV's regulatory regime.

Weight placed on airport comparators

Based on our review of the airport comparators in light of their experience of COVID-19, we conclude the following:

- Sydney and Vienna airports operate under regulatory regimes that are significantly different from NERL. Whereas NERL operates under formal price controls with a fixed duration, we understand from the CAA that Sydney does not face a formal price control, while Vienna's price cap arrangement lacks specified duration or regular reset points. As discussed above, there is also a risk that these airports' betas are not reliable estimates of their airports' systematic risk. Therefore we place lowest weight on these airports.
- The remaining four airport groups operate in Europe. Zurich airport group is relatively small compared to ADP, Fraport and AENA (but larger than Vienna, and in terms of regulatory asset value, larger too than NERL). It operates under an economic regulatory regime based on similar principles to NERL's, with ex-ante 'backstop' price controls set by the regulator. That said, the duration of the regulatory period is not set in advance. NERL and Oxera suggest Zurich is included as part of the comparator set for NERL, and the CAA and Flint included it as a comparator for the purpose of estimating the COVID adjustment for Heathrow at H7. While Zurich was not included in the CMA's comparator set at RP3, we consider that it is a more relevant comparator than Sydney and Vienna.

[28] See, for example, Oxera report, p. 15-16.

- ADP, Fraport and AENA were all included in the CMA's (pre-COVID) comparator set for NERL at RP3. We have considered whether any changes in their regulatory frameworks (or operating circumstances) might lead them to be less comparable in terms of systematic risk to NERL in the context of COVID-19 and future COVID-like events. As we set out in our report for the CAA at H7, the regulatory regime at Madrid (AENA) and Frankfurt (Fraport) are largely unchanged since the COVID-19 pandemic began. While there were some changes to Paris (ADP)'s regulatory regime during the pandemic, reducing the duration of the control period and effectively increasing the operator's charging flexibility, it remains subject to ex-ante price controls, and it is not clear whether mitigations in place in relation to COVID-19 would remain in place in future.

Therefore, based on this assessment, we present results for three sets of airport comparators:

1 The set of six retained airport comparators,

2 A set of four, Zurich, ADP, Fraport and AENA, and

3 A set of three, consistent with the CMA's preferred comparator group at RP3.

As we show in section 5.3 below, our estimated COVID adjustment is relatively insensitive to our choice of airport comparator set, hence we report results for all three sets for completeness.

The weight placed on ENAV

As the only listed ANSP for which we can estimate a beta, ENAV is a relevant comparator for NERL.

In its RP3 determination, the CMA considered that ENAV faced less comparable risks to NERL than the set of three airports. Since the CMA's range of beta is consistent with the range it estimated for the three airport comparators, it is not clear what weight the CMA actually placed on ENAV.

However, due to the differences between ANSPs and airports and how these may have affected their experience of the COVID-19 pandemic, the CMA's finding does not preclude the possibility that ENAV is equally or more comparable for the purpose of estimating the response to COVID-like events.

NERL (and Oxera) cite factors which might lead an ANSP to face higher systematic risks than airports as a result of an unanticipated demand shock such as COVID-19:

- ANSPs may find it harder to reduce costs in response to a negative demand shock compared to airports. While airports were evidently able to mothball large parts of their airports and reduce costs (e.g. closing terminals), ANSPs were required to continue to provide similar levels of service, and/or appeared unable to reduce costs in the same way.

- ANSPs' cost inflexibility (linked to operating leverage) was particularly apparent during 2020: Oxera estimated that, while airports reduced their operating costs by between 12 and 20% compared to 2019, ENAV and NERL's operating costs fell by only around 6%.[29] Our own analysis of cost responses through COVID-19 supported a similar conclusion.

[29] Oxera report, p. 23.

However, there are also factors which could lead ANSPs to face lower systematic risks than the airport comparators during COVID-like events:

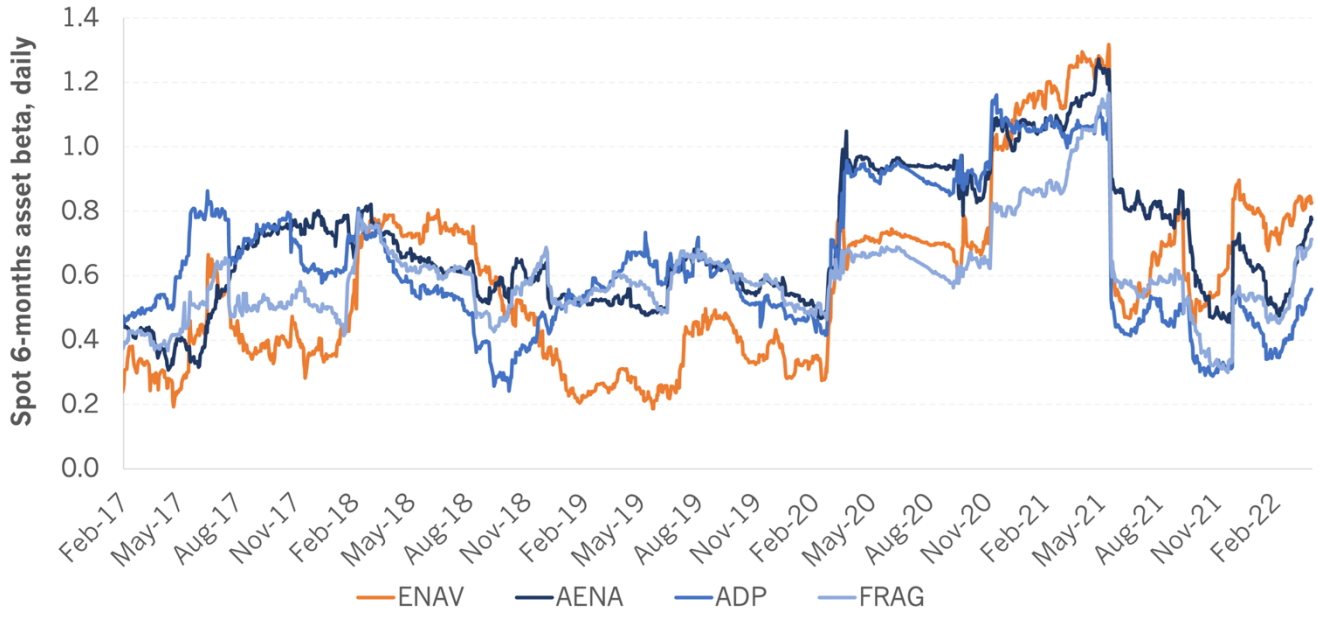
- ENAV and NERL have to date both benefited from an 'ex ante' traffic risk sharing mechanism. This allows them to recover (in arrears) a large proportion of revenue lost when outturn traffic is lower than expected. Airports have not in general benefitted from such mechanisms, and indeed, the chosen airport comparators did not benefit from such mechanisms prior to COVID-19.

- ANSPs tend to face a more diverse mix of aviation types, whereas individual airports may be more exposed to specific segments of the market (e.g. in terms of low-cost or short-haul traffic), meaning they are more exposed to demand risks associated with a particular segment.

In reaching its decision on RP3, and considering these relative risk issues in the round, the CMA were "cautious in trying to measure too narrowly the effect of such risk differentials on beta" and "decided to use ENAV data in coming to [its] judgement, on the assumption that NERL's asset beta was likely to be higher than ENAV's asset beta".[30]

Prior to the COVID-19 pandemic, and as noted by the CMA, ENAV's beta was lower than the airport comparators. However, the figure below illustrates 6-month rolling betas, since the pandemic began (in early 2020). While calculations of beta over short windows should be treated cautiously, we note that ENAV's beta has risen relative to the airports', and is now higher than any of the CMA's main three airport comparators. Furthermore, in the latter months of the pandemic, while betas for airports have fallen towards their pre-COVID level, ENAV's beta has remained higher than its pre-COVID value.

FIGURE 4: 6-MONTH SHORT-WINDOW ROLLING BETA ESTIMATES



The explanation for this pattern in relative betas is not obvious. We have not identified any notable company-specific news or developments which would explain why ENAV's beta has increased in

[30] CMA report, para 13.64.

recent months and remained high, while airport betas appear to have largely reverted to the pre-pandemic level.

Thus, while this may reflect ENAV specific characteristics, it may also plausibly reflect that ANSPs responses to the significant and sustained demand shock of COVID-19 – and revealed operational response – which has exerted and continues to exert greater effect, relative to the protections offered by traffic-risk sharing and other risk reducing factors.

Another plausible contributing factor to the observed recent movements in the ENAV beta is the possibility that – given the short data window adopted for these more recent observations, the increase is simply a reflection of the statistical uncertainty inherent in such estimates. Our preferred airport comparators' betas exhibit greater (like for like) statistical confidence levels than ENAV's. We are able to observe betas for multiple airports and draw greater confidence from the fact that the pattern across the airport comparator set is similar. We are unable to do this for ENAV.

4. Baseline beta

Following the approach set out in Section 2 above, we estimate a beta for NERL at NR23 made up of two components, the first of which is a 'baseline' beta, intended to capture the underlining non-COVID related risks that NERL will face during H7.

4.1 Precedent and context

The CMA's estimate of a pre-COVID beta at RP3

As discussed in Section 2.2 above, the CMA carried out its analysis on a 'pre-COVID' basis. It deliberately did not aim to capture the effect of COVID-19 on NERL during RP3 when setting its beta (or indeed, other parameters of the price control). As such, the CMA's RP3 beta represents its' views of a 'pre-COVID' beta for NERL, reflecting the CMA's view about the forward-looking risks that NERL would face during RP3 other than those associated with the then-ongoing COVID-19 pandemic.

The CMA's beta relied on a range of different beta evidence, estimated for four comparators (ENAV, ADP, Fraport and AENA, as discussed in Section 3 above):[31]

- Betas using 2-years of data and 5-year of data;
- Spot estimates (as of 28 February 2020), 1-year rolling averages, 2-year rolling averages and 5-year rolling averages; and
- Betas estimated based on daily and weekly returns.

The CMA relied on the Stoxx 600 (or Eurostoxx 600) index, a pan-European market index, as opposed to domestic (or world-wide) indices.[32]

The CMA determined a beta range (of 0.50 to 0.60 with zero debt beta – or 0.52 to 0.62 when assuming a debt beta of 0.05)[33] from the full range of the betas set out above (of 0.39 to 0.88) based on an "in the round" assessment, but noted that it placed least weight on 2-year weekly betas.[34]

Oxera proposes a single beta capturing baseline and COVID-related systematic risks

In its report, Oxera agrees that the CMA's RP3 determination estimates a 'pre-COVID' WACC.[35]

While Oxera does not estimate a separate baseline beta and COVID adjustment, it argues that betas during NR23 are likely to be higher than they were pre-pandemic, and choses to place weight on betas made up of pre- and post-COVID data, as we discuss in more detail in Chapter 5 below.

[31] CMA final report, para 13.98.
[32] CMA final report, para 13.125.
[33] See Section 8 below.
[34] CMA final report, para 13.99-13.102.
[35] Oxera report, p. 2.

For its NERL beta estimate, Oxera relies on a range of evidence estimated from its comparators similar to the CMA (2-year betas and 5-year betas, estimated using daily and weekly data, and measured against the Stoxx 600 market index), but choses not to use rolling betas, arguing that, by placing uneven weight on data points across the time period, they overestimate the effect of pre-2020 (i.e. pre-COVID) data.[36]

CAA's approach at H7

For Heathrow's H7 price control, the CAA assumed a 'baseline beta' for Heathrow of 0.50 to 0.60, informed by analysis carried out by Flint in 2020 and 2021. The CAA then reduces its estimate of Heathrow's forward-looking beta to captures the effect of new risk-sharing mechanisms it has introduced.

4.2 Our approach

A 'pre-COVID' beta is the best estimate of the baseline beta for NR23

Our baseline beta is intended to capture the forward-looking risks that NERL will face during NR23 outside of those associated with COVID-like events. As we discuss in Chapter 5 below in more detail, COVID-19 appears to have affected aviation infrastructure betas since February/March 2020 and throughout 2021. Therefore, it is not possible to estimate a (reliable) non-COVID affected beta using more recent data.

Therefore, the best assessment of systematic risks faced by NERL outside of COVID-like events is based on pre-COVID data, equivalent to the data the CMA relied upon in its RP3 decision.

We align with the CMA's RP3 approach to set the baseline beta for NR23

Having chosen to rely on pre-COVID data, we must also decide whether or not the RP3 beta estimated by the CMA remains appropriate as the baseline beta for NR23. In doing so, we have considered whether there are obvious and significant changes to NERL's business that would mean its systematic risks are changed compared to in early 2020, at the time of the CMA's decision:

- Firstly, we have considered whether there are any significant changes to NERL's regulatory regime that will affect its systematic risks outside of COVID-19. As described in Appendix 1, NERL benefits from a TRS mechanism that protects it from traffic risk. Some timing aspects of this mechanism were adjusted specifically in relation to the COVID-19 pandemic (requiring NERL to recover the short-fall in revenues over a longer period that would usually apply), but NERL continues to benefit from the same scale of protection at all times, and identical protection from demand volatility through the TRS during less extreme demand shocks.

- In light of the COVID-19 pandemic, the CAA (and CMA) reduced the duration of the RP3 price control from 5 years to 3 years. This shorter price control period arguably reduces NERL's exposure to systematic risk. However, the change in price control duration was a temporary intervention following the onset of the COVID-19 pandemic, and does not apply permanently.

[36] Oxera report, p.13-14.

We therefore conclude that the CMA's pre-COVID assessment of NERL's systematic risk remains relevant for use as the anchor point for our baseline beta.

Consistency with Heathrow's H7 beta

In setting a baseline beta for Heathrow's H7 price control, the CAA relies on the same comparators as the CMA's RP3 determination, and estimates betas for a similar time period and equivalent cut-off date. However, as Flint set out in our April 2020 report, we estimate a slightly different asset beta estimate (when accounting for the debt beta), at around 2 basis points lower than the CMA's decision in relation to NERL.

We set out the reasons for the difference in range in our April 2020 report for the CAA, noting that we did not rely on weekly betas and made some different assumptions about comparator's gearing, and that CMA applied judgement to remove outliers and account for the clustering of beta values when determining its range.[37]

While these different methodological choices might have led us to estimate a lower baseline beta for NERL had we carried out our analysis bottom-up (rather than using the CMA's precedent for our NR23 baseline beta), we consider that, for regulatory consistency and to avoid overlaying our own judgement, the CMA's pre-COVID beta is the most appropriate range for NERL's baseline beta. We also note that the qualitative judgements (e.g. to remove outliers) may have reflected the CMA's assessment of the comparators comparability and appropriateness in relation to NERL, a factor that was not relevant in the context of Heathrow's beta.

Risks of double-counting COVID-affected data

Since we propose to add a COVID adjustment on top of our baseline beta, it is important that the baseline beta is not influenced by COVID-19 data, otherwise the effect of COVID-like events will be double counted (i.e. as it would be included in both the baseline and COVID adjustment).

In Chapter 5 below we explain why, in our preferred approach, we treat all data since February 2020 as COVID-affected, meaning that the 'pre-COVID' beta for our comparators ends on 31 January 2020. Therefore, we have considered whether, had the CMA set its cut-off date a month earlier, its assessment of NERL's beta would have been different.

We find that an earlier cut-off date would not materially change the CMA's range. Firstly, for rolling average beta estimates, the change is immaterial. For the CAA's spot estimates (of 2-year and, where available, 5-year betas), betas tend to decrease slightly if assuming an earlier cut-off date, but these spot estimates do not define the bounds of the range that the CMA estimated for each comparator.[38]

We retain the CMA's pre-COVID beta of 0.52 to 0.62

Therefore, we set our baseline beta consistent with the CMA's beta in its RP3 determination. As we discuss in Appendix 2 below, we assume a debt beta of 0.05 for both NERL and its comparators.

[37] Flint April 2020 report, p. 19.
[38] CMA report, para. 13.101.

This is the same as the CMA's assumption at RP3. Therefore, our range is 0.52 to 0.62 (with a debt beta of 0.05), consistent with the CMA's decision.

5. The impact of COVID

In this chapter, we describe our proposed COVID adjustment for NERL's beta at NR23.

5.1 Precedent and context

While consistent with our overall approach, the CMA's analysis does not help us estimate the effect of COVID on forward-looking betas for NERL

The CMA's RP3 determination did not consider the effect of COVID-19 on betas.

As discussed in Section 2.2 above, the CMA's PR19 water redetermination is informative in helping us develop our approach, since it argues that recent betas 'overweight' COVID-19 for the purpose of estimating the forward-looking systematic risks faced over the longer-run.

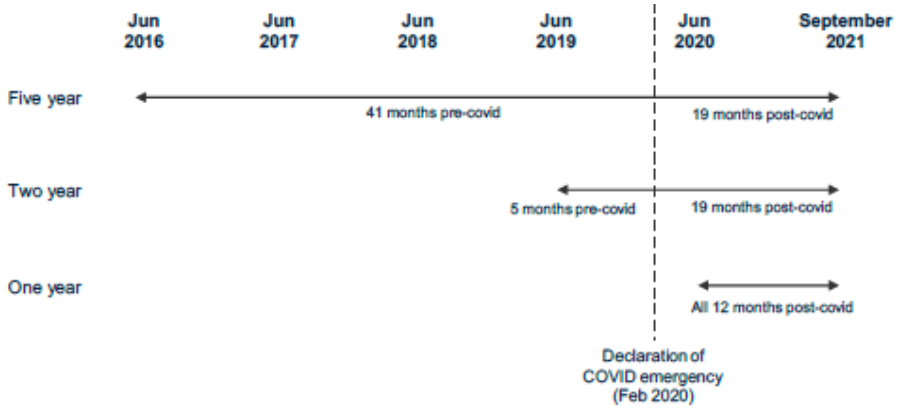
However, the CMA's approach at PR19 does not provide a direct template for executing our approach, since it did not make any quantitative assessment of the impact of COVID.

Oxera approach

While Oxera does not separately estimate a COVID adjustment, Oxera's beta for NR23 is made up of pre-COVID and post-COVID data, and Oxera discusses the weight to place on each type of data in its report.

The figure below shows the estimation windows used in Oxera's report. Since Oxera uses spot estimates, Oxera's 1-year betas are fully made up of data from after the COVID-19 pandemic began, but not the first seven months of the pandemic (February to August 2020). Oxera's 2-year betas are made up of 19 months of COVID-affected data, and 5 months pre-COVID, i.e. around 79% COVID-affected, and Oxera's 5-year betas include a longer pre-COVID window, i.e. made up of around 32% COVID-affected data.[39]

FIGURE 5: BETA ESTIMATION WINDOWS IN OXERA'S REPORT



[39] Oxera report, p. 15.

In drawing its conclusions, Oxera chooses to place greatest weight on five-year betas, "as they are less driven by the COVID-19 data than one-year and two-year betas".[40]

Our advice to the CAA on H7

In advising the CAA on the H7 cost of capital, Flint developed a methodology for estimating a COVID adjustment relative to a pre-COVID beta that captures the increase in forward-looking betas that arises due to the risk/likelihood that a future COVID-like event occurs.

For each of our chosen comparators, we estimated a series of reweighted betas using an OLS regression with adjusted weights on individual observations; weights were based on the assumed frequency of COVID-like events, reducing the influence on the OLS regression of COVID-affected data. This can be thought of as equivalent to a longer-window beta where COVID happens only once – but synthesised using recent historical data. These constructed betas were then converted into an implied 'COVID adjustment' by comparing the results to the pre-COVID beta.

Specifically, our results were calculated as follows:[41]

- Using a dataset of around five years of pre-COVID data, and around 2.2 years of data since the start of the COVID-19 pandemic, leading to a c. 7-year dataset of daily price movements.
- Assuming future COVID-like events occurred with a similar impact to COVID-19, and also allowing for greater/lower impact future events, proxied by assuming events last between 17 months and 39 months in duration.
- Our recommended range was based on such COVID-like events occurring between once-every-20 and once-every-50 years.

5.2 Our approach

Modelling technique

A stock's equity beta (β) is calculated as the covariance between the return of the stock index (r_i) and the return of the market index (r_m), divided by the variance of the market index:

$$\beta = \frac{Cov(r_i, r_m)}{Var(r_m)}$$

However, we can also calculate this relationship from the coefficient on the slope in a simple linear regression between the return on the stock and the return on the market index.

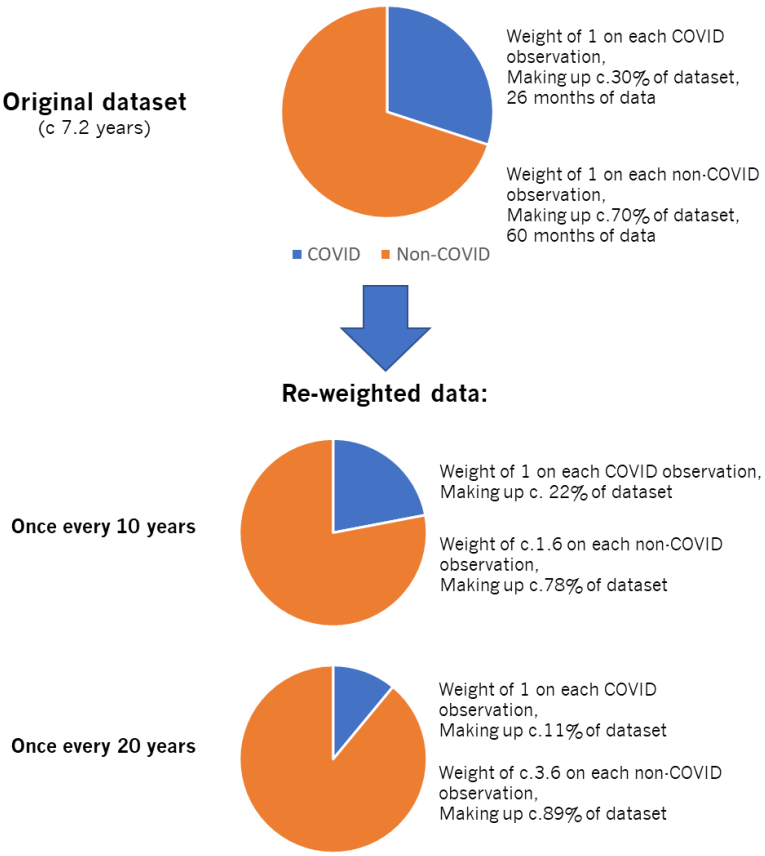
To implement our preferred approach, we first we classify daily observations (for each comparator) as COVID-affected data and non-COVID affected data. We then calculate an equity beta for each comparator using a linear OLS regression, with different weights assigned to COVID and non-COVID observations. The weights can be translated – in effect – into an equivalent 'frequency' at which a 'COVID-like' event occurs.

[40] Oxera report, p.34.
[41] Flint (May 2020), Support to the Civil Aviation Authority: H7 Updated Beta Assessment, p.28-29.

We then repeat this regression for a series of different weightings of 'COVID-like' events to represent different frequencies. Finally, we convert the equity betas into asset betas using the observed gearing over the period. We use a weighted average gearing, consistent with the weights we assign for COVID and non-COVID data and assume a debt beta of 0.05 for all comparators (see Appendix 2 below).

Figure 6 below illustrates this approach, for two frequencies of COVID-like event, based on the modelling assumptions and scenarios which we discuss in the subsection below.

FIGURE 6: ILLUSTRATION OF OUR REWEIGHTING APPROACH



Modelling parameters

In order to implement our approach, we must make assumptions in our model.

1. First, we must decide on the historical dataset used.
2. Second, we must classify data into 'COVID-affected' and 'non-COVID affected' subsets.
3. We must make assumptions about the frequency at which similar events may occur in future.
4. Finally, we must make an assumption about the potential nature of such future events.

Choice of dataset

Consistent with our approach in our H7 report, we use a cut-off date of 31st March 2022. Our six airport comparators were all listed for at least 7 years prior this point.

We chose to rely on the c. 7-year dataset again for this exercise. This gives us c. 5 years of pre-COVID data,[42] providing a relatively robust foundation for estimating 'pre-COVID' systematic risk conditions for our comparator airports.

ENAV has only been listed since July 2016. Therefore, we can only estimate its 'pre-COVID' beta based on a smaller dataset, spanning approximately 3.5 years (i.e. 18 months short of the full five-year period).

Classification of data into 'COVID-affected' and 'non-COVID affected'

We treat all data since 1st February 2020 as COVID-affected. As a result, we have split our dataset into around 2.2 years of 'COVID-affected' data and 5 years of 'non-COVID affected' data (from before the pandemic).

In relying on a single COVID window we avoid subjective choices about the classification of data into periods where COVID-related news and volatility was most heightened compared to periods since the pandemic began when COVID was likely to be less relevant to comparators' systematic risks.

We use 1st February as the start date of our COVID window, since there were notable increases in betas across our comparator group during February 2020, suggesting investors and markets had reacted to the early effects/initial expectations about the COVID-19 pandemic.[43]

We have considered whether we should treat very recent data as COVID-affected or non-COVID affected. On the one hand, for many comparators, observed asset betas in recent months may have started to revert closer to pre-COVID levels (when estimated over shorter windows). Furthermore, prominent non-COVID related news (for example, associated with the Ukraine conflict) may have materially affected stock market data in early 2022, and may also have had a particular effect on aviation share prices. On the other hand, news associated with COVID-19 also continued to be prominent at points in this period, for instance, related to the removal of travel and testing restrictions in European countries in early 2022, and related to lockdowns in China in March 2022.[44] Including this period of data in our COVID window allows us to capture the full 'cycle' of market movements associated with a COVID-like event.

We therefore treat all data in this period as COVID-affected, but conduct sensitivities around our assumptions, as we discuss in more detail in Section 5.4 below. Asset betas for our comparators for our chosen pre-COVID and COVID-affected periods, as well as the full, combined dataset, are set out in the table below.

[42] Precisely, our dataset begins on 12th February 2015, since this is the first date for which AENA data is available. This means our total dataset is 12 days short of 7-years and two months duration.
[43] As we set out in our August 2022 report for the CAA in relation to H7, sensitivities around our assumption about the exact start date of our COVID window have a very limited effect on our results.
[44] See, for example, Financial Times (14 March 2022), China stocks suffer worst fall since 2008 as Omicron spooks investors.

TABLE 2: PRE- AND POST-COVID BETAS FOR OUR 7 COMPARATORS

	AENA *Madrid*	ADP *Paris*	Fraport *Frankfurt*	Zurich	Vienna	Sydney	ENAV
Pre-Covid beta	0.52	0.54	0.48	0.58	0.21	0.51	0.41
COVID-affected beta	0.90	0.79	0.65	0.76	0.86	0.56	0.75
Combined (unweighted) beta	0.70	0.72	0.63	0.70	0.51	0.53	0.68

Note: ENAV betas are estimated for a shorter pre-COVID window of 3.5 years. Sydney cut off is 9 February 2022, when it was delisted from the ASX.
Source: Flint analysis based on Thomson Reuters data as of 31st March 2022.

Frequency of future events

Alongside the choices above about the historical dataset upon which we rely, we must also made assumptions about future COVID-like events.

It is not possible to predict precisely how often COVID-like events will occur in the future. Therefore, we present results for a wide range of different frequencies of COVID-like event, from once every five years through to once every 100 years.

Recognising the uncertainty about the duration of future COVID-like events, we recommend a COVID adjustment based on results from a relatively wide range, of between one-in-20 years and one-in-50 years. This assumption is consistent with the CAA's approach to other parameters of its NR23 decision.

Nature of future events

Future COVID-like events will not be identical to COVID-19. It is not possible to predict the nature of the effect on NERL's betas due to future COVID-like events. This is why we base our analysis on the historical, observed COVID-19 experience, i.e. the only event that has occurred in recent history and during which we can observe the effect on aviation infrastructure betas.

By adjusting the relative weight on COVID-affected and non-COVID affected data, we use our model to generate results for a range of different durations of COVID-like events. While there are a variety of dimensions by which we could attempt to adjust the COVID-19 data to capture events of a different nature (or specifically, events which lead to a different effect on beta estimates), we chose to use the duration of future COVID-like events as a representative mechanism through which we conduct sensitivities related to the nature of future COVID-like events, compared to the actual COVID-19 experience to date.

In presenting our results below, we first consider a 'base case' result, in which we assume that future COVID-like events will have similar impact to that observed during COVID-19. We model this, as before, by assuming that a future event might last as long, and demonstrate similar share price behaviours, as during the observed 26-month window between February 2020 and March 2022, when COVID-19 has been prominent.

We then relax this restrictive assumption about the nature of future COVID-like events, by considering a symmetrical lower and upper bound around our base case. We use the duration of COVID-like events as a proxy for impact:

- For our lower bound, we assume future COVID-like events last two thirds of the duration of our 'base case', i.e. that future COVID-like events may be one third shorter, and last 17 months. We anchor our lower bound assumption to the possibility that a future event might be shorter (or less impactful) than COVID-19. This could be the case if future events are less severe in underlying nature, or if, for instance, airports and the wider economy are better equipped to deal with future COVID-like events. Our lower bound effectively assumes an impact around one third lower than that of COVID-19.

- For our upper bound, we assume future COVID like events last 1.5 times the duration of our 'base case', i.e. 39 months. We continue to anchor our upper bound assumption to the possibility that a future event might last longer (or prove more impactful) than COVID-19. Our upper bound effectively assumes a potential impact one and a half times greater than that of COVID-19. Until the news of vaccine development emerged in November 2020, it seemed plausible that COVID-19 related disruption could continue to persist throughout 2022 to a similar extent as in the earlier stages of the pandemic. Therefore, our upper bound provides a reasonable, if cautious, alternative view of the potential impact of future COVID-like events.

5.3 Results

Base case results

For our base case results, we capture the effect on long-run betas of future COVID-like events which are similar in duration (26 months) and impact to COVID-19.

In Table 3 and Table 4 below, we set out the results of this analysis across a range of frequencies of future COVID-like events. We set out results for the individual comparators, and then the comparator sets upon which recommend the CAA relies for the COVD adjustment.

First, we set out the reweighted betas associated with different frequencies of COVID-like event. The N/A row shows the beta which places zero weight on COVID-affected data, i.e. the pre-COVID beta, based on 5-years of airport data or 3.5-years of ENAV data.

TABLE 3: REWEIGHTED ASSET BETA ESTIMATES FOR OUR ASSUMED FREQUENCY OF COVID-LIKE EVENTS OF 26-MONTH DURATION

	AENA *Madrid*	ADP *Paris*	Fraport *Frankfurt*	Zurich	Vienna	Sydney	ENAV	3 airport	4 airport	6 airport
Frequency of COVID-like event (1 in X years)										
10	0.65	0.69	0.60	0.67	0.44	0.53	**0.61**	**0.65**	**0.65**	**0.60**
15	0.61	0.65	0.57	0.65	0.37	0.53	**0.57**	**0.61**	**0.62**	**0.56**
20	0.59	0.63	0.55	0.64	0.34	0.52	**0.54**	**0.59**	**0.60**	**0.54**
50	0.55	0.58	0.51	0.61	0.26	0.52	**0.47**	**0.55**	**0.56**	**0.50**
100	0.53	0.56	0.50	0.60	0.24	0.52	**0.44**	**0.53**	**0.55**	**0.49**
N/A	0.52	0.54	0.48	0.58	0.21	0.51	**0.41**	**0.51**	**0.53**	**0.47**

Note: Assumes debt beta of 0.05.
Source: Flint analysis based on Thomson Reuters data as of 31st March 2022.

We then convert the reweighted betas into a COVID adjustment, simply by subtracting the reweighted beta from the beta we assume would have prevailed in the absence of COVID-like events, i.e. each comparator's pre-COVID beta.

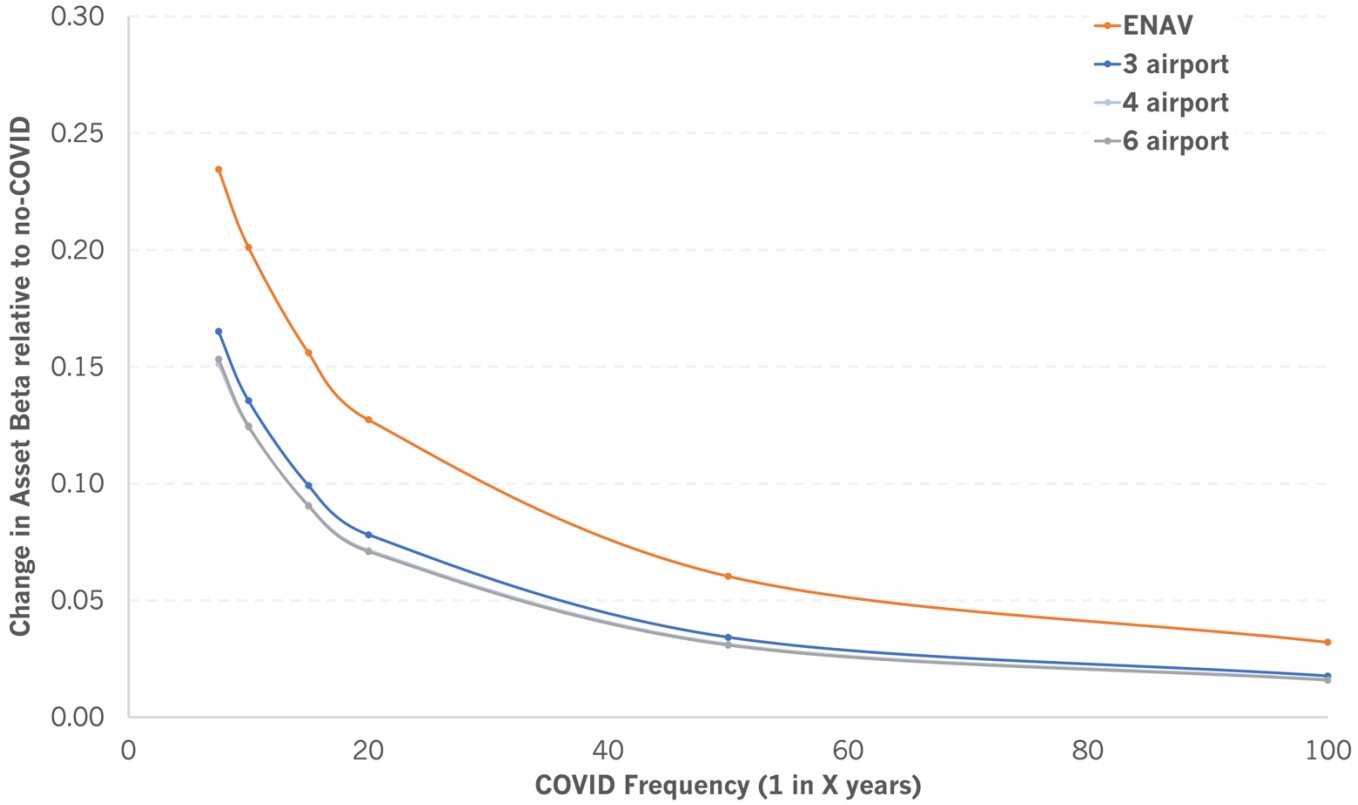
TABLE 4: ESTIMATED COVID ADJUSTMENT FOR OUR ASSUMED FREQUENCY OF COVID-LIKE EVENTS OF 26-MONTH DURATION

	AENA *Madrid*	ADP *Paris*	Fraport *Frankfurt*	Zurich	Vienna	Sydney	ENAV	3 airport	4 airport	6 airport
Frequency of COVID-like event (1 in X years)										
10	0.14	0.14	0.12	0.09	0.24	0.02	**0.20**	**0.14**	**0.12**	**0.12**
15	0.10	0.11	0.09	0.07	0.17	0.01	**0.16**	**0.10**	**0.09**	**0.09**
20	0.08	0.08	0.07	0.05	0.13	0.01	**0.13**	**0.08**	**0.07**	**0.07**
50	0.03	0.04	0.03	0.02	0.06	0.00	**0.06**	**0.03**	**0.03**	**0.03**
100	0.02	0.02	0.02	0.01	0.03	0.00	**0.03**	**0.02**	**0.02**	**0.02**

Note: Assumes debt beta of 0.05.
Source: Flint analysis based on Thomson Reuters data as of 31st March 2022.

Figure 7Figure 7 below illustrates these same results as a graph, for ENAV and our three airport comparator sets. For all comparators, the reweighted beta, and hence the implied COVID adjustment, falls as we reduce the frequency of COVID-like events (and the weight placed on COVID-affected data within our dataset). Therefore, for assumed COVID-like events occurring between once every 20 and once every 50 years, our base case would imply a COVID adjustment of between 0.06 and 0.13 based on ENAV's evidence, and 0.03 and 0.08 based on the averages from our airport comparator sets, with a highest value set by our 3-airport comparator set than for our 4- and 6-airport averages.

FIGURE 7: CHANGE IN ASSET BETA RELATIVE TO NO-COVID AT DIFFERENT FREQUENCIES OF COVID-LIKE EVENTS FOR OUR COMPARATOR SETS



Source: Flint analysis of Thomson Reuters data as of 31st March 2022.

Lower bound results

For our lower bound, we model future COVID-like events that are one-third shorter than COVID-19.

TABLE 5: REWEIGHTED ASSET BETA ESTIMATES FOR OUR ASSUMED FREQUENCY OF COVID-LIKE EVENTS OF 17-MONTH DURATION

	AENA *Madrid*	ADP *Paris*	Fraport *Frankfurt*	Zurich	Vienna	Sydney	ENAV	3 airport	4 airport	6 airport
Frequency of COVID-like event (1 in X years)										
10	0.61	0.65	0.57	0.65	0.37	0.53	**0.57**	**0.61**	**0.62**	**0.56**
15	0.58	0.62	0.55	0.63	0.32	0.52	**0.53**	**0.58**	**0.60**	**0.54**
20	0.57	0.60	0.53	0.62	0.30	0.52	**0.50**	**0.57**	**0.58**	**0.52**
50	0.54	0.57	0.50	0.60	0.25	0.52	**0.45**	**0.54**	**0.55**	**0.50**
100	0.53	0.55	0.49	0.59	0.23	0.52	**0.43**	**0.52**	**0.54**	**0.48**
N/A	0.52	0.54	0.48	0.58	0.21	0.51	**0.41**	**0.51**	**0.53**	**0.47**

Note: Assumes debt beta of 0.05.
Source: Flint analysis based on Thomson Reuters data as of 31st March 2022.

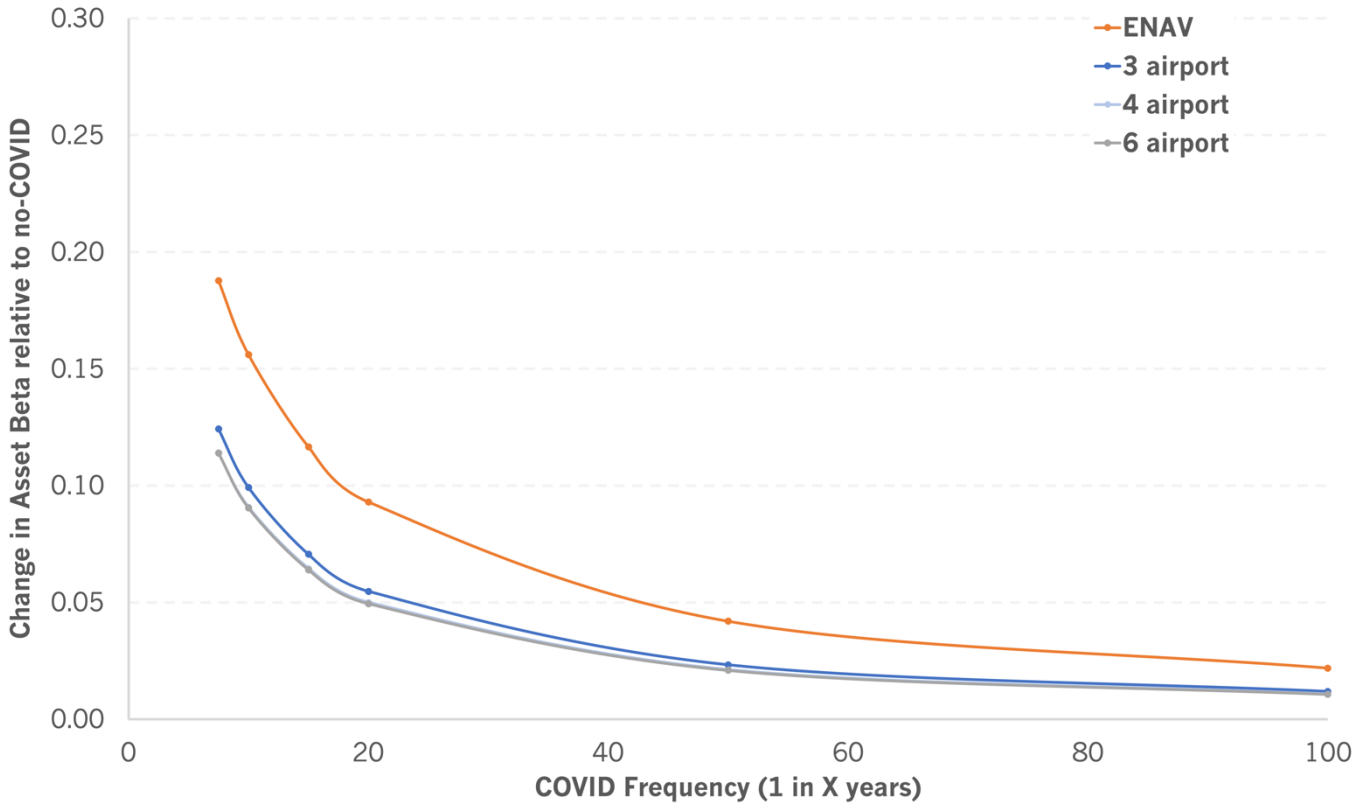
For assumed COVID-like events occurring between once every 20 and once every 50 years, our lower bound would imply a COVID adjustment of between 0.04 and 0.9 based on ENAV's evidence, and 0.02 and 0.05 based on the averages from our airport comparator sets.

TABLE 6: ESTIMATED COVID ADJUSTMENT FOR OUR ASSUMED FREQUENCY OF COVID-LIKE EVENTS OF 17-MONTH DURATION

	AENA *Madrid*	ADP *Paris*	Fraport *Frankfurt*	Zurich	Vienna	Sydney	ENAV	3 airport	4 airport	6 airport
Frequency of COVID-like event (1 in X years)										
10	0.10	0.11	0.09	0.07	0.17	0.01	**0.16**	**0.10**	**0.09**	**0.09**
15	0.07	0.08	0.07	0.05	0.12	0.01	**0.12**	**0.07**	**0.06**	**0.06**
20	0.05	0.06	0.05	0.04	0.09	0.01	**0.09**	**0.05**	**0.05**	**0.05**
50	0.02	0.03	0.02	0.02	0.04	0.00	**0.04**	**0.02**	**0.02**	**0.02**
100	0.01	0.01	0.01	0.01	0.02	0.00	**0.02**	**0.01**	**0.01**	**0.01**

Note: Assumes debt beta of 0.05.
Source: Flint analysis based on Thomson Reuters data as of 31st March 2022.

FIGURE 8: CHANGE IN ASSET BETA RELATIVE TO NO-COVID AT DIFFERENT FREQUENCIES OF COVID-LIKE EVENTS FOR OUR COMPARATOR SETS



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Upper bound results

For our upper bound, we model COVID-like events which are 1.5 times longer than our base case, i.e. 39 months in duration.

TABLE 7: REWEIGHTED ASSET BETA ESTIMATES FOR OUR ASSUMED FREQUENCY OF COVID-LIKE EVENTS OF 39-MONTH DURATION

	AENA *Madrid*	ADP *Paris*	Fraport *Frankfurt*	Zurich	Vienna	Sydney	ENAV	3 airport	4 airport	6 airport
Frequency of COVID-like event (1 in X years)										
10	0.71	0.73	0.64	0.70	0.53	0.54	**0.66**	**0.69**	**0.69**	**0.64**
15	0.65	0.69	0.60	0.67	0.44	0.53	**0.61**	**0.65**	**0.65**	**0.60**
20	0.63	0.66	0.58	0.66	0.39	0.53	**0.58**	**0.62**	**0.63**	**0.57**
50	0.56	0.60	0.53	0.62	0.29	0.52	**0.50**	**0.56**	**0.58**	**0.52**
100	0.54	0.57	0.51	0.60	0.25	0.52	**0.46**	**0.54**	**0.55**	**0.50**
N/A	0.52	0.54	0.48	0.58	0.21	0.51	**0.41**	**0.51**	**0.53**	**0.47**

Note: Assumes debt beta of 0.05.
Source: Flint analysis based on Thomson Reuters data as of 31st March 2022.

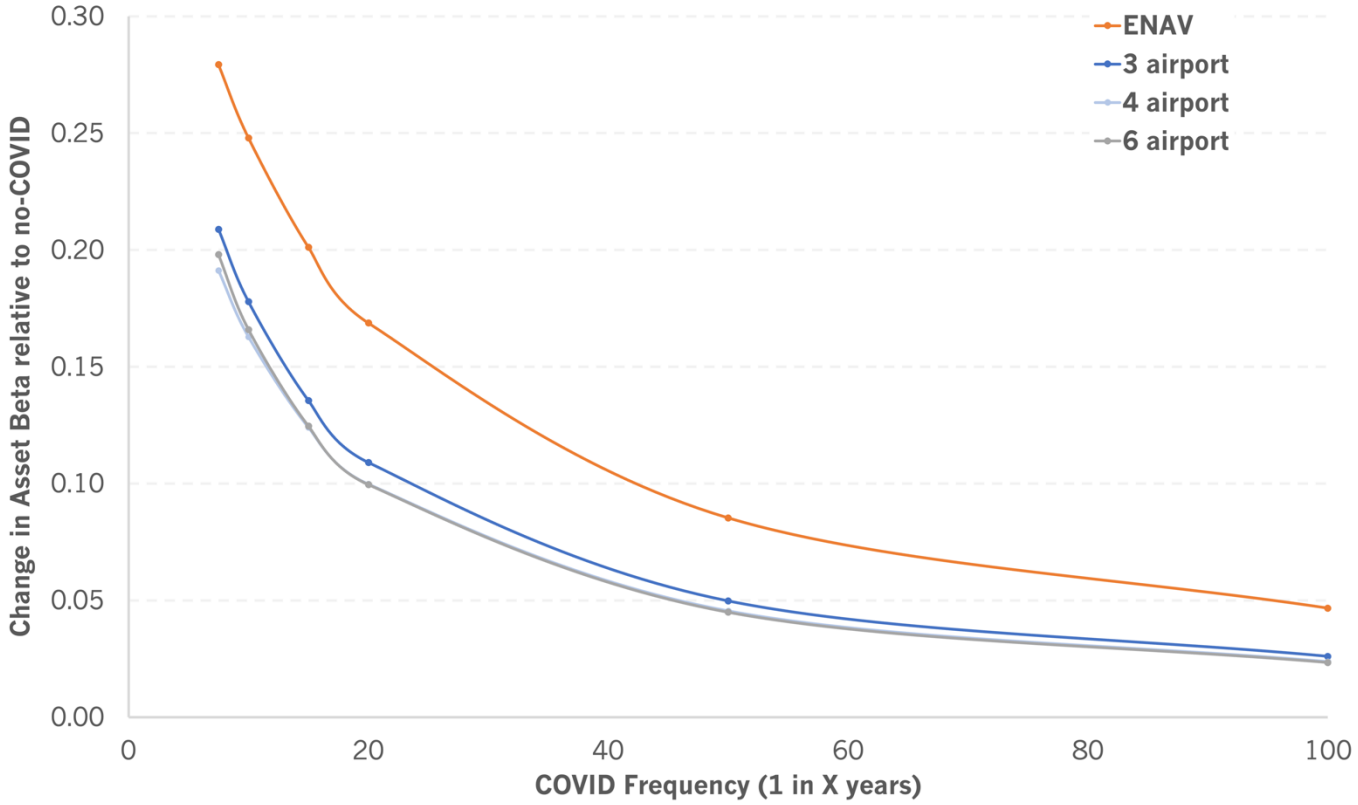
For assumed COVID-like events occurring between once every 20 and once every 50 years, our upper bound would imply a COVID adjustment of between 0.09 and 0.17 based on ENAV's evidence, and 0.04 and 0.11 based on the averages from our airport comparator sets.

TABLE 8: ESTIMATED COVID ADJUSTMENT FOR OUR ASSUMED FREQUENCY OF COVID-LIKE EVENTS OF 36-MONTH DURATION

	AENA *Madrid*	ADP *Paris*	Fraport *Frankfurt*	Zurich	Vienna	Sydney	ENAV	3 airport	4 airport	6 airport
Frequency of COVID-like event (1 in X years)										
10	0.19	0.19	0.16	0.12	0.32	0.02	**0.25**	**0.18**	**0.16**	**0.17**
15	0.14	0.14	0.12	0.09	0.24	0.02	**0.20**	**0.14**	**0.12**	**0.12**
20	0.11	0.12	0.10	0.07	0.19	0.01	**0.17**	**0.11**	**0.10**	**0.10**
50	0.05	0.05	0.05	0.03	0.08	0.01	**0.09**	**0.05**	**0.05**	**0.04**
100	0.02	0.03	0.02	0.02	0.04	0.00	**0.05**	**0.03**	**0.02**	**0.02**

Note: Assumes debt beta of 0.05.
Source: Flint analysis based on Thomson Reuters data as of 31st March 2022.

FIGURE 9: EFFECT OF COVID-LIKE EVENTS ON ASSET BETA RELATIVE TO NON-COVID EVENTS, FOR EVENTS OF 3 YEARS DURATION



Source: Flint analysis of Thomson Reuters' data as of 31st March 2022.

Summary of results

The table below summarises the results above for our main comparator sets, for COVID-like events occurring between once in 20 and once in 50 years, and for COVID-like events of between 17 and 39 month duration.

TABLE 9: SUMMARY OF UPPER AND LOWER BOUND COVID ADJUSTMENT

Frequency of COVID one in X years	ENAV	3 airport	4 airport	6 airport
Base case 26-months duration				
20	0.13	0.08	0.07	0.07
50	0.06	0.03	0.03	0.03
Lower bound 17-month duration				
20	0.09	0.05	0.05	0.05
50	0.04	0.02	0.02	0.02
Upper bound 39-month duration				
20	0.17	0.11	0.10	0.10
50	0.09	0.05	0.05	0.04
Overall range				
Min	**0.04**	**0.02**	**0.02**	**0.02**
Max	**0.17**	**0.11**	**0.10**	**0.10**

Source: Flint analysis based on Thomson Reuters data as of 31st March 2022.

We make two main observations on these results:

- First, the results for our 'base case' sit closer to our lower bound than to our upper bound. Accounting for a lower bound reduces our overall range by 1 basis point (compared to the base case), whereas accounting for the upper bound increases our range by 4 basis points. This asymmetry suggests that the possibility of more severe future COVID-like events may exert a larger effect on the perceived systematic risk, and forward-looking beta, than the reverse scenario of a less severe future event.

- Second, the range of COVID adjustment implied by ENAV is around 50% higher than for the airport comparators, at 4 to 17 basis points, compared to 2 to 10 or 11 basis points for the airport comparators (depending on the choice of airports in the comparator set).

5.4 Sensitivity analysis

In the results for our preferred approach (see Section 5.3 above), we assume that all data since the COVID-19 outbreak in February 2020 are (to at least some extent) COVID-affected. As such, when we construct reweighted beta estimates for a longer (e.g. 20-year) period, we reduce the weight on data since the COVID-19 pandemic began, relative to the pre-COVID data in our dataset.

However, as we discuss in section 5.2 above, there is emerging evidence that recent stock market data may be less dominated by COVID-related news than in the earlier stages of the pandemic, which might suggest it should not be included in our assumed COVID-window.

Therefore, we have tested the sensitivity of our results to alternative assumptions about our treatment of more recent data. First, we assume that the last six months of our data window (October 2021 to March 2022) is not (materially) affected by COVID-19. Second, we test a more extreme assumption, and assume that the last 12 months of data (April 2021 to March 2022) is not (materially) COVID-affected.

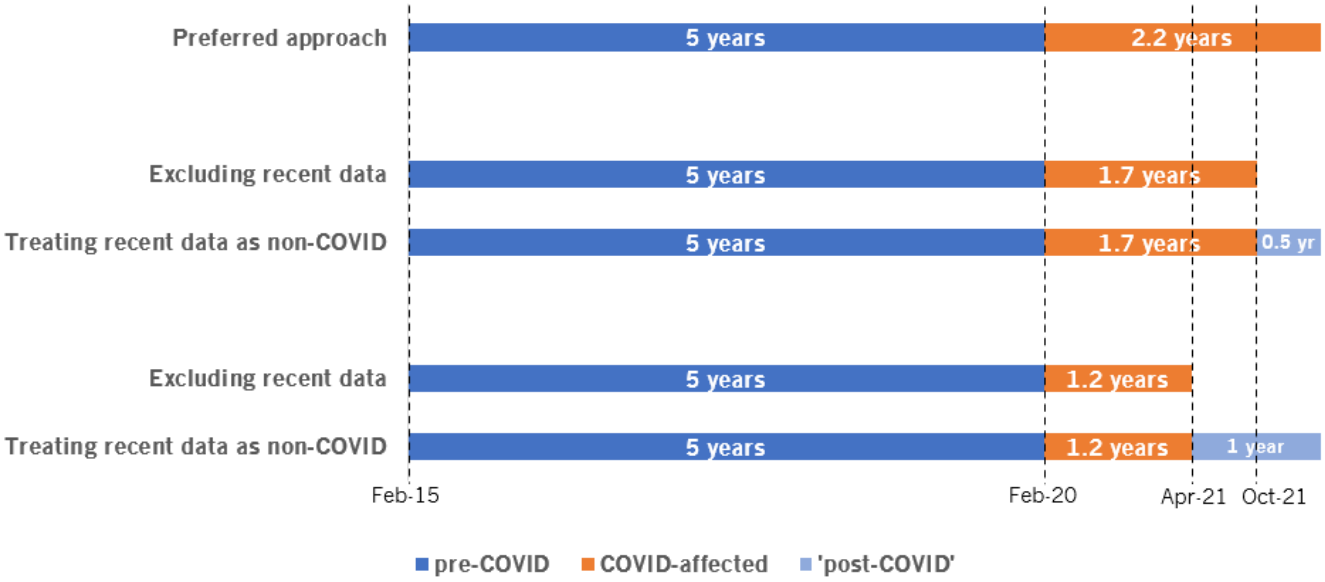
For each of these assumptions, we then run two alternative versions of our model:

A. First, we exclude the more recent data (from the last six months/twelve months) and conduct our analysis over a truncated dataset.[45]

B. Second, we include the more recent data in our non-COVID affected dataset rather than our COVID-affected dataset, i.e. treating recent datapoints equivalently to datapoints from before the pandemic.[46]

The figure below illustrates these alternative model runs for each of our alternative assumptions about recent data. In each model run, we use COVID-affected data (shaded in orange) as a proxy for the effect of future COVID-like events on estimates of the long-window beta. We then use the blue/light blue shaded data as a proxy for the beta that would prevail in the absence of a COVID-like event.

FIGURE 10: SUMMARY OF OUR TREATMENT OF DATA SINCE THE COVID-19 PANDEMIC BEGAN IN OUR SENSITIVITIES



Since this sensitivity is intended to test our treatment of historical data, and not our assumptions about the nature of future COVID-like events, we focus our analysis on the 'base case' scenario, where we assume future COVID-like events have the same duration (and impact) as COVID-19.

We present full results for these sensitivities in Appendix 3 below, and a short summary in the table below.

[45] By excluding recent data entirely, this sensitivity effectively tests whether recent data is polluted by noise and/or unrepresentative of the risks that would have prevailed in the absence of COVID-19 (e.g. because it is affected by market reactions to the Ukraine crisis).

[46] This sensitivity effectively tests whether recent data, which covers a period of time when various news and market developments would have affected share prices (and when COVID-19 related news was less prominent), may be considered equally representative of the balance of risks that companies would have faced in the absence of COVID-19 as pure pre-pandemic data.

TABLE 10: SUMMARY OF COVID ADJUSTMENT IN OUR SENSITIVITIES

Frequency of COVID like events (one in X years)		ENAV	3 airport / 4 airport averages
Preferred approach (COVID-like events based on 26-months data)			
	20	0.13	0.08
	50	0.06	0.03
'6 month' sensitivity (COVID-like events based on 20-months data)			
Excluding recent 6-months			
	20	0.10	0.07
	50	0.05	0.03
Treating recent 6-months as non-COVID			
	20	0.04	0.06
	50	0.02	0.02
'12 month' sensitivity (COVID-like events based on 14-months data)			
Excluding recent 12-months			
	20	0.10	0.07
	50	0.05	0.03
Treating recent 12-months as non-COVID			
	20	0.05	0.06
	50	0.02	0.03

For our preferred approach, and for our preferred 3/4 airport comparators, we find a COVID adjustment of between 3 and 8 basis points (to be added to the baseline beta). For our sensitivities, this range falls slightly, to 2 to 7 basis points.

Meanwhile, for ENAV, we find that the implied COVID adjustment is very sensitive to these alternative assumptions. Whereas in our preferred approach we estimate a COVID adjustment of between 6 and 13 basis points, when excluding more recent (6/12 months of) data the implied COVID adjustment falls to 5-10 basis points. Moreover, treating more recent data as if it were unaffected by COVID-19 *and* including it in the non-COVID window, the COVID adjustment falls further to 2-4 basis points.

Implications for our analysis

Whereas the COVID adjustment implied by the airport comparators is not very sensitive to our alternative treatments of recent data, we find that the COVID adjustment implied by ENAV is very sensitive. It falls materially when recent data is excluded or, in particular, if it is assumed to be non-COVID affected and included in the baseline against which we compare our reweighted beta estimates.

This result has two main implications for our interpretation of ENAV's data. First, it confirms that the apparent evolution in observed beta at ENAV in the months and years since the pandemic began differs compared to the airport comparators. This may be due to an increase in the underlying systematic risk at ENAV or because the *observed* beta is overstated or understated prior to the pandemic and/or in 2021 due to the lower statistical reliability of its beta. Second, it suggests that we may be less confident in our assumption about the beta that would have prevailed

(e.g. in 2020 and 2021) had COVID-19 not happened, and therefore casts doubt on the baseline against which we compare the reweighted beta when estimating the COVID adjustment.

In our conclusion below, we discuss our recommendation on the weight that the CAA places on the evidence derived from the airports compared to ENAV.

6. Conclusions and recommendations

Background and approach

The CAA must estimate a beta for NERL's NR23 price control, which runs from 2023 to 2027.

In this report, we rely on recent historical market evidence to estimate a forward-looking beta for NERL, to inform the CAA's decision. In doing so, we aim to capture the balance of systematic risks that NERL will face in the future.

Recent comparator evidence suggests two broad periods of very different systematic risk, before and since the COVID-19 pandemic began. In common with other stakeholders, we consider that both periods are informative for NERL's NR23 beta. Therefore, we have developed an approach which combines pre-COVID and COVID-affected data into a series of re-weighted betas capturing the balance of risk that a company may face if a COVID-like event were to occur less often, for example, than the once every 5 years implied by a raw 5-year beta observed in January 2022.

Consistent with this approach, we recommend a beta for NR23 made up of two parts.

- A baseline beta – which captures the balance of risks faced by NERL which are unrelated to COVID-19 (effectively a 'pre-COVID' beta).
- A 'COVID adjustment' – to be added to the baseline beta, reflecting the risk of events similar to COVID-19 that may occur in the future.

NERL itself is not listed on a stock exchange, and there is only one available ANSP comparator – ENAV. In common with the CMA at RP3, we have also considered evidence from airport comparators, since they arguably faced (and may still face) a comparable set of systematic risks to an ANSP, particularly when operating in a similar market and under similar regulatory arrangements – despite other recognised differences.

Prior to COVID-19, the CMA concluded that ENAV was likely to face lower systematic risks than NERL, and more comparable risks to a set of three major European airport groups, ADP, Fraport and AENA, which had a slightly higher beta than ENAV.

During the COVID-19 pandemic, ENAV's beta has increased to a greater extent than the CMA's chosen airport comparators. As such, the airport data and ENAV's data may point towards different levels of beta for NERL in the future, even at benign times. However, we also recognise the potentially lower reliability of the data available for ENAV than that available for the airport comparators.

Summary of our findings

The table below summarises our recommended range for NERL's beta at NR23.

Our baseline beta is consistent with the CMA's pre-COVID assessment of NERL's beta at RP3, since the CMA's assessment was based on evidence available immediately prior to the pandemic, we consider it captures an appropriate baseline beta and represents an important specific regulatory precedent for application to NERL.

Our recommended COVID adjustment is based on the change in betas observed across the comparator set, reweighted to account for the possible frequency of COVID-like events in the future. For our recommended range, we rely on COVID-like events (of between 24 and 36 month duration) occurring between 1-in-20 and 1-in-50 years.

Due to the contrasting results from different sources, we report our COVID adjustment for two sets of evidence. First, we report the COVID adjustment based on airport comparators' evidence, which implies an increase in NERL's beta of between 2 and 11 basis points. Second, we report a COVID adjustment based on ENAV's evidence, which implies a COVID adjustment of between 4 and 17 basis points.

TABLE 11: ESTIMATED COVID ADJUSTMENT

	Lower Bound	Upper Bound
COVID adjustment based on airport data	0.02	0.11
COVID adjustment based on ENAV data	0.04	0.17

Note: Assumes debt beta of 0.05.
Source: Flint analysis based on Thomson Reuters data as of 31st March 2022.

Recommended interpretation of our results

In its RP3 determination, the CMA effectively adopted a beta at the midpoint of its range, at 0.57. Since our baseline beta relies on the CMA's RP3 beta, it likely remains appropriate to rely on the midpoint of the range for the baseline beta.

There are several factors which the CAA should consider when selecting a point estimate for our COVID adjustment and choosing the weight to place on evidence derived from airports and the evidence derived from ENAV, the only listed ANSP provider. On the one hand, ENAV's beta rose markedly during the COVID-19 pandemic – more so than the airports'. As the only listed ANSP, it provides the only available evidence on ANSPs in the context of COVID-like events and appears to point to a greater impact of COVID for ANSPs than for the airports. The apparent increase in relative systematic risk may, for example, reflect that ANSPs' lower operational gearing has a particularly prominent effect during unanticipated shocks of the nature of COVID-like events.

However, there are several other factors which point towards placing primary weight on the range derived from the airport evidence.:

- First, the airport evidence is derived from a wider set of comparators and is robust to the inclusion/exclusion of individual airports (hence similar results for our 3-airport, 4-airport and 6-airport comparator sets). Meanwhile, our evidence from ANSPs is based on a single comparator alone and thus potentially less reliable.

- ENAV is a smaller firm than the three/four preferred airport comparators. Its beta is therefore at greater risk of measurement error or being influenced by company-specific factors – as the CMA noted in the RP3 decision. (In fact, the CMA used this criterion to drop Vienna and Zurich airport from its comparator group – although it understandably did not lead it to drop ENAV outright as it was the only ANSP comparator). We have not identified any obvious and significant specific news/developments which lead us to think ENAV's beta was materially influenced by a non-COVID factor in the months and years since the pandemic began, but note

that, prior to the pandemic, ENAV's beta was less stable over time than our preferred airport comparators.

- ENAV has been listed for a shorter period of time (5.5 years in total) compared to at least 7-years for all the airport comparators. The shorter window of pre-COVID data appears to reduce the statistical reliability of its beta estimate compared to the 5-year pre-COVID data for the airports, and makes it more difficult to establish the counterfactual beta that is likely to have prevailed had the pandemic not occurred. The lower certainty reads directly across into the COVID adjustment, implied by ENAV data, derived from our model.

Our sensitivity analysis builds on this and tests the results of our model further. We do so by looking at the impact of assuming that recent data may provide relevant alternative or additional information to inform the assessment of the baseline beta. The sensitivity analysis suggests airport betas that appear to have broadly reverted to near pre-pandemic levels. The results of our model do not change materially for the airport comparators.

This is not the case for ENAV. Recent raw data points to a higher beta for ENAV than prevailed pre-pandemic, and in turn, may suggest a smaller increase in the beta due to COVID-19, and therefore a smaller COVID adjustment. The reasons for ENAV's sensitivity may be related to changes in fundamental risk at ENAV, or may be a consequence of the lower reliability of ENAV data. While it is not possible to confidently determine which, we believe that results indicate that caution should be placed on the modelled COVID adjustment for ENAV, which may – in our preferred model – be inflated by either an artificially low pre-pandemic beta observation or a misrepresentative assumption about the beta that would have prevailed during COVID-like events. Alternative formulations of our model, which blend more recent data into a baseline beta for ENAV, generate results that are different from our base case, even suggesting a lower COVID adjustment that those derived from the airport comparators.

We therefore recommend a range for NERL based on the airports alone.

TABLE 12: FLINT NR23 ASSET BETA RECOMMENDATION

	Lower Bound	Upper Bound
Baseline beta	0.52	0.62
COVID adjustment derived from airport evidence	0.02	0.11
Combined beta for NR23	**0.54**	**0.73**

Note: Assumes debt beta of 0.05.
Source: Flint analysis based on Thomson Reuters data as of 31st March 2022.

Comparison of our recommendation with precedent and stakeholder views

In accounting for the effect of COVID-19 on NERL's beta on top of the underlying (non-COVID) risks it faces, we inevitably estimate a higher beta for NR23 than the CMA estimated at RP3.

The sum of our baseline beta and our preferred airport based COVID adjustment would lead to an overall beta range of between 0.54 and 0.73.

The midpoint of this range, 0.64, is slightly below the midpoint of NERL's proposed range (of 0.60 to 0.70), which is in turn, slightly below the spot estimate of 0.678 that NERL proposed in its November 2021 analysis.

However, while NERL and Oxera calculate its beta for NR23 using similar comparator evidence as we do in this report, they combine the evidence from before and since the COVID-19 pandemic began using a very different approach to ours. NERL and Oxera's analysis also places greater weight on ENAV's evidence, whereas we place limited weight on it. Despite the significant differences in approach, however, we end with similar results.[47]

[47] We note that, since NERL's analysis relied in full on spot estimates estimated at the date of its cut-off, the results arising from its analysis are likely to have changed since then.

Appendices

Appendix 1: Operational and regulatory features of comparators

In this appendix we discuss in more detail the regulatory and operational features of the comparators, up to and during the COVID-19 period, to assess their appropriateness as comparators – in line with Appendix 3 of our August 2021 report ("operational and regulatory features of airport comparators").[48] We do not repeat the operational and regulatory features of airport comparators here. Instead, we apply a similar framework to that used for the airports, where data is available, to compare the differences between NERL and ENAV.

Assessment of comparators

NATS (en Route), NERL

NERL is the sole provider of air traffic control services in UK airspace and the North Atlantic eastern part. NERL is regulated by the CAA on three different services: en-route, Oceanic, and London approach.

En-route is the most significant operation, representing around 90% of NERL's regulated income.[49] While NERL is, to some extent, protected on its en-route and London approach services through a traffic risk sharing mechanism, it bears all the volume risk for the Oceanic service (with the exception of Tango Route).[50]

NERL is part of NATS, a wider provider air traffic services which, in addition to NERL, provides other non-regulated services. NATS is 49% Government owned (golden share).[51] According to the CMA provisional findings report in March 2020, NERL accounted for 77% of NATS Group's third party revenue.[52]

NERL has a regulated asset base of £1.2bn in 2021.[53] Until RP3, NERL was – under the Single European Sky legislation – subject to similar traffic risk sharing mechanisms as the other listed ANSP comparator, ENAV. These traffic risk sharing mechanisms are:[54]

- No protection for traffic volumes that are 2% above or below the forecasts
- 70% revenue protection for traffic volumes within 2% to 10% above or below the forecasts
- Full protection for all traffic volumes registered beyond 10% of the forecasts.

[48] Flint (Aug 2021), Estimating Heathrow's beta post-COVID-19, Appendix 3.
[49] Flint estimate based on the regulated income reported in NATS (2021), Annual Report and Accounts 2021, p.116.
[50] CMA (Mar 2020), NATS (En Route) Plc / CAA Regulatory Appeal, Provisional findings report, Appendix B: Regulated revenue and charges, pp.B3-B4
[51] See NATS, Our ownership, at https://www.nats.aero/about-us/company/
[52] CMA (Mar 2020), NATS (En Route) Plc / CAA Regulatory Appeal, Provisional findings report, p.15.
[53] NATS (2021), Annual Report and Accounts 2021, p.166.
[54] CAA (2019), UK RP3 CAA Decision Document, pp.117-119.

This traffic risk sharing mechanism caps the amount of regulated revenue shortfall at 4.4%. In addition to traffic risk protection, we understand from the CAA that NERL also enjoys significant pension protection.

During the pandemic outbreak, NERL suffered a significant decrease in traffic, losing slightly over 70% of flights and chargeable service units between the 2020 and 2021 financial years.[55] This is similar to the traffic downturn suffered by the comparator airports.[56] Despite the major downturn in flights, NERL's revenues (including regulated and non-regulated revenues) fell by 8% only – although the under-recovered regulatory allowance, 48% of 2021 total income, is expected to be recovered over coming years.[57]

TABLE 13: REGULATORY FRAMEWORK OF NERL DEFINED PRIOR AND DURING THE COVID-19 OUTBREAK

	Length	Form	Flexibility
Prior	5 years (2020-24)	Price cap	Flexible, with adjustments in place for volume and pension risk. As for other ANSPs, NERL was regulated under the Single European Sky regulation.
During	3 years (2020 to 2022), then 5 years (2023-27)	Price cap	Flexible, with adjustments in place for volume and pension risk. One-off reduction in duration of price control during the COVID pandemic.

Since the UK left the European Union, the CAA has greater flexibility to adjust NERL's regulatory framework. At present, however, we understand it remains largely aligned to the Single European Sky Regulation.

We understand from the CAA that the most significant change at NR23 regulatory framework is that the revenue allowance under-recovered during the COVID outbreak – but protected by the traffic risk sharing mechanisms – will be recovered over a longer period. This is also the case for other European ANSPs. Thus, in value terms, the substance of the traffic protection mechanism remains broadly unchanged.

ENAV

ENAV is, like NERL, the sole provider of air traffic control and navigation services, but in Italy. ENAV is also the only listed Air Navigation Service Provider (ANSP).

ENAV has smaller market value than the comparator airports, but a larger market value than NERL's RAB, at c. EUR 2.6bn.[58] It also has a similar proportion of Government ownership to NERL, 53%.[59]

[55] NATS (2021), Annual Report and Accounts 2021, p.11.
[56] Flint (Aug 2021), Estimating Heathrow's beta post-COVID-19, Appendix 3.
[57] Flint estimate based on the regulated income reported in NATS (2021), Annual Report and Accounts 2021, p.115.
[58] Flint estimate based on Thomson Reuters ENAV data in 2022.
[59] Ministero dell'Economia e delle Finanze (Jul 2016), Privatization of ENAV S.p.A.

ENAV provides en-route, terminal and other services. Each of the regulated services ENAV provides is subject to different charging arrangements, as described in the table below. The en-route and terminal services are regulated, and its income makes up 97% of ENAV's total net income.[60]

TABLE 14: REGULATION APPROACH TO ENAV'S SERVICES

Business	% Reg. Revenue	Charging regulation
En-route	73%	**Some protection:** RP3 traffic risk sharing mechanism. Inflation risk full cost recovery. Full upside OPEX efficiencies above regulatory target. Partial CAPEX cost recovery. Bonus/malus performance mechanism on quality targets (+/-2% of determined costs).
Terminal charging zone 1 Rome Fiumicino	4%	**Some protection:** Same as above.
Terminal charging zone 2 Milan Linate, Milan Malpensa, Venice and Bergamo	7%	**Significant protection:** Same as above but with full traffic protection.
Terminal charging zone 3 Other airports: 40 ENAV, 4 Italian Air Force	15%	**Full protection:** Full cost recovery, in line with the national regulatory framework.

Source: ENAV (Jul 2021), Investor Presentation, p.16.

Terminal charging zone 2 and 3 represent 22% of ENAV's regulated revenues, and are subject to different regulatory regimes than NERL en-route (and London approach) services – this provides ENAV a different degree of protection to NERL.

Following the pandemic outbreak, ENAV's en-route air traffic and terminal traffic contracted by around 60% compared to 2019.[61] However, the fall in total revenues (both regulated and non-regulated) was lower, at around 15%, due to the protection offered by the regulatory system.[62]

TABLE 15:REGULATORY FRAMEWORK OF ENAV DEFINED PRIOR AND DURING THE COVID-19 OUTBREAK

	Length	Form	Flexibility
Prior	5 years (2020-24)	Price cap	Flexible. We understand there were adjustments in place for volume risk. As for other ANSPs, ENAV was regulated under the Single European Sky regulation.
During	5 years (2020-24)	Price cap	Flexible. We understand there are adjustments in place for volume risk. However, the European Commission implemented legislation to extend the period for recovery of charges to five years (or, at the discretion of the Member State, up to seven years).

[60] ENAV (Jul 2021), Investor Presentation, p.27.
[61] Eurocontrol suggests both ENAV and NERL lost around 60% of its total en-route traffic service units between 2019 and 2020.
[62] ENAV (Jul 2021), Investor Presentation, p.14.

During the COVID-19 outbreak the European Commission changed legislation so that the revenues under-recovered during the pandemic are recovered equally over five calendar years. National authorities can extend these five years to a maximum of seven years to avoid a "*disproportionate effect of the carry-overs on the unit rates charged to airspace users*".[63]

Appendix 2: Debt beta

The comparative analysis in this report is largely conducted by reference to asset beta. Asset betas represent the 'de-geared' equity betas for our comparators, adjusted to reflect the principle that companies with higher gearing will – other things equal – exhibit inflated equity betas. By de-gearing, the equity betas can be translated into asset betas that more properly describe the underlying risk of the business and its operations.

In order to undertake this process, we need to make an assumption about debt beta. Debt betas are typically small. Also, when considering a comparator set that exhibits similar gearing levels to the notional gearing assumed in the regulatory model, the debt beta assumption has limited impact.

Nonetheless, we explain in this section the assumptions made regarding debt beta.

Precedent and context

At RP3, the CMA assumed a 0.05 debt beta for NERL and comparators

In principle, the debt beta reflects the systematic risk of holding debt. However, as the CMA notes, the debt beta is generally more difficult to measure than equity beta because "bonds are less well traded than equities."[64] The evidence that NERL and the CAA submitted at that time supported a debt beta between zero and 0.1:

- NERL proposed a beta of 0.05, based on econometric evidence from NERL and Heathrow airport bonds, and iBoxx indices which supported a debt beta for NERL below 0.1, but not statistically different from zero.
- The CAA proposed a beta of 0.1, based on the evidence NERL submitted and Europe Economics' decomposition analysis using market parameters and an assumed probability of default. At the time, the CAA proposal was below Ofwat's PR19 Draft Determination and Ofgem's RIIO-2 midpoint estimate of 0.125.

The CMA considered that "the evidence to support the debt beta was largely speculative"[65], but considered likely that the actual debt beta of NERL would be below 0.1. In the round, the CMA provisional findings concluded a beta of 0.05 was appropriate for NERL in light of the low risk of

[63] Official Journal of the European Union (Nov 2020), COMMISSION IMPLEMENTING REGULATION (EU) 2020/1627 of 3 November 2020 on exceptional measures for the third reference period (2020-2024) of the single European sky performance and charging scheme due to the COVID-19 pandemic, p.L366/8.
[64] CMA (Mar 2020), NATS (En Route) Plc / CAA Regulatory Appeal, Provisional findings report, p.130, para 12.15.
[65] CMA (Mar 2020), NATS (En Route) Plc / CAA Regulatory Appeal, Provisional findings report, p.160, para 12.114.

NERL's debt and the CMA's decision to use a notional gearing assumption of 30%. The CMA also assumed a debt beta of 0.05 for NERL's comparators.

TABLE 16: SUMMARY OF DEBT BETAS AND GEARING CONSIDERED AT THE NERL/CAA APPEAL TO THE CMA

Stakeholder	Debt beta	Notional Gearing
CAA	0.10	60%
NERL	0.05	60%
CMA	0.05	30%

Source: CMA (Mar 2020), NATS (En Route) Plc / CAA Regulatory Appeal, Provisional findings report, p.202.

Oxera's approach

Oxera suggested the CMA's provisional debt beta of 0.05 was an appropriate estimate for NERL, at a notional gearing level of 30%.[66]

CAA's approach at H7

In its H7 final proposals, the CAA assumed a debt beta range for Heathrow of 0.05 to 0.10 for an average gearing over the price control of just over 60%. The CAA also noted the "*lower bound estimate of 0.05 corresponds to an assumption that there is no difference in debt beta between HAL and its comparators.*"[67]

In our April 2020 report for the CAA, we aligned with the CMA's view that a 0.05 debt beta was consistent with 30% gearing in the context of Heathrow, and for the comparators used to estimate asset beta.[68]

Recent regulatory precedent

At its the final determination for the PR19 appeals, the CMA concluded that there were "*significant calculation uncertainties associated with debt beta*"[69] and used a debt beta range of 0.05 to 0.10 for the water companies. The CMA's used the 0.075 midpoint for the debt beta, alongside a 60% notional gearing.

The CMA's view of a 0.075 debt beta for a notional gearing of 60% in the water sector is not obviously inconsistent with its earlier our assumption for NERL of a 0.05 debt beta at a notional gearing of 30%.

Our approach to the debt beta

For the purposes of our analysis, in arriving at an asset beta for NERL, we should use a debt beta in line with the notional gearing assumption for NERL.

[66] Oxera, p.16.
[67] CAA (Oct 2021), Economic regulation of Heathrow Airport Limited: H7 Initial Proposals, Section 2: Financial Issues, p.58, para 9.99.
[68] Flint (Apr 2020), Business as Usual WACC for H7, p.21.

We understand the CAA will adopt a notional gearing for NERL's cost of capital of 30%, in line with the CMA's earlier approach for NERL. We therefore consider that we should continue to assume a debt beta of 0.05 for re-gearing of comparators' asset beta into an estimate of NERL's equity beta, consistent with the CMA's approach at RP3.

For de-gearing the comparators equity beta into an asset beta, we also use a debt beta of 0.05. The comparators exhibit gearing broadly around the level of 30% assumed in the CMA's notional model.

We note ENAV, Zurich and Vienna have actual average gearing levels below the 30% threshold, and Fraport above, as shown in the table below. Such difference could potentially justify a slightly lower or, in the case of Fraport, higher debt beta assumption.

However, given the impact of a different debt beta assumption, in line with the comparators actual gearing, is trivial,[70] we prefer to align with the CMA's approach, of using a consistent debt beta across all comparators over the period.

TABLE 17: AVERAGE ACTUAL GEARING OF COMPARATORS

Comparator	Averaging period (Y)	Average gearing (%)
ENAV	5.7 years	5%
AENA	c.7.2 years	27%
ADP	c.7.2 years	27%
Fraport	c.7.2 years	44%
Zurich	c.7.2 years	13%
Vienna	c.7.2 years	12%
Sydney	c.7.2 years	35%

Note: the averaging window considers the period from July 2016 for ENAV, and February 2015 for the airports, up to March 2022. ENAV is 5.7 years, since it was quoted, while for airports is around7.2 years.
Source: Flint analysis based on Thomson Reuters data as of 31st March 2022.

Appendix 3: Detailed results of our COVID window sensitivities

In section 5.4 above, we describe our alternative 'sensitivity' model runs which tests our classification of recent data as COVID and non-COVID affected, and set out the model runs in each case.

The tables below set out the implied betas for the component windows (COVID-affected and non-COVID affected) in each of these sensitivities. The non-COVID-affected beta (in Table 18) also acts as the baseline from which we subtract our reweighted beta estimates to estimate

[70] We have replicated the analysis for ENAV, the comparators with the largest gearing difference to NERL's 30% notional gearing. The impact of using a debt beta of 0 at ENAV's 5% average gearing level does not change our estimate of its beta to the nearest basis point, and hence does not affect our proposed range.

TABLE 18: ALTERNATIVE ASSUMPTIONS ABOUT NON-COVID AFFECTED ASSET BETA

	AENA *Madrid*	ADP *Paris*	Fraport *Frankfurt*	Zurich	ENAV	3 airport	4 airport
pre-COVID data	0.52	0.54	0.48	0.58	0.41	0.51	0.53
pre-COVID blended with 6 recent months of data	0.55	0.56	0.54	0.59	0.57	0.55	0.56
pre-COVID blended with 12 recent months of data	0.55	0.54	0.53	0.59	0.56	0.54	0.55

TABLE 19: ALTERNATIVE ASSUMPTIONS ABOUT COVID AFFECTED ASSET BETA

	AENA *Madrid*	ADP *Paris*	Fraport *Frankfurt*	Zurich	ENAV	3 airport	4 airport
26 months COVID affected beta	0.90	0.79	0.65	0.76	0.75	0.78	0.77
20 months COVID affected beta	0.92	0.84	0.63	0.79	0.74	0.80	0.80
14 months COVID affected beta	0.96	0.88	0.65	0.81	0.77	0.83	0.82

Note: Assumes debt beta of 0.05. The first row uses 5 years of pre-COVID data from 12 February 2015 to 31 January 2020, ENAV betas are estimated for a shorter pre-COVID window of 3.5 years due to its more recent listing. The second row uses 5.5 years data, i.e. 5 years pre-COVID dataset (3.5 for ENAV) and the most recent 6 months of data (October 2021 to March 2022). We follow the same approach in the third row, i.e. 5 years pre-COVID and the most recent 12 months (April 2021 to March 2022).
Source: Flint analysis based on Thomson Reuters data as of 31st March 2022.

To avoid conflating changes in beta that arise due to alternative assumptions about the *duration* of *future* COVID-like events, we focus these sensitivities on COVID-like events equal in duration to our assumed COVID-window in each case, i.e. equivalent to our 'base case' results above. We also focus on our preferred 3-airport and 4-airport comparator sets, since these are the airport comparators we recommend the CAA places greatest weight on, and since betas for these airports appear to be more robust/reliable than betas estimated for Sydney and Vienna.

Sensitivities around recent 6 months of data

Table 20 below sets out our results for two model runs which remove the most recent 6 months from our COVID-window (from October 2021 to March 2022). The first removes the data entirely, and the second treats it as part of the non-COVID window. The COVID adjustment implied by the airports is similar to that in our preferred base case scenario: the lower bound decreases slightly, by one basis point (from 0.03 to 0.02), and the upper bound by two basis points (from 0.08 to 0.06). Across both sensitivities, the result is similar.

ENAV's COVID adjustment falls by a greater extent. In the second sensitivity, where we include the last 6 months of data in our non-COVID window, the lower bound falls by four basis points (from 0.06 to 0.02) and the upper bound by nine basis points (from 0.13 to 0.04). The decrease in the first sensitivity (where we exclude recent data), it falls by a lesser extent, but still more so than the airport comparators.

TABLE 20: REWEIGHTED BETAS AND COVID ADJUSTMENT FOR '6-MONTH' SENSITIVITIES

	AENA *Madrid*	ADP *Paris*	Fraport *Frankfurt*	Zurich	ENAV	3 airport	4 airport
Preferred approach							
Re-weighted beta							
20	0.59	0.63	0.55	0.64	0.54	0.59	0.60
50	0.55	0.58	0.51	0.61	0.47	0.55	0.56
N/A	0.52	0.54	0.48	0.58	0.41	0.51	0.53
Beta adjustment							
20	0.08	0.08	0.07	0.05	**0.13**	**0.08**	**0.07**
50	0.03	0.04	0.03	0.02	**0.06**	**0.03**	**0.03**
Excluding recent 6 months of data							
Re-weighted beta							
20	0.58	0.63	0.54	0.64	0.51	0.58	0.60
50	0.54	0.58	0.51	0.61	0.46	0.54	0.56
N/A	0.52	0.54	0.48	0.58	0.41	0.51	0.53
Beta adjustment							
20	0.07	0.08	0.06	0.05	**0.10**	**0.07**	**0.07**
50	0.03	0.04	0.03	0.02	**0.05**	**0.03**	**0.03**
Treating recent 6 months of data as non-COVID affected							
Re-weighted beta							
20	0.61	0.63	0.58	0.64	0.61	0.61	0.61
50	0.58	0.59	0.56	0.61	0.59	0.57	0.58
N/A	0.55	0.56	0.54	0.59	0.57	0.55	0.56
Beta adjustment							
20	0.06	0.07	0.04	0.05	**0.04**	**0.06**	**0.06**
50	0.03	0.03	0.02	0.02	**0.02**	**0.03**	**0.02**

Note: Assumes debt beta of 0.05.
Source: Flint analysis based on Thomson Reuters data as of 31st March 2022.

Sensitivities around recent 12 months of data

Table 21 below, sets out our results when making alternative assumptions about the last 12 months of data (from April 2021 to March 2022).

Results are similar compared to the '6-month' sensitivities shown in the table above; the range for the airport comparators falls slightly, whereas the results for ENAV fall materially.

TABLE 21: REWEIGHTED BETAS AND COVID ADJUSTMENT FOR '12-MONTH' SENSITIVITIES

	AENA *Madrid*	ADP *Paris*	Fraport *Frankfurt*	Zurich	ENAV	3 airport	4 airport
Preferred approach							
Re-weighted beta							
20	0.59	0.63	0.55	0.64	0.54	0.59	0.60
50	0.55	0.58	0.51	0.61	0.47	0.55	0.56
N/A	0.52	0.54	0.48	0.58	0.41	0.51	0.53
Beta adjustment							
20	0.08	0.08	0.07	0.05	**0.13**	**0.08**	**0.07**
50	0.03	0.04	0.03	0.02	**0.06**	**0.03**	**0.03**
Excluding recent 12 months of data							
Re-weighted beta							
20	0.58	0.63	0.54	0.64	0.51	0.59	0.60
50	0.54	0.58	0.51	0.61	0.46	0.54	0.56
N/A	0.52	0.54	0.48	0.58	0.41	0.51	0.53
Beta adjustment							
20	0.07	0.09	0.06	0.05	**0.10**	**0.07**	**0.07**
50	0.03	0.04	0.03	0.02	**0.05**	**0.03**	**0.03**
Treating recent 12 months of data as non-COVID affected							
Re-weighted beta							
20	0.61	0.62	0.58	0.63	0.61	0.60	0.61
50	0.58	0.57	0.55	0.61	0.59	0.57	0.58
N/A	0.55	0.54	0.53	0.59	0.57	0.54	0.55
Beta adjustment							
20	0.06	0.08	0.05	0.05	**0.05**	**0.06**	**0.06**
50	0.03	0.03	0.02	0.02	**0.02**	**0.03**	**0.03**

Note: Assumes debt beta of 0.05. ENAV betas are estimated for a shorter pre-COVID window of 3.5 years due to its more recent listing.
Source: Flint analysis based on Thomson Reuters data as of 31st March 2022.