H7 asset beta and inflation

Response to CAA Final Proposals

Prepared for
Heathrow Airport Limited

9 August 2022

www.oxera.com

compelling economics

Contents

Figures and tables

Executive summary

In June 2022, the Civil Aviation Authority (CAA) published its Final Proposals for the H7 price control. In its proposals, the CAA set out its response to evidence from Heathrow Airport Limited (HAL) and other stakeholders on various cost of capital issues.[1]

HAL asked Oxera to provide theoretical and empirical evidence in response to the Final Proposals, on specific cost of capital issues. In this report, we examine three aspects related to the cost of capital estimates for HAL: the estimation of asset betas; the impact of the TRS mechanism on asset betas; and inflation.

Asset beta estimation

First, with respect to the estimation of asset betas, we examine the methodology used by the CAA to estimate the impact of the COVID pandemic on HAL’s asset beta. The CAA’s approach places lower weight on data from the pandemic period, to ensure that the impact of the pandemic is not ‘over-represented’ in its asset beta estimate.

We present three main critiques to the CAA’s approach to re-weighting the pandemic data. First, we show that the CAA has arbitrarily defined the length of the pandemic period. This implies that the CAA’s re-weighting approach is arbitrary. Second, we show that it is based on arbitrary data manipulation. If upheld, the CAA’s re-weighting approach would represent a concerning departure from regulatory practice grounded in the observable evidence. Finally, the lower end of the CAA asset beta range implicitly assumes zero impact of the COVID pandemic on systematic risks.

We propose our estimation of asset betas, based on an approach that simply relies on the available data without any artificial manipulation. We regard this approach as scientifically sound and in line with well-established regulatory practice.

For the daily asset betas, the two-year average estimate based on data available until 4 July 2022 is 0.687 (range of 0.611–0.787), while the corresponding figure for five-year betas is 0.774 (range of 0.689–0.816).

For the weekly asset betas, the two-year average estimate based on data available until 4 July 2022 is 0.755 (range of 0.665–0.849), while the corresponding figure for five-year betas is 0.818 (range of 0.799–0.860).

[1] Civil Aviation Authority (2022), ‘Economic regulation of Heathrow Airport Limited: H7 Final Proposals’, June.

We have also estimated asset betas using the 30-month period from February 2020, which results in an average of 0.749 based on daily data and 0.784 based on weekly data. We also show the averages excluding Fraport due to the different risk characteristics compared with the other airport stocks, not least of which is the large amount of state aid received by Fraport during the COVID pandemic. These averages are 0.800 and 0.816 for daily and weekly data respectively.

These estimates of asset beta for comparable airports are now higher than the asset beta for the average company, which is approximately 0.60 based on the constituents of the FTSE 100 index and 0.75 based on the constituents of the FTSE All-share index.

The impact of the proposed traffic risk-sharing mechanism

Second, we examine the impact of the proposed traffic risk-sharing (TRS) mechanism on the value of asset betas. The CAA has proposed a downwards adjustment of 0.08–0.09 to Flint's estimates of asset beta, on the grounds that the TRS would help to reduce HAL's financial exposure to systematic traffic risks relative to comparator airports. Specifically, the downwards adjustment is estimated in three steps:

- the CAA assumes that traffic risk accounts for between 50% and 90% of the difference between its estimate of the pre-TRS asset beta for HAL (0.52–0.71) and the average of the asset betas determined by Ofwat and Ofgem for water companies and energy networks respectively (0.342);
- it then assumes that the TRS mechanism will reduce HAL's financial exposure to traffic risk by 50%, on the basis that the TRS mechanism will help HAL reduce 50% of traffic-related revenue loss/gain for deviations from traffic forecasts that are lower than 10%;
- multiplying the estimated traffic risk differential of 50–90% and the estimated traffic risk reduction of 50% by the asset beta difference, the CAA calculates the impact of TRS on asset beta to be 0.08–0.09.

The CAA's approach to estimating the impact of the TRS on the asset betas is incorrect, for six main reasons.

First, as acknowledged by the CAA itself, the Competition and Markets Authority has decided against using the betas of UK utilities in calculating an estimate of NERL's beta. This is relevant because NERL also has a TRS mechanism. The CAA's own advisers, CEPA, also acknowledge that there are multiple sources of risk differentials between airports and regulated water and energy networks. For the CAA to assume that volume risk accounts for 50–90% of the asset beta differential between listed airports and UK utilities is arbitrary and reductions of this magnitude are not supported by any evidence.

Second, the CAA was also incorrect to assume that the TRS mechanism will reduce HAL's exposure to traffic risks by 50% under non-pandemic traffic shock scenarios. The CAA's own analysis shows that the TRS mechanism could hypothetically protect HAL from around 43–45% of the expected overall impact on its EBITDA of traffic levels being up to 10% higher or lower than expected. Furthermore, we use the CAA's Price Control Model (PCM) to show that even under the assumptions of the CAA, the TRS mechanism can provide a profitability and liquidity risk reduction of only 4–14% during the H7 price control.

Third, although the TRS mechanism is intended to provide risk-sharing on a net-present-value (NPV) basis over a ten-year period, it does not address any potential liquidity issues faced by HAL in low-traffic scenarios. This concern was shared by credit rating agencies, Moody's and S&P Global.

Fourth, the risk-sharing provided by the TRS is based on the presumption that an increase in allowed airport charges will lead to an increase in revenue. Since HAL's demand is price-sensitive, there is no guarantee that increasing prices after a negative demand shock will generate the additional revenue required under the TRS. The features of the airports market are different to those of water and energy networks, and a regulatory mechanism such as TRS cannot override these differences and make the demand for airports behave in a similar way to the demand for utilities.

Fifth, the TRS is not a legally binding commitment, and the CAA would in future be able to modify the TRS or make offsetting adjustments elsewhere in the price control. Regulators are not legally obliged to apply the proposed TRS under all circumstances. We discuss how existing TRS mechanisms for AdP and European air navigation service providers (ANSPs) failed to function as originally intended during the COVID pandemic. This gap between the hypothetical and actual outcomes of TRS mechanisms suggests that investors would be less sanguine about the risk reduction properties of the TRS than the CAA is.

Sixth, the broader unreliability of the CAA's methodology is also demonstrated in its decision to take the average of the asset betas of PR19 and RIIO-GD2/T2. In fact, the comparability between energy and water betas is highly controversial and has been heavily disputed by companies and regulators. The CAA's approach of taking the simple average of the water and energy betas, without deliberating the analyses underlying each determination, calls into question the broader robustness of its framework for quantifying the impact of TRS, which appears to be largely based on assumptions not supported by evidence.

We have also performed an expected value cross-check on the asset beta reductions estimated by the CAA. Our analysis shows that, from the perspective of expected monetary pay-off, the proposed asset beta reduction of 0.08–0.09 is disproportionately large compared with the hypothetical protections provided by the TRS mechanism.

In sum, the CAA was incorrect to adjust HAL's asset beta downwards to account for the impact of the TRS mechanism. While the mechanism would in theory be expected to provide some reduction to the net exposure to systematic risks, these reductions are in practice likely to be small and of limited value to investors. The quantification of the adjustment by the CAA is largely based on arbitrary assumptions rather than being evidence-based. Applying downwards adjustments for the weak and uncertain TRS protections to the volatile and noisy asset beta estimates for comparator airports is more likely to reduce, rather than increase, the accuracy of the final asset beta estimate for HAL.

The impact of inflation

Third, we discuss the impact of inflation. Observing that inflation forecasts for the H7 price control are above the long-term inflation forecast, the CAA has proposed setting revenue allowances for the real cost of debt based on inflation forecasts for the H7 price control. As the inputs for the cost of debt are in nominal returns, this reduces the allowance for the real cost of debt compared with using long-term inflation forecasts. Following the approach proposed by the CAA would lead to annual revenues for HAL being approximately £135m lower than if a long-term inflation forecast of 2.73% were used to set the real cost of debt allowance.[2]

Our first critique is that the CAA approach contradicts extensive regulatory precedent for using long-term inflation forecasts to deflate the cost of debt allowance. A clear recent example is provided by the PR19 water redeterminations, where the Competition and Markets Authority (CMA) explicitly rejected a request by Yorkshire Water to increase the real cost of debt allowance on the basis that inflation during AMP7 (2020–25) was forecast to be lower than the long-term target.

Our second critique is that HAL has already raised long-term nominal fixed-rate debt to match the lives of the assets. As such, remunerating HAL for the real cost of this pre-existing debt using long-term inflation forecasts spanning multiple price control periods is consistent with how the cost of this debt was determined in the capital markets. Basing the real allowance for this debt on short-term inflation forecasts, when inflation is high, would be asymmetric since it would claw back the allowance that investors would have expected to receive for the cost of embedded debt.[3]

Our third critique is that the CAA has never prescribed a specific inflation risk policy. To do so now would retrospectively undermine the capital structing and financing decisions of HAL regarding the desired exposure of real equity returns to inflation risk, achieved by raising a proportion of debt linked to inflation and/or by entering into inflation swaps. This would be expected to reduce the confidence of investors in the predictability and stability of the regulatory regime.

Our fourth critique is that the CAA proposals significantly reduce the extent to which real equity returns increase (decrease) when inflation is higher (lower) than its long-term expected value. This reduces the ability of investors with inflation-linked liabilities (e.g. pension funds) to create a leveraged equity exposure to inflation as a hedge to the exposure of their liabilities to inflation. As such, it undermines a fundamental reason for investors to provide equity to inflation-linked assets.

Our fifth critique is that the impact of the CAA Final Proposals is to offset an expected inflationary increase in revenue to HAL by making an actual fixed reduction to the calculated real revenue requirement that flows into the price cap. This reduction in the level of real revenues in combination with an elevated level of inflation uncertainty exposes HAL to a greater risk that inflation is significantly below assumptions thereby creating a greater risk to financeability than in previous price controls.

In summary, it would not be in the interests of consumers for the CAA to set the cost of debt allowance in a way that reduces the remuneration that investors expect when inflation exceeds its long-term expected level. This would undermine the confidence of investors when investing in long-term inflation-

[2] Based on a difference of 183 basis points (bp) between the arithmetic average RPI inflation forecast over H7 (4.56%) used to deflate the nominal cost of embedded and new debt, and the historical long-term RPI inflation forecast (2.73%) used by the CAA. The difference of 183bp is multiplied by the share of nominal fixed-rate debt (70%) in the total debt assumed for the notional capital structure and multiplied by notional gearing (60%). This gives a 77bp reduction in the real weighted average cost of capital (WACC). Based on the opening H7 RAB of £17.5bn, this is equivalent to a £135m reduction in annual revenue.

[3] For example, the expected real cost of debt with a nominal coupon of 5% would be 3% based on a 2% long-term inflation forecast, with a distribution of outcomes either side of 3%. Truncating the upper half of the distribution of the revenue allowance for the real cost of debt in an environment when inflation is high will lead to under-compensation relative to the expected real cost of debt over the long term.

linked regulated assets and increase the cost of capital for these assets, and hence increase passenger charges.

1 Introduction

In June 2022, the Civil Aviation Authority (CAA) published its Final Proposals for the H7 price control. In its proposals, the CAA set out its response to evidence from Heathrow Airport Limited (HAL) and other stakeholders on various cost of capital issues.[4] HAL asked Oxera to provide theoretical and empirical evidence in response to the Final Proposals, on specific cost of capital issues including asset beta and the inflation rate.

This report covers a range of issues related to the estimation of cost of capital for H7, primarily with regard to the treatment of COVID asset beta impacts in the approach followed by the CAA, the impact of the proposed Traffic Risk Sharing (TRS) mechanism, and the impact of inflation.

The report is structured as follows:

- section 2 gives an overview of the CAA's methodology for estimating asset betas;
- section 3 presents our critiques of this methodology;
- section 4 presents our proposed methodology and estimates of HAL's asset betas;
- section 5 sets out our response on the TRS adjustment to the asset beta;
- section 6 gives an overview of the CAA's proposals for how inflation forecasts will be used to calculate the real cost of debt;
- section 7 presents our critique of these proposals for inflation and the cost of debt.

[4] Civil Aviation Authority (2022), 'Economic regulation of Heathrow Airport Limited: H7 Final Proposals', June (henceforth, the 'Final Proposals').

2 Review of the CAA's methodology for the estimation of asset betas

In this section we review the methodology used by the CAA to estimate the beta of assets. In drafting the Initial Proposals, the CAA commissioned a report from Flint Global ('Flint') on the estimate of the asset betas for H7. The approach proposed by the CAA in its Initial and Final Proposals for the estimation of the asset betas for H7 is closely based on the approach proposed by Flint.

In essence, Flint places lower weight on data from the pandemic period, to ensure that the impact of the pandemic is not 'over-represented' in the asset beta estimates. In essence, its approach estimates the impact of pandemic-like events on airports' asset betas (i.e. a 'COVID adjustment') by calculating the difference between a pre-pandemic 'baseline beta' and a probability-weighted 'pandemic beta'.

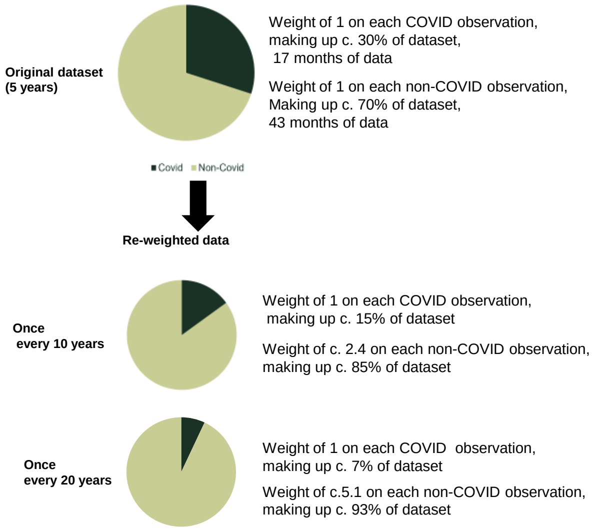
The probability-weighted betas rely on two key assumptions:

- **The frequency of pandemics**—this assumption determines how much of the stock and index returns data during the pandemic are included in the regression sample. For example, for five-year beta estimations, and assuming a valuation date at June 2021, without any adjustments c. 30% of the data in the sample falls during the COVID period (17 out of 60 months). By assuming that pandemics occur every 20–50 years, Flint divides the 30% by 4 (calculated as 20 years ÷ a five-year estimation period) and by 10 (calculated as 50 years ÷ 5), and decided that the COVID period should make up 3% to c. 7% of the sample.

- **The duration of pandemics**—this assumption functions similarly to the frequency of pandemics. Using the above example, the duration of pandemics determines how many of the 60 months are during the COVID period. While 17 months represents the lower bound of the duration of the pandemic (since the COVID pandemic was 17 months old at the time of Flint's analysis), Flint assumed that the impact of COVID and similar future events could last up to 2.5 years, which forms the upper bound of the duration.

The CAA implements this approach as follows. Across its comparator set, it classifies daily data as COVID-affected and non-COVID-affected data. It then calculates an equity beta for each comparator using a linear regression, with different weights assigned to COVID and non-COVID observations. In effect, the weights can be translated into an equivalent 'frequency' at which a 'COVID-like' event occurs. It then repeats this regression for a series of different weightings of COVID-like events to represent different frequencies. Figure 2.1 below illustrates this approach, for two frequencies of a COVID-like event.

Figure 2.1 Illustration of Flint's re-weighting approach



Source: Flint (2021), 'Support to the Civil Aviation Authority: Estimating Heathrow's beta post-COVID-19', August, Figure 3.

2.1 Definition of the pandemic period in the Final Proposals

To identify the time period over which COVID materially affects estimates of beta, the CAA, in its Final Proposals, has followed the approach outlined in the Flint report, with an update on the 'end date' of the pandemic.

2.1.1 Start date of the pandemic

Analysing share price movements (for airport stocks and for market indices) and two-year rolling betas, Flint observes a pronounced decline in airport and market indices in early 2020 (around February and March). Based on this analysis, it considers that a start date between January 2020 and March 2020 can be justified. While stock market movements are most pronounced in March 2020, there is some evidence of material stock market movements slightly earlier. Therefore, Flint chooses to rely on a start date of 1 February 2020, to ensure that all data affected by emerging COVID-related news is included in its COVID time window.

2.1.2 End date of the pandemic

Flint assumes that COVID continues to affect share prices and betas until the end of its dataset, which runs to 18 June 2021. Flint assumes that airport share prices and index values remain significantly influenced by COVID-related news and events through to June 2021. Flint recognises that there is some emerging evidence that market movements and share price responses may be returning towards their pre-COVID pattern and are no longer dominated by COVID news and events in the way observed during 2021.

Since the Initial Proposals, the CAA has updated its duration assumptions to include all data from February 2020 to March 2022 as affected by the pandemic, which is 26 months in total, or around 30% of the total dataset. The CAA then sets out an assumed range for the duration of future pandemic-like events: at the upper bound, it assumes a duration of 150% of the observed pandemic window, amounting to 39 months, compared with 30 months at the Initial Proposals; and at the lower bound, it assumes a duration of two-thirds of the observed pandemic window, amounting to 17 months.

3 Critiques of the methodology employed by the CAA

In this section, we present two main critiques of the methodology used by the CAA in its re-weighting of the pandemic data. Our objective is to show that this re-weighting is not guided by a scientifically sound approach.

We also observe that the lower end of the CAA asset beta range implicitly assumes zero impact of the COVID pandemic on systematic risks. This is a straightforward error and is therefore not discussed further in this section.

1. Definition of the pandemic period

First, we argue that the CAA has arbitrarily defined the pandemic period, and specifically its end date. This implies that the re-weighting approach used by the CAA is arbitrary.

More specifically, we argue that the CAA's choice of March 2022 as the end date for the COVID pandemic appears unjustified on the basis of scientific evidence from multiple directions. The pandemic is still affecting the air transport sector because:

1. the number of infection cases is still rising, and lockdowns are still in place;
2. the stock prices of airports and airlines are still depressed compared to the stock index;
3. the implied volatilities of relevant airports remain high relative to that of the index;
4. the recovery in the corporate travel sector is slow and may reflect a permanent shift in business travel expenditure.

2. Ad-hoc treatment of a subset of observations

Second, we argue that by allocating a lower weight to the pandemic data, the CAA is treating a subset of relevant observations in an ad hoc way.

The motivation for the CAA to allocate a lower weight to the pandemic data is based on the assessment of the pandemic as 'not representative of normal times', and consequently as not relevant for the purpose of estimating betas in the future. This assessment is not motivated by scientific evidence, nor does it represent a scientifically sound approach to the issue. More importantly, the CAA's decision has the potential to establish a precedent for regulators to carry out *arbitrary data manipulation*. If upheld, the CAA's methodology would represent a concerning departure from regulatory practice.

We show that the impact of the pandemic on the stock market was not remarkable when compared to other shocks in recent times (e.g. 11 September 2001, the global financial crisis of 2007–09, and the EU sovereign crisis of 2010–12). Consequently, it does not deserve special treatment.

We also argue that outliers should not be excluded from the analysis because they contain important information about tail risk. The importance of outliers for risk management is shown by the widespread use of value-at-risk (VaR) methodologies used by financial institutions. It is common practice for asset managers to look at 'special' events when examining the performance of a trading strategy.

The main conclusion that we reach in this section is that the approach proposed by the CAA to re-weight the COVID pandemic data is not based on best academic and regulatory practice, and has the potential to create a concerning precedent for data selectivity.

Instead, we support a scientifically sound and objective approach based on 'let the data speak'.

It is worth noting that, as part of the PR24 consultation process, Ofwat published its proposed methodology to estimate the allowed returns of the regulated water companies. With regard to the beta estimation and treatment of the COVID pandemic data, Ofwat states:[5]

> We consider that pandemics are a clear example of a systematic risk whose relevance is unlikely to diminish, given research indicating pandemics like the Covid-19 outbreak will become more frequent in future. On this basis, we therefore do not agree it would be appropriate to omit data from Covid-19 affected periods from our analysis. We recognise however, that focusing excessively on a period dominated by Covid-19 may result in a beta estimate that is not reflective of the 2025-30 period. Our current preference to address this issue is through relying on evidence from a range of estimation periods (of 2, 5, and 10 years), ensuring that our approach encompasses data from unaffected periods and a reasonable span of years. **We do not propose to apply bespoke weights to the Covid-affected data**, as we note that a selective treatment of just one of many sources of systematic risk might miscalibrate weightings for alternative sources of risk that are more relevant to the 2025-30 period. [emphasis added]

3.1 The CAA's choice of the end date of the pandemic is arbitrary

The CAA assumes that airport share prices and index values remain significantly influenced by COVID-related news and events through to March 2022.

We argue that the effects of the pandemic are still being felt at the time of writing (July 2022) and will probably remain relevant for the near future.

Specifically, we show that: i) the number of cases is still rising, and lockdowns are still in place; ii) the stock prices of airports and airlines are still depressed compared to the stock index; iii) the implied volatilities of relevant airports remains high relative to that of the index; and iv) there is a slow recovery in the corporate travel sector and a possible permanent shift in business travel expenditure.

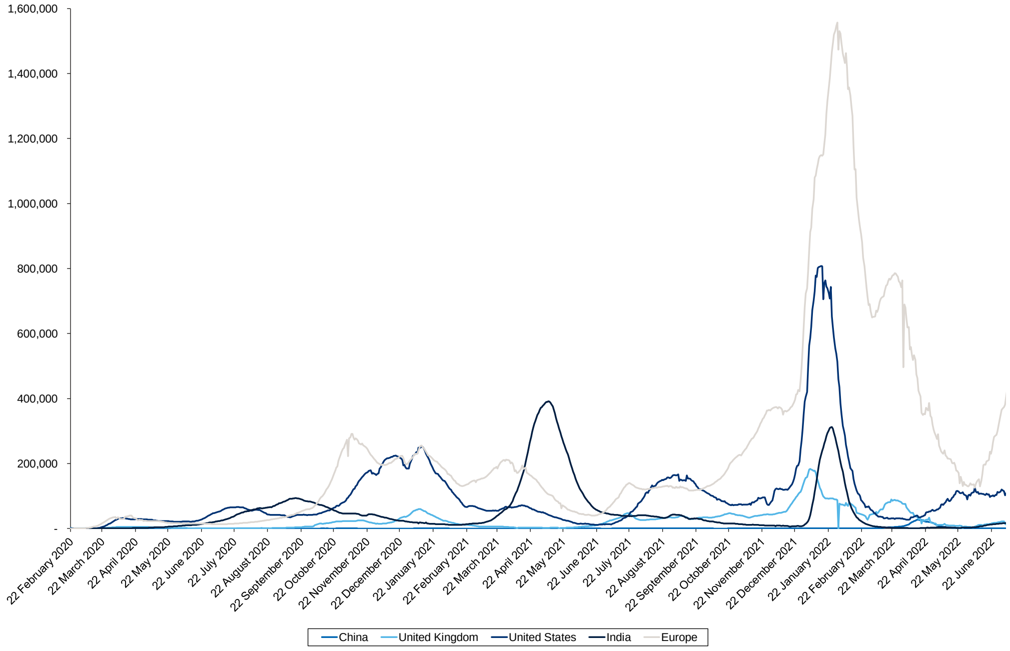
3.1.1 Cases are still rising, and lockdowns are still in place

In this section we examine the evidence on COVID cases around the world. Figure 3.1 below reports the evolution of COVID cases in several selected regions (the EU, the US, India, the UK and China). It can be seen from the figure that by far the largest peaks in new cases occurred during 2022.

The most recent data shows that there is currently a strong resurgence in cases in the EU. While these figures are not associated with a large number of COVID-related deaths, as were observed in 2020 and 2021 when vaccines were not widespread among the population, they do indicate a strong persistence in the pandemic that could lead to prolonged disruptions in the aviation industry.

[5] Ofwat (2022), 'Creating tomorrow, together: consulting on our methodology for PR24', Appendix 11 – Allowed return on capital, 7 July, p. 16.

Figure 3.1 COVID cases in selected regions: number of new cases



Notes: Europe includes the UK.

Source: Oxera analysis based on Our World in Data (2022).

In the second half of July 2022, an Omicron sub-variant spread rapidly in India and was also detected in several European countries. The relevant authorities believe that this variant may be better than other coronavirus strains at overcoming immunity provided by prior infection and vaccines.[6] In July 2022 Unicef stated that, while it had been expected that COVID would cause a 'pandemic hangover' last year, due to lockdowns and other disruptions caused by the disease, a continued decline [in the number of children getting immunised] is now evident.[7]

The persistent concerns around the pandemic have been reflected in enduring lockdowns, particularly in China, putting strain on the global supply chain. China continues to pursue a zero-COVID policy, which has left millions of workers across the country confined to their homes. The port city of Shenzhen was closed briefly in March 2022 and Shanghai went into lockdown at the end of that month. Authorities have now imposed restrictions on Beijing, while the central Chinese city of Zhengzhou, a gateway for air freight, also limited the movement of people in May 2022.[8]

The main takeaway from this section is that setting March 2022 as the date for end of the COVID pandemic appears unjustified on the basis of the scientific evidence from new cases and persistent lockdowns.

3.1.2 Stock prices of airports and airlines are still depressed compared to the stock index

In this section, we compare the performance of airports and airlines with the relevant stock market indices to show that in a differences-in-differences (DIFF-

[6] 'Coronavirus sub-variant "Centaurus" spreads across India and parts of Europe', Financial Times, 15 July 2022.
[7] '"Red alert" on global child health issued after drop in vaccinations', Financial Times, 15 July 2022
[8] Financial Times, 15 May 2022. [Add actual FT article title… being referred to here]

in-DIFF) setting, airports and airlines are performing markedly worse than the corresponding stock indices. The DIFF-in-DIFF approach is designed to separate the effects of news on the economy as a whole from the effects that are specific to a given sector.

Figure 3.2 reports the time series of the stock prices of Aena, Frankfurt Airport, Aéroports de Paris (AdP), and Zurich Airport, alongside the Euro Stoxx 600. Before the pandemic, all four airports outperformed the index. For all four airports, we observe a sharp drop in March 2020 of greater magnitude than the corresponding shock observed in the index. All four airports have performed (and still are performing) worse than the Euro Stoxx 600. The most recent valuations of the stock remain below the last pre-pandemic data point.

Arguably, the most recent stock performance (of both airports and the index) is influenced by a number of other events that are unrelated to the pandemic, such as the Russia–Ukraine war and the associated spike in fuel prices, and the increase in inflation. This further illustrates the shortcomings of the CAA approach to beta estimation and its focus on reweighting the data to reduce the impact of one driver of share prices in isolation from the broader market situation.

The DIFF-in-DIFF setting allows the broader effects on the economy to be controlled for and the specific effects on the airport sector to be isolated. The difference in the difference between the performance of the index and the airports before and after the shock shows that the airport sector remains significantly weaker than the rest of the economy. This evidence suggests that there are enduring effects associated with the pandemic that are specific to the airport sector, rather than to the wider economy.

Figure 3.2 Difference in performance between airports and the Euro Stoxx 600 index

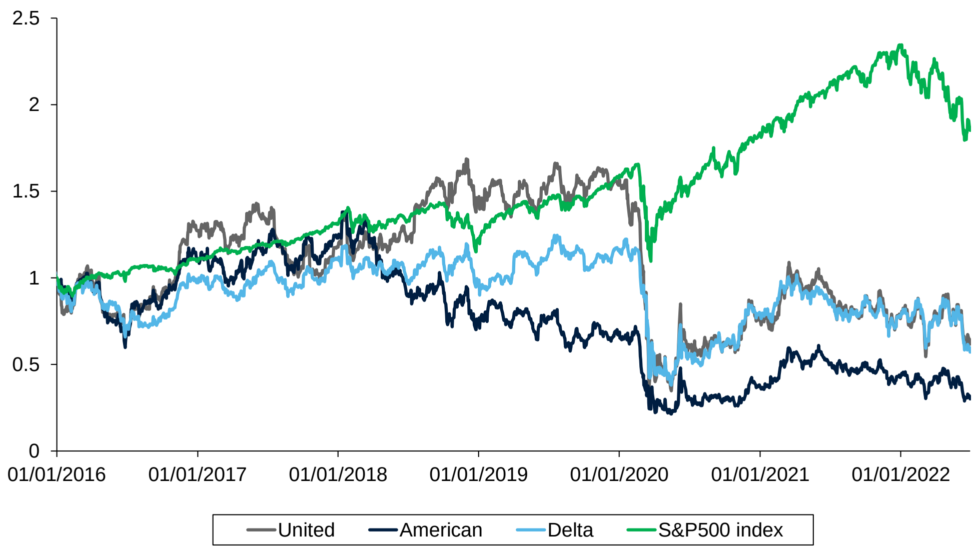
Source: Oxera analysis based on data from Bloomberg.

Considering the close dependence of airports on airlines, it is useful to look at the stock performance of a selected sample of airlines that operate at HAL. Specifically, we examine the time series of main US airlines operating at HAL (United Airlines, American Airlines, Delta Airlines), UK airlines (IAG and easyJet) and Asian airlines (Singapore, ANA, Japan Airlines), all compared to the corresponding stock market indices.

The time series reported in Figure 3.3 to Figure 3.5 below share a common pattern: the difference in the performance between the airlines and the corresponding stock indices widened after the COVID-related shock of March 2022.

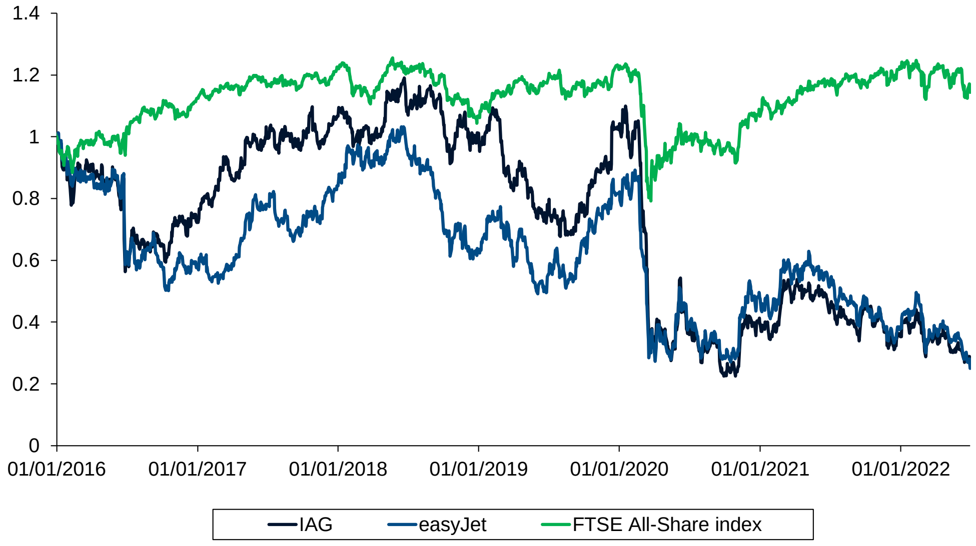
The DIFF-in-DIFF approach allows us to highlight the laggard performance of airlines vis-à-vis the broader market. Again, this evidence is suggestive of persistent depressing factors associated with the prolongation of the COVID pandemic that affect the airline industry specifically.

Figure 3.3 Difference in performance between selected US airlines and the S&P 500 index



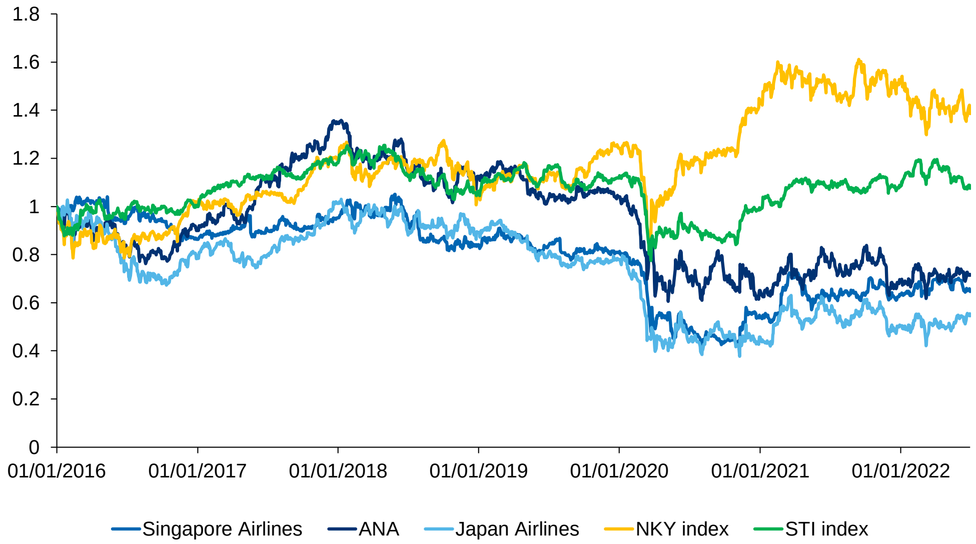
Source: Oxera analysis based on data from Bloomberg.

Figure 3.4 Difference in performance between selected UK airlines and the FTSE All-share index



Source: Oxera analysis based on data from Bloomberg.

Figure 3.5 Difference in performance between selected Asian airlines and the corresponding indices



Source: Oxera analysis based on data from Bloomberg.

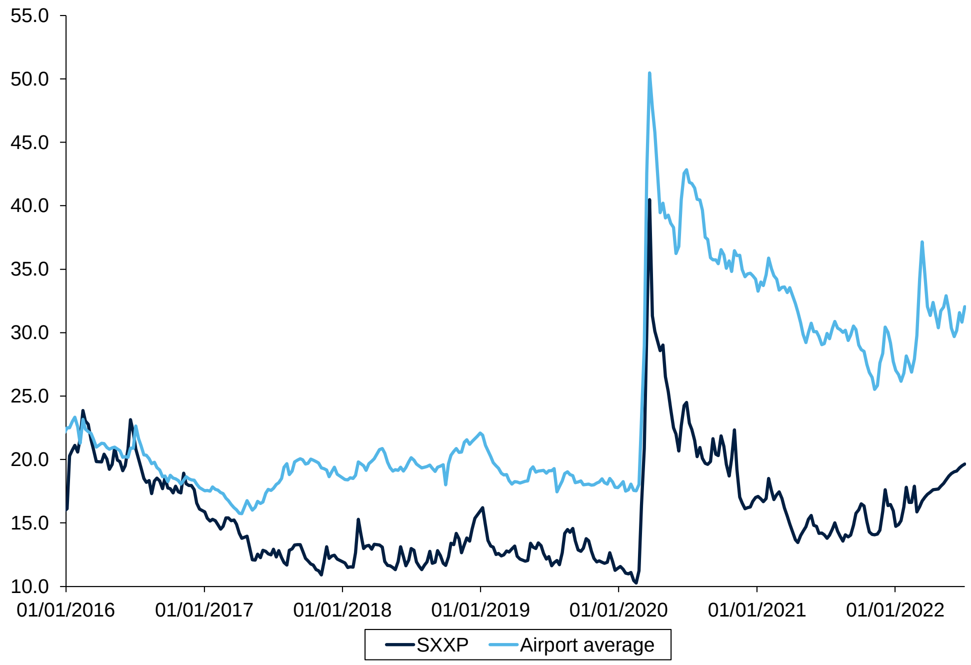
3.1.3 Implied volatilities of airports remain high relative to that of the index

Similar to the previous section, we use a DIFF-in-DIFF approach to examine the evidence on the implied volatilities of airports compared to the implied volatility of the corresponding index. The DIFF-in-DIFF setting allows us to separate effects that are common to the wider economy and to airports from those that are specific to airports.

Option-implied volatilities are derived from the market prices of equity options, by inputting market parameters, such as the risk-free rate (RFR), underlying spot equity prices, strike prices and option time to maturity, to option-pricing models such as the Black–Scholes model. Figure 3.6 shows that the implied volatilities on airport equity options remain elevated relative to the implied volatilities from options in the market as a whole. This widening gap can be visualised as the increased ratio of average airport implied volatilities to index implied volatilities since the pandemic started.

The increase in the difference between the two volatilities before and after the shock of March 2020 confirms that airports are still facing relatively more uncertainty than the rest of the market.

Figure 3.6 Implied volatilities of the STOXX European 600 index and airport comparators, based on prices of one-year call options



Note: Comparators include Aena, AdP, Fraport and Zurich.

Source: Oxera analysis based on data from Bloomberg.

Persistent uncertainty in the sector for airports and airlines is also perceived by analysts. Equity analysts and credit rating agencies still believe there are significant headwinds against airports and airlines. Recovery to 2019 volumes is proving slow and other factors such as structural shifts, ESG factors, and shifts to other transport modes may change the transport sector permanently. The resurge of inflation poses additional challenges to the recovery in demand.

In October 2021, Fitch Ratings downgraded Aena, AdP and Manchester Airport Group, arguing that 'there is still significant uncertainty in the airports sector on medium-term traffic recovery, including the possibility of structural shifts, ESG factors, and modal shifts to other transportation such as high-speed rail.'[9]

On 31 January 2022, Moody's expressed a credit opinion on Heathrow Finance plc, stating: 'While traffic will be an important driver of the group's revenue, there

[9] Fitch Ratings (2021), 'Downgrade of AENA, AdP and Manchester Airport Group', 6 October.

are significant downside risks linked to the consequences of the coronavirus pandemic, particularly in the context of the emergence of the Omicron variant and the increase in the number of cases and continued restrictions to travel.'[10]

Overall, the evidence of this section indicates that there has been an increase in uncertainty for the airport sector due to the ongoing pandemic, and that the higher uncertainty persists to this very day.

3.1.4 Slow recovery in the corporate travel sector and a possible permanent shift in business travel expenditure

Corporate travel recovery has stalled in the US and bookings look to have slowed in Europe too. Some of these effects are temporary, while others may represent a permanent change in the way corporations view business travel.

In its July 2022 report on Fraport, Berenberg observes that:

> We maintain our more-bearish-than-consensus view of business travel recovery for the post-pandemic world. The rebound of corporate travel volumes in the US has already stalled at c30% below pre-COVID levels (in line with our long-term forecasts for a new corporate baseline) while in Europe corporate bookings also appear to be rolling over as we head into the summer (though the data is less clear in that region). However, a bearish scenario for Frankfurt's business travel segment is already very much incorporated into our numbers.[11]

According to Berenberg, corporate ticket sales lag behind leisure and other segments and remain at approximately 30% below the corresponding figure for 2019. These values are suggested to represent the new long-term average for corporates.

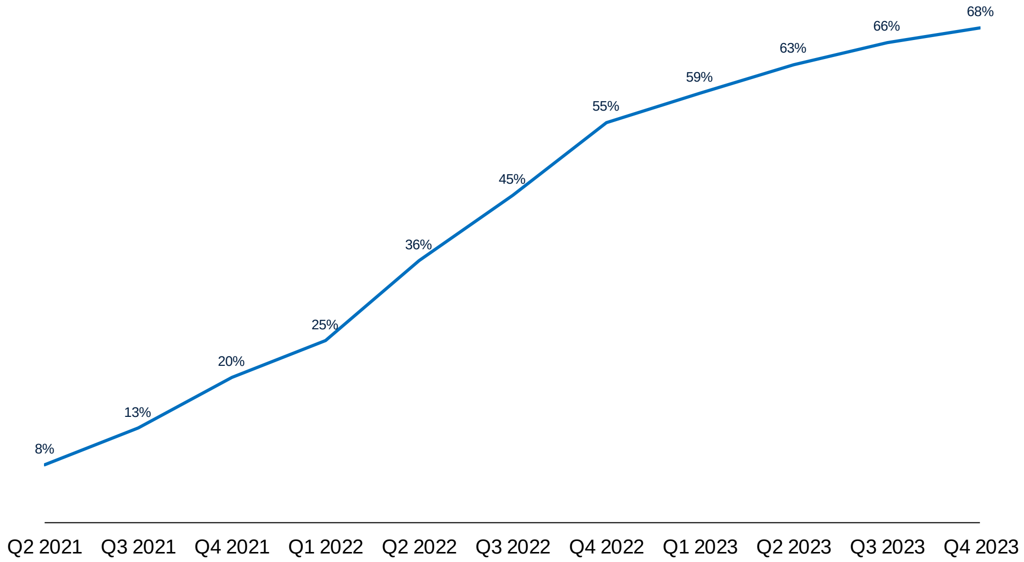
A corporate travel survey for 2022 by Deloitte shows that only 17% of travel agents expect a full recovery by the end of 2022, versus more than half of the respondents to its 2021 survey. The experience of the Delta and Omicron variants partly explains this less optimistic outlook. Two-thirds of respondents say that new variants and outbreaks since summer 2021 caused them to push back their travel timelines.[12]

Figure 3.7 shows the projected recovery of business travel expenditure as a percentage of 2019 expenditure. While business travel expenditure is expected to increase, it is expected to remain more than 30% below the 2019 figures.

Airline profitability is leveraged off business travel, given that this segment cross-subsidies the economy seats. Hence, airline profitability is now structurally more leveraged as it is built on a smaller base of business travel. Airlines will attempt to mitigate this additional operational leverage by changing capacity on routes (number of aircraft and seats flown) more regularly in response to changes in demand. This increases the sensitivity of total passenger numbers to changes in the economy and makes airport revenues more sensitive to the economy.

[10] Moody's (2022), 'Heathrow Finance PLC Credit opinion', 31 January.
[11] Berenberg Fraport AG, 12 July 2022.
[12] Daher, M., Crowley E., Caputo, P., Jackson, A.J., Rauch, M. and Terry, B. (2022), 'Reshaping the landscape: Corporate travel in 2022 and beyond', Deloitte.

Figure 3.7 US business travel spend as a percentage of 2019 spend



Source: Daher et al. (2022).

3.2 Arbitrary data manipulation

In the Initial Proposals, the CAA states:

> At the same time, we consider that it is necessary to place lower weight on data from the pandemic period, to ensure that the impact of the pandemic is not over-represented in the asset beta estimate.[13]

This statement in effect amounts to giving the CAA discretion over which data should be included in the analysis and which data should be excluded. We argue that data manipulation and arbitrary selection of data is contrary to standard scientific procedure.

More specifically, we argue that:

1. the impact of COVID on the stock market has not been exceptional by historical standards;
2. outliers should not be excluded from the analysis because they contain important information about tail risk.

3.2.5 The impact of COVID on the stock market was not exceptional

In this section, we take a long view at the performance of FTSE All-share index and examine its performance during the last 20 years. Our objective is to assess whether the COVID pandemic generated a shock to the market that was exceptional by historical standards.

Figure 3.8 reports the annual returns of the FTSE All-share index since January 2001. The choice of looking at annual returns is motivated by the fact that in its analysis the CAA only considers windows for the pandemic that are of at least one year.

[13] CAA Initial Proposals, section 9.30. [put full reference?]

In building the figure, we give special attention to the following key events:

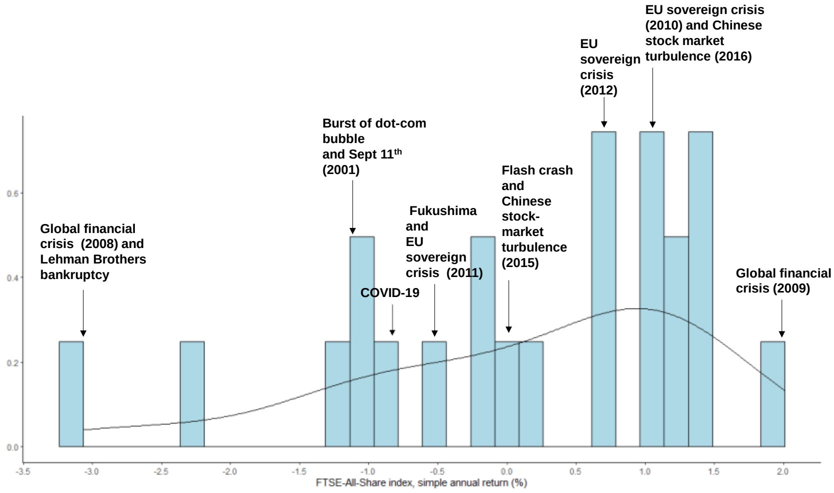
1. the burst of the dot-com bubble in 2001;
2. the attack of 11 September 2001;
3. the bankruptcy of Lehman Brothers on 15 September 2008;
4. the global financial crisis of 2007–09;
5. the EU sovereign crisis of 2010–12;
6. the Fukushima meltdown of 11 March 2011;
7. the 15 October 2014 flash crash in US treasury bonds;
8. the Chinese stock market turbulence of 2015–16;
9. the COVID shock of March 2020.

Figure 3.8 shows that 2020 was not a remarkable year for the FTSE All-share index. During that year, the index reported a small loss, of similar magnitude to its performance during the EU sovereign crisis in 2011 and 2012, and in 2001, the year in which the dot-com bubble burst and the September 11 attacks took place.

The main message from this section is that the 2020 COVID shock cannot be classified as an outlier in the context of the long-term time series of the FTSE All-share index.

The choice of the CAA to reduce the weight on data from 2020 in its analysis appears unjustified and equivalent to arbitrary data manipulation.

Figure 3.8 Annual returns of the FTSE All-share index



Note: Figure 3.8 is a combination of a histogram and a density plot. It illustrates the frequency distribution of simple yearly returns of the FTSE-All-Share index from 2001 to 2022. The x-axis depicts the annual returns (represented in percentage) and the y-axis illustrates the relative frequency of returns. The histogram is built of equal sized bins where the height of each bin is representative of the frequency of the returns that fall within a certain range. The density plot is the continuous and smoothed version of the histogram.Source: Oxera analysis based on data from Bloomberg.

3.2.6 Should outliers be excluded from the analysis?

The CAA's decision to allocate a lower weight to the data of the COVID pandemic is ultimately motivated by the perception of the pandemic as an outlier. We question whether outliers should be excluded from the analysis.

In banking and asset management, outliers are given special attention. They are given more rather than less weight. The importance of outliers for risk management is shown by the widespread use among financial institutions of VaR methodologies. It is common practice for asset managers to look at 'special' events when examining the performance of a trading strategy.

The VaR model

Value-at-Risk is a statistical method for quantifying exposure to market risk. The VaR measures the maximum possible loss expected for a fund or portfolio with a probability rate (typically 95%) in a specific timeframe. It is used to anticipate and control the level of risk exposure based on past performance. This method takes three variables into account: time, probability of loss, and the amount of that loss. For example, using this method, a company (typically a financial institution with a large portfolio) can estimate that there is a 5% chance (95% percentile) of losing €10m in a one-month timeframe. In other words, there is a 5% probability that the company will lose €10m in one month or another and a 95% probability that this loss will be less.

For the present discussion, the VaR method is notable in that it represents an analysis that is primarily focused on 'extreme' events. This is the opposite approach to that adopted by the CAA.

The importance of exceptional events in portfolio back-testing

In asset management, it is standard practice to highlight drawdowns during exceptional events. When back-testing their trading strategies, active investors such as hedge funds dedicate a section of the performance analysis to 'special' events such as those listed in the previous section.

For asset managers, outliers produced by exceptional events contain important information that should not be under-weighted, but rather highlighted in the analysis of past portfolio performance.

The main takeaway from this section is that, in the context of risk management, financial institutions pay particular attention to extreme events that are contained in the tails of the distribution of expected returns.

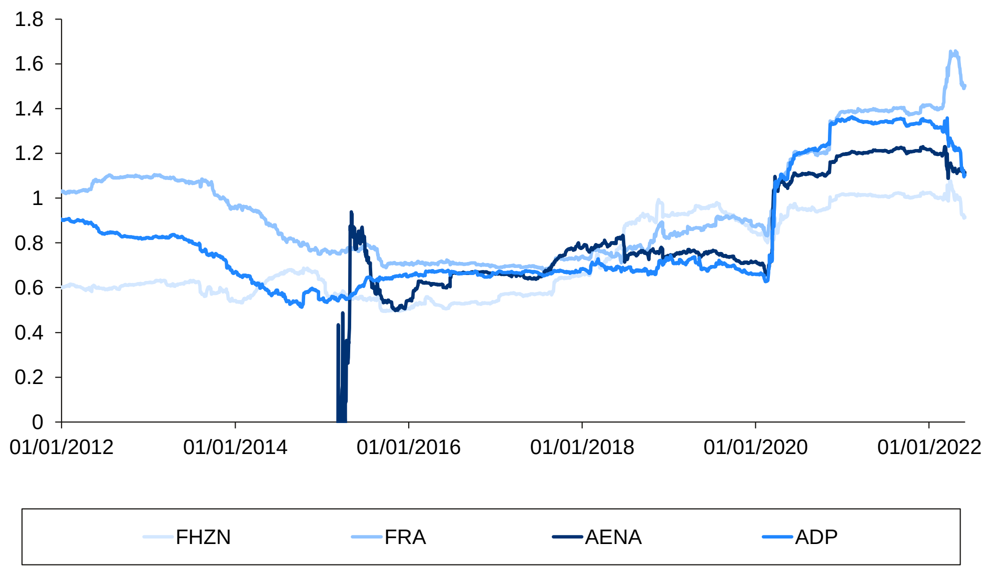
4 Proposed methodology and estimates of asset betas

In this section we propose our estimation of asset betas, based on an approach that relies simply on the available data without any artificial manipulation or selection. We regard this approach as scientific and in line with well-established regulatory practice.

4.1 Evolution of betas of comparable airports

Figure 4.1 and Figure 4.2 illustrate the equity betas of a selected group of airports. The equity betas are estimated by regressing the returns of the stock on the returns of the Stoxx Europe 600.[14] A window of two years is used to estimate the two-year beta and a window of five years is used to estimate the five-year beta, and non-traded days are excluded from the sample.

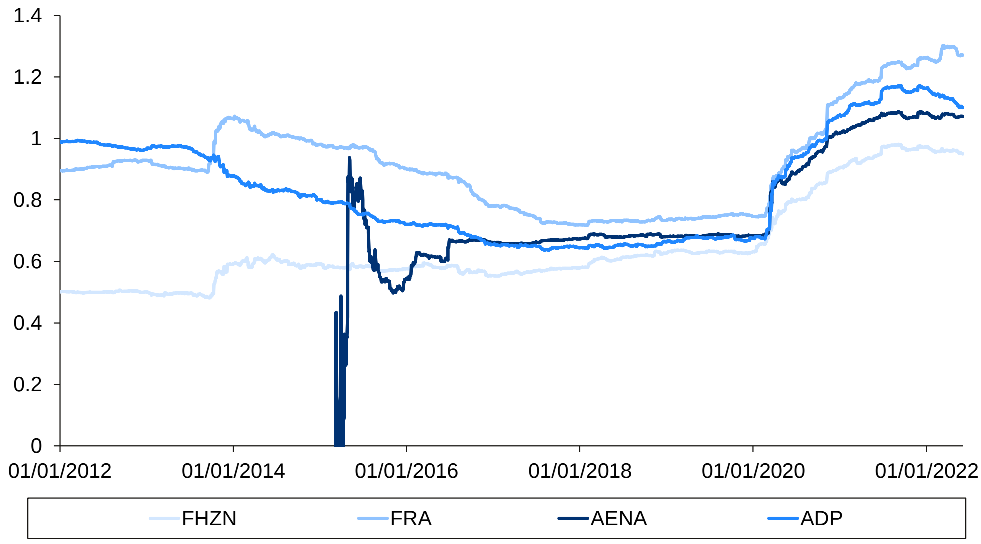
Figure 4.1 Two-year equity betas of airports



Source: Oxera analysis based on data from Bloomberg.

[14] For the purpose of being consistent with the CAA's FPs, the equity betas for all airports and airlines set out in this report are estimated based on the returns of the STOXX Europe 600 index.

Figure 4.2 Five-year equity betas of airports



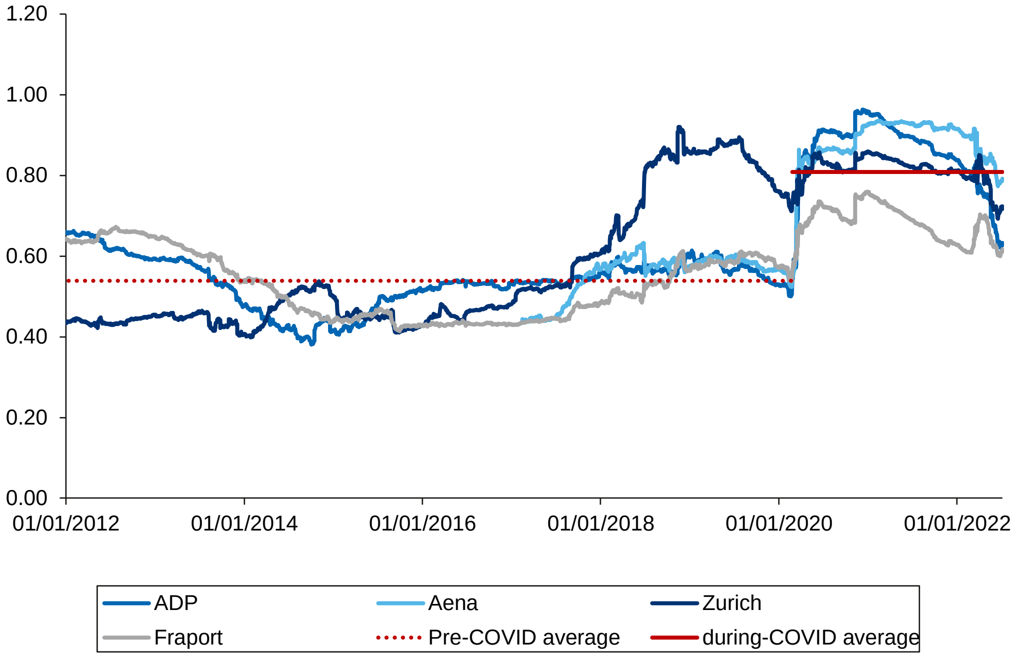
Source: Oxera analysis based on data from Bloomberg.

Figure 4.3 and Figure 4.4 show the two-year and five-year daily asset betas of the sample of airports considered. The asset betas are derived by de-gearing the equity beta using the Harris-Pringle formula and the average gearing over the same period—i.e. two-year average gearing for the two-year beta and five-year average gearing for the five-year beta. A debt beta of 0.05 is assumed to de-gear the equity beta.

The during-COVID average is still higher than pre-COVID (the period between the beginning of January 2010 and the end of February 2020), and the high volatility in March 2020 has now dropped out of the two-year estimation window.

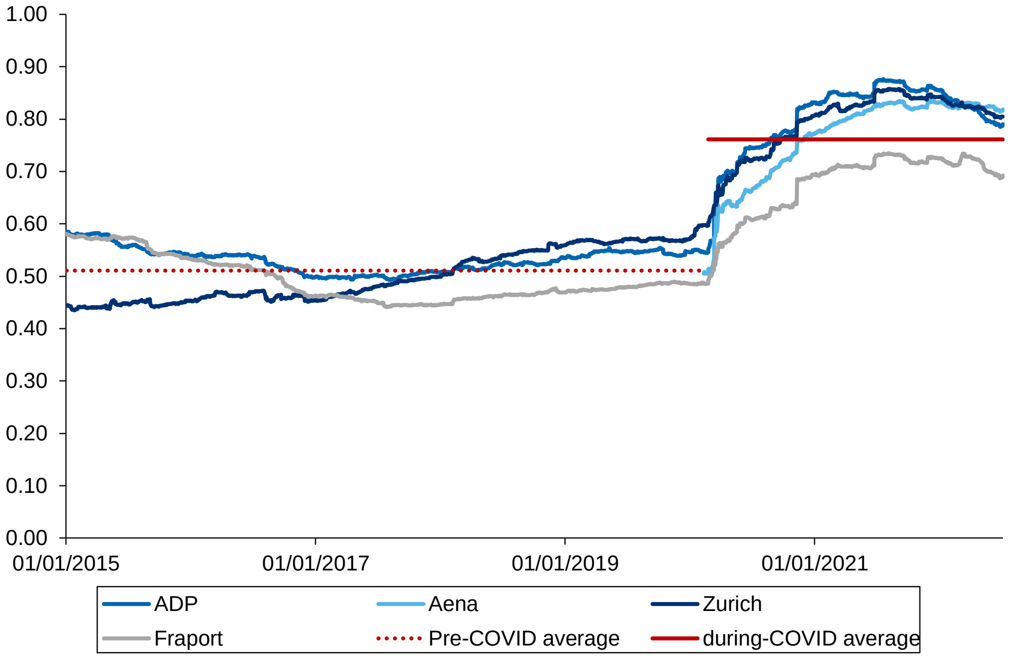
The recent behaviour of betas, and the corresponding impact on the updated estimates, provide further reason for adopting an approach that excludes any manipulation or selection of the data employed in the analysis.

Figure 4.3 Two-year asset betas of airports



Source: Oxera analysis based on data from Bloomberg.

Figure 4.4 Five-year OLS asset betas of airports

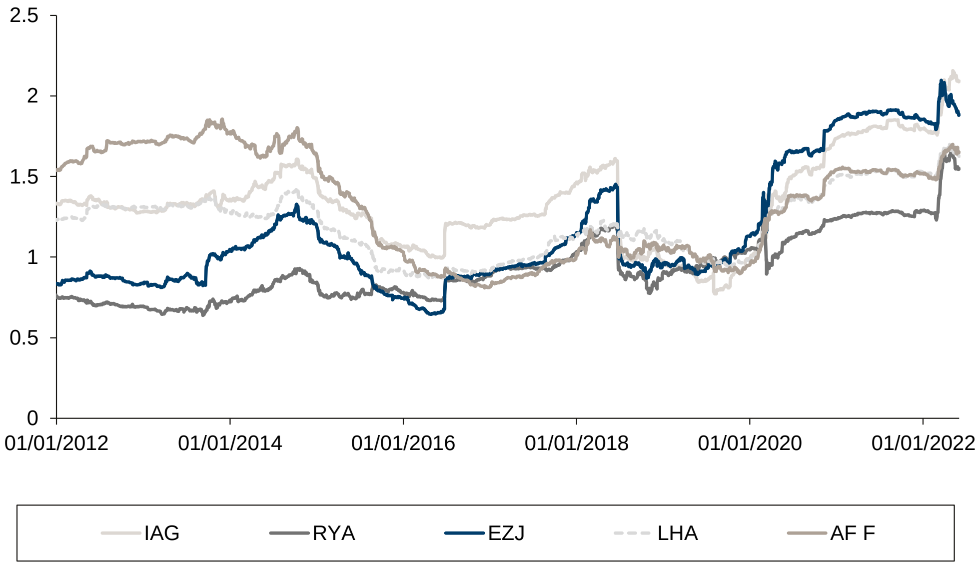


Source: Oxera analysis based on data from Bloomberg.

4.2 Evolution of the betas of selected airlines

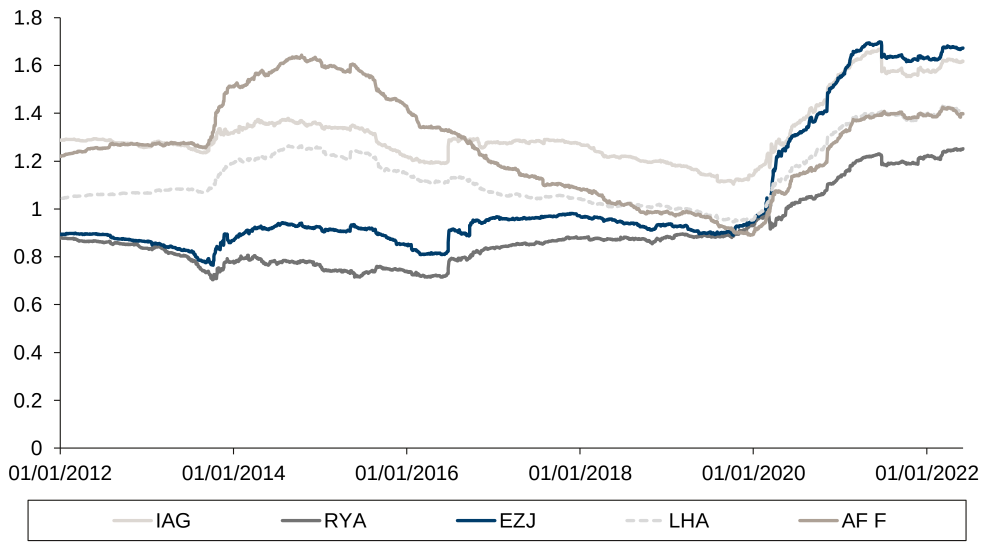
In this sub-section, we present the evolution of betas of a selected group of airlines. Figure 4.5 and Figure 4.6 illustrate the equity betas of a selected group of airlines.

Figure 4.5 Two-year equity betas of selected airlines



Source: Oxera analysis based on data from Bloomberg.

Figure 4.6 Five-year equity betas of selected airlines

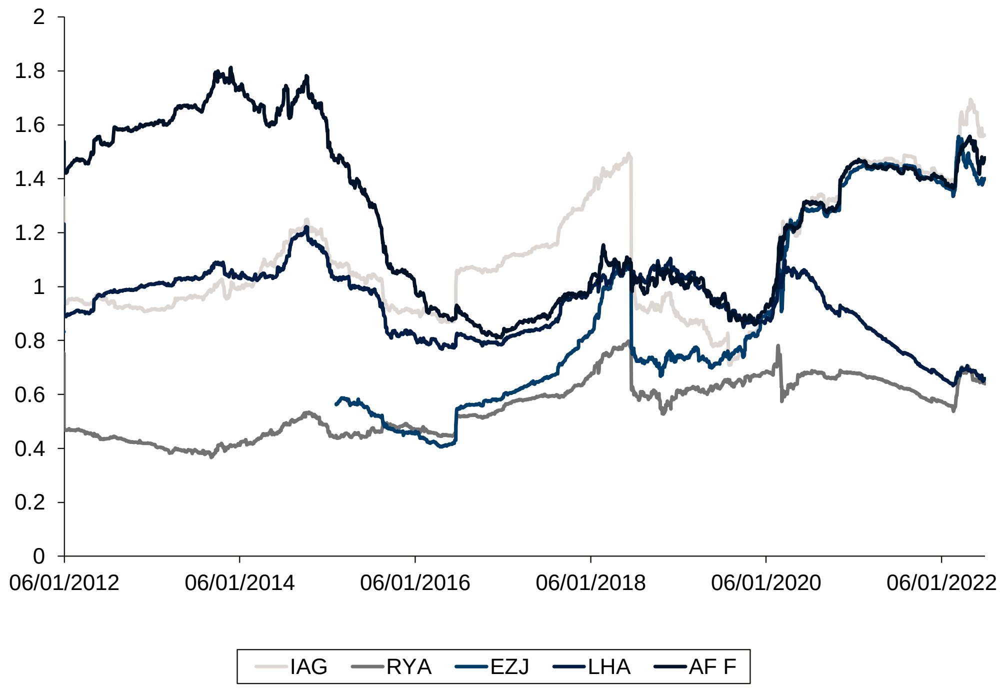


Source: Oxera analysis based on data from Bloomberg.

Figure 4.7 and Figure 4.8 show the two-year and five-year daily asset betas of the sample of airlines considered.

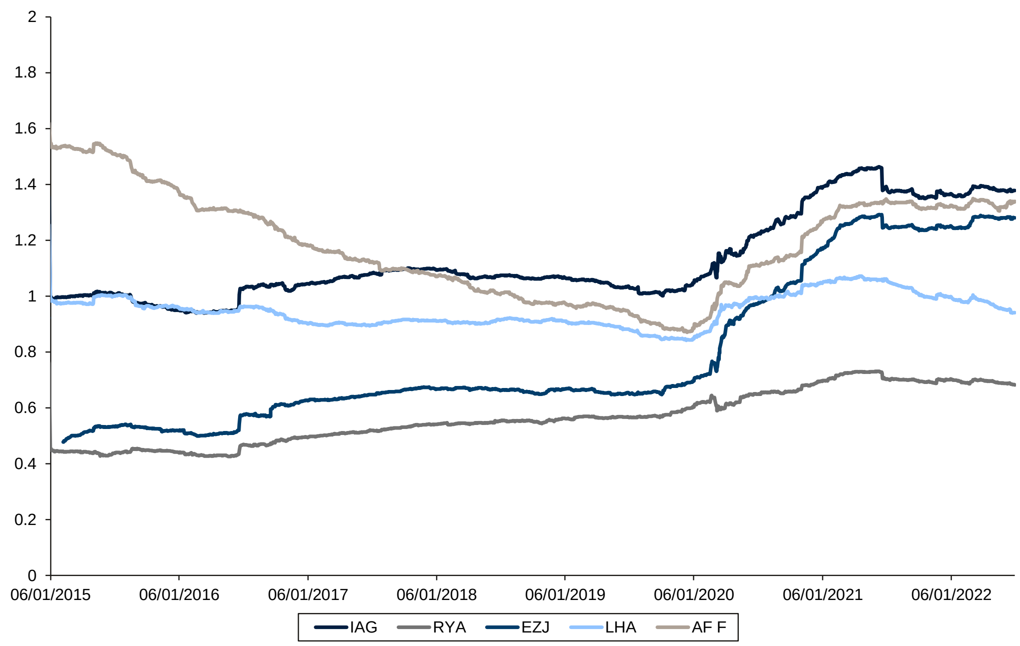
The graphs show that both the two-year and the five-year betas remain higher than the pre-pandemic levels. Furthermore, there has been a divergence between the betas of airlines with operations more weighted towards the UK compared with those more weighted towards mainland Europe, suggesting that the upward trend in the betas of European airports may underestimate the increase in the beta of HAL.

Figure 4.7 Two-year OLS asset betas of selected airlines



Source: Oxera analysis based on data from Bloomberg.

Figure 4.8 Five-year OLS asset betas of selected airlines



Source: Oxera analysis based on data from Bloomberg.

4.3 Asset betas of airports versus the index

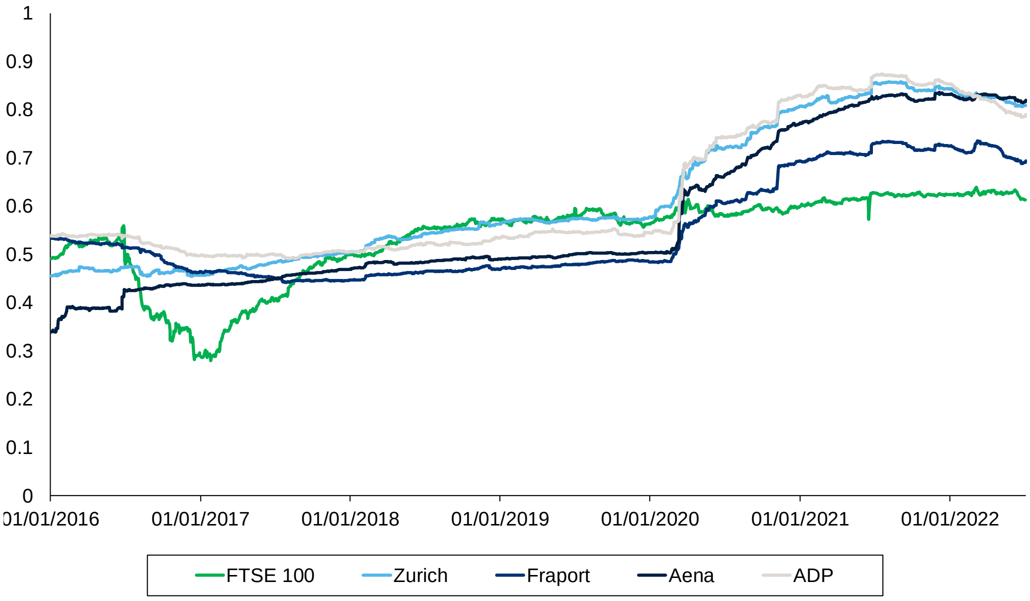
Figure 4.9 below depicts the five-year daily weighted average asset beta for FTSE-100 constituents and for comparator airports.

In order to construct the weighted average asset beta for FTSE-100 constituents, we have first estimated the beta of each single equity in the index. We have then de-geared the equity betas using the firm-specific average leverage over the previous five years, to obtain the corresponding firm-specific asset beta. We have then computed the weighted average of the asset betas using each firm's market capitalization as weight.

The asset betas of all airports are now significantly higher than the average asset beta of the constituents of the FTSE-100. In other words the asset risk of this sample of airports is higher than that of an average company.

We have cross-checked this result against the constituents of the FTSE All-share index which as at 4 July 2022 had gearing of 26% on average, weighted by market capitalisation. This implies a weighted average asset beta of around 0.75 for the FTSE All-share.[15] With the exception of Fraport, the asset risk of the comparator airports is higher than the average company in the FTSE All-share.

Figure 4.9 Five-year daily asset betas of selected airports versus weighted asset beta of FTSE 100 constituents



Source: Oxera analysis based on data from Bloomberg.

4.4 Proposed estimates for asset betas of HAL

Table 4.1 and Table 4.2 contain our estimates for the asset betas of HAL based on daily and weekly returns respectively. The average of the sample is calculated by placing equal weight on the spot estimates of the different airports in the sample. We also show the average excluding Fraport due to the different risk characteristics compared with the other airport stocks, not least of which is the large amount of state aid received by Fraport during the COVID pandemic.

For the daily asset betas, the two-year average estimate based on data available until 4 July 2022 is 0.687 (range of 0.611–0.787), while the corresponding figure for five-year betas is 0.774 (range of 0.689–0.816).

For the weekly asset betas, the two-year average estimate based on data available until 4 July 2022 is 0.755 (range of 0.665–0.849), while the corresponding figure for five-year betas is 0.818 (range of 0.799–0.860).

[15] Assuming a debt beta of 0.05, although the result is relatively insensitive to this assumption.

An illustrative partitioning of the data into pre- and post-February 2020 shows that the average asset beta for the sample has increased significantly for both daily and weekly data.

Table 4.1 Daily asset betas for comparators

Capital asset pricing model betas	Latest available data (4 July 2022 cut-off)		Pre-pandemic data only (Feb 2020 cut-off)		During-pandemic data only (4 Feb 2020 to 4 July 2022)
Regression period	**2-year**	**5-year**	**2-year**	**5-year**	
AdP	0.626	0.787	0.505	0.546	0.762
Aena	0.787	0.816	0.524	0.506	0.868
Zurich	0.723	0.805	0.712	0.597	0.770
Fraport	0.611	0.689	0.539	0.486	0.594
Average	0.687	0.774	0.570	0.534	0.749
Average (excl. Fraport)	0.712	0.803	0.580	0.549	0.800

Note: The average is calculated as the mean of the beta of the four airports in the sample at the cut-off date of interest. The figures refer to a spot estimate of the two- and five-year betas at the cut-off date of interest.

Source: Oxera analysis using Bloomberg data.

Table 4.2 Weekly asset betas for comparators

Capital asset pricing model betas	Latest available data (4 July 2022 cut-off)		Pre-pandemic data only (Feb 2020 cut-off)		During-pandemic data only (4 Feb 2020 to 4 July 2022)
Regression period	**2-year**	**5-year**	**2-year**	**5-year**	
AdP	0.682	0.811	0.725	0.575	0.749
Aena	0.826	0.801	0.590	0.478	0.829
Zurich	0.849	0.860	0.549	0.561	0.869
Fraport	0.665	0.799	0.586	0.510	0.689
Average	0.755	0.818	0.612	0.531	0.784
Average (excl. Fraport)	0.786	0.824	0.621	0.538	0.816

Note: The average is calculated as the mean of the beta of the four airports in the sample at the cut-off date of interest. The figures refer to a spot estimate of the two- and five-year betas at the cut-off date of interest.

Source: Oxera analysis using Bloomberg data.

5 Traffic risk-sharing mechanism adjustment

5.1 Background

In its April 2021 Way Forward document, the CAA first set out its intentions for introducing a TRS mechanism for the H7 price control. The CAA cited three main motivations for the proposed mechanism:[16]

1. limiting the risks of windfall gains or windfall losses associated with the recovery in passenger traffic volumes;
2. reducing upward pressure on HAL's cost of capital, which would lead to a direct and immediate increase in airport charges;
3. facilitating the certainty and advantages for stakeholders of the H7 price control while helping to clarify the risks that HAL is expected to bear during that period.

In its Initial Proposals, the CAA formally proposed the TRS mechanism, which was later revised substantially in the Final Proposals. The latest version of the TRS states that, for each calendar year during the price control period, the difference between realised revenues and forecast allowed revenues will be calculated by multiplying the maximum allowable airport charge for that year by the difference between outturn passenger numbers and the CAA's forecast of passenger numbers.[17]

Specifically, for each year during the price control period, the amount of risk sharing will be:

- 50% of any difference up to 10% of forecast allowed revenues;
- 105% of any difference above 10% of forecast allowed revenues.

The CAA explained that the risk shared for each year t will be recovered over a ten-year period on a present-value (PV) basis, starting at year t+2. For years that fall within the H7 price control period, recoveries will be applied in the form of an increase to the revenue requirement and the airports charges cap. For those years outside the H7 period, adjustments to the regulated asset base (RAB) will be made at the start of the H8 period.[18]

As a result of the introduction of the TRS mechanism, the CAA has proposed downwards adjustments to Flint's estimates of HAL's asset betas, on the grounds that the TRS would help to reduce HAL's financial exposure to traffic risks relative to comparator airports. To quantify the risk reduction resulting from the TRS, the CAA compared its estimate of the pre-TRS asset beta for HAL (0.52-0.71) with the average of the PR19 and RIIO-GD2/T2 asset beta (0.342).The regulator concludes that demand risk is the main driver of the differences in these asset betas. Without the support of any empirical evidence, the CAA simply assumes that traffic risk accounts for between 50% and 90% of the difference.[19]

[16] Civil Aviation Authority (2021), 'Economic regulation of Heathrow Airport Limited: Consultation on the Way Forward', April, p. 60.
[17] Final Proposals, section 1, para. 2.36.
[18] The CAA explains that HAL will be able to update its RAB during the course of H7 to reflect these adjustments, but the only impact on charges during H7 will be through the direct uplifts to the revenue requirement.
[19] Final Proposals, section 3, para. 9.158.

The CAA then assumes that the TRS mechanism will reduce HAL's exposure to traffic risk by 50%, on the basis that the TRS mechanism will help HAL reduce 50% of traffic-related revenue loss / gain for up to 10% of deviation from the traffic forecast. Multiplying the estimated traffic risk differential of 50–90% and the estimated traffic risk reduction of 50% by the difference between the pre-TRS asset beta and the average of the PR19 and RIIO-GD2/T2 asset beta, the CAA calculates the impact of TRS on asset beta to be 0.08–0.09.[20]

5.2 Summary of Oxera's responses

We do not disagree that in theory the protections provided by a TRS mechanism can help to reduce HAL's volume risks (part of which are systematic risks). However, the CAA has overlooked numerous factors that could significantly impair the systematic risk reductions provided by the TRS, and has estimated the impact of TRS on HAL's asset betas based on a framework largely supported by arbitrary assumptions rather than evidence.

The CAA's approach to estimating the impact of TRS on asset beta is incorrect, for six main reasons.

First, as acknowledged by the CAA itself, the CMA has decided against using the betas of UK utilities in calculating an estimate of NERL's beta. This is relevant because NERL also has a TRS mechanism. The CAA's own advisers, CEPA, also pointed out that there are other drivers of the differences in systematic risks between energy/water and HAL. We discuss this in more detail in section 5.3.

Second, the CAA was wrong to assume that the TRS mechanism would reduce HAL's exposure to traffic risks by 50% under non-pandemic traffic shock scenarios. While, mechanistically, the TRS proportionately compensates for the lost revenue, the existence of fixed costs and correlations between airport charges and non-aeronautical revenue lead to lower risk-sharing in terms of profits. The CAA's own analysis shows that the TRS mechanism will protect HAL from around 43–45% of the expected overall impact on its EBITDA of traffic levels being up to 10% higher or lower than expected.[21] In our analysis in section 5.3, we use the CAA's PCM to show that even under the assumptions of the CAA, the TRS mechanism can provide a profitability and liquidity risk reduction of only 4–14% during the H7 price control period.

Third, although the TRS mechanism provides risk-sharing on an NPV basis over a ten-year period, it does not address any liquidity issues faced by HAL in low-traffic scenarios. This concern was shared by credit rating agencies, and we discuss it in more detail in section 5.3.

Fourth, the risk-sharing provided by the TRS is based on the presumption that increases in allowed airport charges will lead to an increase in revenue. Since HAL's demand is price-sensitive, there is no guarantee that increasing prices will generate the additional revenue required under the TRS. The features of the airports market are different to those of water and energy networks, and a regulatory mechanism such as TRS cannot override these differences and make the demand for airports behave in a similar way to the demand for utilities. We set out the magnitude of the price increase required under low-traffic scenarios in section 5.3.

[20] Final Proposals, section 3, para. 9.158.
[21] Final Proposals, section 1, para. 2.41.

Fifth, the TRS is not a legally binding commitment, and regulators are not legally obliged to apply the proposed TRS under all circumstances. In section 5.5, we discuss in more detail how existing TRS mechanisms in regulatory precedents failed to function as originally intended during the COVID pandemic. This gap between the hypothetical and actual outcomes of TRS mechanisms suggests that investors would be less sanguine about the risk reduction properties of the TRS than the CAA is.

Sixth, the broader unreliability of the CAA's methodology is also demonstrated in its decision to use the average of the asset betas of PR19 and RIIO-GD2/T2 as the reference point. In fact, the comparability between energy and water betas and how they should be estimated is highly controversial and has been heavily disputed by companies and regulators. The CAA's approach of taking a simple average of the water and energy betas, without deliberating the analyses underlying each determination, calls into question the broader robustness of its framework for quantifying the impact of TRS, which appears to be largely based on assumptions not supported by evidence.

We have also performed an expected value cross-check on the asset beta reductions estimated by the CAA. Our analysis shows that, from the perspective of expected monetary pay-off, the proposed asset beta reduction of 0.08–0.09 is disproportionately large compared with the hypothetical protections provided by the TRS mechanism.

In sum, the CAA was incorrect to adjust HAL's asset beta downwards to account for the impact of the TRS mechanism. While the mechanism would in theory be expected to provide some reduction to the net exposure to systematic risks, these reductions are in practice likely to be small and of limited value to investors. The quantification of the adjustment by the CAA is largely based on arbitrary assumptions rather than being evidence-based. Applying downwards adjustments for the weak and uncertain TRS protections to the volatile and noisy asset beta estimates for comparator airports is more likely to reduce, rather than increase, the accuracy of the final asset beta estimate for HAL.

Below, we expand on points 1–5, as follows.

- section 5.3 considers the drivers of systematic risk differences between water/energy and HAL (point 1);
- section 5.3 relies on the CAA's PCM to quantify the expected risk-sharing under the different traffic scenarios modelled by the CAA. Our analysis focuses on the proportion of profit and liquidity losses shielded by the TRS (points 2 and 3) in the pandemic and non-pandemic low-traffic scenarios, and the increase in allowed airport charges required for HAL to recover its losses under the proposed TRS mechanism (point 4);
- section 5.5 examines the implementation of TRS mechanisms in the context of airport and air traffic control regulation, and why these mechanisms have proved ineffective in practice (point 5);
- section 5.6 presents a cross-check on the proposed TRS for H7, which shows that HAL's probability-weighted expected payoff from the TRS mechanism is significantly lower than its expected loss of regulatory revenue resulting from the asset beta deduction by the CAA.

5.3 The drivers of systematic risk differences between water/energy and HAL

The CMA has decided against using the betas of UK utilities in calculating an estimate of NERL's beta. This is relevant because NERL also has a TRS. In the CMA's view: 'NERL was exposed to additional risks that were likely to imply a materially higher beta than those comparators.'[22]

While evidence supports that the water and energy networks are exposed to significantly lower volume risks than NERL and HAL, it is inappropriate for the CAA to assume that volume risks account for 50–90% of the asset beta differentials. As acknowledged by CEPA, the risk differentials could also have been driven by non-aeronautical activity and counterparty risk embedded in the TRS:

> This [residual risk] could include the financial implications of non-aeronautical activity and longer-term valuation effects (around the value of growth options). We can also consider counterparty risk i.e. the value of the TRS in mitigating downside risk is based on airline passengers being willing and able to pay future charges to achieve the RAB compensation foreseen.[23]

Moreover, CEPA pointed out that, compared to regulated water and energy networks, HAL has 'the potential for changing forms of economic regulation in future due to market power assessments'. This difference is likely to imply higher regulatory risks for HAL.

For the CAA to assume that volume risk accounts for 50–90% of the asset beta differential between listed airports and UK utilities is arbitrary and reductions of this magnitude are not supported by any evidence.

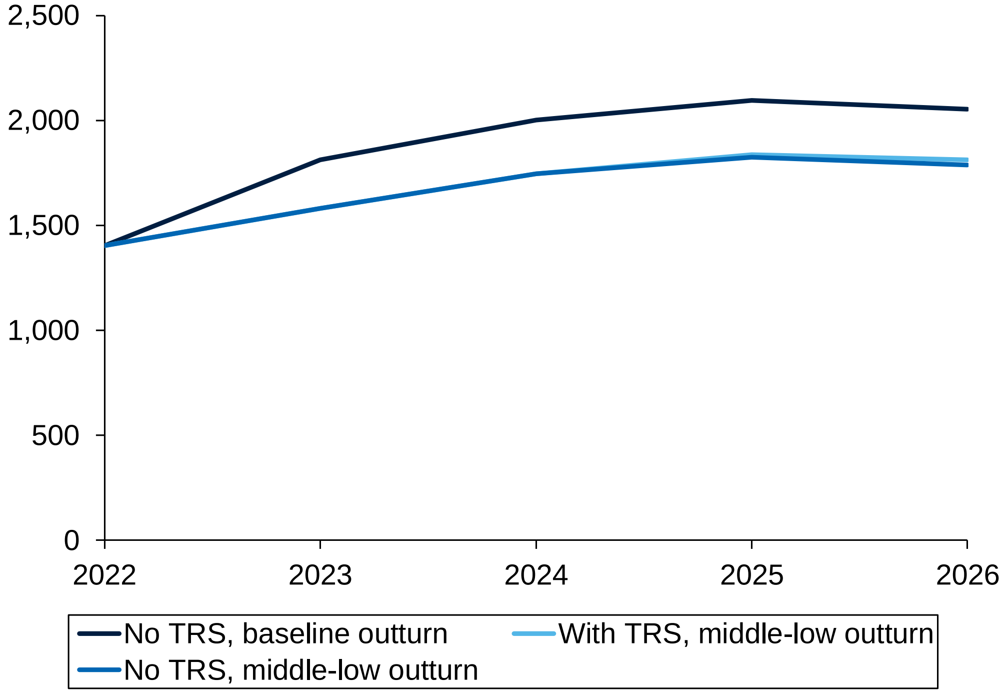
5.4 The amount of profit risk-sharing implied by the proposed TRS mechanism

In this sub-section we use the CAA's PCM for the H7 price control to quantify the impact of the TRS under various traffic scenarios modelled by the CAA. Specifically, we focus on the level of protection provided by the TRS mechanism against decline in liquidity and profitability in a number of low-traffic scenarios. We also quantify the impact of the TRS mechanism on the airport charges that would need to be set for future price controls. More details of our analysis can be found in Appendix A1.

First, the CAA did not consider the level of profitability and liquidity protections provided by the TRS mechanism. This is evidenced by the stress-testing scenarios modelled by the CAA. In the PCM model, a realistic 'middle–low' traffic profile assumes outturn traffic decline of 10% relative to the CAA's baseline forecast. Under this traffic profile, for each year, the TRS mechanism allows for 50% sharing of annual revenue losses over a ten-year period, subject to a two-year lag. The outturn EBITDAs assuming the baseline traffic profile and the middle-low traffic profile, both with and without TRS payments, are set out in Figure 5.1.

[22] CMA (2020), 'NATS (En Route) Plc /CAA Regulatory Appeal – final report', 23 July, para. 13.55.
[23] CEPA (2021), 'Response to CAA H7 Initial Proposals: Cost of Capital', 17 December, p. 48.

Figure 5.1 Outturn EBITDAs under baseline and middle-low traffic profiles (£m, nominal)



Note: 'No TRS, baseline outturn' is based on inputs for scenario 1, whereas both 'With TRS, middle-low outturn' and 'Without TRS, middle-low outturn' are based on scenario 4.

Source: Oxera analysis based on the PCM.

It can be seen that, due to the ten-year payback period and two-year lag underlying the TRS mechanism, HAL would receive an annual average EBITDA protection of c. 3.5% during the H7 price control period, with the rest accrued to its RAB and gradually paid back during the H9 and H10 price control periods. This shows that the TRS provides minimal immediate protection against realistic traffic shortfalls during the H7 price control period. Table 5.3 below provides a more granular breakdown of how the TRS mechanism protects HAL's revenue and EBITDA against middle-low traffic outturn.

Table 5.1 EBITDA protections provided by the TRS mechanism against middle-low traffic profile

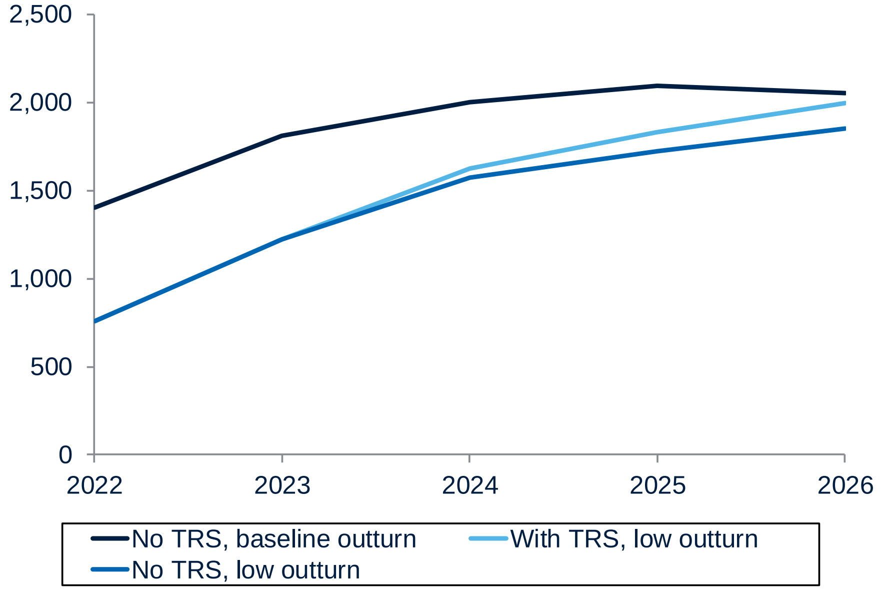
		2022	2023	2024	2025	2026
Forecast traffic (middle, million pax)		54.90	67.30	75.40	81.00	81.60
Outturn traffic (middle-low, million pax)		54.90	60.57	67.86	72.90	73.44
Difference (million pax)		**0.00**	**6.73**	**7.54**	**8.10**	**8.16**
TRS payments (£m)	[A]	0	0	0	11	24

Total airport charges revenue loss before TRS payments (£m)	[B]	0	200	214	221	215
% of airport charges revenue loss protection	[C] = [A] / [B]	n/a	0.0%	0.0%	5.1%	11.4%
Total EBITDA loss before TRS payments (£m)	[D]	0	233	256	269	266
% of EBITDA loss protection	[E] = [A] / [D]	n/a	0.0%	0.0%	4.2%	9.2%
% of revenue loss protection over H7	**[F] = Sum ([A]) / Sum ([B])**			**4.2%**		
% of EBITDA loss protection over H7	**[G] = Sum ([A]) / Sum ([D])**			**3.5%**		

Source: Oxera analysis based on the PCM.

The CAA also modelled HAL’s financial performance under the low-traffic scenario, where the annual outturn traffic is expected to decline 33%, 25%, 18%, 16% and 10% in 2022–26 respectively. Under this traffic profile, the level of risk-sharing increases due to the traffic variation of greater than 10%. HAL would receive an annual average EBITDA protection of c. 13.9% during the H7 price control period, still far less than the nominal PV protection of 50% highlighted by the CAA, as set out in Figure 5.2. The rest will be accrued to its RAB and gradually paid back during the H9 and H10 price control periods.

Figure 5.2 Outturn EBITDAs under baseline and low-traffic profiles (£m, nominal)



Note: ‘No TRS, baseline outturn’ is based on inputs for scenario 1, whereas both ‘With TRS, low outturn’ and ‘Without TRS, low outturn’ are based on scenario 2.

Source: Oxera analysis based on PCM.

Table 5.2 below provides a more granular breakdown of how the TRS mechanism protects HAL's revenue and EBITDA against low traffic outturn.

Table 5.2 EBITDA protections provided by the TRS mechanism against middle-low traffic profile

		2022	2023	2024	2025	2026
Forecast traffic (middle, million pax)		54.90	67.30	75.40	81.00	81.60
Outturn traffic (low, million pax)		36.98	50.34	62.04	68.35	73.26
Difference (million pax)		**17.92**	**16.96**	**13.36**	**12.65**	**8.34**
TRS payments (£m)	[A]	0	0	56	108	148
Total airport charges revenue loss before TRS payments (£m)	[B]	541	491	350	298	153
% of airport charges revenue loss protection	[C] = [A] / [B]	n/a	0.0%	16.0%	36.2%	96.7%
Total EBITDA loss before TRS payments (£m)	[D]	647	589	429	372	204
% of EBITDA loss protection	[E] = [A] / [D]	n/a	0.0%	13.0%	29.0%	72.7%
% of revenue loss protection over H7	**[F] = Sum ([A]) / Sum ([B])**			**17.0%**		
% of EBITDA loss protection over H7	**[G] = Sum ([A]) / Sum ([D])**			**13.9%**		

Source: Oxera analysis based on the PCM.

The level of EBITDA protection under the low-traffic scenario also depends on the assumptions for the elasticities of OPEX and non-aeronautical (commercial) revenue. While higher elasticities for OPEX mean that a higher proportion of profit losses is offset by the increased reduction in OPEX in low-traffic scenarios, higher elasticities for non-aeronautical revenue amplify the overall profit losses. We note that HAL disagrees with the CAA's assumptions for the elasticities. HAL's own analysis shows that the CAA overestimated the elasticities for OPEX and underestimated those for non-aeronautical revenue. Under HAL's elasticity assumptions, the levels of profitability and liquidity protection provided by the TRS would decrease even further.

The limitation of the TRS mechanism deferring recoveries into future price controls was also acknowledged by the credit rating agencies. For example, in July 2022 S&P stated that:

> the cash conversion period [provided by the TRS] is **not sufficient** to sustain credit metrics if an event like the COVID-19 pandemic should occur in the future. The recovery will start two years after the mismatch, and full recoverability will take 10 years.[24] [emphasis added]

The agency reiterated HAL's negative credit outlook after the publication of the Final Proposals.

Similarly, Moody's noted: 'any benefit of the traffic risk sharing mechanism **would not be immediately reflected in cash flows**, if the actual traffic performance were below the regulatory assumption'.[25] [emphasis added]

The above discussion calls into question the 50% traffic risk reductions used by the CAA in reducing HAL's unmitigated asset beta. In contrast, our analysis supports a profitability and liquidity risk reduction of 4–14% in H7 based on the CAA's own stress-testing scenarios, with the rest deferred to future price controls and subject to decisions by future regulators. We note that these estimates are likely to decrease further if we adopt HAL's estimates of the elasticities of OPEX and non-aeronautical revenue with respect to traffic volume.

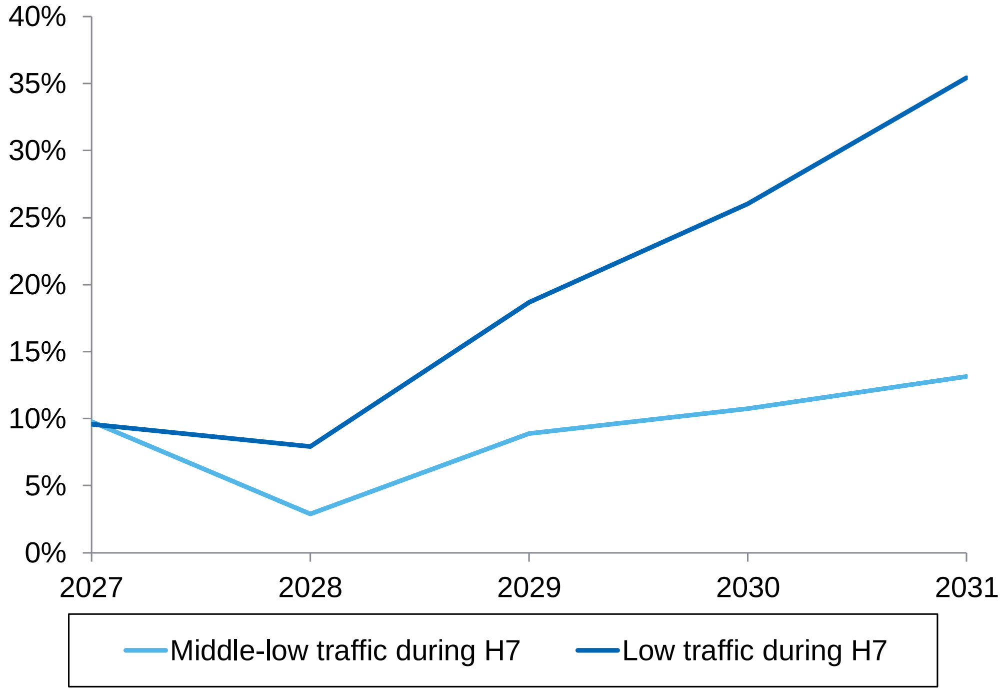
Second, the application of a TRS mechanism will require charges for airport users to be increased, when they are already facing the impact of low demand. This could make it difficult to adjust charges in the event of a significant downturn.

Figure 5.3 sets out the increase in airport charges during H8 implied by the PCM under various traffic profiles during H7. These increases are driven by the accrued TRS RAB adjustments during H7. On average, the airport charges would increase by 9.1% or 19.5% during H8 if the outturn traffic were middle-low or low, respectively, during H7. Without the support of any stress-testing modelling, it is incorrect for the CAA to presume that such increases in price would be sustainable in future price control periods. Moreover, the uncertainties surrounding the practicalities of implementing these price increases are likely to offset, at least partially, the risk reduction provided by the TRS. The features of the airports market are different to those of water and energy networks, and a regulatory mechanism such as TRS cannot override these differences and make the demand for airports behave in a similar way to the demand for utilities.

In section 5.5, we use regulatory precedents to show that, during the pandemic, established TRS mechanisms implemented prior to COVID have failed to function as they were originally intended.

[24] S&P Global (2022), 'Heathrow Funding Ltd. Class A And Class B Ratings Remain On CreditWatch Negative After Regulator's Final Proposals', 7 July.
[25] Moody's (2022), 'Heathrow Finance plc – update to credit analysis', 31 January.

Figure 5.3 Increase in airport charges during H8 (£m, nominal)



Note: Price increases are calculated based on profiled airport charges per passenger for middle-low traffic (scenario 4) and low traffic (scenario 2) without the TRS RAB adjustments, and the allowed charges with the TRS RAB adjustments. The allowed charges are computed by dividing the unprofiled allowed airport charges revenue by the realised passenger volume.

Source: Oxera analysis based on the PCM.

5.5 Review of TRS mechanism in the context of airport and air traffic control regulation

In this sub-section, we review the TRS mechanisms designed for AdP and ANSPs in Europe. We set out the details of these TRS mechanisms and show why during the COVID pandemic they have failed to function as originally intended.

5.5.1 Aéroports de Paris

For the 2011–15 charges period, the tariff cap determined in the economic regulatory agreement (ERA) for AdP incorporated an adjustment mechanism for deviations between outturn and forecast traffic. The mechanism is justified in the ERA as follows:[26]

> This adjustment factor is consistent with an equitable sharing of traffic risks between Aéroports de Paris and the airlines. Moreover, it is also in line with the specific nature of an airport operator's business model, whose cost structure is not very adaptable to the volume of activity in the short term.

This traffic adjustment method (the 'TRAF' factor) measured deviations in passenger traffic at Paris-Charles de Gaulle and Paris-Orly. The TRAF specified a buffer zone (set at ±0.5% annual variance in passenger traffic) within which no

[26] Aéroports de Paris (Economic Regulation Agreement 2011–15).

adjustment to the tariff formula was to be made. Beyond this buffer, 50% of the traffic deviation was applied to adjust all fee caps in the following year.

For the 2016–20 regulatory period, AdP proposed to extend this adjustment mechanism while introducing a different sharing rate, allocating more risk to airlines. In addition, it proposed to define a new zone that would replace the associated penalty with new capacity investments if a sharp rise in traffic required the provision of new airport infrastructure.

AdP proposed the following modifications to the mechanism:

- distributing traffic risk between airlines (bearing 70% of the risk) and AdP (bearing 30% of the risk);
- capping the TRAF factor at -0.5% to +0.2% of the tariff cap for each period of application;
- replacing the price penalty by new investments not included in the investment plan if the growth in passenger traffic exceeds 3.5%. Such new investments would be financed by the income generated by the additional traffic.

The 2016–20 ERA adopted the cap to the TRAF factor proposed by AdP (-0.5% to +0.2% of the tariff cap). Within these limits, the TRAF factor is then calculated such that 50% of the surplus or 20% of the shortfall in the projected income from fees is offset by an adjustment to the fee rates.

On 26 May 2020, citing the extreme traffic shock induced by the COVID pandemic, AdP announced the early termination of the 2016–20 ERA and termination of the public consultation document for the 2021–25 ERA.[27] The TRS mechanism and the TARF factor were effectively rendered obsolete, and as acknowledged by the CAA and its advisers, AdP's asset beta remains 'unmitigated'. This indicates that the TRS mechanism did not in practice provide much protection to AdP.

Advice provided to the CAA indicates that:

> AdP now has an annual price control which in principle mitigates traffic risks through annual recalculation of the price cap.[28]

Therefore, the beta of AdP since the early termination of the 2016–20 ERA represents a 'mitigated' beta, albeit the limited practical consequences of the TRS suggest little or no difference between the values of 'unmitigated' and 'mitigated' betas.

5.5.2 ANSPs

As another example, to allow for a longer recovery of the revenue lost by ANSPs in 2020 and 2021, a traffic risk-sharing mechanism applied in the European air traffic control sector has been temporarily modified over a five- to seven-year period, rather than the previous two-year period. However, similar to the CAA's proposed TRS mechanism, this does not help to address immediate cash-flow issues.

The regulatory framework for European air traffic control includes a volume risk-sharing mechanism that partially protects ANSPs from substantial fluctuations in traffic. The ANSP bears all the risk on differences of up to 2% from the forecast

[27] Groupe AdP (2020), 'Termination of the 2016-2020 Economic Regulation Agreement (ERA) and termination of the public consultation document for the 2021-2025 ERA', 26 May.
[28] Deloitte (2022), 'Review of the CAA's proposed traffic risk sharing (TRS) mechanism', 23 June, p. 24.

traffic levels (i.e. there is a 2% symmetrical deadband) and 30% of the risk on differences of up to 10%. For differences in excess of 10%, ANSPs are protected from all risk because it is passed through to users two years later (i.e. n+2).

In response to the exceptional circumstances of the COVID pandemic, the TRS scheme was amended for 2020 and 2021. In particular, a new target cost baseline for 2020 and 2021 was set based on the actual and expected cost savings by ANSPs. Moreover, the revenue recovery will be spread over a period of five to seven years starting from 2023 (instead of the previous two-year lag).

In summary, the examples of AdP and ANSPs show that TRS mechanisms, even when carefully designed following formal consultations with stakeholders, can, in pandemic-magnitude scenarios, fail to function as originally intended. There is no guarantee that the TRS mechanism proposed by the CAA will provide the theoretical protections detailed in the Financial Proposals. Investors still bear the risks of the TRS being suspended and/or modified in the face of extreme traffic shocks.

5.6 Expected value cross-check

In this sub-section, we draw on the CAA's own analysis of pandemic-magnitude events to show that HAL pays a very high monetary premium relative to the probability-weighted payout provided by the TRS mechanism.

As acknowledged by the CAA, the TRS mechanism does not compensate for the asymmetric downside risks borne by HAL. To compensate for this residual downside risk, the CAA estimated separate allowances for non-pandemic shocks (in the form of traffic forecast adjustments) and pandemic-magnitude events (in the form of direct revenue allowance). To estimate the allowances for pandemic-magnitude events, the CAA adopted a four-step approach:[29]

- **step 1**: estimate the traffic loss that HAL might expect to experience if a pandemic-magnitude event occurs;
- **step 2**: calculate the annual losses of profit that HAL would suffer if a pandemic-magnitude event were to crystallise in any given year during the H7 period;
- **step 3**: evaluate how frequently a pandemic-magnitude event might be expected to occur in future, and calculate the equivalent probability of a shock occurring in any given year;
- **step 4**: weigh the losses of profit identified in step 2 by the probability identified in step 3 and add these amounts to HAL's H7 aeronautical revenue allowance.

Table 5.3 and Table 5.4 set out the CAA's estimates of TRS payments following a pandemic-magnitude event, and HAL's probability-weighted, expected net loss due to pandemic-magnitude events.

[29] Final Proposals, p. 115.

Table 5.3 TRS ‘payments’ following a pandemic-magnitude event (£m, 2020 CPI-real)

	2022	2023	2024	2025	2026
If an event were to recur in:					
2023	-	1,217	1,368	534	-
2024	-	-	1,305	1,406	514
2025	-	-	-	1,341	1,355
2026	-	-	-	-	1,292

Source: Final Proposals, section 3, Table 11.3.

Table 5.4 Probability-weighted, expected net loss due to pandemic-magnitude events (£m, 2020 CPI-real)

	2022	2023	2024	2025	2026
If an event were to recur in:					
2023	-	6	9	7	-
2024	-	-	8	10	8
2025	-	-	-	10	10
2026	-	-	-	-	10

Source: Final Proposals, section 3, Table 11.4.

The CAA reduced the asset beta by 0.08–0.09 to account for the traffic risk reductions provided by the TRS mechanism. This exchange is economically similar to an insurance, which (partially) compensates purchasers of the insurance for their losses in low-probability bad states of the world. The difference between regular insurance and the TRS mechanism is that the latter is symmetrical, meaning that it also deducts economic benefits from the buyer (i.e. HAL) in good states of the world (i.e. upside traffic shocks).

While the TRS mechanism is symmetrical, as acknowledged by the CAA, risks of traffic shocks are asymmetrical and HAL faces more downside risks than upside risks. In economics terms, HAL is effectively paying for:

- symmetric reductions in traffic volatilities; and
- the asymmetric downside risk protections provided by the TRS mechanism.

The former is in theory value-adding to risk-averse investors, the latter can be categorised as an exchange of PVs between HAL and its users:

- HAL pays its users in the form of lower airport charges, which is transmitted through the asset beta deductions of 0.08–0.09;
- the airport users pays HAL an upfront revenue allowance for pandemic-magnitude events, and compensates part of HAL’s revenue losses if such an event materialises.

While the benefit of the symmetric component of risk reduction is unobservable and depends on the investors’ utility functions, the exchange of PVs can be quantified using the CAA’s estimates in the Final Proposals.

The PV of revenue losses from the TRS adjustments to asset betas, discounted using the allowed WACC, is approximately £691m (nominal).[30] This represents HAL's payment for the insurance. Discounting and summing the TRS payments set out in Table 5.3 results in £419m (nominal), which represents the monetary protections provided by the TRS against asymmetric downside traffic shocks.

In other words, HAL overpays its users £272m (calculated as £691m - £419m) in exchange for the symmetrical component of traffic risk reductions during H7. This represents a premium of over 65% on the monetary protections provided by the TRS mechanism (i.e. £419m). Thus, from an economics point of view, by adopting the CAA's method for asset beta deduction in the Final Proposals, HAL is very likely to be overpaying for the TRS protections.

The above calculations are likely to have underestimated the levels of overpayment. Since the TRS protects HAL against both systematic and non-systematic risks, the monetary protections provided by the TRS mechanism against systematic risks are likely to be lower than £419m. This means that HAL is likely to have overpaid a premium of higher than 65% (in the form of asset beta reductions) for the TRS mechanism.

[30] Calculated by summing the PV of revenue losses each year during H7, which are estimated by multiplying the pre-tax WACC differences resulting from the asset beta deductions (0.08–0.09) by the RAV [or RAB] estimated in the baseline scenario (scenario 1).

6 Why does the treatment of inflation matter?

This section explains the CAA's concerns about the regulatory treatment of inflation in the current environment.

- Section 6.1 shows that currently the forecast of inflation over the next price control period (the 'short term') is higher than the long-term forecast.
- Section 6.2 explains how the CAA proposes to deflate the allowance for the cost of debt by short-term inflation forecasts and how this results in a lower revenue allowance than if long-term forecasts had been used.

6.1 Short-term inflation forecasts are above the long-term level

Forecasts of inflation for converting nominal inputs into real WACC parameters are generally made over a 'long-term' horizon. However, there has been relatively little consideration in past UK regulatory price controls of what constitutes the 'long term'. Two options are the next price control period (the 'short term'), and a long-term horizon spanning multiple price control periods. At the current point in time, the inflation forecasts over these horizons differ significantly.

Table 6.1 presents forecasts of RPI inflation for the next five years, with the geometric average annual rate of inflation forecast to be 4.6% over this period. In contrast, the long-term forecast of the Office for Budget Responsibility (OBR) of RPI inflation is 2.7%, based on a long-term CPI of 2% (the Bank of England is tasked with setting monetary policy to achieve this level) and an estimated RP–CPIH wedge of 0.7%.[31] Using forecasts over the next five years instead of long-term inflation forecasts will therefore result in lower real allowances for parameters of the WACC where the inputs are expressed in nominal terms.

In UK regulated sectors, the main area where inputs are expressed in nominal terms is the cost of debt, given that the majority of observable data on the market cost of debt is expressed in nominal terms.

Table 6.1 OBR's RPI inflation forecasts

	2022	2023	2024	2025	2026
RPI	9.8	5.5	2.3	2.5	2.7

Source: Office for Budget Responsibility (2022), 'Economic and Fiscal Outlook', March, p. 72.

It is therefore important to determine which horizon should be adopted for the inflation forecasts used to determine the real WACC.

6.2 Inflation and the cost of debt in the H7 Final Proposals

The CAA proposes to deflate the nominal cost of Heathrow's fixed-rate debt (embedded and new) by the forecast of inflation over the H7 period rather than by long-term forecast inflation. Nominal fixed-rate debt is assumed to constitute 70% of the total debt of the notional capital structure of Heathrow.

The remaining 30% is assumed to be index-linked to inflation, which means that the real cost of this debt will generally be less affected by changes in inflation. The CAA uses historical long-term inflation expectations to derive the real cost of

[31] Office for Budget Responsibility (2022), 'Inflation', 25 April.

embedded index-linked debt from an estimate of the nominal cost of embedded debt. Long-term inflation forecasts, as of today, are used to derive the allowance for the real cost of new index-linked debt, from an estimate of the nominal cost of debt to be raised during H7.[32]

According to the CAA, '[this] approach to the cost of debt entails remunerating interest costs in full within the confines of each five-year regulatory period.'[33] This is only the case in expectation, because there will be no true-up of the real cost of debt allowance if actual inflation is different to forecasts. The CAA approach does not eliminate the risk that the real cost of debt and real equity returns will deviate from their expected values.

Following the approach proposed by the CAA would lead to annual revenues for HAL being approximately £135m lower than if a long-term inflation forecast of 2.73% were used to set the real cost of debt allowance.[34] It is therefore important to determine which horizon should be adopted for the inflation forecasts used to set the real cost of debt: the five-year regulatory period or the long term.

[32] Final Proposals, paras 9.232–9.235
[33] Final Proposals, para. 9.206
[34] Based on a difference of 183bp between the arithmetic average RPI inflation forecast over H7 (4.56%) used to deflate the nominal cost of embedded and new debt and the historical long-term RPI inflation forecast (2.73%) used by the CAA. The difference of 183bp is multiplied by the share of nominal fixed-rate debt (70%) in the total debt assumed for the notional capital structure and multiplied by notional gearing (60%). This gives a 77bp reduction in the real WACC. Based on the opening H7 RAB of £17.5bn, this is equivalent to a £135m reduction in annual revenue.

7 Is there a justification for regulatory change?

This section responds to the CAA inflation proposals and proceeds as follows.

- Section 7.1 reviews how inflation is compensated in the RAB-WACC model and how investors can use leverage to create a positive relationship between real equity returns and inflation, which can be used to hedge inflation-linked liabilities.
- Section 7.2 then reviews the inflation forecast horizons adopted by regulators and shows that there are several precedents for regulators adopting horizons that extend beyond the current price control period.
- Section 7.3 explains that regulators have not previously had a policy on how real equity returns should vary with inflation and that this exposure has been managed by companies through capital structure decisions.
- Section 7.2 presents historical inflation as evidence that investors have previously experienced negative impacts on real equity returns from the leveraged effect of inflation, and therefore that basing the real cost of debt allowance on forecasts limited to the H7 period would be asymmetric in effect.
- Section 7.5 explains that the proposed reduction in the level of real revenues when there is a high level of inflation uncertainty exposes HAL to a higher risk that inflation is significantly below assumptions and creates a greater financeability problem than in previous price controls.

7.1 Treatment of inflation in the RAB-WACC model

Investment in infrastructure is subject to the ‘hold-up’ problem. After the investment is made (‘sunk’), the regulator has an incentive to reduce the prices charged to customers to a level below that which is required to recover the total capital, financing and operating costs of the asset. Knowing that the regulator will have this incentive, investors do not invest unless protections are in place. The hold-up problem requires a mechanism that commits regulators and their successors to set prices such that the company can fully recover its total efficiently incurred costs.

The concept of the RAB was introduced for this purpose. It acts as a record of the value of capital that has been invested by companies to deliver services to customers net of the value of capital that has been charged to customers through the regulatory depreciation allowance.

The RAB needs to be financed through a mixture of different forms of debt and equity capital. As it contains long-term assets, it is generally financed through long-term debt that spans multiple price control periods. The required return on the RAB is the WACC.

Compensation for inflation is part of the cost of financing the RAB and is related to the WACC. This compensation can be based on expected inflation or actual, out-turn inflation. The former approach is usually implemented through a regulated revenue allowance for WACC that is set in nominal terms and fixed for the duration of the price control (e.g. BT Openreach). The latter approach is implemented by indexing the RAB to actual inflation and setting the regulated WACC allowance in real terms based on a forecast of inflation. As the RAB is generally financed using long-term debt, deflating nominal inputs for the cost of debt using long-term inflation forecasts spanning multiple price control periods is consistent with how the cost of this debt was determined in the capital markets.

The 'indexed RAB/real WACC' approach is prevalent in UK regulated sectors and has two properties:

- the real value of the RAB is held constant, relative to whichever measure of inflation it is indexed by;
- although the regulated WACC allowance is set in real terms based on a forecast of inflation, it is multiplied by a RAB that is indexed to actual inflation.

Therefore an investment in the RAB is 100% hedged against changes in inflation.[35] Real returns on the RAB will not vary if inflation deviates from long-term forecasts.

Full preservation of the real value of the RAB is valuable and particularly attractive to classes of investors that require a hedge against inflation. For example, Ofgem recognised this in 2018 in its RIIO-2 Framework Consultation when evaluating whether changing the regulatory model to set allowed returns on a nominal instead of a real basis would be a suitable approach for addressing financeability concerns. Ofgem stated:

> This option would be a significant change to the regulatory framework. Changing the way we pay the return could reduce demand from investors with inflation-linked liabilities (eg pension funds) who are looking for inflation-proof investment opportunities. It could also have an impact on companies that have large inflation-linked liabilities.[36]

The use of nominal fixed-rate debt by companies means that the real return on equity will positively co-vary with deviations of actual inflation from forecasts. This means that equity in inflation-linked regulated assets provides a leveraged exposure to inflation. Investors with inflation-linked liabilities, such as pension funds, can therefore use a leveraged position in the equity of regulated assets to hedge the inflation risk of a larger portfolio of liabilities. As inflation-linked assets are relatively scarce, this ability to obtain leveraged exposure to inflation is valuable to investors. It is a fundamental reason why certain types of investor are prepared to provide equity to inflation-linked assets.

7.2 Regulatory precedent on inflation forecast horizon

It is unclear whether the CAA applied a short- or long-term forecast of inflation to derive the cost of debt for Q6, but the determination implies an inflation rate lower than the forecast for Q6 and more in line with the long-term forecast. In other regulated sectors, there is clear precedent for regulators deflating the cost of debt using inflation forecast horizons that extend beyond the current price control period.

7.2.1 CAA

In its Final Proposals for Q6, the CAA examined inflation forecasts from a variety of sources including the OBR, Consensus Forecasts and HM Treasury's survey of independent forecasters, which suggested an RPI inflation of 3.0–3.4% for Q6.[37] These inflation estimates overlapped with those adopted for the CAA's price cap modelling (3.0–3.1%). On this basis, the CAA adjusted the real cost of new debt estimated by PwC (2.6%) downwards by 10bp to 2.5%.[38] Given that PwC assumed an inflation rate of 2.8%, the CAA's adjustments imply an inflation

[35] Setting aside the question of whether OPEX is adequately hedged against inflation.
[36] Ofgem (2018), 'RIIO-2 Framework Consultation', March, para. 7.79.
[37] Civil Aviation Authority (2013), 'Estimating the cost of capital: a technical appendix to the CAA's Final Proposal for economic regulation of Heathrow and Gatwick after April 2014', October, para. 6.60.
[38] Ibid., para. 6.68.

of 2.9%, which is below the low-end inflation forecast for Q6. It is unclear whether 2.9% represents a short- or long-term forecast, but we note that it was broadly aligned with long-term forecasts made at the Q6 price review.

7.2.2 Ofgem

In the RIIO-2 Framework Consultation, Ofgem noted the advice from the UKRN cost of capital study and proposed to use long horizons for looking at historical data, forecasting the future, and for assumptions on investment holding periods.[39]

In the RIIO-2 Sector Specific Methodology Decision, in rejecting the suggestion made by one company to align the calculation of the expected RPI–CPIH wedge to the price control period, Ofgem stated:

> To do so would considerably shorten the investment horizon, and contradict our decision in July 2018 to consider a long-horizon approach for all cost of capital components. We continue to believe that the cost of capital should be estimated over a long horizon, and propose to do this consistently for all aspects of the cost of capital, including debt and equity, and therefore, a long horizon is necessary for estimating real costs of debt and real costs of equity.[40]

In the same document Ofgem stated specifically in relation to the real cost of debt:

> We continue to believe that a long-term estimate of inflation expectations is more appropriate for deflating an index based on long-term debt rates.[41]

In the RIIO-2 Final Determinations Ofgem deflated the nominal iBoxx cost of debt index using the most distant forecast of CPIH inflation provided by the OBR.[42] This forecast is for annual inflation at a five-year horizon and therefore does not include forecasts of inflation for the earlier years of the price control and serves as a proxy for the long-term expected rate of inflation.

7.2.3 Ofwat and the CMA

In PR19, Ofwat adopted a long-term view for its inflation estimates, including a Bank of England long-term CPI target of 2.0% and an OBR long-term RPI–CPI wedge of 1.0%.[43]

Ofwat’s PR19 approach assumed that: (i) CPIH is 2.0%, based on the assumption that the Bank of England will hit its **2.0% CPI inflation targets over the long term**, and that CPIH will not systematically be higher or lower than this; and (ii) RPI is 3.0%, based on the assumption that the OBR estimate of the **long-term RPI–CPI wedge is 1.0%**.

In the PR19 appeals, Yorkshire Water argued that, because inflation at the time of the appeals was known to be below target in the first year of PR19, a lower inflation estimate for the price control is needed to recover the nominal cost of capital in full, and to avoid weakening of interest coverage ratios.

While the CMA acknowledged Yorkshire Water’s arguments and agreed that adjusting the price control to reflect short-term inflation forecasts would result in

[39] Ofgem (2018), ‘RIIO-2 Framework Consultation’, March, Appendix 2.
[40] Ofgem (2019), ‘RIIO-2 Sector Specific Methodology Decision – Finance’, May, para. 3.40.
[41] Ofgem (2019), ‘RIIO-2 Sector Specific Methodology Decision – Finance’, May, para. 2.85.
[42] Ofgem (2021), ‘RIIO-2 Final Determinations – Finance Annex (REVISED)’, 3 February, p.10.
[43] Competition and Markets Authority (2021), ‘Anglian Water Services Limited, Bristol Water plc, Northumbrian Water Limited and Yorkshire Water Services Limited price determinations – Final report’, 17 March, para. 9.18.

additional revenue for the companies,[44] it decided against adopting short-term inflation for the PR19 price control.

The CMA explained that the real cost of capital for the entirety of the PR19 price control period should not be based on 'what could prove to be temporarily distorted figures'.[45]

As a concluding remark, the CMA noted that 'using a longer-term estimate is **the fairest way** to calculate the real cost of capital at this time.' [emphasis added] It pointed to historical periods of higher and lower inflation, which were met with corrective actions from the Bank of England that pushed average inflation back towards the long-term target within a short timeframe.[46]

7.3 Inflation risk allocation and management

Not only is the leveraged effect of inflation not new, it is not unique. Any debt in the capital structure will create a leveraged effect on real equity returns from any deviations in actual revenues or costs from their expected values. It is unclear why deviations in inflation should be treated any differently from the leveraged effect of deviations in other parts of the price control.

Investors in regulated assets commit capital for a long-term horizon—the average tenor at issuance of bonds is c. 20 years and equity investment horizons span multiple price control periods.[47] Investment and financing decisions will therefore put more weight on long-term inflation forecasts than forecasts for the next five years.

Unless a regulated company issues no fixed-rate nominal debt, equity investors will be exposed to the 'leveraged effect of inflation' and the associated risks if inflation deviates from forecasts. The amount of exposure increases as gearing increases. It is the decision of investors how much this exposure of equity to inflation risk should be hedged, either by issuing inflation-linked debt or by entering into inflation-linked swap contracts. Regulators have repeatedly stated that such decisions are for companies to make and not for regulators to prescribe.

Ofgem:

> We [Ofgem] consider it more appropriate that a network company's shareholders are instead exposed to these risks [network's decisions on debt type, tenor, timing and risk management], in common with corporates in the broader market.[48]

The CMA:

> the notional approach reflects the principle that companies and their investors are best placed to bear the risks associated with their borrowing choices.[49]

Ofwat:

---

[44] Competition and Markets Authority (2021), 'Anglian Water Services Limited, Bristol Water plc, Northumbrian Water Limited and Yorkshire Water Services Limited price determinations – Final report', para. 9.33.
[45] Ibid., para. 9.35.
[46] Ibid., para. 9.36.
[47] See, for example, Ofgem (2020), 'Consultation - RIIO-2 Draft Determinations – Finance Annex', p. 203.
[48] Competition and Markets Authority (2021), 'Cadent Gas Limited, National Grid Electricity Transmission plc, National Grid Gas plc, Northern Gas Networks Limited, Scottish Hydro Electric Transmission plc, Southern Gas Networks plc and Scotland Gas Networks plc, SP Transmission plc, Wales & West Utilities Limited vs the Gas and Electricity Markets Authority. Final determination. Volume 3: Individual Grounds', 28 October, para. 14.81.
[49] Ibid., 14.82.

> We [Ofwat] propose to assume a proportion of index linked debt in the opening balance sheet. Our decision on the proportion will be informed by the level of issuance across the sector.[50]

The current regulatory discussion suggests that regulators believe that the leveraged effect of inflation justifies amending the link between real equity returns and inflation. Relative to the current operation of the regulatory framework, this would reduce the allowed revenues of companies and customer bills when inflation is significantly above expectations. This would be a break from how the regulatory model has operated since privatisation and would be the first time that regulators have expressed a policy position on what should be the exposure of real equity returns to the risk that inflation deviates from long-term forecasts.

Companies already adopt policies for how much real equity returns should vary with inflation and achieve their chosen exposure by linking a proportion of their debt to inflation. They do this by either issuing index-linked bonds or entering into inflation-linked swaps. If regulators retrospectively decide that the exposure of equity to inflation risk should be reduced such that real returns on equity do not deviate from expected returns as a result of inflation, this equity risk profile is equivalent to having the entire debt book of the notional company indexed to inflation.

The impact of regulatory intervention in this manner is that capital structure decisions made in line with investor preferences regarding the exposure of real equity returns to inflation risk would now result in a different (lower) exposure to inflation risk. Companies that prefer having 100% of their equity being exposed to inflation will not be able to achieve their preferred equity exposure to inflation. Other companies with a relatively high proportion of inflation-linked debt may now experience real equity returns that are lower when inflation is above long-term expectations. These companies face additional financing costs in high-inflation environments, but would receive lower revenues than under the pre-existing regulatory framework.

In summary, the CAA has never prescribed a specific inflation risk policy. To do so now would retrospectively undermine the capital structing and financing decisions of HAL regarding the desired exposure of real equity returns to inflation risk, This would be expected to reduce the confidence of investors in the predictability and stability of the regulatory regime.

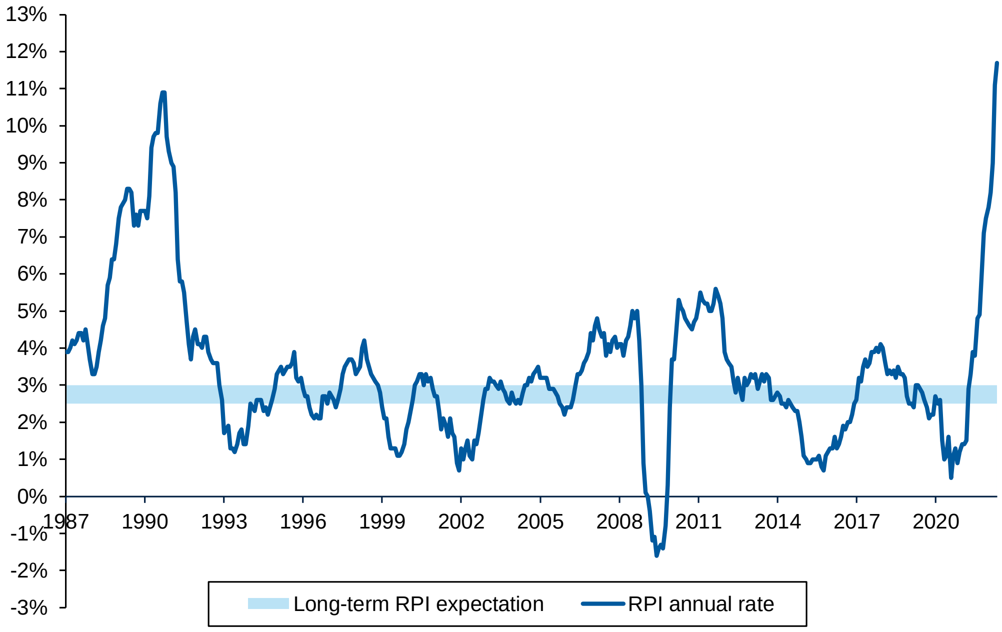
7.4 Historical variation in inflation

The leveraged effect of inflation on real equity returns is not a new effect—it has always existed in the regulatory model as applied in the UK, and capital has been invested on this basis.

Figure 7.1 below shows historical inflation rates. RPI is depicted as it was the relevant measure of inflation for indexing the RAB and setting allowed returns on capital until recently. The chart begins in 1987, the year after BAA was privatised. Inflation has been below long-term expectations on multiple occasions since privatisation (1993–94; 1999–2000; 2001–03; 2009; 2015–17).

[50] Ofwat (2022), 'Creating tomorrow, together: consulting on our methodology for PR24', p. 101.

Figure 7.1 Historical RPI inflation



Source: Oxera analysis based on ONS data.

These periods have resulted in real equity returns and customer bills being lower than expected. Regulators have not sought to intervene during these episodes in response to either forecast or actual inflation being lower than the long-term average. This illustrates that equity bears the leveraged effect of inflation and the notional company has previously experienced periods when real returns have been lower than expected when the price control was set.

In the current high-inflation environment, basing the real allowance for the cost of long-term debt on short-term inflation forecasts, would be asymmetric. Specifically, this would claw back benefits that investors would expect to receive from the embedded nominal fixed-rate debt currently being relatively cheap in real terms, without compensating for times when inflation was low or negative and the real cost of nominal embedded debt was relatively expensive.

7.5 The CAA's proposals increase financeability risk

Inflation is volatile but is a mean-reverting process. Annual inflation measured over the long run will be less volatile than annual inflation measured over the next five years. The Final Proposals therefore adopt a variable that has a wide range of potential outcomes (annual inflation for the next five years) in place of a variable with a much narrower range of potential outcomes (annual inflation over the long term). The proposed approach does not eliminate the risk to investors and customers that arises from the treatment of inflation, but instead increases the risk of using an inaccurate inflation forecast.

The impact of the Final Proposals is to offset an *expected* inflationary increase in revenue to HAL by making an actual fixed reduction to the calculated real revenue requirement that flows into the price cap. This reduction in the level of real revenues combined with a high level of inflation uncertainty exposes HAL to a higher risk that inflation is significantly below assumptions and creates a greater financeability problem than in previous price controls.

A1 The CAA Price Control Model (PCM)

For our analysis of the TRS mechanism in section 5, we have relied on the CAA's PCM, which was published together with the Final Proposals. Below, we set out the detailed methodology on how the PCM was used to produce outputs.

A1.1 EBITDA with / without TRS protections

Figure 5.1 and Figure 5.2 set out output EBITDA from the 'O_FinStats' sheet of the PCM model. To compute these underlying EBITDA estimates, we change the live scenario set out on sheet 'I_Scenarios':

- Figure 5.1 relies on Scenario 1 (baseline outturn traffic) and Scenario 4 (middle-low outturn traffic);
- Figure 5.2 relies on Scenario 1 (baseline outturn traffic) and Scenario 2 (low outturn traffic).

We note that the CAA has also modelled separately the OPEX and non-aeronautical revenue profiles for each of these scenarios.

To include/exclude the impact of the TRS mechanism during the H7 price control period, we include/exclude the allowed revenue adjustments provided to HAL throughout H7, which was modelled on sheet 'C_TRS' and added to the revenue allowance on sheet 'C_Revenue'.

A1.2 Increase in airport charges during H8

Figure 5.3 set out the increase in airport charges during H8. To compute these estimates, we rely on Scenario 2 and Scenario 4 of the PCM.

As modelled in the PCM, the increase in airport charges from the TRS during H8 is driven by the TRS RAB additions at the start of H8. This addition increases the revenue allowances throughout H8 via additional depreciation and return on the RAB; the former is explicitly computed on sheet 'C_TRS', and the latter can be directly calculated using the allowed WACC and RAB, both of which are set out in the model.

Having calculated the allowed revenue with and without the TRS RAB additions, we compute the airport charges using the realised passenger numbers in each scenario. The price increases are calculated by comparing the new airport charges that account for the TRS RAB additions with the profiled airport charges that exclude the RAB additions. The latter is computed internally in the PCM using a macro written by the CAA.

www.oxera.com

compelling economics