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Critique of 2023 IM Draft Decision on Asset Beta for NZ Airports

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1 Introduction

1. I, Tom Hird of [redacted] Victoria, Australia have been engaged by Russell McVeagh, on behalf of the New Zealand Airports Association, to provide an independent expert opinion on the New Zealand Commerce Commission's (NZCC) 2023 draft decision on asset beta for the New Zealand airports input methodology (IM).

2. I hold the following qualifications:
   - Bachelor of Economics (Honours First Class), Monash University (1989); and
   - PhD in Economics, Monash University.

3. From 1990 to 2000 (both prior to, during and after the completion of my PhD in economics) I was employed by the Australian Commonwealth Treasury. Since 2001 I have worked as a consulting adviser specialising in economics: first with Arthur Andersen, then NERA Australia and, since 2007, for my own firm (Competition Economists Group). I have advised private clients, regulators, and other Government agencies on a large number of cases specialising in finance theory.

4. I have more than 30 years of experience in the economic analysis of markets and in the provision of expert advice in regulatory, litigation and policy contexts. I have provided expert testimony before courts and tribunals and in numerous regulatory forums in Australia but also in the United Kingdom and New Zealand.

5. In completing this report, I have received assistance from my colleagues at CEG, Ker Zhang, Samuel Lam and Michael Boon. Notwithstanding this assistance, all of the opinions expressed in this report are my own.

6. In preparing this report I have had regard to the materials specifically identified throughout the report, in the form of footnotes or in the text.

7. I confirm that I have been referred to the Code of Conduct for Expert Witnesses (Code), as contained in Schedule 4 of the High Court Rules 2016 for New Zealand, and that this report, as well as my previous reports, have been prepared in accordance with that Code.

1.1 Report structure

8. The remainder of this report is structured as follows:
   - Section 2 provides an executive summary;
   - Section 3 summarises the draft decision;

- Section 4 explains why the best sample is one that tracks AIAL's asset beta in the long run but also provides a stable asset beta estimate. Section 4 explains that the 2016 IM sample does both while the 2023 draft decision does neither;
- Section 5 explains that the reason that the 2023 draft decision does not closely correspond to AIAL's asset beta is because the airports in that sample are, on average, very low risk (and much lower than New Zealand airports);
- Section 6 critiques the 2023 draft decision's basis for arriving at its narrow sample;
- Section 7 explains why I view the 2023 draft decision's reduction in asset beta in the wake of the evidence from the COVID-19 pandemic is unreasonable;
- Section 8 critiques technical problems with the 2023 draft decision's COVID-19 adjustments to asset beta;
- Section 9 details why I consider that no COIVID-19 adjustment to asset beta should be made and ongoing problems for future IMs associated with attempting to do so;
- Section 10 details what I consider to be a failure in the draft decision to address expert evidence (including from the NZCC's own experts) put before it; and
- Section 11 describes the implications for the travelling public of setting the compensation for airport risk too low.

2 Executive summary

2.1 Key conclusions

9. The draft decision arrives at an asset beta estimate for New Zealand airports of 0.55 which is below what I consider reasonable. The best estimate of asset beta for New Zealand airports is 0.81 which is the value derived from application of the 2010 and 2016 IM methodologies to the most recent 10 years of updated data.

10. I note that 0.81 is lower than the most recent 0.97 asset beta for Auckland International Airport Limited (AIAL) which is by far the best comparator to New Zealand airports. I nonetheless prefer an estimate of 0.81 because it is based on a larger sample of 24 comparators and the sample average is less volatile than AIAL's individual estimate while still providing a close approximation to AIAL's asset beta in the long run.

11. The draft decision asset beta of 0.55 is based on:

    a. A sample of AIAL plus 7 unrepresentative airports. With one possible exception (Zurich), these 7 airport companies:

        i. have lower risk operating environment (higher capacity utilisation, larger scale, more passenger diversity, lower passenger volatility and lower risk regulatory regime) than New Zealand airports;

        ii. universally (across time and companies) lower measured asset betas than AIAL.

    b. A set of *ad hoc* departures from regulatory precedent to adjust the impact of COVID-19. In doing so the NZCC adopts:

        i. A problematic 0.53 estimate of the average long run pre-pandemic asset beta for New Zealand airports. By contrast, AIAL's asset beta over the 20 years to 21 February 2020 was 0.73;[1]

        ii. An unreasonably low, and mathematically incorrect, 0.02 uplift for exposure to pandemic risk. (Noting that the draft decision has an effective 0.04 uplift for pandemic risk for energy suppliers that face next to zero pandemic risk relative to airports. [2])

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[1] Noting that, for the purpose of arriving at a long run average, there is a stronger case to simply adopt an AIAL specific estimate given that "noise" in individual asset beta estimates cancel out over a long time period.

[2] See section 2.5 for more details.

12. In justifying the reasonableness of its 0.55 estimate, the draft decision misapplies international regulatory precedent. That precedent, correctly interpreted, would support an asset beta of 0.81 or higher (more weighted to AIAL) for New Zealand airports.

13. The draft decision's *ad hoc* approach to adjusting for COVID-19 also generates material uncertainty about what is the relevant regulatory precedent (if any) for the 2030 IM and beyond. This is, one of the most problematic aspects of the draft decision. The decision takes:

- a well-designed and calibrated set of regulatory precedents (10 years of the most recent data for a wide sample of comparators) and
- replaces this with unresolved ambiguity as to what the 2030 IM and beyond IMs will hold.[3]

14. I expect this decision will have a serious negative impact on willingness to invest in new capacity at New Zealand airports. This is due to the combination of:

- setting compensation for risk far below the best estimate of risk exposure; and
- failing to properly consider regulatory precedent (both in terms of justifying departures from past precedent and signalling to stakeholders the implications for future decisions).

15. The net effect, if these problems are not corrected in the final decision, is likely to be a lack of investment in capacity expansions at New Zealand airports and the development, over time, of more material capacity constraints (especially likely at Auckland). Ultimately, this will mean that airline passengers pay materially more for flights than if the NZCC had adhered to its 2016 IM methodology. This is because the best theory and evidence predicts capacity constrained airports reduce competition between airlines and raise ticket prices.

2.2 Summary of draft decision

16. The NZCC draft decision involves significant departures from previously well-established regulatory precedent in relation to the estimation process for airport asset betas. The effect of these departures from regulatory precedent is to reduce the proposed asset beta (and therefore the compensation for risk) by more than 25%

3 Will the NZCC now always refer to a "long run average" asset beta plus pandemic uplifts? If so, how will the "long run average" be estimated in the future? If not, how will the 2030 IM define and treat the COVID period? Etc. etc.

relative to the level of compensation that would have prevailed had established regulatory practice been maintained (0.55 vs 0.76).[4]

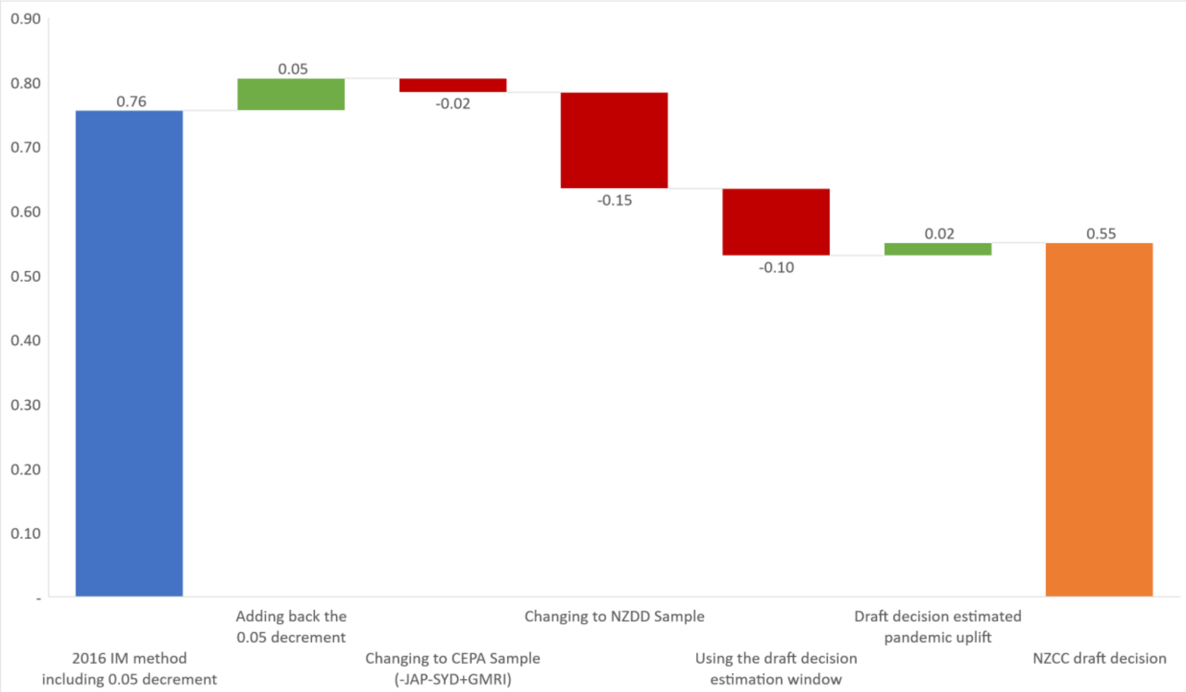
17. The individual impacts of changes in regulatory precedent are described in Figure 2-1 below.

- Strict application of 2016 IM regulatory precedent (using 10 years of data to 31 March 2023 and the wider sample) would have resulted in an asset beta of 0.76 – equal to the wider sample average of airport asset betas (0.81) less a 0.05 decrement to arrive at an estimate of the asset beta for aeronautical operations;
- Adding back the 0.05 decrement takes the estimated asset beta up to 0.81 (or, if the CEPA version of the wider sample is used, then 0.79);
- The change from a wide to a narrow sample reduces the estimated asset beta by 0.17 or 0.15 depending on whether my or the CEPA wider sample is adopted;
- The change in the estimation window to end prior to COVID-19 results in a further 0.10 reduction;
- The estimated pandemic uplift raises the asset beta estimate by 0.02.

18. The net effect of all three departures from regulatory precedent is a reduction of **0.23** in the asset beta relative to continuation of the established 2016 and 2010 IM method.

4 0.76 is calculated as follows. 0.81 is the average asset beta for the wider sample (2016 IM methodology) measured over two 5 year periods ending 30 March 2018 and 30 March 2023. Then a 0.05 decrement (2016 IM methodology) is applied to that value to arrive at an estimate of the asset beta for aeronautical operations.

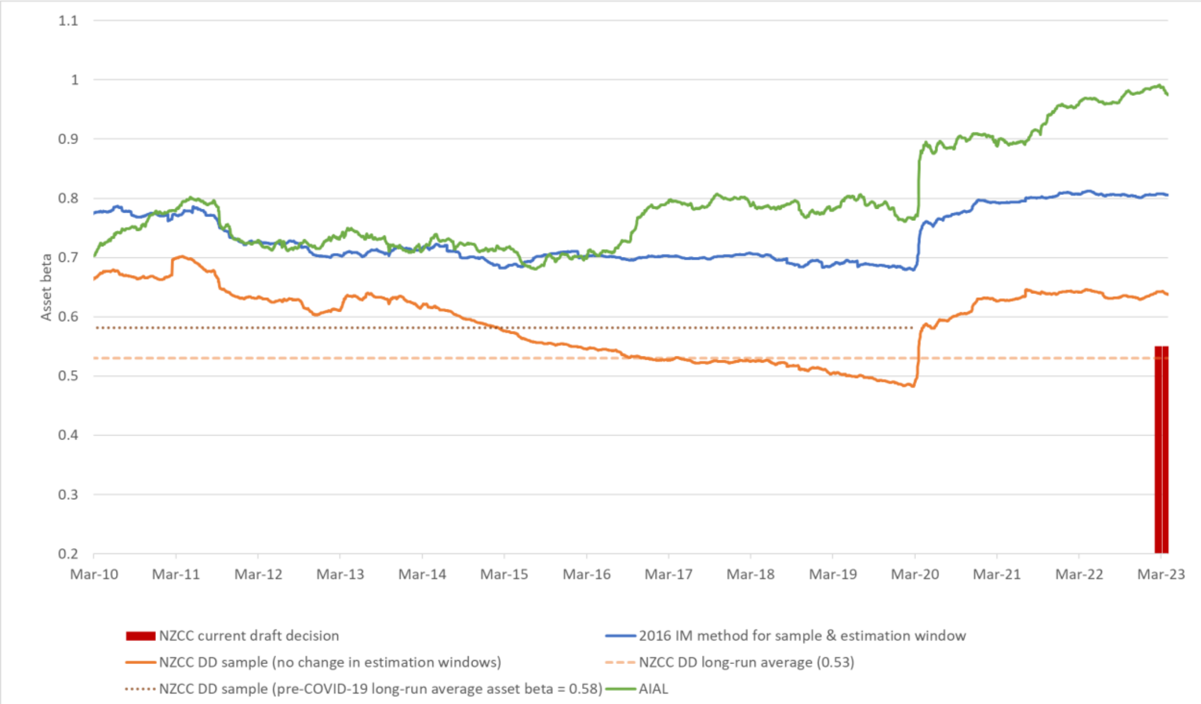
Figure 2-1: NZCC draft decision vs CEPA and CEG samples with estimation windows based on 2016 IM method



Notes: the estimation windows that aligns with the 2016 IM method are 1 April to 2013 to 31 March 2018 (first five-year period) and 1 April 2018 to 31 March 2023 (second five-year period).

19. Figure 2-2 below provides a similar comparison using timeseries charts for the asset beta using the 2016 IM and the 2023 draft decision sample methodologies. The blue time series shows the average asset beta for the wider (2016 IM methodology) sample. The 10-year asset beta in March 2023 is 0.81 (being the average of two 5 year periods ending 31 March 2023).

Figure 2-2: 10 year (average of two 5 year) asset betas overtime (draft decision sample versus 2016 IM methodology sample)



Notes: I apply the CEPA sample +JAT & SYD less GMR which, relative to the 2016 IMs excludes some low beta firms (TAV, Airport Fac, Save and GMR) and one high beta firm (Aero). The time series are based on NZCC's 2023 R code. It is noted that the March 2016 number is around 0.05 higher than the 0.65 (sample average without applying 0.05 decrement) in the 2016 IM. This appears to be due to slight differences in the sample set and between NZCC's 2023 R code and its 2016 excel spreadsheet that are not discussed in the draft decision but which are outlined in Appendix C.1.4.

20. The impact of the NZCC draft decision choosing a lower risk sample can be seen in the difference between the blue and the orange time series. Had the NZCC applied this sample in its 2016 IM decision then the 10-year sample average asset beta would have been 0.55 (in March 2016) and, after a 0.05 decrement (consistent with the 2016 IM method), the final asset beta would have been 0.50.

21. This would have been well below the 2016 IM final decision (0.60) but also at the bottom end of the range of the 2016 IM "reasonableness checks" (0.50).[5] The bottom end of that range was defined by the UKCAA's estimate of Heathrow's asset beta. As explained below, prior to the pandemic the UKCAA consistently, and in my view correctly, argued that Heathrow airport's operating environment makes it one of the, if not the, lowest risk airport in Europe.

22. Had the NZCC's only departure from regulatory precedent been in relation to the chosen sample it would have estimated an asset beta of 0.63 (based on the average of

5 NZCC, Input methodologies review decisions, Topic paper 4: Cost of capital issues, Figure 12 on page 126.

two five-year periods ending 31 March 2023). This would have been barely above the UKCAA's 0.615 post pandemic (but pre traffic risk sharing (TRS) mechanism) estimate for Heathrow which I discuss further in section 2.5.1 below.

23. However, the draft decision instead determines that New Zealand airports have materially lower post pandemic (and pre TRS) risk than Heathrow. The draft decision arrives at this conclusion by:

- Estimating a "long term airport asset beta of 0.53".[6] This is estimated using data from before March 2020 in an attempt to arrive at an estimate that is free from the impact of COVID-19. The draft decision estimate of a 0.53 "long term airport asset beta" is shown in Figure 2-2 as the constant light orange dashed line.
- The NZCC draft decision adds back 0.02 in compensation for pandemic risk – bringing its estimate to 0.55. This is shown as the height of the red bar.

24. If both UKCAA and NZCC decisions are correct, the only way that they can be reconciled is if, on a more or less apples-for-apples comparison in terms of regulatory regime, Heathrow airport is 12% riskier than New Zealand airports (0.615 vs 0.55).

25. For the reasons explained below, I consider that the actual explanation is that the NZCC draft decision is affected by a number of errors.

- First and foremost, the draft decision narrows its sample to the lowest risk and least comparable airports to New Zealand airports;
- Second, the NZCC's treatment of pandemic risk is incorrect both in terms of its:
  - underestimate of pre-pandemic average asset betas (even for its own sample); and
  - 0.02 pandemic uplift for airports – which is disproportionate to the real world evidence and, tellingly, lower than the NZCC's pandemic uplift for energy distributors.

2.3 Unreasonable sample selection

2.3.1 The NZCC sample is not fit for purpose

26. A fit for purpose sample must, on average, have similar risk to New Zealand airports. Empirically, this means that the sample average must, in the long run, provide a reasonable approximation to AIAL's asset beta (where AIAL is, by far, the best proxy

[6] NZCC, Cost of capital topic paper, Part 4 Input Methodologies Review 2023 – Draft decision, 14 June 2023 ("NZCC draft decision" henceforth), paragraph 4.55.

for an airport with an operating environment similar to that which exists in New Zealand).

27. The sample average is not fit for the purpose of setting regulated returns if the sample average is:

a. Inconsistent, over the long run, with the estimated asset beta for AIAL: and

b. Comprised of firms that have, on average, demonstrably lower/higher risk operating environment than New Zealand airports.

28. In which case, the sample average must be amended along one or more of the following lines:

- Adding more comparators to the sample until a. and b. above are no longer true;
- Giving more weight to AIAL than other comparators in the sample. This is consistent with
  - i. Bela's advice to the NZCC (discussed in section 4.4.1); and
  - ii. the international regulatory practice incorrectly cited by the draft decision as supporting its approach (discussed in section 4.4.2); and
- Applying an uplift to the sample average to correct the bias apparent in a. and b.

29. In sections 4.3 and 4.1 I explain why 100% weight should not be given to AIAL even though it is by far the best comparator. In essence, this is because it is important to trade off long run accuracy in the estimate (achieved if AIAL is the sole comparator) with short run volatility (which would result from giving 100% weight to a single company's estimated asset beta).

30. In section 4.2 I show that the wider (2016 IM method) sample achieved both:

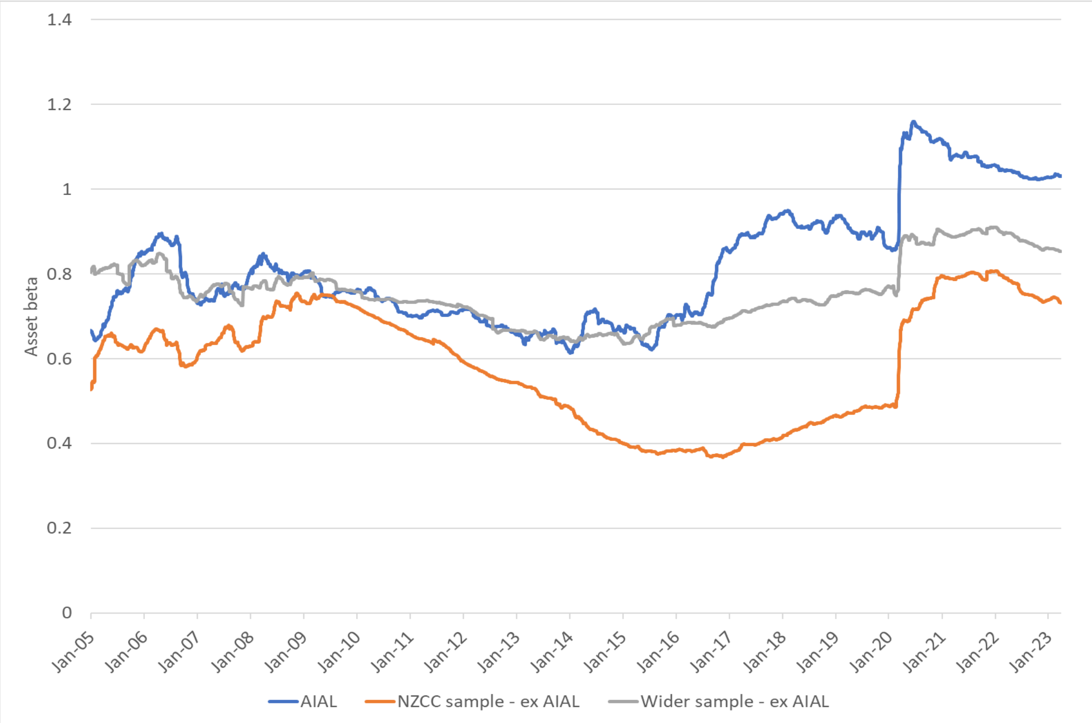
- long run accuracy (albeit underestimating AIAL asset beta in recent years); and
- lower short term volatility.

31. On this basis, I conclude that this sample is fit for purpose.

32. I also show that the draft decision sample is very inaccurate (always lower than AIAL's asset beta) in the long run and very volatile in the short run (in fact, more volatile than AIAL alone). On this basis, the draft decision sample performs worse on both counts (accuracy and volatility) than simply giving 100% weight to AIAL. On this basis, I conclude that the draft decision sample is not fit for purpose.

33. Figure 2-3 below illustrates the underlying data on which I made these conclusions.

Figure 2-3: Time series of AIAL vs draft decision and wider sample asset betas 5 year rolling asset betas



Notes: each single point on the line represents a 5 year asset beta with the respective sample

34. The higher volatility and lower accuracy of the draft decision sample is plain to see. This is borne out by statistical testing performed in section 4.2.

35. The above conclusions can be reached purely based on analysis of estimated asset betas for the various samples. However, the evidence presented in section 5 demonstrates that all the (non-AIAL) airports in the draft decision sample have lower risk operating environments than New Zealand airports.

    a. Five of the seven non-AIAL airport companies in the draft decision sample have demonstrably lower risk regulatory environments where prices are reset more frequently and where there exists material passenger volatility risk sharing. The exceptions are:

        i. AENA has a very similar 5-year regulatory regime with no explicit adjustments for variations in passenger demand during that period.

        ii. Public information is not available for Sydney airport because its "regulatory regime" is entirely determined by commercially negotiated contracts which are not publicly available.

    b. All seven have much lower exposure to passenger demand volatility than the New Zealand airports due to:

i. Higher levels of capacity constraints which leads to lower demand risk as discussed in sections 2.3.1 and 5.2.1 below. Notably, the average capacity utilisation index (CUI)[7] at the 7 comparators' main airports is 18% higher than for AIAL and 31% higher than for the New Zealand average. The four most capacity constrained airports are Frankfurt, Charles de Gaulle, Madrid and Beijing. These four airports are 40% more capacity constrained than the New Zealand average.

ii. Greater diversity of passenger traffic (origin and destination) as discussed in sections 2.3.1 and 5.2.3 below.

iii. Much greater scale than the New Zealand airports as discussed in section 5.3.

c. Two of the seven airport companies (Fraport and AdP) are dominated by airport operations outside their home countries and, consequently, their measured asset betas relative to their home country stock market index are likely to be materially biased down relative to an airport company operating in a single country. This is discussed in section 5.4.

36. The bias in the draft decision sample can be further illustrated by noting:

- That airlines from the draft decision "developed country" sample have higher asset betas than airlines in the "less developed" countries excluded from the draft decision sample (see section 5.6). Therefore, it cannot reasonably be asserted that it is a lower risk aviation sector in the draft decision developed country sample that explains the lower airport asset betas in those countries. Rather, Occam's razor points to the lower risk of those capacity constrained airports explaining their unusually low asset betas (relative to airports in other countries and airlines in the same country).
- That the draft decision sample is comprised of airport companies that have materially higher gearing than AIAL (see section 5.5). This suggests bias in the draft decision sample because:

  i. As a matter of finance theory, lower risk companies will rationally tend to adopt higher gearing; and

  ii. This pattern is born out in the data for airlines – with a strong negative relationship between asset beta and gearing.

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7 A commonly used measure of capacity utilisation described in section 5.2.1.

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2.3.2 The draft decision sample is not consistent with its own selection criteria

37. On the NZCC's own selection criteria the following firms would be excluded for the following reasons:

    a. Vienna. Vienna airport is more illiquid than HNA (which is excluded) but Vienna is not excluded. Vienna airport also has a more variable asset beta estimates than airports that the NZCC identified as having unreliable asset betas due to variability in those estimates. See section 6.3.1.

    b. Fraport AG, AdP and Beijing all have around half or more of their operations in countries that are not "developed" and should be excluded based on the basis of this NZCC criteria (see section 6.3.2).

    c. Japan Airport Terminal (JAT) satisfies all the NZCC criteria and should be included. JAT was excluded by CEPA but past submissions by me (repeated in section 6.3.3) show that its non-aeronautical share of profits are smaller than Fraport, AIAL, AENEA and AdP (the only airport companies that also report EBIT/EBITDA by segment).

2.4 Unreasonable long run pre-COVID estimate of asset beta

38. In Figure 2-2, it can be seen that the draft decision estimate of the pre-pandemic long run average asset beta (0.53 and denoted by the height of light orange dashed line) is below not just the COVID-19 affected part of orange time series (representing the draft decision sample) but also below the orange time series on average from March 2010 to February 2020 (which covers data from March 2000 to Feb 2020). That is, the NZCC's estimated "long term airport asset beta" can be seen to be materially below the pre-COVID average asset beta for its own sample.

39. The following tables show the four non-overlapping 5 year asset betas ending February 2020 using the Draft Decision NZCC sample and the wider (2016 IM) sample (see Appendix A for the full list of firms that underpin the relevant samples).

Table 2-1: 20 years of 5 year asset betas ending pre-COVID (using the NZCC 28 February definition for the start of COVID)

	2000-05	2005-10	2010-15	2015-20	Average
NZCC DD sample	0.61	0.72	0.43	0.55	0.58
Wider (2016 IM) samples	0.81	0.74	0.62	0.74	0.73

Notes: each period is the average of weekly and four-weekly asset betas between 1 March and end of February. Firms are included if they have at least 42 months of data (70% of 5 year, see Appendix C for more details).

40. It is noteworthy that the average asset beta for the draft decision NZCC sample over the 20 years pre COVID is 0.58.[8] This is materially higher than the NZCC estimate of a long run average pre-COVID asset beta for the same sample of 0.53. Even using the last 15 years the average asset beta is 0.57.

41. In arriving at a 0.53 long run average asset beta estimate the NZCC made several unexplained, and difficult to rationalise, methodological choices. Specifically, I have the following questions that are not answered in the draft decision:

    a. why did the NZCC not simply take estimates for 5 year periods ending February 2020, 2015, 2010 and 2005 as I have done and as would have been most consistent with its past practice?

    b. why did the NZCC split up the pre-COVID period into two 5 year periods and a two year period?

    c. why did the NZCC leave a gap of data that is unused between 1 October 2017 to 28 February 2018?

    d. why did the NZCC not seek a long run estimate of both pre and post pandemic data?

42. The result of these choices can be illustrated graphically by reference to Figure 2-2 above and noting that the NZCC's 0.53 (dashed light orange line) is almost always below the average asset beta for the NZCC sample (orange time series). The NZCC choices can also be illustrated graphically as per Figure 2-4 below.[9]

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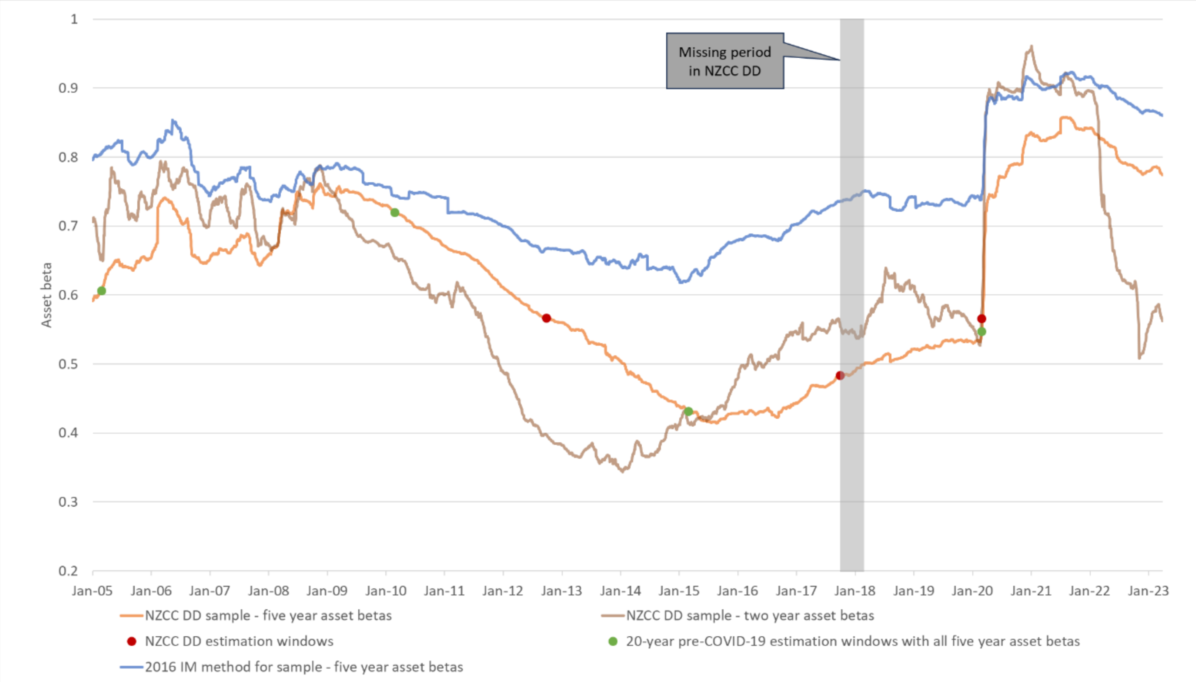
8 The reader should also note that this is not exactly the same as the average of the time series graphed visually – because that data is a rolling average and this table splits that data up into 4 discrete non-overlapping periods.

9 The NZCC's 0.53 is the average of the three red dots in Figure 2-4 – with the right most dot (which is on a 2 year asset beta time series) receiving $2/5^{th}$ of the weight of the other red dots. The 0.58 value in Table 2-1 is the equal weighted average of the four green dots. The 0.73 value in Table 2-1 is the equal weighted value of the points on the blue time series directly above the green dots. The shaded column in Figure 2-4 represents the data that the NZCC simply did not use to estimate its long run average asset beta of 0.53 (it is the gap between the end of the 5-year period ending September 2017 and the beginning of the 2 year period starting 28 February 2018).

Figure 2-4: 5 and 2-year asset rolling asset beta -with the 3 observations underpinning the NZCC's 0.53 estimate highlighted



43. In section 9.7 I explain that, using the statistical test recommended to the NZCC by Bela, that the Eurozone debt crisis (starting in 2012 and ending in 2014) is equally as statistically significantly different to other periods as is the COVID-19 period.

44. The unusually low asset beta estimates for the NZCC sample from 2012 onwards are depressed by the Eurozone debt crisis.[10]

45. I do not propose that the NZCC should remove the Eurozone debt crisis from any historical analysis on the basis that it is "abnormal". However, this is because I do not believe that the NZCC should make any such adjustments – including for COVID-19. However, if the NZCC does make an adjustment for COVID-19 it should also remove the Eurozone debt crisis.

46. As Figure 2-2 highlights that, when looking at the draft decision sample, it is highly problematic to remove the post 2020 asset beta estimates (which are modestly above the pre-2012 asset betas) in order to focus the weight on the period where the NZCC sample has an abnormally low asset beta estimate. A reasonable interpretation of Figure 2-2 is that the 2012 to 2017 period is the period with the most "abnormal" asset betas.

10 In this period financial stocks were highly volatile and the effect of this was that the financed industry betas were raised, and other industries betas were depressed – noting that equity beta always averages to 1.0 across all industries.

2.5 Problematic response to COVID-19

47. The COVID-19 pandemic is clearly the most important new evidence on the risk of airport companies since the 2016 IM was determined. Airport companies suffered very large and unexpected real revenue and profit shocks. Consistent with these real-world impacts, measured asset betas for airport companies rose materially as can be seen in Figure 2-2 above.

48. By way of illustration, AIAL's passenger numbers and revenue dropped to 25% of forecast levels in 2021 and 2022. Moreover, the uncertainty about the path of demand and the onerous consultation process for any change in prices[11] led AIAL to defer price changes for PSE4 by a year (beginning FY2024). I am instructed that AIAL's losses in PSE3 are not recovered in PSE4 or beyond.

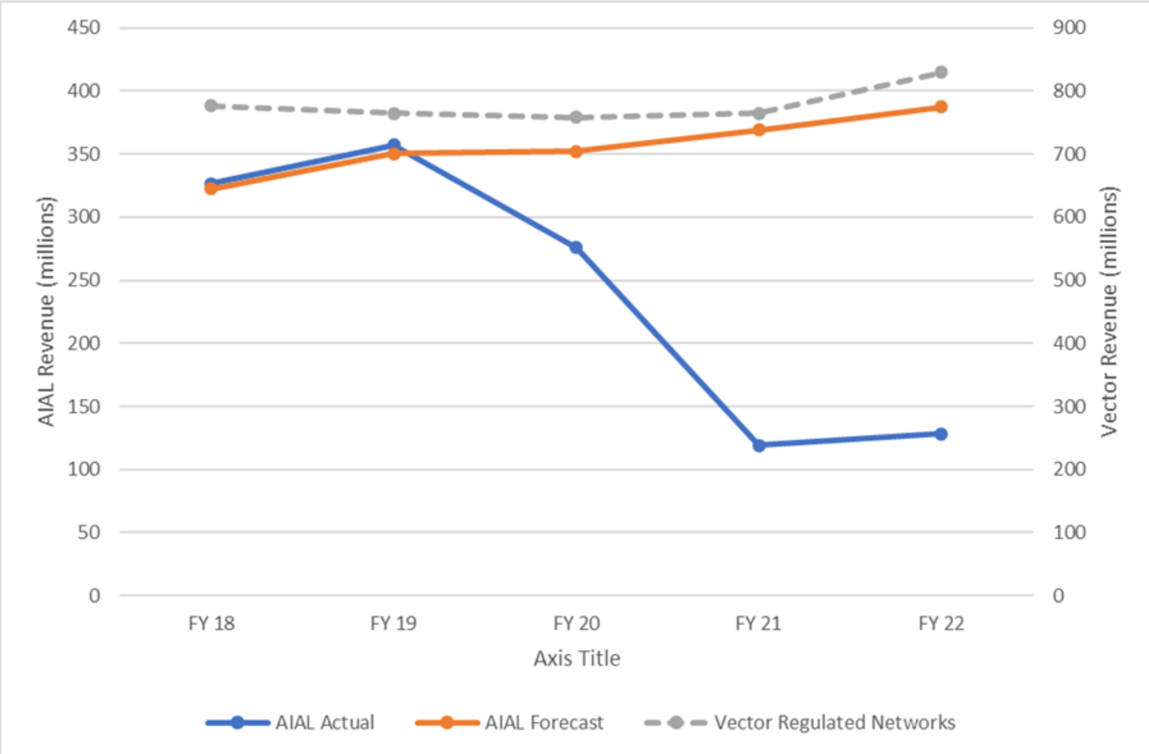
49. Figure 2-5 shows the impact of the pandemic on AIAL revenues (left hand axis) which fell by more than two thirds. For reasons that will become clear below, I also show the impact of the pandemic on Vector's (New Zealand's largest electricity distributor) regulated revenues (right hand axis).

[11] Under the Airport Authorities Act 1966, section 4B,

> *Every airport company must* ***consult with every substantial customer*** *in respect of* ***any charge payable*** *by that substantial customer to the airport company in respect of* ***any or all identified airport activities***—
>
> *(a) before fixing or altering the amount of that charge; and*
>
> *(b) within 5 years after fixing or altering the amount of that charge.*

Information on airport websites suggests that the consultation process has historically taken over a year to complete. For example, AIAL states "*This pricing decision is the outcome of a robust and constructive consultation process with airline partners over the last 2 years" Auckland Airport (2023), Aeronautical Pricing Decision, June 8 2023, available at* https://corporate.aucklandairport.co.nz/-/media/Files/Corporate/Investors/2023/Regulation/2023-Aeronautical-Pricing-Decision-June.ashx, *page 34.*

Figure 2-5: AIAL (and Vector) revenue impact of pandemic



Source: Auckland Airport, Annual Information Disclosure for the years ended 30 June 2018-2022, available at https://corporate.aucklandairport.co.nz/investors/regulation. Vector data comes from Annual reports 2018/20/22, available at [https://www.vector.co.nz/investors/reports.](https://www.vector.co.nz/investors/reports)

50. In recognition of the impact of COVID-19 on airports, the UKCAA explicitly raised its asset beta compensation for Heathrow Airport Limited (HAL) by 0.115 to 0.615 (prior to a further adjustment to account for the effect of the TRS). This represented a 23% increase in the UKCAA pre-pandemic asset beta of 0.50 (as outlined in sections 7.2 and 7.4.1 and Appendix F).

51. In addition, the UKCAA provided further ongoing compensation to HAL that was directly tied to the pandemic but not provided in the form of an asset beta uplift (e.g., direct compensation for exposure to asymmetric risk). These forms of compensation would be equivalent to a further permanent 0.28 uplift in asset beta for New Zealand airports (or an asset beta of around 0.90).[12]

52. In my view, the UKCAA response to the COVID-19 pandemic is proportionate to the importance that the new evidence that the pandemic revealed about the risk of airport companies. The UKCAA response was, before adjusting for the effect of the TRS, to

12 That is, if the logic for all UKCAA pandemic compensation were to be applied to New Zealand airports in the form of an asset beta uplift the resulting asset beta would be 0.90 (=0.615+0.28). This is 0.09 above my best estimate of the asset beta for the 2023 IM of 0.81. However, it is 0.45 above the NZCC's draft decision estimate.

raise the explicit asset beta by 23% (=0.115/0.5) and to provide other compensation for pandemic related risk worth more than double this.

53. Adherence to the 2016 IM methodology applied in 2023 would have resulted in a 0.16 (or 25%) increase in the asset beta from 0.65 to 0.81 with no other compensation for pandemic risk (e.g., no asymmetric risk allowance). A 25% increase in risk compensation is both in the correct direction and consistent in magnitude with the UKCAA direct uplift for asset beta. It is smaller than the UKCAA's increase in total compensation for pandemic risk.

54. By contrast, the draft decision has estimated 15% *lower* risk attached to airport companies in New Zealand since the pandemic than before the pandemic (0.55 vs 0.65[13]). That is, contrary to real world evidence. Post-COVID-19 the NZCC is estimating materially lower risk exposure for New Zealand airports than it estimated in both of the last two IMs.

55. It follows that there must be a very significant error in the NZCC asset beta decisions. Logically, this error must be infecting either:

- the past 2010 and 2016 IM decisions; or
- the current 2023 IM draft decision.

56. For the detailed reasons I explain in this report, I consider that it is the latter. However, two simple "cross-checks" can be used to infer why this is the case. Specifically comparing:

- Heathrow to New Zealand airports; and
- New Zealand airports to New Zealand energy businesses.

2.5.1 Low risk Heathrow gets a higher asset beta than high risk NZ airports

57. The draft decision states:[14]

> "Our estimate of a pre-COVID-19 asset beta of 0.53 is similar to the CAA's pre-COVID-19 asset beta of 0.5".

58. The draft decision seems to present the UKCAA precedent for Heathrow Airport (the most capacity constrained airport in Europe) as supportive of it adopting a similar asset beta for the substantially different New Zealand airports. It is, therefore, useful

13 Noting that 0.65 was the 2016 IM estimated asset beta for airport companies and 0.60 was its estimate for aeronautical operations.

14 NZCC draft decision, paragraph 4.59.

to explore the basis of the UKCAA decision for Heathrow and to ask whether it is, in fact, supportive of the draft decision.

59. Pre-pandemic the UKCAA correctly and consistently identifies Heathrow as being exposed to lower underlying demand risk than other airports. This is due to its position as a capacity constrained primary airport serving a major international city which is also served by a number of secondary airports. For example, the UKCAA's consultant, PwC, summarised the UKCAA's position in 2017 emphasising capacity constraints as a major determinant of low asset beta:[15]

> *In terms of HAL's relative risk compared to the market, the CAA found that there was little evidence to suggest a material change in relative risk.* ***The CAA view was that HAL remained a capacity constrained airport with excess demand*** *and that the asset beta range was logical when placed against broader regulated companies.*

60. This was reaffirmed in 2019 when PwC advised:[16]

> *"... in our view HAL's beta is towards the lower end of the proposed beta range* ***given that capacity constrained hub-airports, such as Heathrow, are likely to have lower betas than unconstrained airports****."*

61. In early 2020 CEPA states:[17]

> *"Furthermore,* ***capacity constraints are only one factor shielding HAL from volume risk****. It also benefits from the following traffic market features:*
>
> - *London's profile as a major global city provides balanced outbound and inbound demand;*
> - *greater exposure to intercontinental long-haul traffic, with long-term prospects for demand from emerging markets; and*
> - *transfer traffic, with traffic tending to concentrate towards hubs during downturns."*

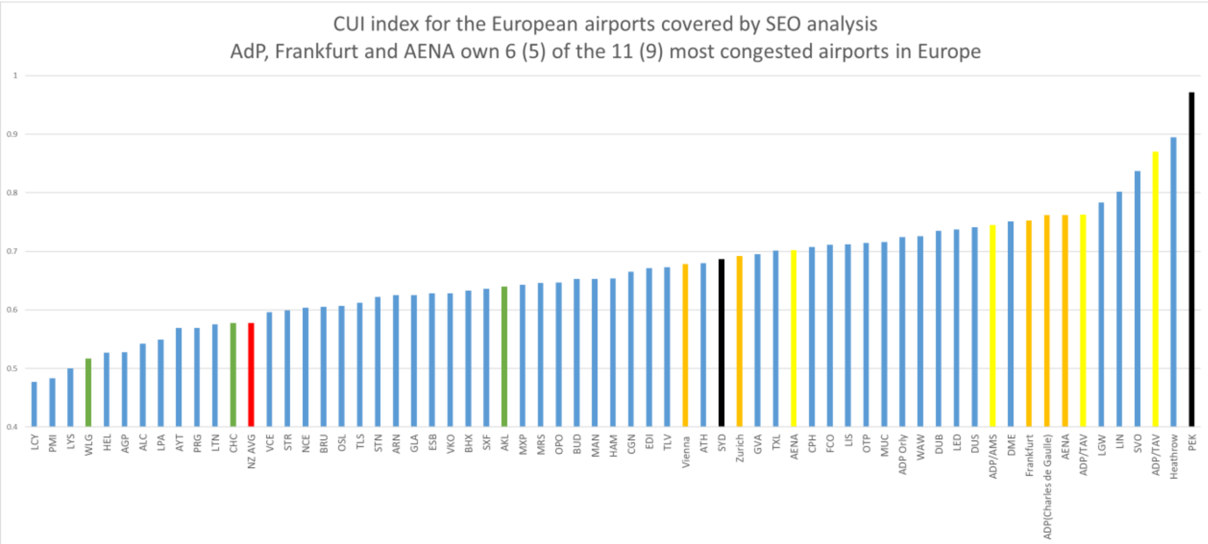
[15] PwC, Estimating the cost of capital for H7 A report prepared for the Civil Aviation Authority (CAA) November 2017, pp. 13-14.

[16] PwC, Estimating the cost of capital for H7 -Response to stakeholder views A report prepared for the Civil Aviation Authority (CAA) February 2019, page 71.

[17] CEPA, H7 financial issues: CAP1876 response, 9 March 2020, page 31.

62. Figure 2-6 takes data from a report by SEO Amsterdam Economics measuring the Capacity Utilisation Index (CUI) at European Airports.[18] The bars are coloured orange if the airport is European and owned outright by one of the draft decision sample of companies and yellow if partially owned (by AdP). Green bars have been added for New Zealand airports, a red bar for the average of the 3 New Zealand airports and black bars for Sydney and Beijing. Beijing (PEK) is the most capacity constrained airport of and Heathrow is the most capacity constrained in Europe.

Figure 2-6: The NZCC European "comparables" own the highest capacity utilisation airports in Europe



2016 data for Auckland, Christchurch & Wellington (green) and Sydney & Beijing (grey) have been added to SEO's graph using data from Sabre.

63. It can also be seen that the draft decision sample of companies own most of the highly capacity constrained airports and all of them are much more capacity constrained than AIAL or the average for New Zealand airports.

64. On the basis of Heathrow's capacity utilisation and the other considerations set out above, the UKCAA estimated a pre-pandemic asset beta for Heathrow of 0.50.

65. By contrast, New Zealand airports have much lower levels of capacity constraints and have none of the other key risk reducing attributes described by CEPA above.

66. Table 2-2 below compares the UKCAA and NZCC pre and post-pandemic asset beta estimates (already discussed previously).

18 SEO, The impact of airport capacity constraints on air fares, 24 January 2017, Commissioned by ACI EUROPE.

Table 2-2: UKCCA Heathrow versus NZCC draft decision New Zealand airport asset beta risk assessments

	UKCAA for Heathrow	NZCC draft decision for AIAL, WIAL and CIAL
Pre pandemic asset beta estimate	0.50	0.53
Post pandemic asset beta estimate (no risk sharing within 5 year regulatory period)	0.615	0.55
Post pandemic asset beta with most (of already small) traffic volatility risk shifted to airlines	0.53	NA

67. The first row of this table illustrates that, notwithstanding the evidence of much lower risk for Heathrow than New Zealand airports, the NZCC draft decision has estimated a pre-pandemic asset beta for Auckland, Christchurch and Wellington airports that is only 0.03 above that for Heathrow.

68. Having an asset beta estimate for New Zealand airports that is similar to that for the very different, and much lower risk, Heathrow suggests that the draft decision's estimate of the pre-pandemic asset beta for New Zealand airports is flawed.

69. The second row of this table compares the two regulators' post pandemic assessment of asset beta risk. Prior to adjusting for the traffic risk sharing (TRS) mechanism as explained in paragraph 72 below, the UKCAA raised its estimate of Heathrow's asset beta by 0.115 to 0.615 (based on a similar regulatory environment to New Zealand airports).[19] By contrast, the draft decision only raised the NZCC's estimate of post pandemic asset beta risk by 0.02 to 0.55. The draft decision estimate (0.55) is 0.065 below the equivalent UKCAA direct estimate (0.615) of asset beta for Heathrow. And well below full compensation for asset beta and all pandemic risk (equivalent to an asset beta of around 0.90).

70. In my view, this is not a justifiable estimate of the relative risk of Heathrow versus Auckland, Christchurch and Wellington airports. It implies:

- Heathrow is more exposed to pandemic risk than NZ airports;
- Heathrow has higher overall risk than NZ airports.

71. Holding the regulatory regime constant across the airports, any reasonable estimate would have New Zealand airports with materially higher asset beta risk than Heathrow and higher pandemic risk exposure (see also paragraph 73 below).

72. The UKCAA then introduced a traffic risk sharing (TRS) mechanism for Heathrow the effect of which was to compensate Heathrow for 50%/105% of all variations from

[19] A 5 year regulatory period with no within period adjustments for deviations of traffic from forecast, i.e., before any change to reflect changes in traffic sharing risk.

forecast demand up-to/beyond 10% (see Appendix F, section F.1.1 for details). That is, the TRS halves all demand risk up to 10% variation from forecast and eliminates all demand risk beyond 10%. In recognition of the TRS, the UKCAA reduced the asset beta by 0.085 to 0.53. A 0.53 asset beta for Heathrow with almost zero passenger demand risk[20] makes the draft decision 0.55 asset beta for Auckland, Christchurch and Wellington airports even less justifiable.

73. I further note that, as an island nation with no significant road or ferry linkages to other countries, it is reasonable to assume that New Zealand is more likely than other countries to follow a policy of severe border controls in future pandemics (as was the case during the period prior to widespread availability of COVID-19 vaccines). This suggests that the uplift for New Zealand airports should be, if anything, higher than for most other airports.

2.5.2 NZ energy suppliers receive double to triple the pandemic uplift provided to NZ airports

74. The draft decision estimates a 0.31 long run average asset beta for New Zealand energy suppliers and estimates a COVID uplift of 0.01 to arrive at a 0.32 estimate. This 0.32 estimate is arrived at in an equivalent manner to the 0.55 estimate arrived at for airports.

75. However, the NZCC ultimately sets an asset beta of 0.35 for energy suppliers. The 0.35 estimate is arrived at by the NZCC adopting as the "top of its range" a 0.36 estimate that is based on 10 years of data that includes the COVID-19 period.

76. This difference in treatment is striking in the context of the relative dislocation that airports and energy suppliers had as a result of the COVID-19 pandemic. As can be seen in Figure 2-5, AIAL's revenues collapsed by more than two thirds during the pandemic while energy suppliers' revenue (proxied by Vector) have no discernible pandemic effects.

77. The NZCC has, in effect:

- For energy suppliers, arrived at a 0.04 higher estimate of asset beta than its long run pre-COVID-19 average by giving more weight to 2010 and 2016 IM precedent (choosing a value just 0.01 less than the most recent 10 years of data); but
- For airports, given zero weight to 2010 and 2016 IM precedent (choosing a value (0.55) that gives zero weight to COVID-19 impacted data.

78. In effect, the NZCC energy supplier asset beta incorporates a 0.04 uplift for pandemic risk relative to its long run average. I further note that if the uplift is measured in

[20] Noting that Heathrow still has all the benefits of low underlying demand volatility outlined above and now, with the traffic risk sharing mechanism, only bears 50%/0% of that volatility up-to/beyond 10%.

percentage terms the energy supplier pandemic uplift is actually more than three times higher than for airports (13% (=0.04/0.31) versus 4% (=0.02/0.53)).

79. Energy consumption was not materially affected by the pandemic (see Figure 2-5 above) and, even if it were, electricity distribution businesses are regulated on the basis of a revenue cap (such that prices adjust automatically to variations in demand). Consequently, my expectation would be for a low or zero pandemic uplift for these businesses. I do not understand how the draft decision can estimate double (triple) the COVID-19 uplift for energy suppliers compared to airports (0.04 vs 0.02.

80. I contrast this outcome with the results of simply applying 2016 IM precedent in 2023.

Table 2-3: Energy and airports draft decision versus 2016 IM precedent

	Pre-COVID	2023 post COVID	Pandemic uplift	Observation
		2023 draft decision		
Energy	0.31	0.35	13%	Not reasonable
Airports	0.53	0.55	4%	
	Application of 2016 and 2010 IM precedent for airport companies*			
Energy	0.35	0.36	3%	Rational
Airports	0.65	0.81	25%	

* The 2016 and 2010 IM methods estimate a different (0.05 lower) asset beta for aeronautical operations than for airport companies *per se*. An alternative comparison would be for aeronautical operations where the comparison would be 0.60 to 0.81 but this would reflect both the observed impact of COVID-19 and the impact of the NZCC accepting evidence that its 0.05 decrement for lower risk aeronautical operations was not well founded.

81. Had the NZCC applied the same method as applied to energy businesses for arriving at a range for airports that range would have been, based on its own assumptions about sample and its own estimates of asset beta:

- 0.55 lower bound;
- 0.63 upper bound.[21]

82. Had the draft decision also, as it did for energy suppliers, chosen an asset beta that was 0.01 lower than the upper bound then its estimate for airports would be 0.62.

83. While less problematic than its 0.55 estimate, 0.62 would still be unjustifiably low.

21 NZCC draft decision, table A2 on page 172. 0.63 is the average of weekly and 4 weekly asset betas for 2012-17 and 2017-22.

84. It is also noteworthy that the NZCC arrived at a stable asset beta estimate for energy suppliers (0.35 in 2016 and 2023) by:

- applying "the same" method for airports to arrive at a long run pre pandemic asset beta (0.31); but
- applying an unjustifiably high adjustment to that for COVID-19 affected data.

85. This stable estimate was, in my view, reasonable (although the asset beta should have been 0.36 based on the most recent 10 years of data). However, the means of achieving it was entirely *ad hoc*. In my view, this is evidence for, and appears to be akin to an admission that, the NZCC method applied to airports is unreliable (i.e., it cannot be applied to energy businesses to arrive at a reasonable estimate).

2.6 Adjustment for COVID-19 is not necessary or desirable

86. Section 9 explains that adjustment for COVID-19 is not necessary or desirable. Simply maintaining a rolling average of 10 year[22] estimation windows will ensure that the COVID-19 pandemic shock will receive the correct weighting in the long run.

87. Whatever the true frequency of a COVID-19 like pandemic, my preferred method (which is the NZCC's method to date) will generate asset beta estimates that include such an event with that exact frequency. If a COVID-19 like event (or a global financial crisis etc.) is a one-in-fifty year event then it will have that correct weight in the long run average of estimated asset betas. But if the true frequency is one-in-twenty or one-in-100 years the rolling update will ensure that the event is captured in one estimation window every 20 or 100 years – as appropriate.

88. There is no bias in my preferred methodology because that methodology will, on average and over time, accurately reflect and compensate for the scale and frequency of all shocks.

2.6.1 The draft decision COVID-19 adjustment is, even if correctly implemented, unreliable and unworkable

89. Compared to a simple rolling average, the draft decision method requires:

a. assumptions about the (unknowable) future frequency, severity, and duration of pandemics;

b. a process for removing the estimated impact of COVID-19 on asset betas; and

c. a process for reweighting data affected by COVID-19 in order to estimate an "uplift" for latent pandemic risk;

[22] Or, 14 year estimation windows if the IM's continue to be updated every 7 years.

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d. a process for dealing with, in future IMs:

   i. any events that are also "abnormal" and need the same treatment;

   ii. a new shock of the relevant kind. For example, what happens if a new pandemic occurs in 2035? Does its effect also get removed and the uplift amended?

e. a mechanism to deal with the obvious NPV<0 impact of only providing an uplift for pandemic risk after the pandemic has actually happened.

90. These issues are dealt with in section 9. In my view, the attempt to adjust actual data to superimpose a belief about "true" probabilities of events will ultimately result in a regulatory quagmire of claims and counter claims.

2.6.2 Does the *ad hoc* COVID adjustment signal a fundamental shift to regulating on the basis of "long run average" asset betas?

91. Any *ad hoc* adjustment will also, inevitably, undermine the value created by regulatory precedent. This is manifest in the draft decision. In order to make the adjustment the NZCC has embarked on a series of *ad hoc* changes to the IM methodology that fundamentally undermines the predictability of the regulatory regime. It moves away from allowing the most recent data to feed into the asset beta estimate and, instead, superimposes new concepts of:[23]

> *"…the long term airport asset beta of 0.53."* And *".,. the long-term pre-COVID-19 average of 0.53."*

92. This raises questions in relation to how the asset beta will be set in future IMs.

a. Was this a conscious choice to abandon the past regulatory precedent of using the most recent data to estimate asset betas in favour of a new precedent to try and estimate "the long-term airport asset beta"?

b. Or is the 2023 IM estimation method to be considered an *ad hoc* response to COVID-19 and the 2030 IMs can be expected to revert to 2010 and 2016 precedent?

93. I explore these questions more in section 9.2.

2.6.3 NZCC adjustment for COVID-19 is mathematically wrong

94. The NZCC adjustment for COVID-19 is mathematically wrong. It applies a weighting of betas based on time when, in fact, betas must be weighted based on both time and market volatility. Flint, the UKCAA adviser, advised the UKCAA that this method was not correct. The UKCAA accepted this advice and explicitly rejected the method

[23] NZCC draft decision, paragraphs 4.55 and 4.66.

now used in the draft decision. The NZCC appears to be unaware of the difference between the UKCAA method and its own.

95. Adopting the Flint/UKCAA method results in an asset beta uplift of around 0.09 based on an 18-month duration and a one-in-twenty year frequency and the draft decision sample. On the basis of the same assumptions the NZCC incorrectly estimates a 0.03 uplift.

2.7 Asset beta estimates and UKCAA uplifts for various samples

2.7.1 Equal weighted samples using 10 years of data

96. Table 2-4 shows the asset beta estimates for various samples on the basis of:

- Continuation of regulatory precedent in the use of a 10-year estimation window ending 31 March 2023; and
- The use of the correct UKCAA method to remove the impact of COVID-19 and then add back an uplift based on an assumed 50/20-year frequency[24] of a major pandemic and a duration of 18 months.[25]

[24] These are assumptions that the draft decision employs.

[25] The draft decision estimates that COVID-19 lasted for 18 months. The draft decision also employs a sensitivity of 3 months for the duration of a pandemic. However, if this was the case for COVID-19 then we and the NZCC would only need to exclude 3 months of data as COVID-19 affected. This would materially raise the simple average asset beta excluding COVID-19. It might be thought that COVD-19 lasted for 18 months but the next pandemic might just last for 3 months. In my view, it would be unreasonable estimate a lower bound uplift on an arbitrary one-in-50 frequency and an arbitrary assumption that the next pandemic in 50 years will last for one 6th of the time that COVID-19 did. The one thing we do have is an estimate of the duration of COVID-19 and that duration should inform both our upper and lower bound estimates. Moreover, if a shorter duration of one 6th of 18 is used for the lower bound then a materially higher duration than 18 months should be used for the upper bound.

Table 2-4: Simple average two 5 year periods (two 5 year periods ending 31 March 2023 with 18-month COVID-19 starting 21 Feb 2020)

Sample	Simple average incl COVID	Simple average ex COVID	COVID-19 uplift 50-20 year frequency	Average asset beta including COVID-19 uplift
NZCC DD sample [26]	0.64	0.54	0.03 - 0.07	0.57 - 0.61
AIAL, Zurich, Sydney and AENA	0.77	0.67	0.03 - 0.08	0.70 - 0.74
As above + JAT. (NZCC criteria correctly applied)	0.84	0.75	0.03 - 0.07	0.77 - 0.81
AIAL and Zurich	0.86	0.71	0.05 - 0.10	0.76 - 0.82
Wider (2016 IM method) sample	0.81	0.72	0.03 - 0.06	0.74 - 0.78

97. In my view the best estimate is associated with the wider sample (bottom row). This results in a 0.81 asset beta without any COVID-19 adjustment. This is my best estimate. All other values reported by me are, in my view, inferior to this estimate and are provided to highlight the impacts of various methodological choices.

98. In the same bottom row as the 0.81 estimate, I also report a 0.74 to 0.78 asset beta estimate if a COVID-19 adjustment is correctly implemented using the UKCAA method based on the (arbitrary) assumptions of a one-in-50 and one-in-20-year frequency of pandemics.

99. If the NZCC 2016 IM wider sample were rejected then the most comparable sample restricted to developed country airports should be AIAL and Zurich (which have similar regulatory regimes, size, capacity utilisation and operate in similar countries (population and terrain) as discussed in section 6.4). This would result in higher asset beta estimates (0.86 and 0.76 to 0.82 if COVID-19 data de-weighted).

100. The next best sample is the sample formed by applying the draft decision criteria in a consistent and logical way (see section 6.1). This sample would include AIAL, Zurich, Sydney, AENA and JAT. This results in an asset beta of 0.84 (and 0.77 to 0.81 if COVID-19 data de-weighted). The asset beta for this sample is slightly higher than for the wider sample. If JAT was (incorrectly) excluded from that sample, then the asset beta would fall to 0.77 and 0.70 to 0.74. if COVID-19 data de-weighted.

101. The least accurate sample is the NZCC draft decision (DD) sample. For this sample the asset beta would 0.64 and 0.57 to 0.61 if COVID-19 data de-weighted.

[26] Sydney is excluded from the second period because there is almost two years of data missing after the deal announcement date – see C.1.3. If Sydney is included in the second five year period, simple average incl COVID/ simple average excl COVID/ uplift/ asset beta with uplift = 0.63/ 0.52/ 0.04-0.08/ 0.56-0.61.

2.7.2 Weighted samples using 10 years of data

102. I explain in sections 4.1 and 4.4 that, consistent with the advice of Bela, it would be appropriate to increase the weight to AIAL's asset beta relative to other comparators' estimated asset betas in a small sample especially if the comparators had demonstratively lower average risk and lower long run asset betas than AIAL. Table 2-5 shows the impact of weighting AIAL that I consider is consistent with the literature cited in the Bela advice to the NZCC.

Table 2-5: Weighted average two 5 year periods (two 5 year periods ending 31 March 2023 with 18-month COVID-19 starting 21 Feb 2020)

Sample	Simple average incl COVID	Simple average ex COVID	COVID-19 uplift 50-20 year frequency	Average asset beta including COVID-19 uplift
NZCC DD sample [27]	0.78	0.65	0.04 - 0.09	0.70 - 0.75
AIAL, Zurich, Sydney and AENA	0.82	0.70	0.04 - 0.09	0.74 - 0.79
As above + JAT. (NZCC criteria correctly applied)	0.89	0.77	0.04 - 0.08	0.81 - 0.85
AIAL and Zurich	0.86	0.71	0.05 - 0.10	0.76 - 0.82
Wider (2016 IM method) sample	0.81	0.72	0.03 - 0.06	0.74 - 0.78

2.7.1 Equal weighted samples using 14 years of data

103. In previous advice to the NZCC I recommended that it estimate the asset beta at each IM using two 7-year estimation windows rather than two 5-year estimation windows. The reason for this is that, with the IMs updated every 7 years, it is necessary to have the estimation window based on a multiple of 7 to ensure that all historical data is weighted evenly in IM asset beta estimates. [28]

27 If Sydney is included in the second five year period, simple average incl COVID/ simple average excl COVID/ uplift/ asset beta with uplift = 0.78/ 0.65/ 0.04-0.10/ 0.69-0.74.

28 However, for the purpose of setting asset betas for each airport price setting event (PSE), I considered that a 10-year estimate at the beginning of each 5-year PSE would have the same properties and would be superior in terms of using the most up-to-date data for that PSE. There is, therefore, something of a tension between the IMs setting the method that should be used at each PSE to ensure consistent treatment of data (requiring a multiple of 5 years (e.g., two 5 year periods)) and the IMs published asset beta estimate itself having consistent treatment of data (requiring a multiple of 7 years (e.g., two 7 year periods)). How this tension is best resolved depends on whether the IMs are treated as setting a value for

104. The following table is the same as Table 2-4 except it uses two 7-year estimation windows.

Table 2-6: Simple average two 7 year periods (two 7 year periods ending 31 March 2023 with 18-month COVID-19 starting 21 Feb 2020)

Sample	Simple average incl COVID	Simple average ex COVID	COVID-19 uplift 50-20 year frequency	Average asset beta including COVID-19 uplift
NZCC DD sample [29]	0.62	0.53	0.04 - 0.09	0.57 - 0.62
AIAL, Zurich, Sydney and AENA	0.73	0.64	0.04 - 0.08	0.67 - 0.72
As above + JAT. (NZCC criteria correctly applied)	0.76	0.68	0.03 - 0.07	0.71 - 0.75
AIAL and Zurich	0.81	0.70	0.05 - 0.10	0.74 - 0.80
Wider (2016 IM method) sample	0.74	0.66	0.03 - 0.07	0.70 - 0.74

2.7.2 Weighted samples using 14 years of data

105. Table 2-7 shows the impact of weighting AIAL that I consider is consistent with the literature cited in the Bela advice to the NZCC and using two 7- year estimation windows.

asset beta to be used in PSEs (in which case two 7 year periods is best) or a method by which asset beta should be estimated at the start of each PSE (in which case two 5-year periods is best).

29 If Sydney is included in the second five year period, simple average incl COVID/ simple average excl COVID/ uplift/ asset beta with uplift = 0.62/ 0.52/ 0.04-0.09/ 0.56-0.61.

Table 2-7: Weighted average two 7 year periods (two 7 year periods ending 31 March 2023 with 18-month COVID-19 starting 21 Feb 2020)

Sample	Simple average incl COVID	Simple average ex COVID	COVID-19 uplift 50-20 year frequency	Average asset beta including COVID-19 uplift
NZCC DD sample [30]	0.73	0.62	0.04 - 0.09	0.67 - 0.72
AIAL, Zurich, Sydney and AENA	0.76	0.67	0.04 - 0.09	0.71 - 0.76
As above + JAT. (NZCC criteria correctly applied)	0.80	0.71	0.04 - 0.08	0.74 - 0.79
AIAL and Zurich	0.81	0.70	0.05 - 0.10	0.74 - 0.80
Wider (2016 IM method) sample	0.74	0.66	0.03 - 0.07	0.70 - 0.74

2.8 Failure to invest in airport capacity raises airline fare prices

106. The CUI index discussed above relies on data from a 2016 study by SEO Amsterdam Economics. The focus of that study was on the role of airport capacity constraints diminishing competition between airlines and, ultimately, leading to higher airfares. Their conclusions are summarised below .[31]

- Theory predicts failing to invest in airport capacity raises airline prices materially;
- Econometric analysis using CUI confirms this;
- Airline tickets at the most congested airports (CUI of 0.60 and above) were €5.65 higher due to capacity constraints in 2014 and were projected to be €10.42 in 2035. In New Zealand dollars this is around $10 and $18 per fare.
- Regulatory reform was needed to:
  - i. deliver the required continued investments in airport capacity; and
  - ii. "remove the incumbent airline's disincentives to support capacity expansion".

30 If Sydney is included in the second five year period, simple average incl COVID/ simple average excl COVID/ uplift/ asset beta with uplift = 0.72/ 0.62/ 0.04-0.10/ 0.66-0.72

31 SEO, The impact of airport capacity constraints on air fares, 24 January 2017, Commissioned by ACI Europe.

107. In 2016 AIAL's CUI was around 0.64 – marginally above the 0.60 threshold identified by the authors as triggering higher airline prices. That is, even though AIAL has low CUI compared to the draft decision comparators, it is still high enough to be of concern regarding its effect on retarding competition between airlines.

108. If AIAL does not expand capacity in line with growth in demand this could lead to material medium to long-term effects on airline competition in New Zealand – with customers flying through Auckland paying premiums on their airfares consistent with the SEO estimates ($10 to $18).

109. In this context it is important to understand that airlines and airline customers' incentives are not aligned in relation to setting the regulated WACC for airports. Airlines have a strong incentive to argue for a lower WACC (lower than the airport's cost of capital) because this benefits them in two ways:

- First, by undermining investment in new capacity, the airlines get to charge higher prices for flying through the airport; and
- Second, the airlines pay a lower price for using the capacity.

110. By contrast, customers lose in two ways:

- First, they have to pay the higher airline airfares; and
- Second, they suffer a loss of amenity in the form of poorer terminal facilities and connections as well as more flight delays.

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3 Summary of draft decision

111. The NZCC draft decision involves significant departures from previously well-established regulatory precedent in relation to the estimation process for airport asset betas. The effect of these departures from regulatory precedent is to reduce the final asset beta (and therefore the compensation for risk) by more than 25% relative to the level of compensation that would have prevailed had established regulatory practice been maintained (0.55 vs 0.76).[32]

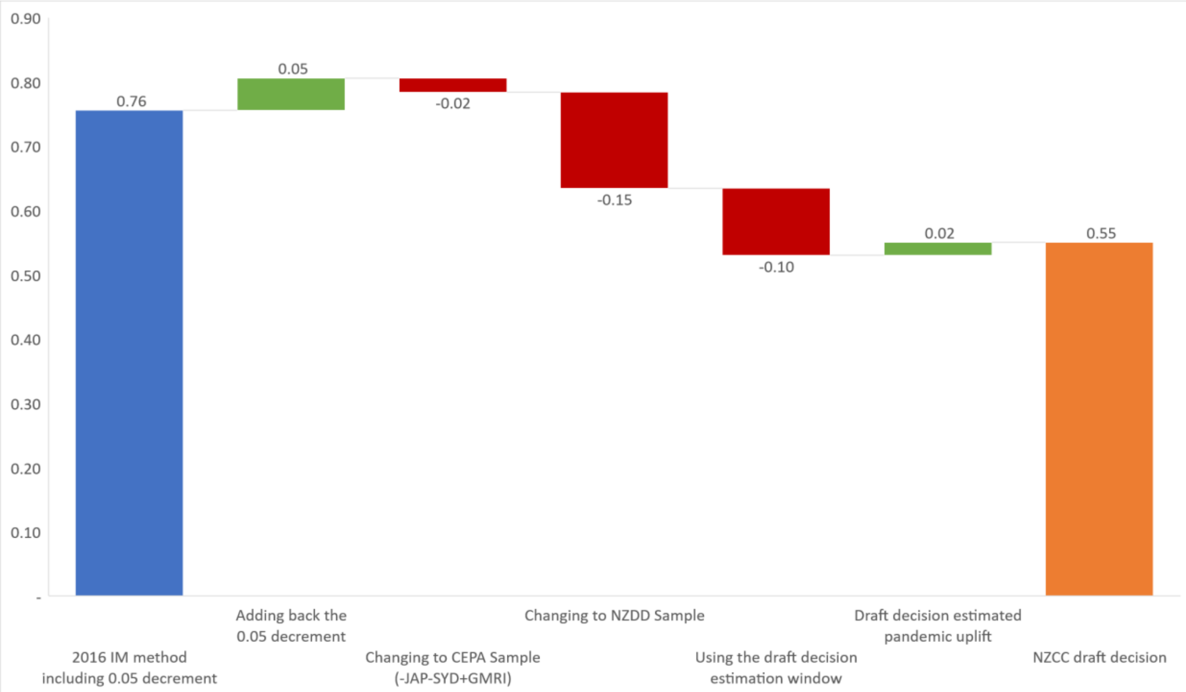
112. The individual impacts of changes in regulatory precedent are described in Figure 2-1 below.

- Strict application of 2016 IM regulatory precedent (using 10 years of data to 31 March 2023 and the wider sample) would have resulted in an asset beta of 0.76 – equal to the wider sample average of airport asset betas (0.81) less a 0.05 decrement to arrive at an estimate of the asset beta for aeronautical operations;
- Adding back the 0.05 decrement takes the estimated asset beta up to 0.81 (or, if the CEPA version of the wider sample is used, then 0.79);
- The change from a wide to a narrow sample reduces the estimated asset beta by 0.17 or 0.15 depending on whether my or the CEPA wider sample is adopted;
- The change in the estimation window to end prior to COVID-19 results in a further 0.10 reduction;
- The estimated pandemic uplift raises the asset beta estimate by 0.02.

113. The net effect of all three departures from regulatory precedent is a reduction of **0.23** in the asset beta relative to continuation of the established 2016 and 2010 IM method.

[32] 0.76 is calculated as follows. 0.81 is the average asset beta for the wider sample (2016 IM methodology) measured over two 5 year periods ending 30 March 2018 and 30 March 2023. Then a 0.05 decrement (2016 IM methodology) is applied to that value to arrive at an estimate of the asset beta for aeronautical operations.

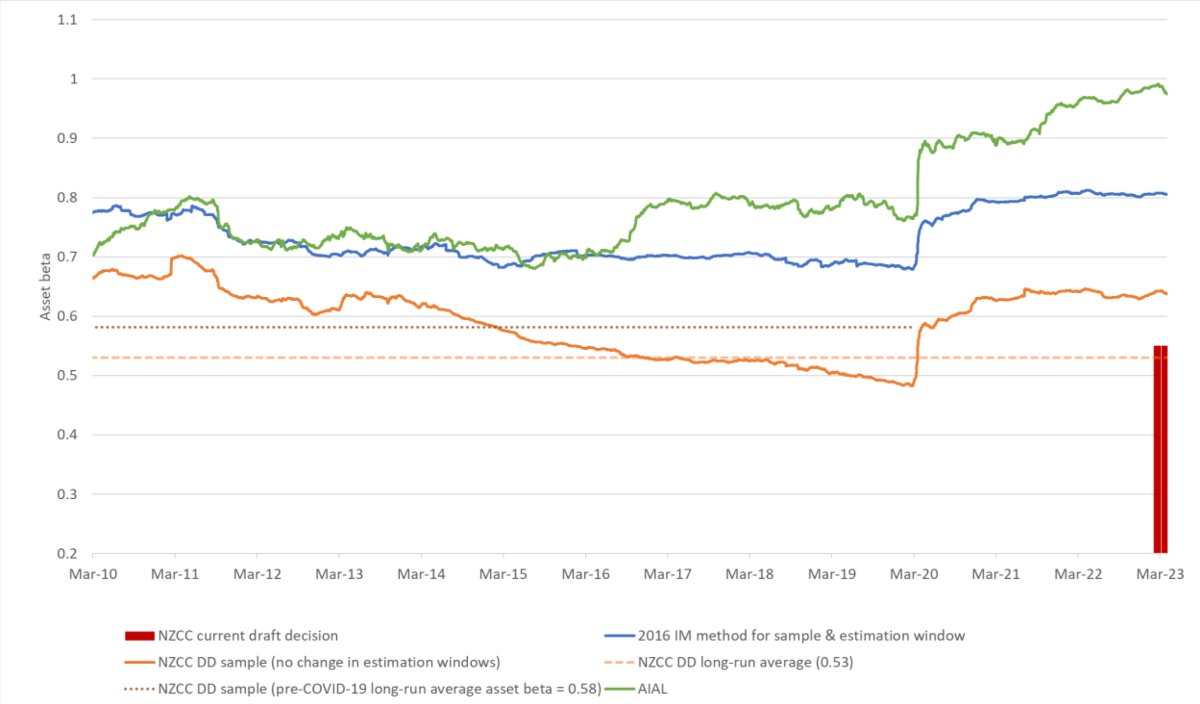
Figure 3-1: NZCC draft decision vs CEPA and CEG samples with estimation windows based on 2016 IM method



Notes: the estimation windows that aligns with the 2016 IM method are 1 April to 2013 to 31 March 2018 (first five-year period) and 1 April 2018 to 31 March 2023 (second five-year period).

114. Figure 2-2 below provides a similar comparison using timeseries charts for the asset beta using the 2016 IM and the 2023 draft decision sample methodologies. The blue time series shows the average asset beta in the wider (2016 IM methodology) sample. The 10-year asset beta in March 2023 is 0.81 (being the average of two 5 year periods ending 31 March 2023).

Figure 3-2: 10 year (average of two 5 year) asset betas overtime (draft decision sample versus 2016 IM methodology sample)



Notes: I apply the CEPA sample +JAT & SYD less GMR which, relative to the 2016 IMs excludes some low beta firms (TAV, Airport Fac, Save and GMR) and one high beta firm (Aero). The time series are based on NZCC's 2023 R code. It is noted that the March 2016 number is around 0.05 higher than the 0.65 (sample average without applying 0.05 decrement) in the 2016 IM. This appears to be due to slight differences in the sample set and between NZCC's 2023 R code and its 2016 excel spreadsheet that are not discussed in the draft decision but which are outlined in Appendix C.1.4.

115. The orange times series is the average asset beta for the draft decision sample. The impact of the draft decision choosing a lower risk sample can be seen in the difference between the orange and the blue time series. Had the NZCC applied this sample in its 2016 IM decision then the 10-year sample average asset beta would have been 0.55 (in March 2016) and, after a 0.05 decrement (consistent with the 2016 IM method), the final asset beta would have been 0.50.

116. Had the NZCC's only departure from regulatory precedent been in relation to the chosen sample it would have estimated an asset beta of 0.63 (based on the average of two five-year periods ending 31 March 2023). However, the draft decision also departs from precedent by:

    a. Estimating a "long term airport asset beta of 0.53".[33] This is estimated using data from before March 2020 in an attempt to arrive at an estimate that is free from

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33 NZCC draft decision, paragraph 4.55.

the impact of COVID-19. The draft decision estimate of a 0.53 "long term airport asset beta" is shown in Figure 3-2 as the constant light orange dashed line.

- The higher (0.58) dark orange dotted line is the 20-year (average of four five-year periods) pre-COVID average for the draft decision sample. The draft decision does not report this figure.

b. Adding back 0.02 in compensation for pandemic risk – bringing its estimate to 0.55. This is shown as the height of the red bar.

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4 The best sample must track AIAL asset beta in the long run

4.1 The most accurate sample has long run average asset beta close to AIAL long run average

117. AIAL is, by definition, the best comparator to AIAL in the sample. AIAL is also demonstrably the most comparable airport company to New Zealand airport companies. AIAL is subject to the same New Zealand economy wide shocks as the other New Zealand airports and is closest in size (see Figure 5-14), capacity utilisation (see Figure 5-2) and diversity of origin/destination shares to those airports (see Figure 5-6 to Figure 5-13).

118. It follows that AIAL's measured asset beta will provide the most accurate proxy asset beta for New Zealand airports asset beta.

119. However, it is also true that measured asset betas for a single firm are noisy. Over any given estimation window, the measured asset beta reflects the mix of economic shocks and responses that occurred in that period. This can cause the measured asset betas for individual companies to "jump around" in a manner that does not always reflect the true underlying asset beta risk for that firm.

120. There are two potential solutions to this "volatility problem" associated with individual company measured asset betas. These are to:

    - Give sole or primary weight to the company's (in this case AIAL's) measured asset beta but to use a longer estimation window in order to average out volatility over time; and/or
    - To form a larger sample of companies who have had, on average, similar asset betas to AIAL in the past.

121. The problem with sole reliance on the first approach is that it might be necessary to have very long estimation windows (longer than 10 years) in order to have enough data to sufficiently "average out" the volatility in a single comparator's measured asset beta. This might be reasonable if it was known that the asset beta for that industry (in this case, airports/aviation) was stable. However, if the asset beta for the industry was changing overtime a long estimation window will introduce bias.

122. For this reason, it is common, and in my view good practice, to form a sample of comparators who, in the past, have had similar asset betas to the best comparator(s) (in this case, AIAL). With a large sample size, the noise in each comparator's asset beta tend to cancel out and the average asset beta is much more stable. This allows for the use of shorter estimation windows (10 years or less) that capture industry

trends but which avoid the volatility that would be associated with a small sample (even if that small sample was comprised of the best comparators).

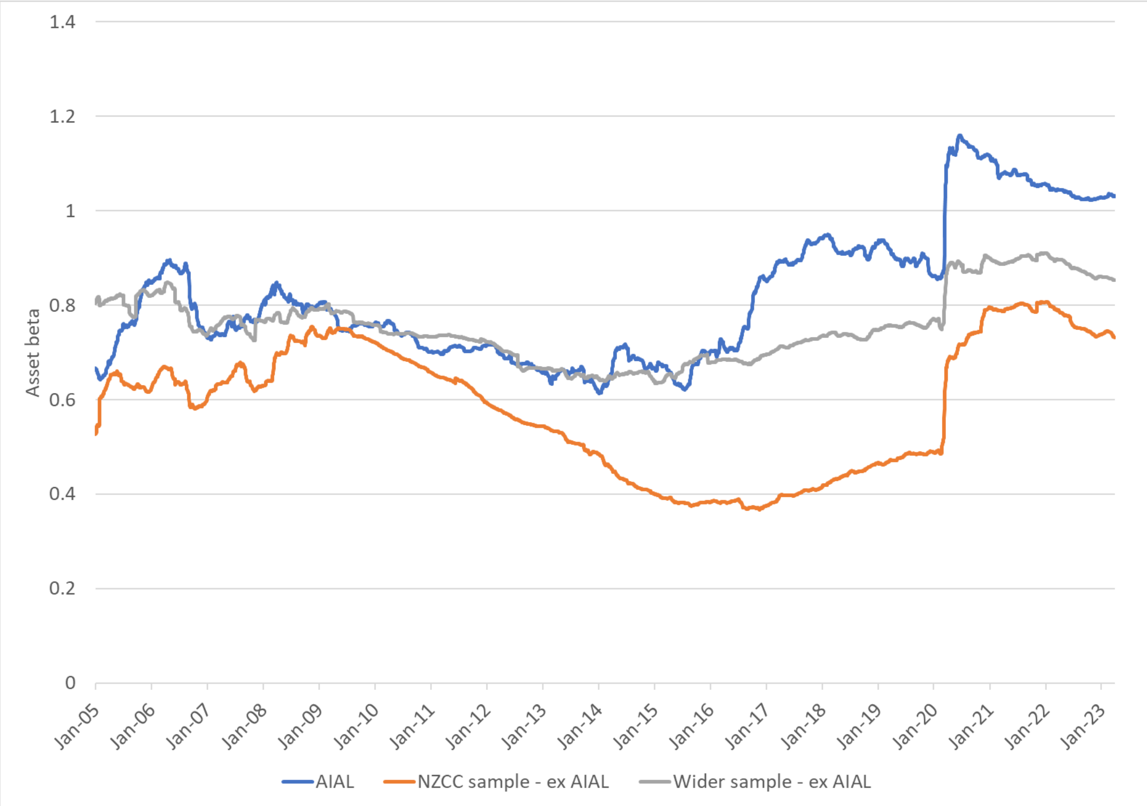
123. In some circumstances it may be necessary to form a sample that the researcher knows is biased. For example, imagine that the only other listed airport companies were companies that were known to have lower risk than AIAL, WIAL and CIAL. In that case, it may still be sensible to form a sample using these comparators and to make other adjustments to attempt to deal with the known bias. For example, one could apply an uplift to correct the bias and/or give more weight to AIAL than to the other airports in the sample.

124. I note that Bela advised the NZCC to consider giving most weight to AIAL and I discuss this further in section 4.4 below. I also discuss the conceptual literature on the trade-off between accuracy and volatility in more detail in section 4.3. However, the relevant themes can be well illustrated in the context of Figure 4-1.

125. Figure 4-1 shows a time series for the 10-year asset beta (using the 2016 IM methodology of averaging over two consecutive 5-year estimation windows) for:

- AIAL (blue line);
- The wider (2016 IM methodology) sample excluding AIAL with 23 comparators (grey line); and
- The narrow NZCC draft decision sample excluding AIAL with 7 comparators.

Figure 4-1: AIAL vs wider (2016 IM) and narrow NZCC draft decision sample



Notes: each single point on the line represents a 5 year asset beta with the respective sample.

126. It can be seen that the wider sample average was very similar to the AIAL asset beta mid 2005 until late 2015 when the AIAL asset beta increased relative to (at a faster rate than) the wider sample average asset beta. A consistent gap of around 0.1 has existed between these estimates since then. Consistent with this, the wider sample average asset beta has been more stable than the AIAL single company beta estimate.

127. However, it is entirely to be expected that the AIAL asset beta will be above the sample average asset beta for some periods. It is possible that this reflects higher risks for AIAL than the sample average. However, it is equally possible that this simply reflects noise in the single company AIAL asset beta estimates.

128. If the same or larger gap was maintained by the time the 2030 IMs were being finalised, it might be appropriate to consider the options described above (an uplift for New Zealand airports relative to the sample average and/or greater weight to AIAL).

129. By contrast, the draft decision sample average asset beta ex AIAL only ever provided a close approximation to the AIAL asset beta during 2008 and 2009. After that, the draft decision sample asset beta fell steadily relative to both the AIAL asset beta and the wider sample average asset beta. The draft decision sample average asset beta has

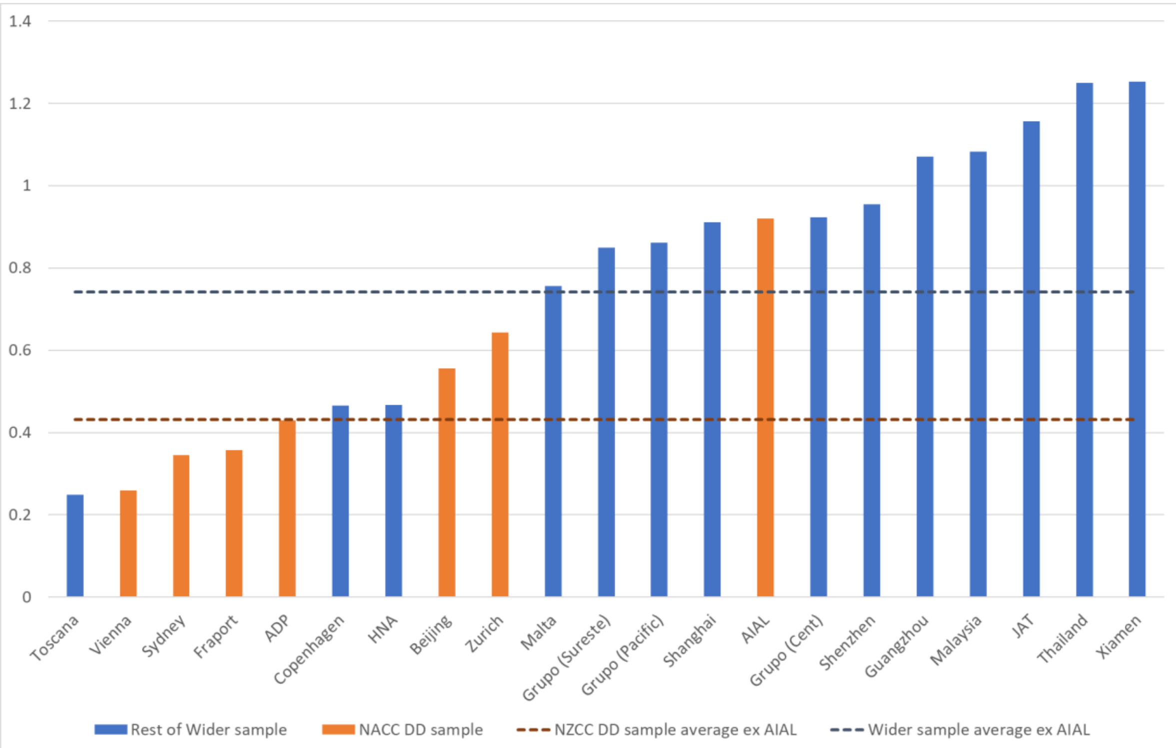
been much more volatile than the wider sample average and less accurate (further from AIAL in the long run). In fact, the draft decision sample average excluding AIAL has been more volatile than the single company AIAL asset beta time series.[34]

130. These facts suggest that the draft decision sample is an extremely poor sample to combine with AIAL. There is considerable sacrifice in terms of accuracy and there is no benefit in terms of reduced volatility.

131. This is strong empirical evidence why I consider that maintenance of the 2010 and 2016 IM sample selection methodology is superior to the draft decision sample selection methodology. This empirical evidence is strongly confirmed by further analysis I perform in section 5 below where I demonstrate that the draft decision sample ex AIAL operate in materially lower risk environments than New Zealand airports (with the only somewhat close comparator being Zurich airport).

132. Consistent with this, Figure 4-2 shows how the NZCC draft decision sample asset betas (orange) compares with the wider 2016 IM sample (orange and blue). The period shown below is 5-years to 31 March 2018.

Figure 4-2: 5 years to March 2018 asset betas for NZCC DD sample and wider sample (2016 IM method)



34 The coefficient of variance (SD/mean) between Jan 2005 and Mar 2023 for the wider sample excluding AIAL is 10%; the DD NZCC sample excluding AIAL is 23% and AIAL is 17%.

133. If the NZCC draft decision had chosen a sample set that is more comparable to the NZ Airports, it would be reasonable to expect the comparators to be clustered around AIAL. Instead, as outlined above, the draft decision sample comparators are exclusively below AIAL and below almost all of the wider 2016 IM sample.

134. In my view, the NZCC has clearly not identified the "most comparable" airports to AIAL and New Zealand airports. Rather, the NZCC has identified a narrow sample that has the lowest asset betas in the wider 2016 IM sample (the only exceptions are the four airports that the NZCC has identified as illiquid (Toscana, Bologna, Copenhagen and HNA).[35]

4.2 Precision and accuracy of the wider sample compared to the DD sample

4.2.1 Precision of the wider sample

135. AIAL is the most comparable of any airport to the NZ airports. However, relying on a large geographically diverse sample (that has, on average over time, resulted in asset betas similar to AIAL) has the advantage that the resulting regulatory asset beta will be more stable (consistent with underlying risk) and less sensitive to noise in the estimation of AIAL's asset beta.

136. However, if a small sample, as proposed by the NZCC, is used then the benefits of stability (noise cancellation) are lost. Moreover, if the sample is less comparable to NZ Airports (as is the case) then the end result is less accuracy and more volatility.

137. These issues are well illustrated in Table 4-1 where it can be seen that:

- The draft decision sample asset beta is **2.4 times more volatile** (as measured by the coefficient of variation) than the wider sample and is 1.4 times more volatile than just relying on AIAL alone; and
- The draft decision sample asset beta is **3 times less accurate** (38% lower versus 13% lower) as a predictor of the AIAL asset beta.

35 NZCC draft decision, attachment A, pages 170 & 171. The NZCC themselves have accepted that illiquidity biases asset betas down.

Table 4-1: Relative volatility in 5 year asset betas over time

Sample	Average of 5 year asset betas	Standard deviation	Coefficient of variation (SD/Mean)
Wider (2016 IM update) sample ex AIAL	0.75	0.08	10%
AIAL	0.82	0.14	17%
NZCC DD sample ex AIAL	0.59	0.14	24%

Notes: These averages and volatilities are based on 5 year asset betas calculated daily between Jan 2005 and March 2023 (i.e., the three lines in Figure 4-1).

4.2.2 Accuracy of the wider sample

138. The wider 2016 IM sample average excluding AIAL is not statistically significantly different to AIAL but the draft decision sample excluding AIAL is. This is illustrated in the table below.

Table 4-2: Average asset beta (with p-value in comparison with AIAL)

	2013-18	2018-23
AIAL	0.92	1.03
NZCC DD sample exAIAL	0.43 (0.3%)	0.73 (4.6%)
Wider (2016 IM updated) sample ex AIAL	0.74 (34.4%)	0.85 (36.2%)

139. The above table compares the asset beta of the NZCC draft decision sample and wider sample excluding AIAL between the asset beta of AIAL. The non-bracket values are the samples' average asset betas in the respective periods. The bracket values are the p-values calculated from the significant test based on the regression standard errors calculated in the NZCC's R model.

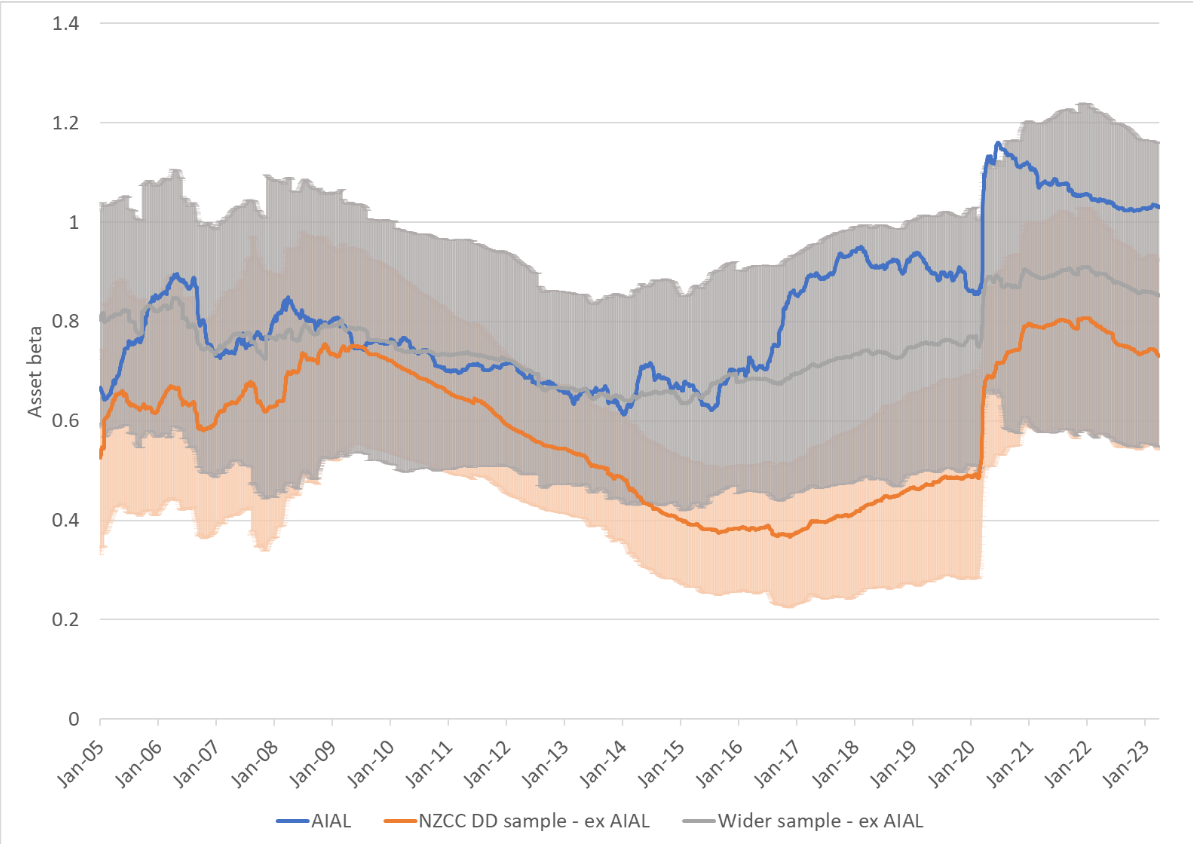
140. In the first 5 year period (31 March 2013 to 1 April 2018), the average asset beta for AIAL is 0.92 and the NZCC draft decision sample excluding AIAL is 0.43 (red line in Figure 4-2). The statistical test suggests that there are 0.3% chance that they are the same (i.e., one cannot reject the null hypothesis of they are different at basically any significance level).[36] Whereas the average asset beta for the wider sample excluding AIAL is 0.74 and has a 34.4% chance of being the same to AIAL's asset beta (i.e., one can reject the null hypothesis that they are different even at the 10% significance level).

[36] The common threshold used are 1%, 5% and 10%.

141. Though the gap became smaller, we can observe that the second 5 year period (31 March 2018 to 1 April 2023) provides a similar conclusion.

142. Extending the above analysis, I have created a time series of 5 year asset betas for AIAL, the NZCC draft decision sample excluding AIAL and the wider sample excluding AIAL. With both the latter samples wrapped with a 95% confidence interval.

Figure 4-3: 5 year asset beta time series (NZCC and wider sample vs AIAL)



Notes: replication of Figure 4-1 with 95% confidence interval added.

143. In the figure above, the grey shaded area is the 95% confidence interval for the grey line (wider sample excluding AIAL), and the orange shaded area is the 95% confidence interval for the orange line (NZCC draft decision sample excluding AIAL).

144. As illustrated, one can observe that the blue line (AIAL) is almost always within the grey shaded area, except for a tiny window during the peak of COVID. Whereas since around mid to late 2013, it has deviated from the orange shaded area.

145. This implies that the sample mean of AIAL consistently falls within the 95% confidence interval of the sample mean derived from the wider sample excluding

AIAL. Furthermore, the NZCC draft decision sample excluding AIAL has been unable to capture the AIAL sample mean over the past 10 years.

146. An alternative approach to illustrate this analysis would be to only wrap the AIAL with its 95% confidence interval, which would result in a very similar observation.

4.3 Trading off accuracy for precision/stability – conceptual framework

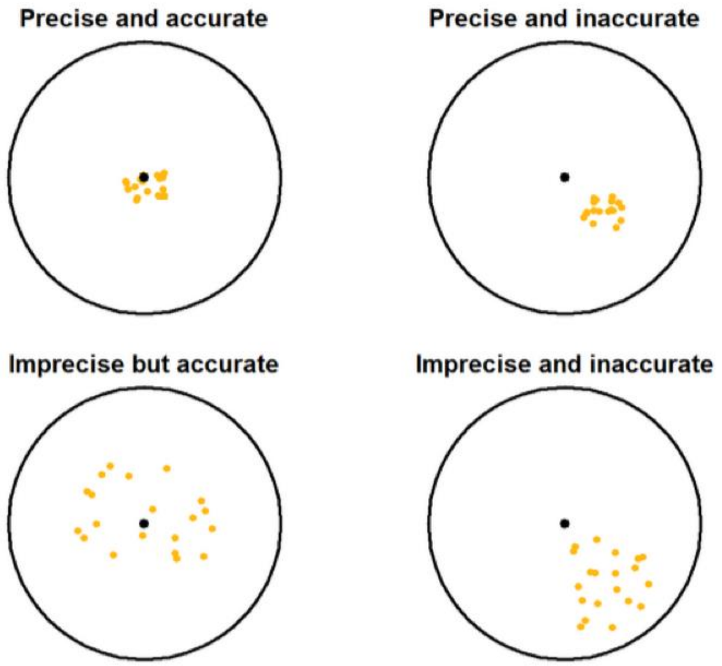
147. The framework set out in section 4.2 is the standard framework for assessing the sampling and other processes where there is an attempt to measure an unknown variable. For example, Dunn (2021) states (emphasis in the original).[37]

> *Two issues concerning sampling, raised in Sect. 2.1, were:* which *individuals should be in the sample, and* how many *individuals should be in the sample be. These two issues address two different aspects of sampling:* ***precision*** *and* ***accuracy*** *(Fig. 2.1).*
>
> ***Accuracy*** *refers to how close a* sample *estimate is to the* population *value (on* average*).* ***Accuracy*** *is related to the statistical concept of* **bias** *(Chap. 2.10).* ***Precision*** *refers to how close all the possible sample estimates are likely to be (that is, how much variation is likely in the sample estimates).*
>
> ***Definition 2.1 (Accuracy)*** Accuracy *refers to how close a* sample *estimate is to the* population *value, on average.*
>
> ***Definition 2.2 (Precision)*** Precision *refers to how close the sample estimates from different samples are likely to be to each other.*
>
> *Using this language:*
>
> *The* type *of sampling (i.e., the way in which the samples in selected) impacts the* accuracy *of the sample estimate. In other words, the type of sampling impacts the* external validity *of the study.*
>
> *The* size *of the sample impacts the* precision *of the sample estimate.*
>
> *For example, large samples are more likely to be* precise *estimates because each possible sample value will produce similar estimates, but they may or may not be accurate estimates. Similarly, random samples are likely to produce* accurate *estimates (and hence the study is more likely to be externally valid), but they may not be* precise *unless the sample is also large.*

37 Dunn, P (2021), Scientific Research and Methodology: An introduction to Quantitative Research in Science and Health, Section 2.2.

148. Figure 4-4 is a modified version of Figure 2.1 from Dunn (2021).

Figure 4-4: Precision and accuracy in sampling (modified from Dunn (2021))



Modified from Dunn, P (2021), Scientific Research and Methodology: An introduction to Quantitative Research in Science and Health, Section 2.2.

149. In the context of estimating the asset beta for New Zealand airports:

a. Relying solely on AIAL's asset beta is the equivalent of the bottom left quadrant (accurate but imprecise);

b. Relying on the wider sample is one of the top two quadrants:

   i. Accurate and precise - if one discounts the recent high AIAL asset betas as noise;

   ii. Precise but inaccurate - if one treats the failure of the wider sample to rise with AIAL's measured asset beta as evidence of downward bias in the wider sample average.

c. Relying on the NZCC draft decision sample is both inaccurate and imprecise. That is:

   i. Always underestimating AIAL's asset beta; and

   ii. Doing so with high levels of fluctuations over time.

4.4 Bela advice to the NZCC to give most weight to AIAL

4.4.1 Bela advice

150. Bela advised the NZCC as follows:[38]

> *The NZCC estimates asset betas for comparable airports around the world including AIAL and assumes that the average asset beta from this comparator sample is the asset beta that applies to AIAL. The NZCC estimates asset betas for comparable airports around the world including AIAL and assumes that the average asset beta from this comparator sample is the asset beta that applies to AIAL.* ***It is more common in the academic literature to use a formula that "shrinks" the beta estimate for a particular firm towards the average beta estimated for peer firms based on metrics such as size and/or industry (e.g., Vasicek, 1973; Karolyi, 1992).*** *However, the NZCC approach has the advantage of giving more transparency as to the impact of each of the comparator firms.*

151. This is advice to the NZCC that it should consider giving AIAL more weight than other comparators in the sample. It is important to note that this advice was given to the NZCC before the draft decision and was based on the wider IM 2016 sample methodology. That is, it was before the NZCC narrowed its sample to firms that had materially and persistently lower measured asset betas than AIAL (see sections 4.1 and 4.2 above) and which operated in clearly lower risk operating environments than AIAL (see section 5 below). As explained in sections 4.1 above, the justification for increasing the weight on AIAL and/or making other adjustments to the sample average is many times stronger if the NZCC were to adopt its narrow sample in the final decision.

152. Notwithstanding this fact, the draft decision did not address/evaluate Bela's recommendation.

153. I am familiar with the literature referred to by Bela and its basic message which I have set out in the previous subsections above.

154. In one of the papers cited by Bela, Vasicek (1973),[39] the primary concern is that equity beta estimates should be informed by prior knowledge. In its example with an estimated equity beta much lower than 1, it states that based on prior knowledge of equity beta, the estimate is more likely to be an underestimate rather than

38 Marshall, B, Nguyen, NH & Visaltanachoti, N (2023), Comment on the Auckland Airport Input Methodologies Submission, Bela Enterprises, paragraph 11.

39 Vasicek (1973), "A Note on Using Cross-Sectional Information in Bayesian Estimation of Security Betas", The Journal of Finance, no. 5, pp. 1233-1239.

overestimate. It therefore supports a Bayesian estimation approach where we give weight to our existing knowledge of equity beta, such that the prior knowledge that the average equity beta in a market is equal to 1.

155. If the sample size is small, the Bayesian approach would put less weight on the data and more weight on the prior. This is consistent with my discussion in section 4.1 above.

156. Vasicek (1973) also gives an example of the Security Risk Evaluation service by Merrill Lynch, Pierce, Fenner & Smith, which utilises a simple formula of weighted average of 1 and regression estimate to avoid the increased likelihood of underestimation when estimated equity beta is less than 1. In the current context, it would be more relevant to use a weighted average of AIAL's asset beta and regression estimated asset beta.

157. The other literature cited by Bela, Karolyi (1992)[40], tests the principles behind Vasicek (1973) using an estimator that allows different priors, depending on the size and the industry of the firm, and finds it produces lower forecasting errors than the standard regression approach or in its terminology "naive" approach.

158. The literature indicates that if the sample size is reduced, then less weight ought to be placed on the estimation results based on standard or "naive" methodology.

159. Based on this literature, I consider that it would be reasonable to weight AIAL relative to other comparators at:

- 2 times the weight when using the wider IM 2016 sample method with over 20 comparators (this is equivalent to giving around one tenth instead of one twentieth the weight to AIAL in the sample);
- 7 (6) times the weight when using the wider IM 2016 sample method with just 8 (7) comparators (this is equivalent to giving half the weight to AIAL in the sample).[41]

160. I do not believe that there is strong evidence that the wider sample is biased as a predictor of AIAL, therefore I do not consider that there is any need to apply an uplift to the wider sample weighted average. However, the same cannot be said for the draft decision sample which, even after the reweighting proposed above, would underestimate the AIAL asset beta since 2005 by 0.12 on average. I note that this is not my recommended approach but is only put forward if my recommended approach (continuation of 2016 IM regulatory precedent) is rejected and the NZCC's biased sample is to be used.

40 Karolyi, GA (1992), Predicting Risk: Some New Generalizations, Management Science, vol. 38, no. 1, pp. 57-74.

41 There are only 7 comparators in 2013-18 due to insufficient data for AENA.

Table 4-3: Impact of weighting on narrow and wider sample

	NZCC DD sample	Wider sample (IM 2016 method)
AIAL beta	0.97	0.97
Rest of sample beta	0.58	0.80
# Firms in sample including AIAL	8	24
Equal weight to all firms beta	0.63	0.81
Increase the weight to AIAL by	7 (6) times	2 times
Weighted average beta	0.78	0.81
Impact of weighting	**0.14**	**0.01**

161. It can be seen that the reweighting has very little impact on the wider sample because it already tracks AIAL's asset beta closely. Due to this, and because regulatory stability is important, I would not propose such an adjustment to the wider 2016 IM sample.

162. However, I consider that an adjustment along the lines set out in Table 4-3 above is critical if the NZCC draft decision narrow sample was maintained.

4.4.2 NZCC, UKCAA and Australian regulatory precedent is consistent with Bela advice and not consistent with NZCC interpretation

4.4.2.1 NZCC 2023 draft decision

163. The draft decision itself notes that international WACC comparisons are not as relevant as domestic WACC comparisons.[42]

> *We consider that New Zealand sourced WACC estimates should be given more weight than overseas estimates. International WACC estimates can be affected, among other things,* ***by country-specific factors such as differences in tax regimes, monetary conditions, regulatory objectives and regimes.*** *In its judgement on the IMs merits appeals, the High Court agreed that "...the most helpful comparative material for cross-checking purposes comprises independent assessments of WACC in the New Zealand context".*

164. This logic applies even more so to the asset beta as it does to other elements of the WACC. The asset beta of an airport operating in New Zealand is of much more

42 NZCC draft decision, paragraph 7.9.

informational content than the asset beta for airports operating internationally - especially the mega airports that dominate the draft decision sample (see section 5.3).

165. Nonetheless, the NZCC has chosen a narrow sample of airports that are least comparable to AIAL (in terms of measured asset betas and observable operating risk) but has failed to give AIAL any more weight than these airports, or to make any other adjustments to the sample average.

166. As can be seen in Figure 4-1, applied today or at almost any other time in the past, this results in a predicted asset beta for New Zealand airports that is around one third lower than the observed asset beta for the only listed New Zealand airport. As explained in 4.2, it results in an asset beta that is statistically significantly different to the level of the measured AIAL asset beta at the 1% level when using the NZCC's own measures of standard error in asset beta estimates for a sample.

167. The draft decision incorrectly cites international precedent from the UKCAA and Australian as supporting its approach.

> *4.38 Evidence from other regulators indicates a preference to have a sample of relatively close comparators.*

4.4.2.2 UKCAA precedent

168. UKCAA and Australian regulatory precedent referred to by the NZCC strongly supports the Bela position of primary weight being given to AIAL.

169. The Civil Aviation Authority (2018) explained that they place more weight on domestic evidence compared to international comparators:[43]

> *While international case studies provide useful evidence, we are likely to place more weight on UK regulatory precedent and evidence from UK financial markets.*

170. In a report for the H7 beta assessment, Flint (2022) explains how Auckland's asset beta is a poor comparator for Heathrow, but more broadly, large European Airports:[44]

> *While European markets are relatively integrated, local indices are more appropriate for Sydney and Auckland which are less integrated markets*
>
> ...

43 Civil Aviation Authority (2018), Economic regulation of capacity expansion at Heathrow: working paper on the cost of capital and incentives, May 2018, footnote 14.

44 Flint (2022), Support to the Civil Aviation Authority: H7 Updated Beta Assessment, page 33.

Auckland operates in such a different geographical market it is likely to be exposed to different risks compared to larger European airports even in more benign times.

171. Clearly, the same logic applies in reverse and European Airports are not the closest comparators to New Zealand airports.

172. In the initial proposal of the H7 decision the UK Civil Aviation Authority (2021)[45] explains that they place different weights on comparators based on the degree of similarities to Heathrow. The relative importance of comparators was determined after discussing factors such as regulatory regimes, relative sizes, market diversification and share of domestic and international traffic.

173. In their 2007 report, the UK competition commission did not place weight on international comparators for Heathrow and Gatwick airport – preferring to rely solely on the most recent direct evidence of Heathrow's measured asset beta.[46] Following this advice, the UK Civil Aviation Authority[47] adopted the Competition Commissions analysis. Only since that data became dated did the UK Civil Aviation Authority begin to rely on international comparators.

4.4.2.3 Australian regulatory precedent

174. The Australian regulatory precedent from the Australian Energy Regulator (AER) and the West Australian Economic Regulation Authority (ERA) that the NZCC cites also strongly supports giving most weight to AIAL's asset beta.

175. Both of these regulators prefer asset beta estimates from Australia and are wary of giving substantial weight to foreign comparators that have asset beta estimates that are materially different to asset beta estimates for domestic comparators.

176. The logic of the AER and the ERA decisions would support both:

    a. Rejecting the NZCC narrow sample asset beta as not comparable to domestic asset beta estimates (i.e., prefer the wider sample average to the narrow sample average because it is more similar to AIAL's asset beta); and

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45 Civil Aviation Authority (2021), Economic regulation of Heathrow Airport Limited: H7 Initial Proposals, Section 2: Financial Issues, paragraph 9.49.

46 Competition Commission (2007), Cost of Capital, Appendix F of March 2007 report, page 30, https://webarchive.nationalarchives.gov.uk/ukgwa/20140606022147mp_/http://www.caa.co.uk/docs/5/ergdocs/ccreport_appf.pdf.

47 Civil Aviation Authority (2007), Heathrow and Gatwick Airports CAA price control proposals, November 2007, see paragraphs 11.45 & 11.50, available at https://webarchive.nationalarchives.gov.uk/ukgwa/20140605050546mp_/http://www.caa.co.uk/docs/5/ergdocs/priceproposals_nov07.pdf.

b. If a narrow sample was to be adopted, giving more weight to AIAL's asset beta than to that of the other comparators.

177. The AER's approach to date has been to give zero weight to foreign comparators. The ERA's approach to date has been to, recently, widen its sample to include foreign comparators but to give more weight to domestic observations than foreign observations.

4.5 Qantas claims that AIAL beta is biased

178. Qantas proposes that AIAL is removed from the IM sample on the basis:[48]

> *"...Auckland Airport contributes 6% to the local index, its beta estimate is overrepresented in systematic risk, introducing an upward bias."*

179. This is factually incorrect. The higher an asset's contribution to the local stock market then the resulting equity beta tends to move towards 1.0. That is, the higher a firm's weight in the index the more like the index the beta becomes and, given that the index has an equity beta of 1.0 by definition, the firm's equity beta will move closer to 1.0.

180. AIAL has a measured equity beta that is well above 1.0.[49] That means, based on Qantas' logic, that AIAL's measured equity beta (and therefore its derived asset beta) is biased downward (i.e., downward towards 1.0). Qantas' proposed ground for removal of AIAL is diametrically opposite to the facts.

181. Moreover, AIAL's weight in the New Zealand index is a fact. All investors, but especially New Zealand investors, exhibit material home bias in their investment decision (see Appendix D). This means that whatever comprises the New Zealand index is the correct measure of the market against which to measure risk for New Zealand investors. There is, in fact, no "bias" up or down due to AIAL's weight in the New Zealand index – it is simply fact of life for airport investors in New Zealand.

182. Modern finance theory also tells us that diversification can be achieved by holding a relatively small number of stocks. This is illustrated in Figure 4-5 below which shows that diversification (measured by the reduction in volatility of a portfolio of stocks) is not materially improved by holding more than 20 or 30 stocks. The NZ50 index is made of 50 stocks.

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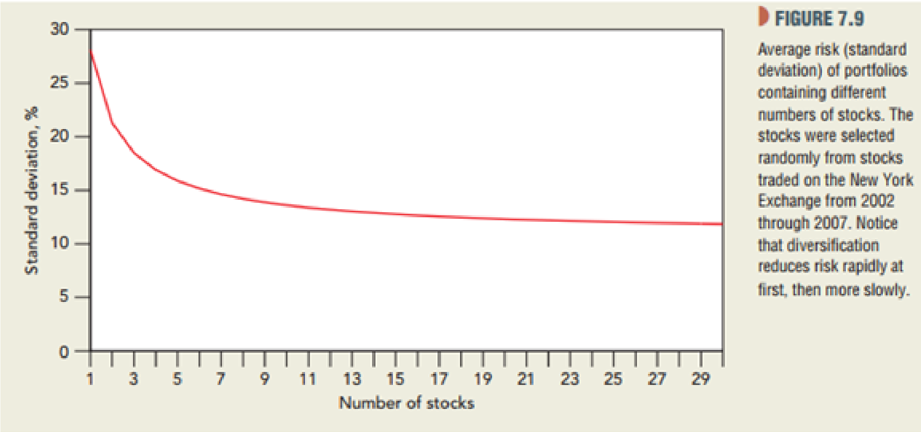
48 Qantas 17 February 2023 submission to the NZCC, *Re: CEPA Report on Aspects of the Cost of Capital Input Methodologies for the 2023 Review*, page 1.

49 AIAL's asset betas measured by CEPA are 0.935 for 2012-17 and 1.025 for 2017-22 with gearings of 21% and 16% respectively. This implies AIAL has equity beta of 1.18 in 2012-17 and 1.22 in 2017-22.

Figure 4-5: Diversification achieved by holding a relatively small number of stocks



Source: Brealey, R. A., Myers, S. C., & Allen, F. (2011). Principles of corporate finance. New York, McGraw-Hill/Irwin.

183. Qantas also removes three separately listed Mexican airports as well as the single listed entity "Airports of Thailand" on the same basis (that they are large relative to the value of the market index). All of these airport companies have measured equity betas above 1.0 and, therefore, to the extent that their size leads to any "bias" in the asset beta it is likely to be downward.

184. However, I also note that Qantas' criteria for assessment of whether a company is large relative to the market is highly peculiar on other grounds. Qantas has applied a rule that all airports in a country are removed from the sample if the sum of the market capitalisation of listed airports in that country exceeds 5% of the total listed equity market capitalisation. This means that even if the individual listed airports in a country are "small" relative to the market then those airports will still be excluded if there are enough of them such that, in aggregate, they constitute more than 5% of the market.

185. I can see no logical basis for applying such an aggregation. By way of illustration of the practical problems of this approach I use summary statistics from the Australian ASX200.[50]

- The three largest companies on the ASX (BHP, CBA and CSL) have market weights of around or above 5%. They are from the Mining/Materials sector, the Banking/Financials sector, and the Drug Manufacturing/Health Care sector. On Qantas' logic it would be inappropriate to use the estimated beta for these companies to assess the beta of their respective industries;

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50 S&P ASX200 Factsheet as of April 28, 2023, accessed on 15 May 2023, available at https://www.spglobal.com/spdji/en/indices/equity/sp-asx-200/#overview.

- Qantas' method is to also disregard estimated betas for all companies in the same industry if the aggregate of the industry market capitalisation exceeds 5%. If a single company has more than 5% index value then, by definition, this would imply disregarding betas for:
  - all listed mining companies in Australia;
  - all listed banking companies in Australia; and
  - all listed drug manufacturers in Australia.
- The above industries are those in which a single company has 5% weight or greater in the index. The Consumer Discretionary sector comprises more than 5% of the index even though no single company has anything close to 5% of the index. The same is true for, Consumer Staples, Real Estate, Energy and Industrials.
- A plausible application of Qantas' method would mean that only companies from 3 sectors (Utilities (1.5%), IT (2%) and Communication Services (4.1%)) would have valid equity beta estimates. This is based on Global Industry Classification Standard (GICS) industry sector definitions. Qantas might argue that it would use narrower industry definitions but this just highlights a further arbitrary delineation problem. For example, if coal miners are to be distinguished from iron ore miners, why would airports not also be distinguished based on their passenger characteristics (e.g., airports serving leisure markets vs serving business markets)?

4.6 Conclusion on best sample

186. Based on the analysis provided above, it can be concluded that the wider (2016 IM method) sample is the preferred option. The wider sample demonstrates better tracking with AIAL over time, reduces noise compared to only using AIAL, and offers increased statistical accuracy and precision compared to the NZCC draft decision sample.

187. Furthermore, it is important to note that retaining the wider sample aligns precisely with the 2016 IM precedent. This not only represents good policy in itself, but also ensures continuity and stability within the regulatory regime. As a result, there is no valid reason to deviate from this approach.

188. In my view the best estimate is associated with the wider sample. This results in a 0.81 asset beta without any COVID-19 adjustment as seen in the bottom row and left-hand column of Table 4-4 below.

189. All other values reported by me are, in my view, inferior to this estimate and are provided to highlight the impacts of various methodological choices.

190. If the NZCC were to use the draft decision sample, which deviates from the 2016 IM, the estimated asset beta with appropriate weighting to AIAL, as discussed previously, would be 0.78.

Table 4-4: Summary table average beta (two 5 year periods ending 31 March 2023)

Sample	**Sample average equal weight to all firms**	**Sample average Bela/UKCAA/Aus reg precedent consistent weights**
Draft decision	0.55	NA
Draft decision sample but retaining regulatory precedent on 10 year estimation window	0.63	**0.78**
Wider sample retaining regulatory precedent o 10 year estimation window	**0.81**	0.81

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5 DD sample has lower asset beta because the airports are lower risk

191. The reason for the low asset betas, which is a measure of systematic risk, in the draft decision sample is their exposure to significantly low risk levels. This lower risk reflects the combination of both:

a. lower risk regulatory regimes which provide greater protection from volume fluctuations; and

b. lower risk underlying volatility of demand.

5.1 Lower risk regulatory regimes

192. A regulatory regime offers protection from fluctuations in demand if:

- Prices are reset more frequently to take into account variations in demand; and/or
- The formula for price setting automatically updates for changes in demand.

5.1.1 New Zealand airport's regulatory regime

193. The regulatory framework in New Zealand does not directly restrict New Zealand airports from setting prices more frequently than every five years (this is a maximum). However, the consultation obligations make it overly onerous for New Zealand airports to sustain shorter pricing periods.

194. In practice, New Zealand airports are subject to five-year pricing periods, which reduces their flexibility and exposes them to negative demand shocks, such as the COVID-19 pandemic.

195. New Zealand airport pricing periods are established by the Airport Authorities Act, which sets out the consultation obligations for aeronautical charges and the five year maximum duration for pricing periods :[51] [emphasis added]

> *Every airport company must* ***consult with every substantial customer*** *in respect of* ***any charge payable*** *by that substantial customer to the airport company in respect of* ***any or all identified airport activities***—

[51] New Zealand Airport Authorities Act (2021), section 4B, https://www.legislation.govt.nz/act/public/1966/0051/latest/whole.html#DLM379824.

(a) before fixing or altering the amount of that charge; and

(b) within 5 years after fixing or altering the amount of that charge.

196. I am instructed that in practice the legislation has established a 5 year pricing period for New Zealand airports within which they bear the risk of demand being lower than forecast at the time prices are set (albeit in light of the uncertainty of demand forecasts post COVID-19 airports (such as Auckland) may seek to include demand risk sharing mechanisms in their pricing to mitigate demand forecasting risk). While airports have a theoretical ability adopt shorter periods or to unilaterally begin a new consultation at their discretion (e.g., after a major shock) these are not, as a matter of practicality, options available to New Zealand airports.

197. For the reasons set out below, for all intents and purposes the regulatory regime that New Zealand airports operate under is best modelled as fixed prices for a 5-year period – within which the airport bears all or most of the risk that traffic deviates from forecast.

198. A media release from Auckland Airport confirms the standard five-year pricing changes and alludes to the consultation process:[52]

> *Auckland Airport re-sets its aeronautical prices every five years, a process that includes consultation with major airline customers and the Board of Airline Representatives New Zealand.*

199. This media release also reveals the magnitude of the onerous consultation process:[53]

> *Auckland Airport's pricing announcement today is the result of 24 months of extensive consultation with major airlines regarding aeronautical investment in Auckland Airport over PSE4 to support their business operations, as well as consultation over the airport's wider ten-year development roadmap.*

200. Unless New Zealand airports are to be in a constant state of pricing consultations, which is highly impractical and costly, pricing periods need to exceed the duration of the extensive consultation process.

201. Therefore, it is little surprise that New Zealand airports and customers would choose the maximum length of pricing periods that the regulation allows.

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52 Auckland Airport (2023), Auckland Airport FY23-27 price changes, available at https://corporate.aucklandairport.co.nz/news/latest-media/2023/auckland-airport-fy23-27-price-changes.

53 Ibid.

202. However, by choosing longer regulatory periods, New Zealand airports minimise the frequency of extensive consultation (with certainty), at the expense of exposing themselves to greater risk to demand shocks between pricing periods.

5.1.1.1 COVID-19 and New Zealand regulation

203. Longer regulatory pricing periods subject airports to greater risks in two distinct ways:

- Firstly, as forecasts get longer, their accuracy diminishes; and
- Secondly, if a shock causes demand to deviate from forecasts within the pricing period, this will lead to deviations from expected profits.

204. The most obvious example of a negative demand shock is the COVID-19 pandemic.

205. Auckland Airport experienced significant deviations from forecasted demand (which informed the airport charges), reaching a low of 25% of forecasted passengers in the 2022 financial year.[54]

> *Actual PSE3 passenger volumes for the five-years commencing FY18 were materially lower than the forecasts prepared in 2017 to set PSE3 aeronautical charges. This was a direct result of the COVID-19 pandemic.*
>
> …
>
> *Passenger movements of 5.6 million for FY22 were only 25% of the forecasted 22.6 million passenger movements for the year.*

206. Auckland had at least two courses of action in FY20.

- Begin a 12+ month consultation period to change prices; or
- Maintain current prices.

207. While we know that Auckland actually chose the latter, it is insightful to consider the implications of the first option.

208. Initiating a costly consultation process would only be worthwhile if the shock lasted longer than the consultation process and if there was sufficient information to allow an effective consultation process. However, the levels of uncertainty engendered by the pandemic meant that a consultation process would have been highly problematic. Moreover, with airlines and airports in "survival mode" attempting to minimise costs in order to survive the shock to revenues, a costly consultation process would have been counterproductive.

54 Auckland Airport, Annual Information Disclosure for the year ended 30 June 2022, Introduction.

209. Furthermore, adding to the uncertainty at the time, no one knew how severe the pandemic would become, which impacted airport's ability to forecast demand:[55]

> *The emergence of Covid-19 is having a significant and immediate impact on travel-demand and it is not possible to reliably forecast future passenger numbers.*

210. In fact, Auckland airports pricing period was set to end in 2022, but was later extended to 2023 to enable consultations to proceed with better information and to assist airlines recover from the pandemic:[56]

> *After considering airline feedback, in January 2022, Auckland Airport announced a price freeze for FY23 which held prices flat at FY22 levels to help airlines rebuild following the COVID-19 pandemic. Prices for FY24 onwards were to be determined following a second round of airline consultation during FY23, with those prices to be based on then forecast passenger volumes and set to achieve Auckland Airport's target return on aeronautical capital for the full 5-year PSE4 pricing period*

211. Wellington Airport was in a unique position in that it was in the process of negotiating PSE4 prices as the pandemic hit.[57]

> *PSE4 forecasts were therefore completed part way during PSE4, incorporating actual results for 2020 and most of 2021, while also factoring in the expected impacts of Covid-19 on 2022–2024 at the time of finalising consultation.*

212. The lengthy consultation process is elaborated by Wellington Airports price setting event disclosure, reproduced below.

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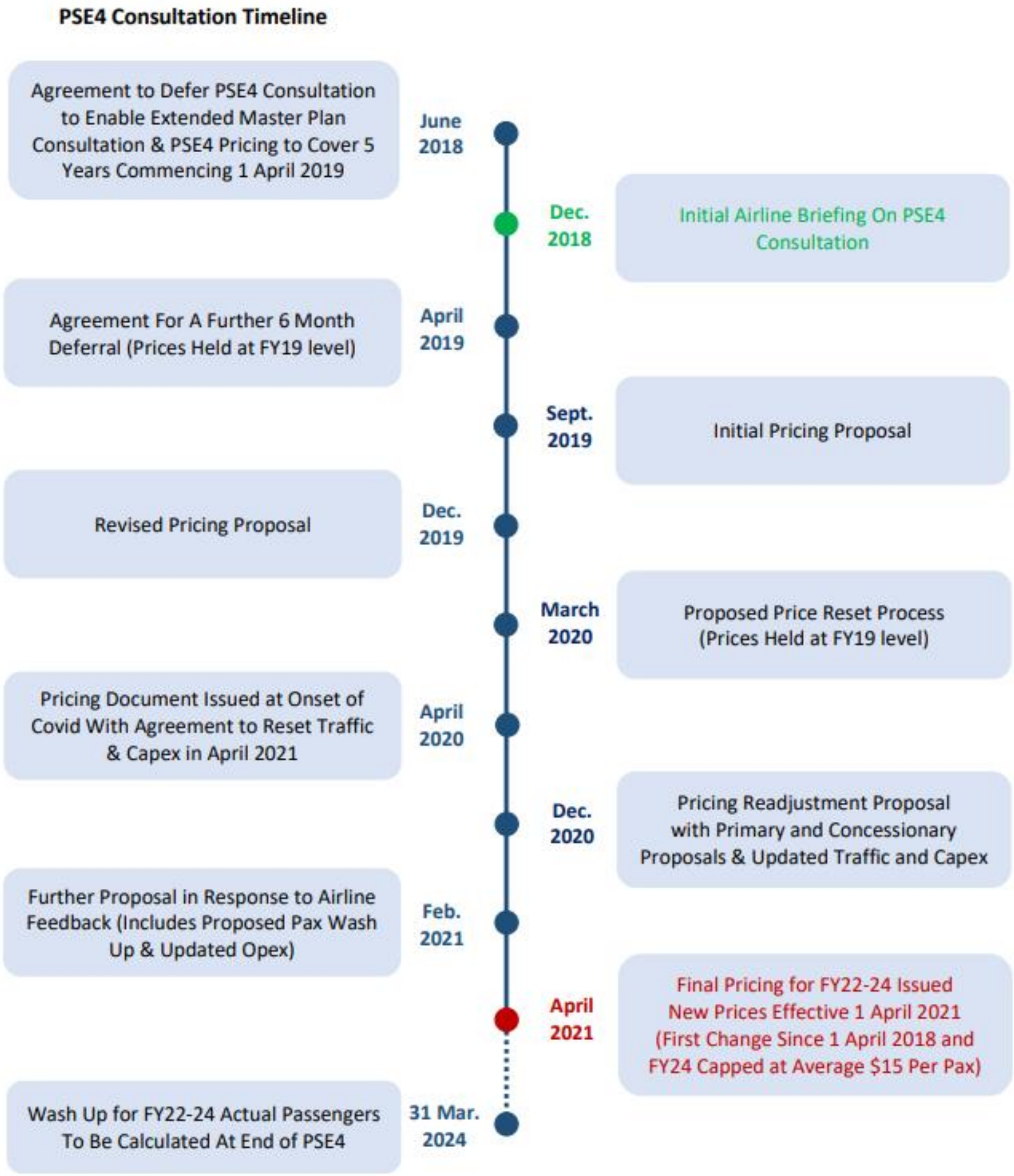
55 Wellington Airport (2020), Annual Disclosure for the year ended 31 March 2020, page 2.

56 Auckland Airport (2023), Regulation, available at https://corporate.aucklandairport.co.nz/investors/regulation.

57 Wellington Airport (2022), Annual Information Disclosure for the year ended March 2022, page 7.

Figure 5-1: Welling Airport PSE4 Consultation Timeline



Source: Wellington Airport (2022), Annual Information Disclosure for the year ended March 2022, page 9.

213. It should be noted that this consultation period lasted nearly 3 years.

5.1.2 Regulatory regimes for other airports

214. The draft decision professes to alter the sample selection method to arrive at more comparable airports to New Zealand airports. However, the draft decision performs no analysis of the regulatory and operating environments at airports when choosing their sample.

215. In this regard, Vienna Airport has, since 2012, reset its prices every year based on updates to the last three years of passenger volumes.[58] This means it has close to zero risk exposure to all but the most dramatic (pandemic level) volatility in passenger numbers. Moreover, Vienna's pricing formulae has a special clause that allows it to reset prices at cost in major traffic reductions and this was triggered by COVID-19 and is currently in the process of prices being amended.

216. Only Copenhagen Airport from the 2016 IM list has a lower asset beta than Vienna in the 5 years to March 2018 and Copenhagen Airport's default regulation is a revenue cap (zero or negative volume risk).[59]

217. Frankfurt[60] and Zurich[61] airport operations have pricing periods that are at their discretion and, in the case of Zurich, must be no more than 4 years. Frankfurt can initiate a new pricing period at its own discretion.[62]

218. Zurich has similar information disclosure and consultation requirements as exist in New Zealand[63] although prices and the term of the agreement must ultimately be approved by the Federal Office of Civil Aviation. For Zurich, once the length of the pricing period has been set: [64]

> *The airport operator may only initiate proceedings for changing the flight operations charges before the prescribed target date if:*

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58 Austrian Airport Charges Act (2012), Federal Law on the Determination of Airport Charges (Airport Charges Act – FEG), May 15 2012, available at https://www.ris.bka.gv.at/eli/bgbl/I/2012/41 & email correspondence with Mr. Ehrengruber.

59 Jaag, C, Trinker, U, Mattmann, M, Schnyder N & Ackerman I (2019), Dublin Airport Cost of Capital for 2019 Determination, Swiss Economics.

60 Germany Aviation Act 19b (2005), https://www.gesetze-im-internet.de/luftvg/__19b.html

61 Ordinance on Airport Charges (2012), https://fedlex.data.admin.ch/filestore/fedlex.data.admin.ch/eli/cc/2012/328/20120601/en/pdf-a/fedlex-data-admin-ch-eli-cc-2012-328-20120601-en-pdf-a.pdf.

62 Jaag, C, Trinker, U, Mattmann, M, Schnyder N & Ackerman I (2019), Dublin Airport Cost of Capital for 2019 Determination, Swiss Economics.

63 See Chapter 2, Section 3 of Ordinance on Airport Charges (2012).

64 See Art. 11 of Ordinance on Airport Charges (2012).

a. extraordinary circumstances arise which have an effect on the cost of airport operation;

b. there are changes to the airport's regulatory environment which were not foreseeable and which have a substantial effect on costs.

219. AdP has a 5 year long pricing period but within those 5 years there are automatic adjustment factors linked to traffic, investments, and operating costs that limit its exposure to unexpected variations in these.[65] However, in May 2020 AdP requested the termination of its 5 year pricing contract due to the exceptional and unforeseeable circumstances of COVID.[66] Since then, AdP has had various prices approved on an annual basis[67] and has postponed the drafting of its next 5 year contract 'sine die'. Beijing Airport's price setting period appears to be at the discretion of the regulator – with periodic price changes being announced. However, these price changes have historically been announced once every 2 or 3 years. For example, between 2007 and 2017, a total of six price related announcements were made.[68]

220. Sydney Airport has the discretion to negotiate with individual airlines for its preferred period and for automatic within period adjustments. Sydney Airport can also

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65 French Civil Aviation Code, Article R224, https://www.legifrance.gouv.fr/codes/section_lc/LEGITEXT000006074234/LEGISCTA000006159872/#LEGISCTA000006159872

66 Autorite De Regulation Des Transports (2020), Decision no. 2020-083 of December 17, 2020, available at https://www.autorite-transports.fr/wp-content/uploads/2021/01/version-publique_decision-2020-083_adp-tarifs-2021.pdf, page 7.

67 Autorite De Regulation Des Transports (2020), Decision no. 2020-083 of December 17, 2020, available at https://www.autorite-transports.fr/wp-content/uploads/2021/01/version-publique_decision-2020-083_adp-tarifs-2021.pdf. Autorite De Regulation Des Transports (2021), Decision no. 2021-068 of December 16, 2021, available at https://www.autorite-transports.fr/wp-content/uploads/2022/01/decision-2021-068-vnc_vf.pdf. https://www.autorite-transports.fr/wp-content/uploads/2021/01/version-publique_decision-2020-083_adp-tarifs-2021.pdfAutorite De Regulation Des Transports (2022), Decision no. 2022-087 of December 8, 2021, available at https://www.autorite-transports.fr/wp-content/uploads/2022/01/decision-2021-068-vnc_vf.pdfhttps://www.autorite-transports.fr/wp-content/uploads/2021/01/version-publique_decision-2020-083_adp-tarifs-2021.pdfhttps://www.autorite-transports.fr/wp-content/uploads/2023/01/decision-2022-087-vnc.pdf.https://www.autorite-transports.fr/wp-content/uploads/2021/01/version-publique_decision-2020-083_adp-tarifs-2021.pdf

68 The announcement in 2008 was for per passenger fee discounts for high utilisation flights. http://www.caac.gov.cn/XXGK/XXGK/ZFGW/201601/t20160122_27655.html. In 2013, one announcement was for charges related to domestic airlines and another announcement was for charges related to diversion landings. http://www.caac.gov.cn/XXGK/XXGK/JGGLL/ZCXWJ/JCSFGL/201603/t20160308_29514.html, http://www.caac.gov.cn/XXGK/XXGK/ZFGW/201601/t20160122_27670.html The announcements in 2007, 2010 and 2017 was related to all services. http://www.caac.gov.cn/XXGK/XXGK/ZFGW/201801/t20180111_48508.html, http://www.caac.gov.cn/XXGK/XXGK/ZFGW/201601/t20160122_27580.html, http://www.caac.gov.cn/XXGK/XXGK/JGGLL/ZCXWJ/JCSFGL/201603/t20160308_29520.html.

negotiate a range of contracts with staggered start and end dates which has the effect of its overall revenues partially updating more frequently than any given contract.

221. Of the airports in the draft decision sample, only AENA has a comparable 5 year regulatory period with no within period adjustments for unexpected developments (AENA did not have enough data to generate a reliable beta for the 5 years ending 30 March 2018).[69] AENA currently applies a 1.87% surcharge to all aeronautical charges to recover the costs of COVID.[70] A key difference between AENA and New Zealand airports is that AENA is majority owned by the state[71] and the key airport legislation in Spain,[72] law 18/2014, prioritises growth and competitiveness. In the foreword of the current pricing contract,[73] the regulator explains that air transportation is a cornerstone of the Spanish economy and that the charges it sets will contribute to the recovery of the sector and ensure its competitiveness.

69 Law 18/2014 on 15 October, Article 32, Adoption Of Urgent Measures For Growth, Competitiveness And Efficiency, available at https://www.global-regulation.com/translation/spain/1448212/law-18-2014%252c-on-15-october%252c-adoption-of-urgent-measures-for-growth%252c-competitiveness-and-efficiency.html.

70 AENA (2023), Price Guide May Edition, available at https://www.aena.es/en/airlines/prices.html.

71 AENA (2023), Aena's History, available at https://www.aena.es/en/corporative/about-aena/our-history.html.

72 Law 18/2014 on 15 October, Article 32, Adoption Of Urgent Measures For Growth, Competitiveness And Efficiency, available at https://www.global-regulation.com/translation/spain/1448212/law-18-2014%252c-on-15-october%252c-adoption-of-urgent-measures-for-growth%252c-competitiveness-and-efficiency.html.

73 AENA (2021), Airport Regulation Document (2022-2026), https://www.aena.es/en/shareholders-and-investors/financial-and-economical-information/regulation.html, Foreword.

Table 5-1: Risk factors for airports[74]

Name	Regulatory Period	Within period price adjustment for deviations from forecasts	Major hub airport
Auckland	5 years	None pre Covid	No
AENA	5 years	None pre Covid	Yes
GAdP Norte (Mexico)	5 years	Unclear	No
GAdP Centro (Mexico)	5 years	Unclear	No
GAdP Sureste (Mexico)	5 years	Unclear	No
Guangzhou	Five price resets in 10 years but not all prices reset. Treat as flexible and <5 years on average	None pre-Covid	Some
HNA			
Beijing			
Xiamen			
Shanghai			
Shenzhen			
Aeroports de Paris	5 years	Yes	Yes
Bologna	4 years	Unclear	No
Toscana	4 years	Unclear	No
Malaysia	3 years	Unclear	Yes
TAV (Turkey)	Annual	Unclear	Yes
Vienna	Annual	Yes	No
Frankfurt	Operator discretion	Yes	Yes
Zurich	Operator discretion (max. 4 years)	Yes	No
Kobenhavns Lufthavne	Operator discretion (max. 6 years)	Yes (default revenue cap)	No

Note: The UKCAA describe AENA, AdP, Frankfurt as Major airport hubs and I further include those airports that exceed Frankfurt's PAX (70 million) in 2019 (Malaysia & TAV).[75] Highlighted are airports included in the draft decision.

74 Auckland Airport (2023), Auckland Airport FY23-27 price changes, available at https://corporate.aucklandairport.co.nz/news/latest-media/2023/auckland-airport-fy23-27-price-changes, Spanish Law 18/2014, available at https://www.global-regulation.com/translation/spain/1448212/law-18-2014%252c-on-15-october%252c-adoption-of-urgent-measures-for-growth%252c-competitiveness-and-efficiency.html, Mexican Airport Law, available at, ttps://www.oma.aero/assets/002/5645.pdf, Groupo Aeroportuario del Pacifico (2019), Grupo Aeroportuario Del Pacifico announces Approval of Master Development Programs and Passenger Tariffs for Its Airports for 2020-2024 Period, available at https://www.globenewswire.com/en/news-release/2019/12/12/1960218/0/en/Grupo-Aeroportuario-Del-Pacifico-announces-Approval-of-Master-Development-Programs-and-Passenger-Tariffs-for-Its-Airports-for-2020-2024-Period.html, French Civil Aviation Code, Article R224, https://www.legifrance.gouv.fr/codes/section_lc/LEGITEXT000006074234/LEGISCTA000006159872/#LEGISCTA000006159872, Cambini, C & Congiu, R (2022), The impact of regulation on the airport industry: the Italian case, The Air Transportation Industry, https://www.sciencedirect.com/science/article/pii/B9780323915229000166, ENAC Italian Civil Aviation Authority (2019), Annual Report and Social Balance,

5.2 Lower underlying demand risk

5.2.1 High capacity constrained airports have lower demand risk

222. Even if the airports in the draft decision sample had the same regulatory regime as NZ airports they would still have much lower risk (and lower beta). This is because, with the exception of Zurich and, to a lesser extent Vienna, the main airports in these companies are strongly capacity constrained – with excess demand unable to be met at these central airports being served by secondary airports. This means that when there is a fluctuation in overall passenger demand this is felt primarily at the secondary airports and not at the central airport.

223. Figure 5-2 takes data from a report by SEO Amsterdam Economics measuring the Capacity Utilisation Index (CUI) at European Airports.[76] This SEO report uses CUI data for 2016 and, to be consistent with this, I have collected 2016 data for non-European airports not covered in the SEO report from Sabre. (Similarly, the concentration data reported in section 5.2.3 is also for 2016 but there is no reason to believe that this would be sensitive to the year of selected.)

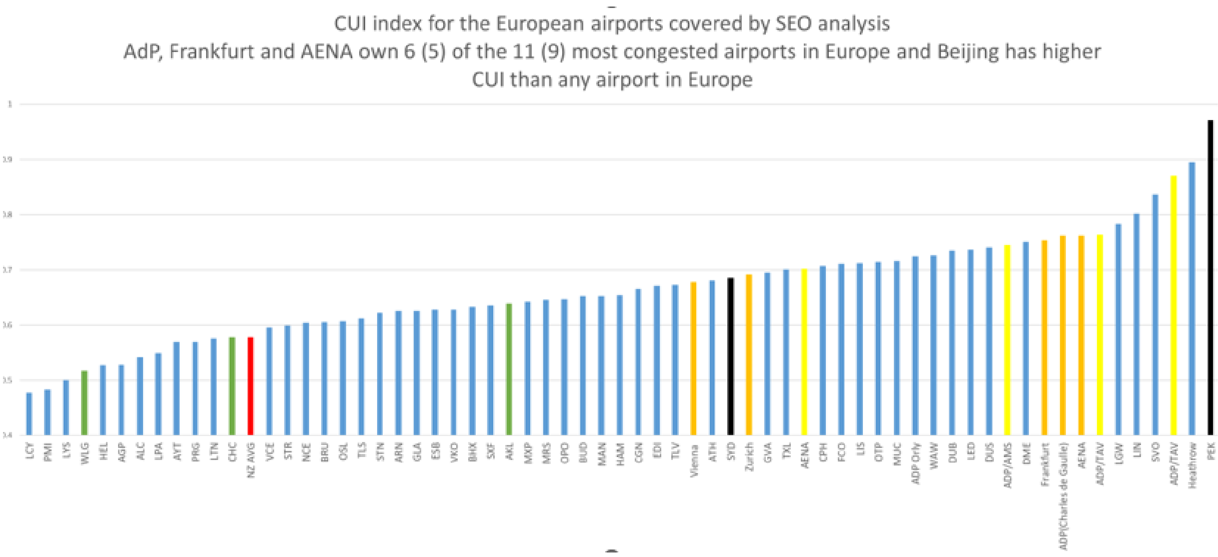
224. The bars are coloured orange if owned outright by one of the draft decision sample and yellow if partially owned (by AdP). Green bars have been added for New Zealand airports, a red bar for the average of the 3 New Zealand airports and black bars for Sydney and Beijing.

https://www.enac.gov.it/sites/default/files/allegati/2020-Lug/ENAC_ING_2019.pdf, Malaysian Aviation Commission (2019), Aeronautical Charges Framework – Second Consultation Paper 18 June 2019 https://www.mavcom.my/wp-content/uploads/2019/06/190618_Consultation-Paper-clean.pdf, Jaag, C, Trinker, U, Mattmann, M, Schnyder N & Ackerman I (2019), Dublin Airport Cost of Capital for 2019 Determination, Swiss Economics, Austrian Airport Charges Act (2012), Federal Law on the Determination of Airport Charges (Airport Charges Act – FEG), May 15 2012, available at https://www.ris.bka.gv.at/eli/bgbl/I/2012/41, Germany Aviation Act 19b (2005), https://www.gesetze-im-internet.de/luftvg/__19b.html, Switzerland Ordinance on Airport Charges (2012), https://fedlex.data.admin.ch/filestore/fedlex.data.admin.ch/eli/cc/2012/328/20120601/en/pdf-a/fedlex-data-admin-ch-eli-cc-2012-328-20120601-en-pdf-a.pdf.

75 UKCAA (2022), Economic regulation of Heathrow Airport Limited: H7 Final Proposals, https://publicapps.caa.co.uk/docs/33/CAP2365D%20H7%20Proposals%20Section%203-kb.pdf.

76 SEO, The impact of airport capacity constraints on air fares, 24 January 2017, Commissioned by ACI EUROPE.

Figure 5-2: The NZCC European "comparables" own the highest capacity utilisation airports in Europe



2016 data for Auckland, Christchurch & Wellington (green) and Sydney & Beijing (grey) have been added to SEO's graph using data from Sabre.

225. Unsurprisingly, some of the most capacity constrained airports are also the largest airports in the world. For example, Beijing Capital International Airport has the largest CUI in our sample and held the position of second largest airport in the world by total passenger traffic in the years leading up to COVID (2016-2019).[77] AdP's Charles de Gaulle and Frankfurt rank highly over the pre COVID years for total passenger traffic, and AENA's Madrid and Barcelona airports break the global top 20 when considering international passenger traffic.[78]

226. Furthermore, Fraport AG, AdP and AENA own outright or partially 6 out of the 11 most congested airports in Europe.

227. Interestingly the lower half of the CUI graph includes all New Zealand airports (green bars) but none of the comparator airports in the draft decision sample. This highlights that New Zealand airports are far less capacity constrained compared to the airports included in the draft decision sample.

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77 ACI (2018), ACI Reveals the World's Busiest Passenger and Cargo Airports, available at https://web.archive.org/web/20180628125151/http://www.airport-world.com/news/general-news/6601-aci-figures-reveal-the-world-s-busiest-passenger-and-cargo-airports.html & ACI (2020), ACI reveals top 20 airports for passenger traffic, cargo and aircraft movements, available at https://aci.aero/2020/05/19/aci-reveals-top-20-airports-for-passenger-traffic-cargo-and-aircraft-movements/.

78 ACI (2020), ACI reveals top 20 airports for passenger traffic, cargo and aircraft movements, available at https://aci.aero/2020/05/19/aci-reveals-top-20-airports-for-passenger-traffic-cargo-and-aircraft-movements/.

228. Note that Sydney Airport, one of the airports that NZCC considers to be very comparable to New Zealand Airports, is much more constrained than all the New Zealand Airports. In fact, it is sufficiently capacity constrained that a new airport is under construction in Western Sydney.

229. Further evidence of a capacity constraint at Vienna airport is indicated by the 30% landing fee surcharge for smaller aircraft that covers 9 hours of peak flight slots through each day.[79]

230. This is consistent with the observed passenger number volatility at the airports, which is discussed below. However, it should be noted that actual passenger number volatility does not always reflect unexpected volatility of the kind that drives beta and may be influenced by non-systemic factors (opening a new runway etc). Therefore, I consider that the CUI is the best source of evidence on the differences in demand volatility between airports.

231. The table below contrasts the New Zealand airports with those included in the draft decision sample.

Table 5-2: New Zealand Airports and draft decision sample CUI, number of Flights

Airport	CUI	Flights	Δ Auckland
Wellington	0.5166	85,829	-42%
Christ Church	0.5774	70,401	-53%
New Zealand Average	0.5778	101,783	-32%
Auckland	0.6395	149,119	0%
Vienna	0.6825	442,004	196%
Sydney	0.6863	316,029	112%
Zurich	0.6894	236,441	59%
Frankfurt	0.7521	435,040	192%
AdP CDG	0.7630	439,440	195%
Madrid	0.7578	354,582	138%
Beijing	0.9716	597,943	301%

5.2.2 Passenger volatility

232. I note that Sydney, Beijing, AdP and Frankfurt's main airports (CDG, Paris-Orly and Frankfurt) all have materially lower standard deviation of passenger numbers than

79 Vienna International Airport (2023), Vienna Airport Charges Regulations, available at https://www.viennaairport.com/jart/prj3/va/uploads/data-uploads/chargesregulations2023.pdf.

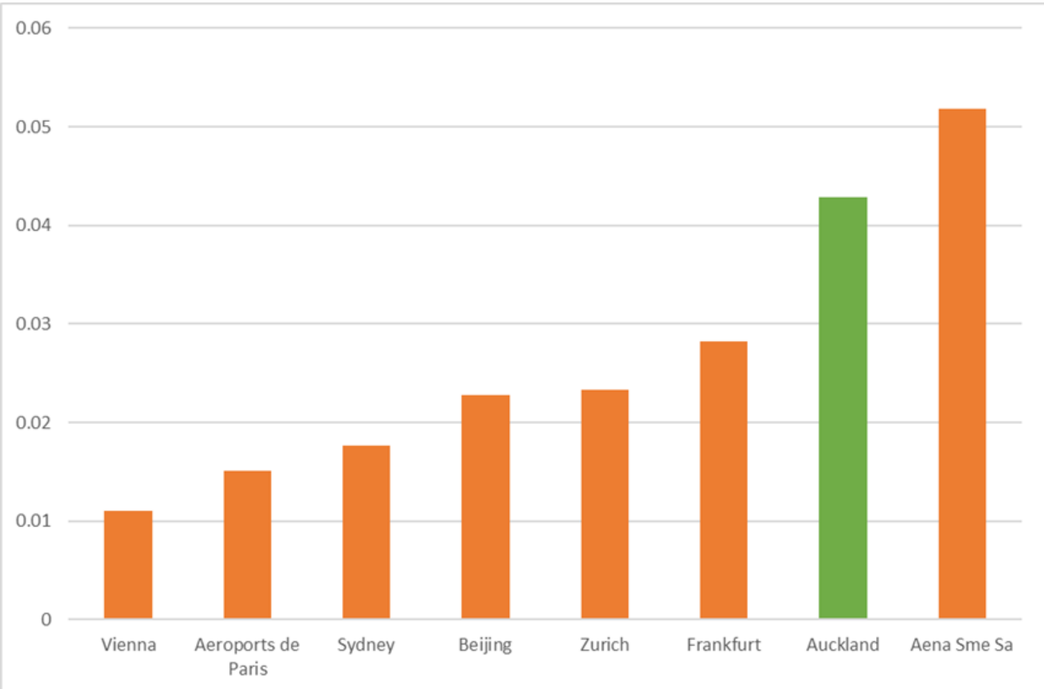
AIAL (and the New Zealand average) over the 10 years to 2019 (i.e., pre-COVID). In the sample, only AENA and Vienna airports have higher passenger volatility than AIAL but in this context it is important to note:

- AENA's passenger volatility is associated with the extreme economic circumstances felt by Spain during the Eurozone debt crisis. During this period passenger numbers at Madrid fell by 9% and 12% in 2012 and 2013 respectively as Spain went into a deep recession.
- Vienna's passenger volatility in this period is almost perfectly offset by its regulatory regime such that the present value of revenues and profits move more smoothly.

233. To deal with both of these factors in the next two charts below I present:

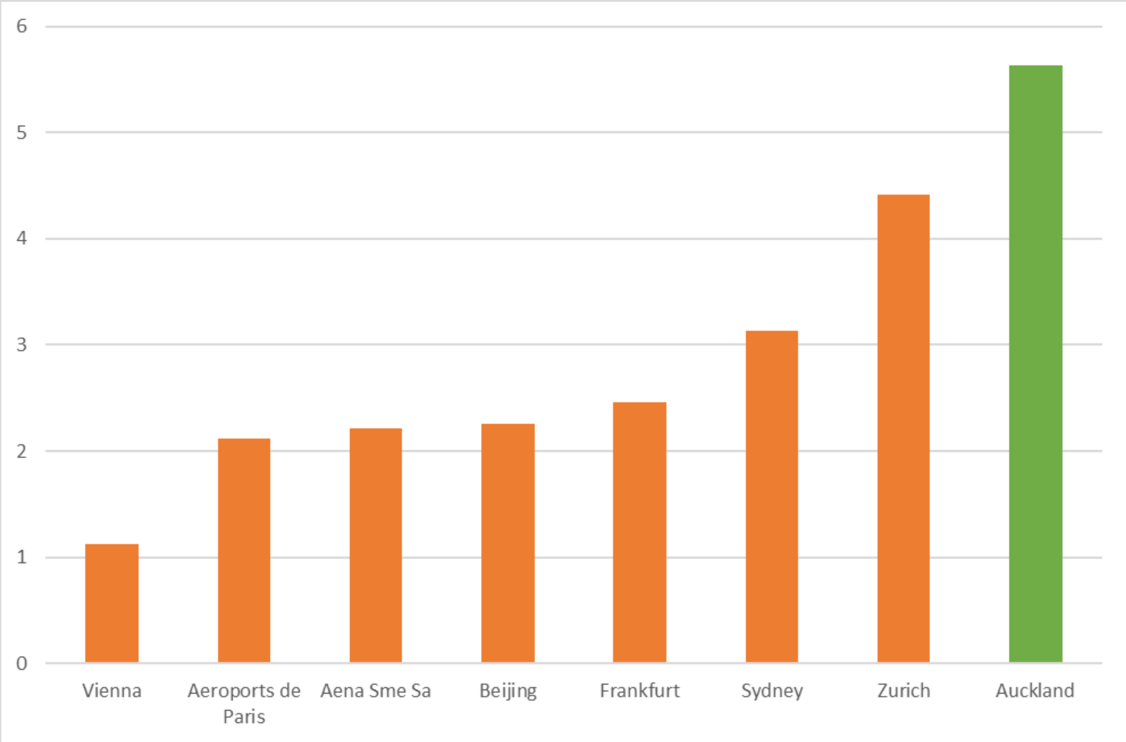
- Figure 5-3: All airports standard deviation of passenger numbers except Vienna's standard deviation is divided by 5 to represent the difference between pricing period for NZ Airports and Vienna; and
- Figure 5-4: As per Figure 5-3 but with passenger volatility expressed as a ratio to GDP volatility. It can be seen that this most materially affects AENA – with Spain having by far the most volatile economy in this period. Zurich and Sydney data points are increased relative to other airports because of the relative stability of the Swiss and Australian economies during these 10 years.

Figure 5-3: Standard deviation of passenger growth using data for the 10 years ending 2019



*Note: *Vienna divided by 5.*

Figure 5-4: Ratio of standard deviation of passenger growth divided to standard deviation of GDP growth



234. It can be seen that Auckland has more than double the average volatility of passenger numbers to GDP volatility as the draft decision sample. Only Zurich is somewhat close.

235. Finally, I report the same volatility ratios in Figure 5-4 except I multiply them by the correlation between passenger number growth and GDP growth. I use the term "demand beta" describe this metric because beta in the CAPM has the same formulae (ratio of stock to market standard deviation multiplied by their correlation). The difference here is that we are measuring the beta between passenger demand and GDP growth.

236. This is equivalent to the income elasticity of demand. The income elasticity of demand is commonly relied on as an indicator of demand and asset beta risk. The UKCAA described the importance of the relationship between passenger and GDP growth risk to beta risk [emphasis added]:[80]

> *Generally speaking, volume risk will not be diversifiable as it moves in line with market risk.* ***An indication of how the two move together is***

[80] CAA (2002), Heathrow, Gatwick and Stansted Airports Price Caps, 2003-2008:CAA recommendations to the Competition Commission, page 26.

> ***given by the relation between passenger growth and GDP growth****, see Figure 1.2. The correlation coefficient of GDP growth and BAA passenger growth is 0.55, the correlation coefficient of GDP growth and total passenger growth is 0.59.* ***When the economy is in a recession, passenger numbers tend to decline. This type of risk can therefore not be diversified and hence is captured by the firm's equity beta.***

237. The ACCC similarly has stated:[81]

> *However, the* ***volatility of passenger numbers*** *is relevant when considering relative differences in systematic risk between Australian airports.* ***In particular,*** *it is the extent to which this volatility is correlated with movements in the broader economy,* ***as proxied by changes in GDP****, which is* ***most likely to mirror what is captured by an asset beta****.*

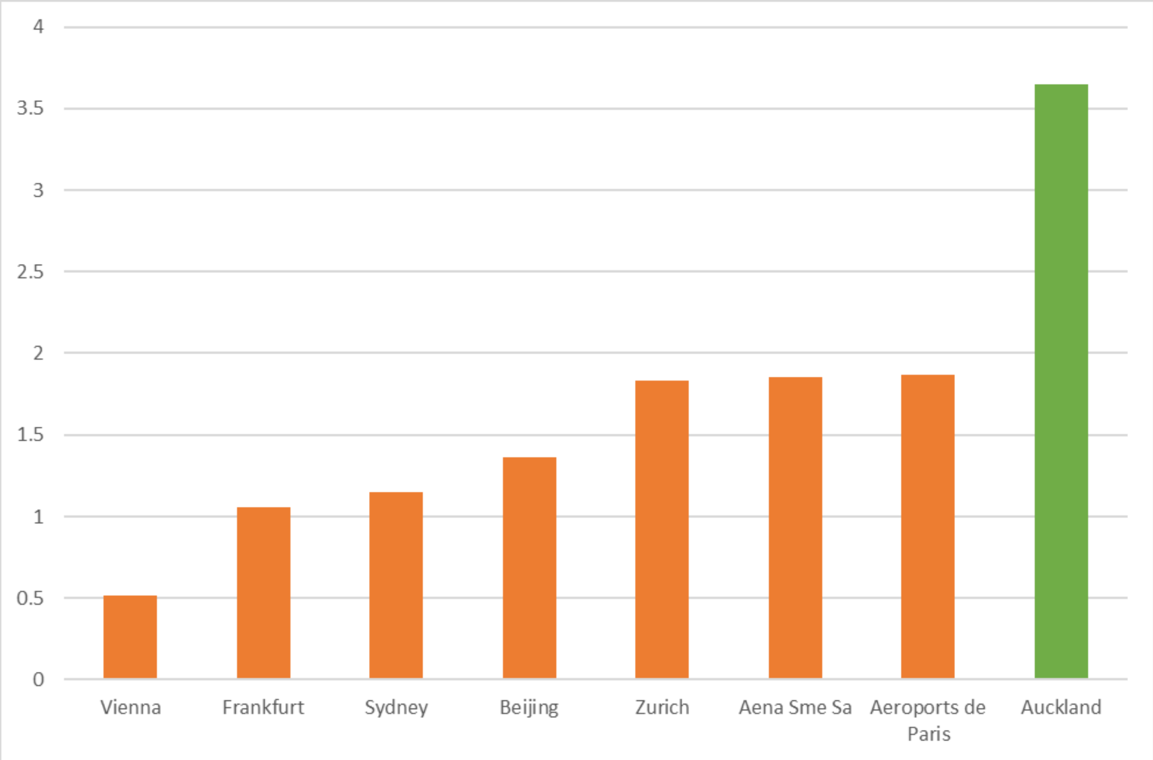
238. This is the same as the approach of PwC in advising the UKCAA where PwC estimated demand betas and stated:[82]

> *In terms of the relationship between economic growth and passenger growth at each airport, we would expect that airports with a greater degree of systematic risk exposure would exhibit greater passenger sensitivity to the economic cycle. …*
>
> *…for this relationship HAL shows the least sensitivity to GDP growth.*

81 ACCC, Melbourne Airport Multi-User Domestic Terminal New Investment Decision August 2000, page 9.

82 PwC, Estimating the cost of capital for H7 A report prepared for the Civil Aviation Authority (CAA) November 2017, page 50.

Figure 5-5: Demand beta (income elasticity of demand)



Note: demand beta/income elasticity of demand in this context is defined as (SD pax)/(SD GDP)×correl(pax, GDP). That is, it is the slope of a regression line fitted between the percentage change in passenger numbers and the percentage change in GDP.

239. It can be seen that AENA rises relative to other airports compared to Figure 5-4. This is because its volatility of demand was more strongly systematic (correlated with GDP volatility) than other airports. On this measure of relative risk AIAL has doubled the risk of the nearest airport (AdP) and nearly closer to three times that of the average.

5.2.3 More diversified airports have lower demand risk

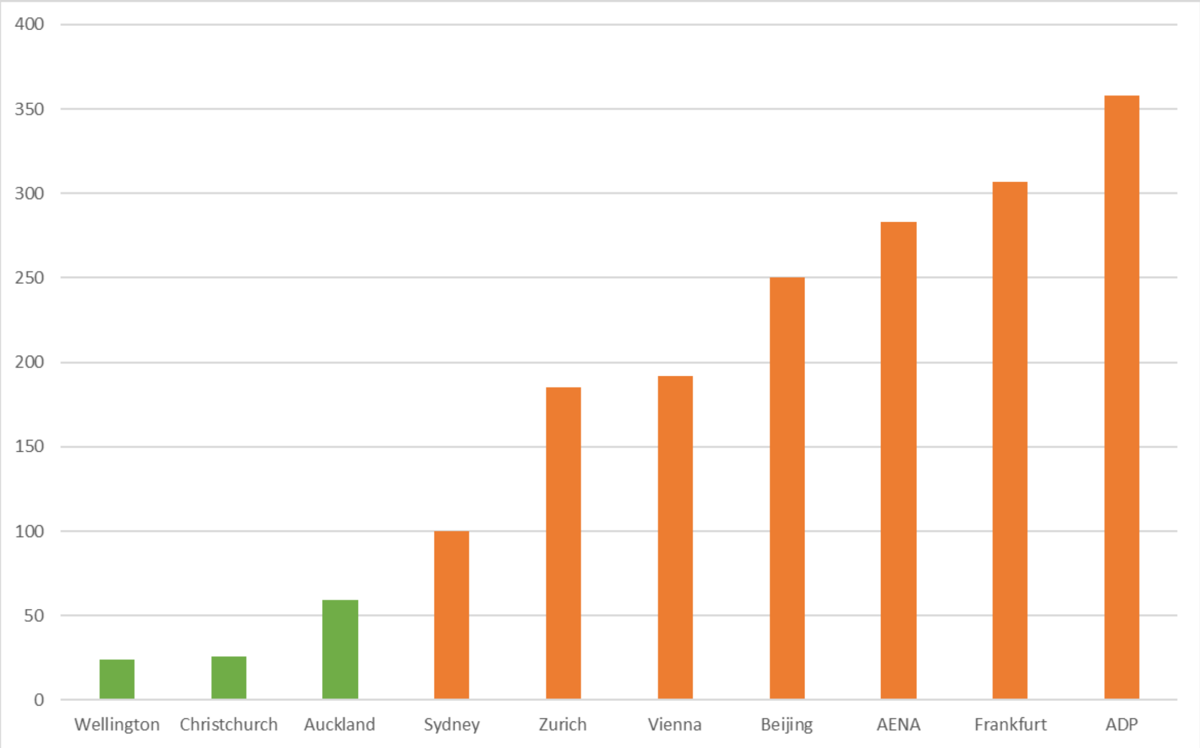
240. In addition to the scale of operation, the airports in the draft decision sample are also more diversified compared to the New Zealand airports in terms of the variety of airlines that serve these airports; and origin and destination locations which the airports are paired up with. The reduced diversity of travel in origin/destination pairs and airlines implies the New Zealand airports are more heavily impacted by a single shock compared to the airports in the draft decision sample.

241. For example, Auckland makes up 39% of the capacity that flies in and out of Wellington in 2016. Therefore, any impact on demand from, or operations at, Auckland will have significant impact to flights and passenger numbers at Wellington. On the other hand, the most important origin/destination city for Vienna is Frankfurt airport making up only 5% of its capacity in 2016. Therefore, any impact

on demand from Frankfurt will have a much smaller impact in flights and passenger numbers at Vienna.

242. The Figure 5-6 below shows the number origin and destination of flights at the New Zealand airports in 2016 compared to the other airports in the draft decision sample. It shows that NZ airports have much lower number of paired origin/destination airports compared to airports in the draft decision sample.

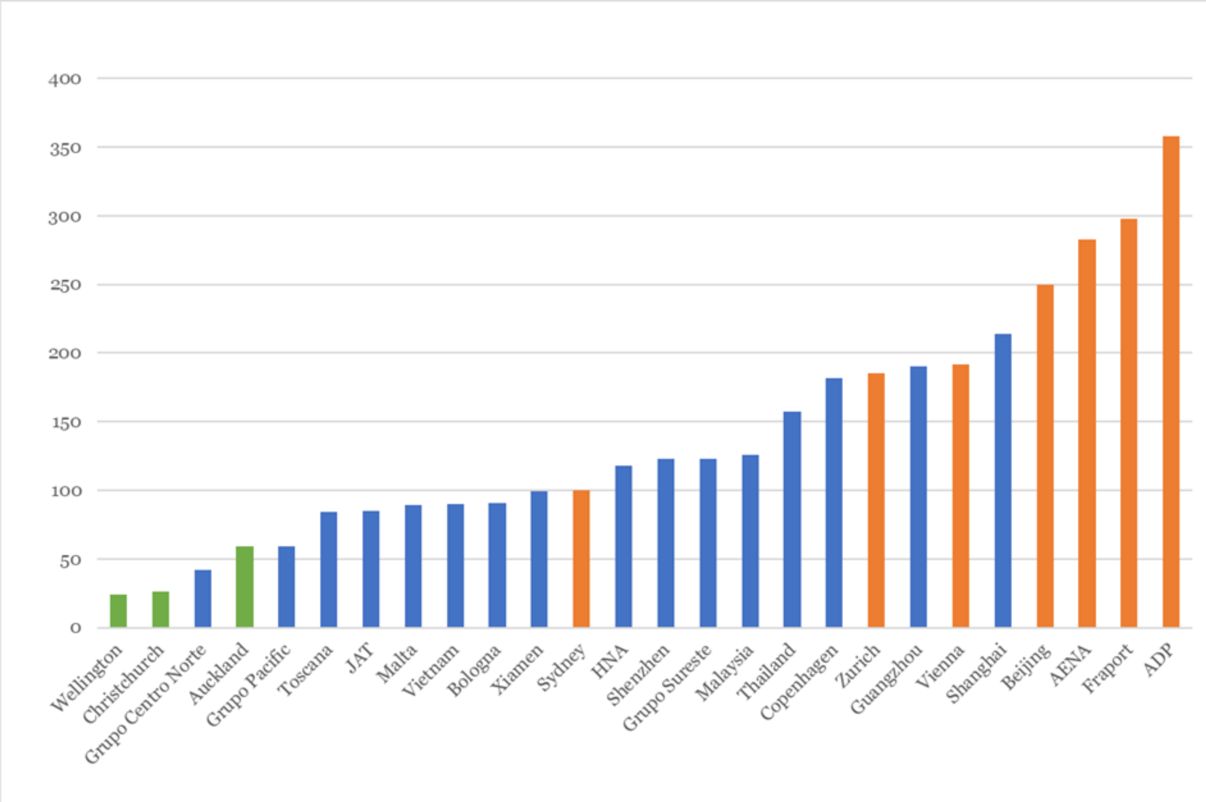
Figure 5-6: Number of routes for the draft decision sample



AENA consists of Barcelona and Madrid. ADP consists of Paris Charles de Gaulle and Paris Orly.

243. Figure 5-7 shows the same data as Figure 5-6 but includes the wider sample. It can be seen that while the New Zealand airports remain as 3 of the four least diversified airports, the average level of diversification for the wider sample is more similar to New Zealand than for the NZCC narrow sample.

Figure 5-7: Number of routes for the wider sample



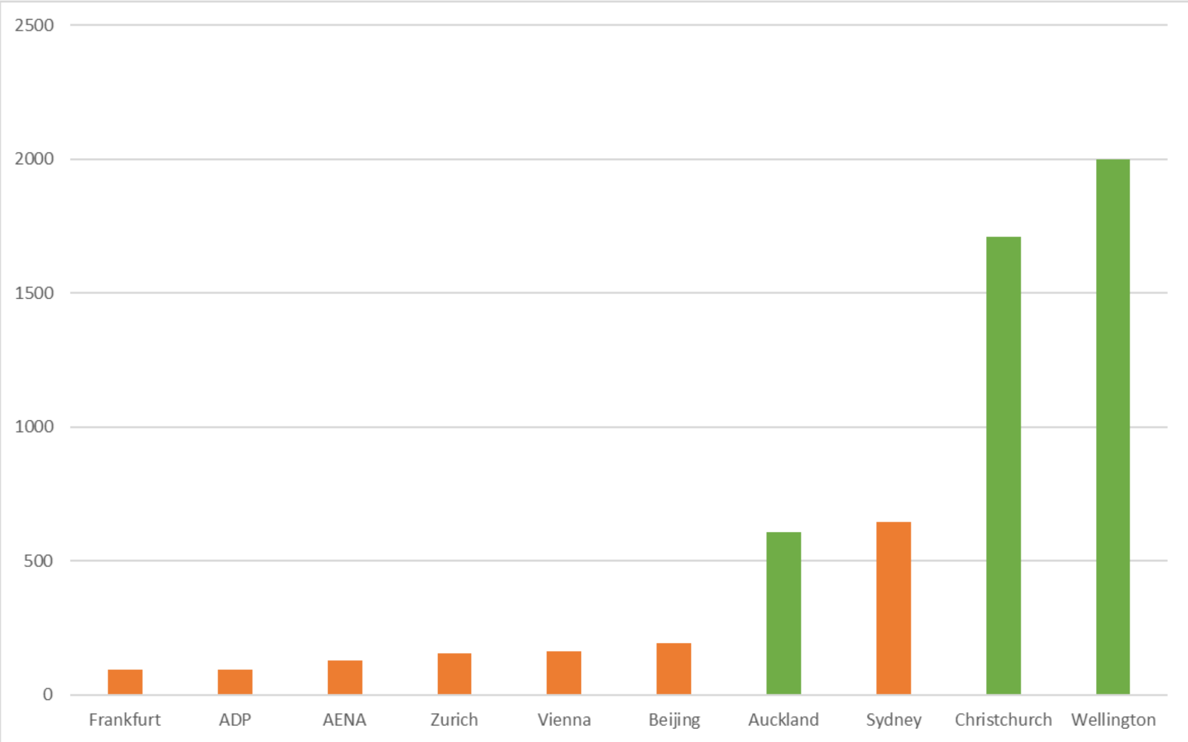
Where an airport company has multiple airports I have taken the largest airport in that company with the exception of AENA and AdP where I have taken the largest two airports.

244. Figure 5-8 below shows the concentration measure of origin/destination airports constructed using the Herfindahl Index.[83] The index measures the concentration of seat capacity on flights arriving and departing at each airport. If the measure is high, it implies a larger percentage of seats on flights arriving and departing at an airport is associated with a smaller number of other airports. If the measure is low, it implies the seats on flights arriving and departing at an airport is more evenly spread across a larger number of other airports.

245. Figure 5-8 shows Auckland airport and Sydney airport having a similar level of concentration but much higher than the other airports in the draft decision sample. Christchurch and Wellington are even more concentrated than Auckland and Sydney.

8383 This is a commonly used measure of concentration in an industry. Its calculation is to take the sum of the squared percentage shares. In this context, if all flights arriving/departing an airport came/went to a single connected airport then the HHI would be 100^2=10,000. If flights were evenly split across two airports then the HHI would be 50^2+50^2=5,000. If all flights were evenly split across 10 airports then the HHI would be $10*10^2$=1,000 etc.

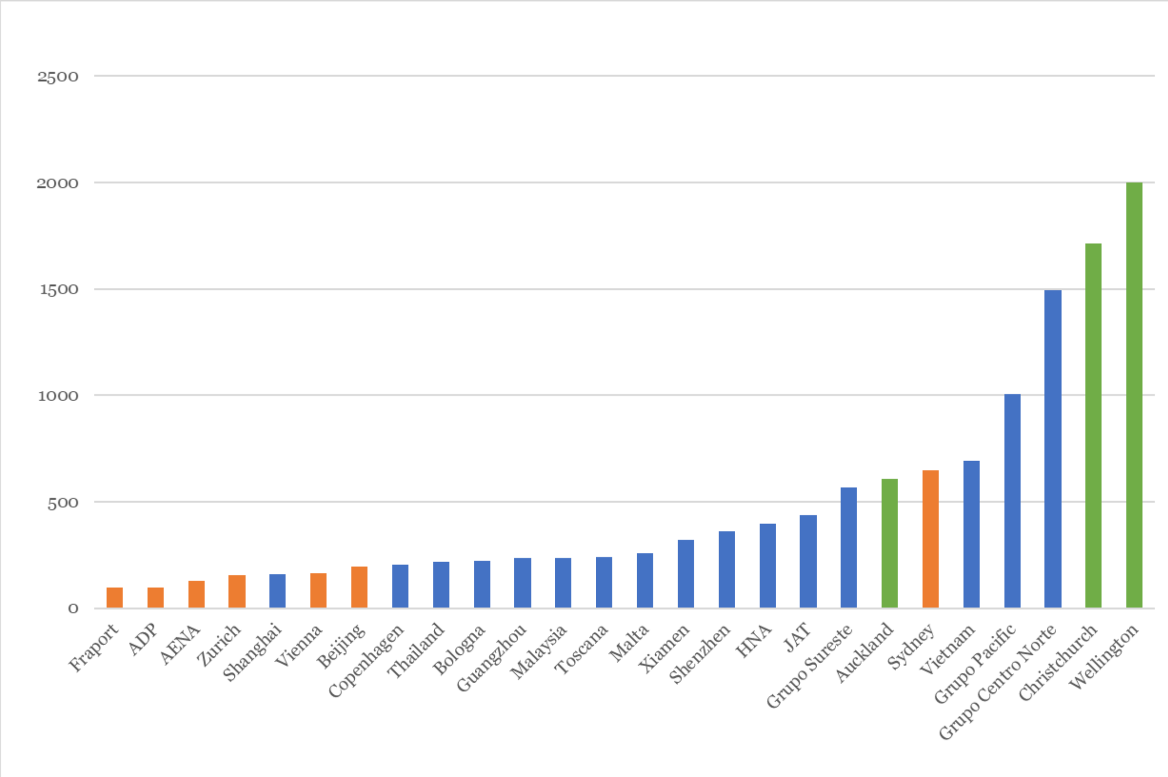
Figure 5-8: Concentration measure of routes (HHI) for the draft decision sample



Where an airport company has multiple airports I have taken the largest airport in that company with the exception of AENA and AdP where I have taken the largest two airports.

246. Figure 5-9 shows the same data but includes the wider sample. Once again, while the New Zealand airports are still amongst the least diversified airports, the average level of diversification for the wider sample is more similar to New Zealand than for the NZCC narrow sample.

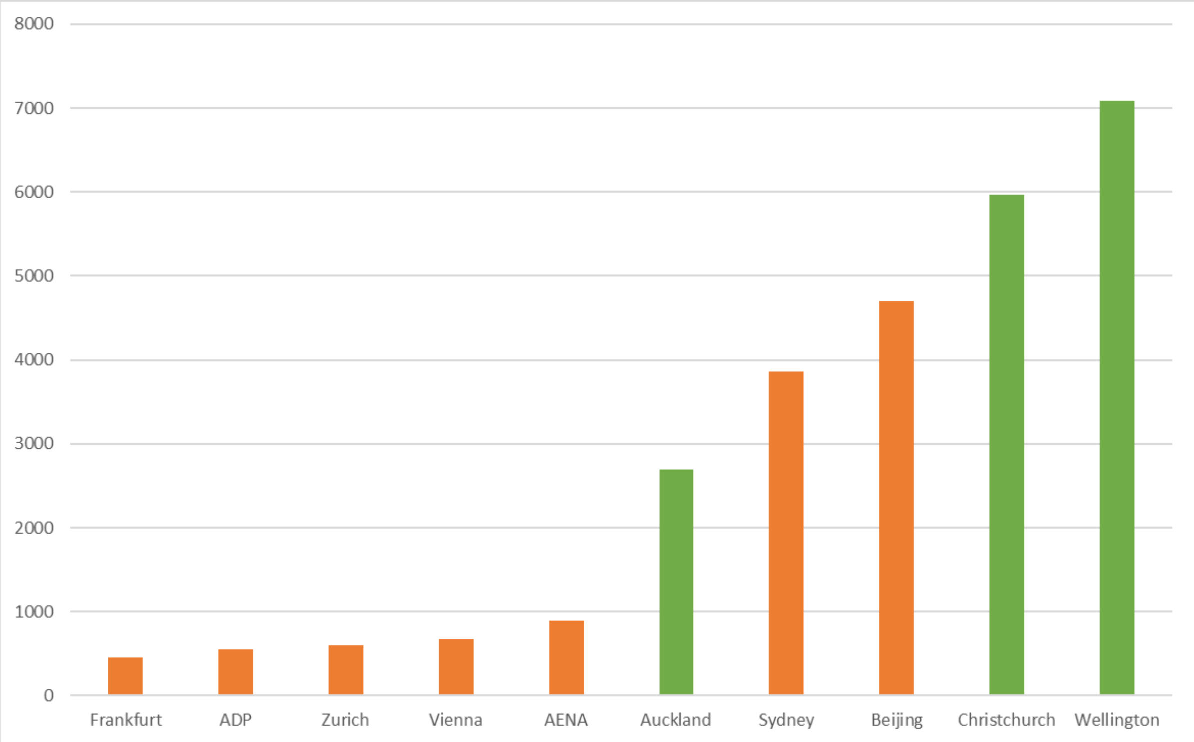
Figure 5-9: Concentration measure of routes (HHI) for the wider sample



Where an airport company has multiple airports I have taken the largest airport in that company with the exception of AENA and AdP where I have taken the largest two airports.

247. Figure 5-10 below shows the concentration measure of countries which form the origin/destination pair of each airport (i.e, the measure here is the share of seat capacity from countries rather than airports). The figure shows Auckland, Sydney and Beijing have much higher than the other airports in the draft decision sample. Christchurch and Wellington are even more concentrated.

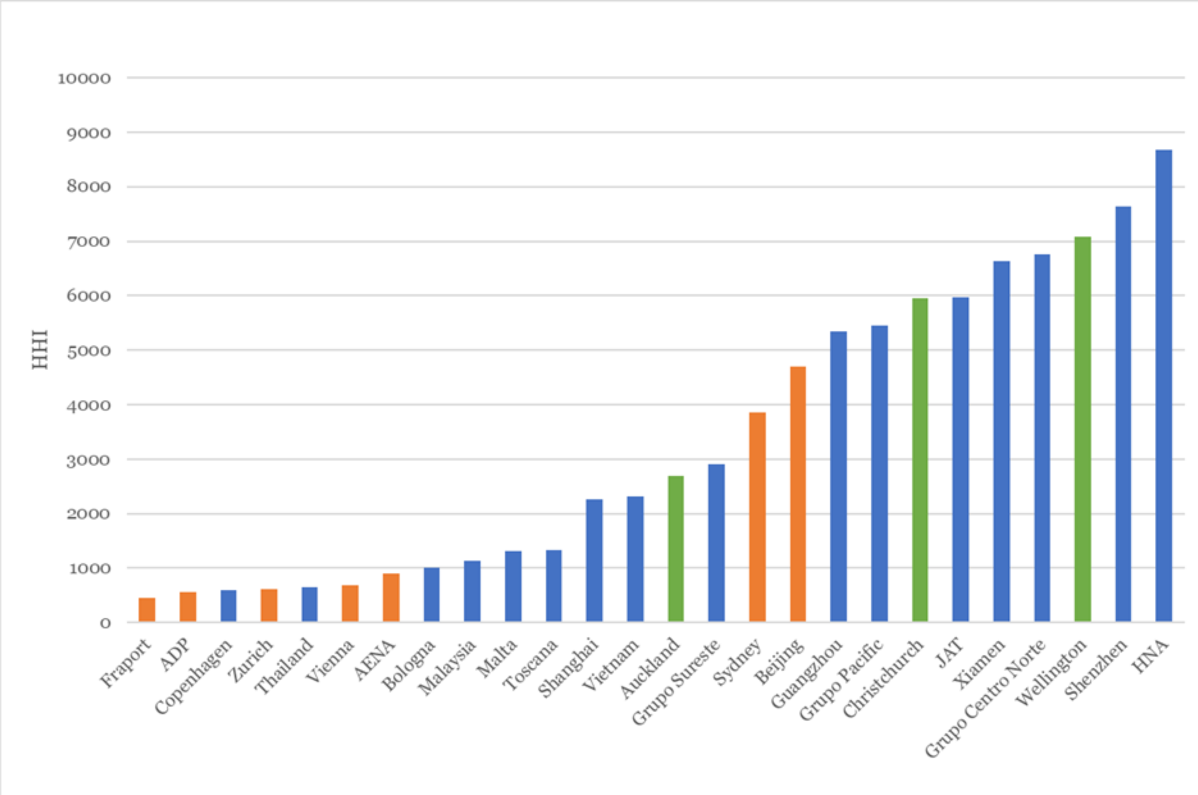
Figure 5-10: Concentration measure of origin/destination countries (HHI) for the draft decision sample



Where an airport company has multiple airports I have taken the largest airport in that company with the exception of AENA and AdP where I have taken the largest two airports.

248. Figure 5-12 shows the same data but includes data for the wider sample. New Zealand airports still have higher than average concentration but there are now more similar airports in the sample, namely: the Japanese Vietnamese, Mexican and Chinese airports.

Figure 5-11: Concentration measure of origin/destination countries (HHI) for the wider sample

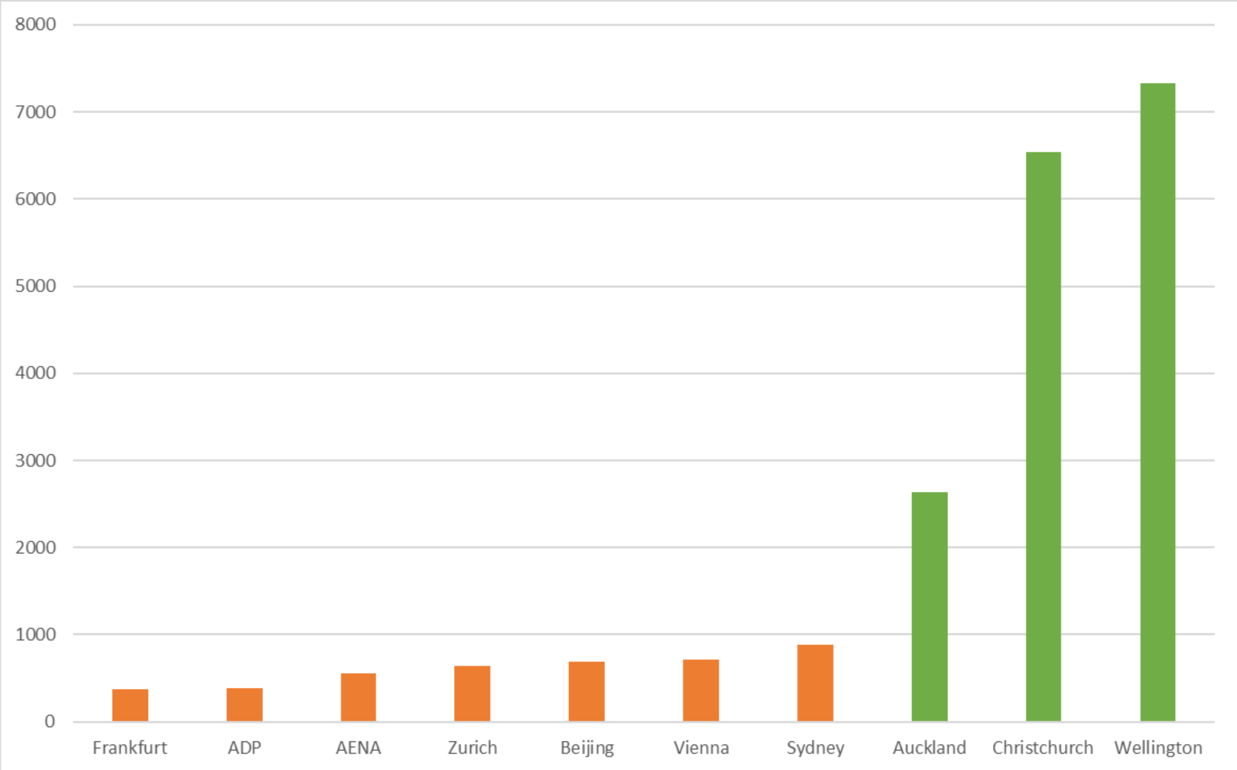


Where an airport company has multiple airports I have taken the largest airport in that company with the exception of AENA and AdP where I have taken the largest two airports.

249. A potential problem with Figure 5-10 and Figure 5-11 is that that they fail to distinguish between domestic and international ports. Beijing and Sydney are more concentrated than Auckland on this measure predominantly because they serve much larger domestic markets (both in terms of geography and population). Figure 5-12 addresses this by calculating the HHI for foreign ports only. New Zealand airports have much higher concentration when measured in terms of countries with international flight origin/destination.

CEG COMPETITION ECONOMISTS GROUP

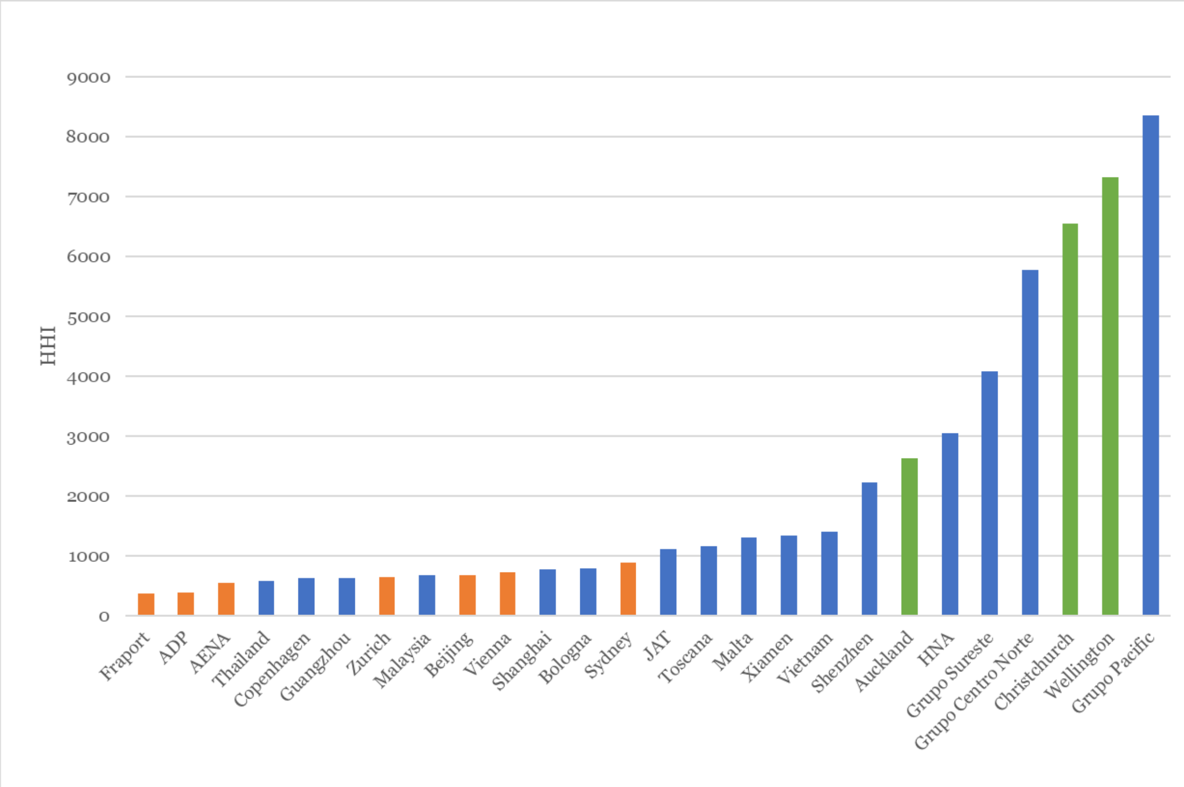
Figure 5-12: Concentration measure of foreign origin/destination countries (HHI) for the draft decision sample



Where an airport company has multiple airports I have taken the largest airport in that company with the exception of AENA and AdP where I have taken the largest two airports.

250. Figure 5-13 provides the same data but includes the wider sample. Once again, the widder sample is more similar to New Zealand airports than the NZCC narrow sample.

Figure 5-13: Concentration measure of foreign origin/destination countries (HHI) for the wider sample

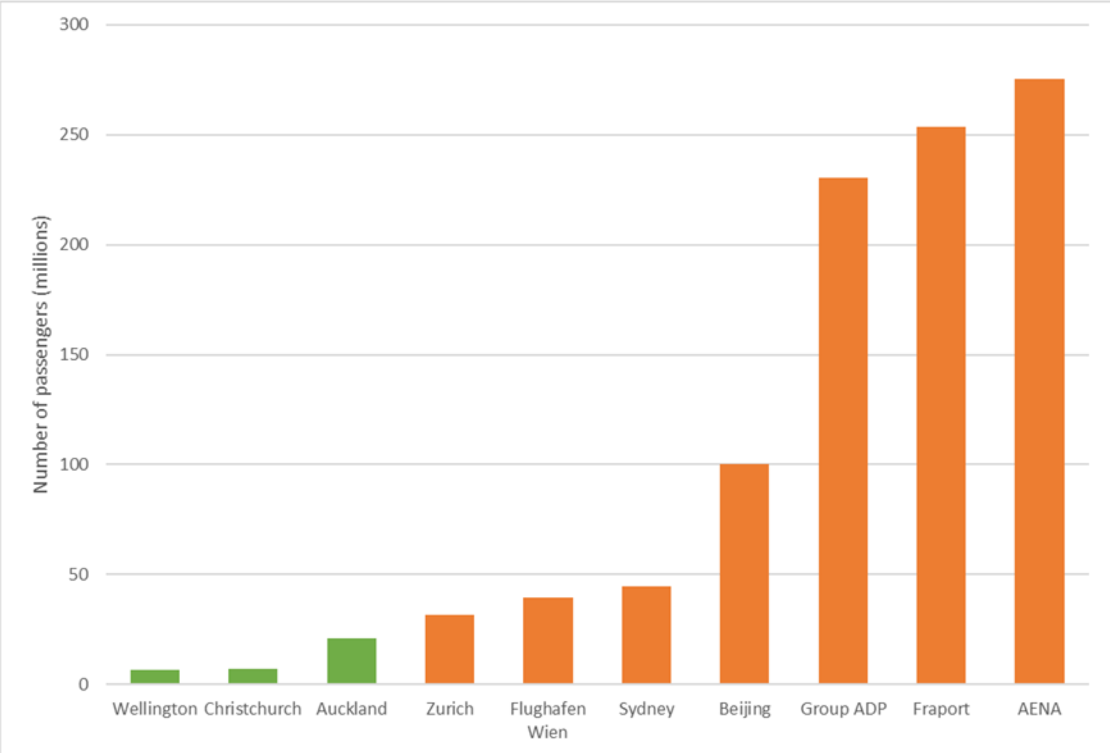


Where an airport company has multiple airports I have taken the largest airport in that company with the exception of AENA and AdP where I have taken the largest two airports.

5.3 Differences in size of airports

251. The difference between NZ airports and the NZCC draft decision sample can also be seen purely by looking at scale of operations (noting that larger airports tend to have more diversified traffic exposure).

Figure 5-14: Total passengers across all airports owned by an airport company



252. Only Zurich, Vienna and Sydney are comparable to AIAL in size – and Sydney is more than double the size of AIAL.

5.4 AdP and Fraport have downward biased betas due to foreign operations

253. Section 6.3.2.1 below explains that more than half of Fraport AG's (AdP's) operations are outside Germany (France). Most of these locations are countries that are not assigned a "developed country" category by FTSE Russel. Section 6.3.2.1 explains that if operations in a less developed country were a valid basis for excluding airport companies (which I do not believe is the case) then Fraport AG and AdP would be excluded.

254. However, Fraport AG's (AdP's) extensive international operations in countries very different to Germany (France) provides a separate explanation for why their measured asset betas are low and are a biased estimate of the asset beta for an airport company with that operates in a single country.

255. This is because the asset betas for Fraport AG (AdP) are measured relative to the German (French) stock market. However, Fraport AG (AdP) majority of operations are in countries that are very different to Germany (France). It follows that the

economic shocks that hit these international operations will tend to have very low correlation with the shocks that are hitting the German (French) economies in the same period. This leads to low correlation of stock prices for Fraport AG (AdP) with the German (French) stock market.

256. Consequently, the measured asset betas for Fraport AG (AdP) will be significantly biased downward relative to a stand-alone German (French) airport. Table 5-3 below reproduces Table 6-1 from section 6.3.2.1 and describes the international operations of Fraport AG and AdP.

Table 5-3: FTSE Classification of Fraport and AdP

Airport	Country	FTSE Classification
Fraport AG		
Frankfurt	Germany	Developed
Ljubljana	Slovenia	Frontier
Fortaleza, Porto Alegre	Brazil	Advanced Emerging
Fraport Greece	Greece	Advanced Emerging
Lima	Peru	Frontier
Twin Star, Burgas, Varna	Bulgaria	Frontier
Antalya	Turkey	Advanced Emerging
St. Petersburg	Russia	NA
Xian	China	Secondary Emerging
AdP		
New Delhi, Hyderabad	India	Secondary Emerging
Cebu	Philippines	NA
Medan	Indonesia	Secondary Emerging
Almaty	Kazakhstan	Frontier
Antalya, Ankara, Izmir, Bodrum, Gazipasa	Turkey	Advanced Emerging
Medinah	Saudi Arabia	Secondary Emerging
Tunisia	Tunisia	Frontier
Georgia	Georgia	NA
North Macedonia	North Macedonia	Frontier
Zagreb	Croatia	Frontier
Paris CDG/Orly	France	Developed
Santiago de Chile	Chile	Secondary Emerging
Amman	Jordan	Frontier

Source: Fraport AG and AdP annual reports and FTSE Russell (2023).[84]

84 FTSE Russell (2023), FTSE Country Classification of Equity Markets, updated 30 March 2023, viewed 30 June 2023, available at https://research.ftserussell.com/products/downloads/matrix-of-markets_latest.pdf.

257. An economic shock that hits the German (French) economy but not the Peruvian, Brazilian, Chinese etc. (Turkish Chilean, Indian etc.) economies will show up in Fraport AG's (AdP's) stock prices with roughly half the weight of a stand-alone listed Frankfurt airport. Consequently, we can expect the asset beta, measured relative to the German stock market, to be materially reduced by Fraport AG's (AdP's) international operations.

258. Including Fraport AG without making an offsetting correction for this will lead to a serious downward bias in the asset beta estimate for a stand-alone New Zealand airport.

5.5 Lower underlying asset risk reflected in gearing

259. When investors lend money to a firm, they typically evaluate the firm's capacity to pay interest and repay the debt. This evaluation often involves assessing the firm's ability to generate income through its assets, considering financial metrics such as profitability and cash flow. This is particularly important for companies with substantial assets, such as airports.

260. As a result, firms that exhibit better profitability and maintain healthier cash flow through their assets are typically capable of sustaining higher levels of gearing. Stated differently, a firm with higher gearing suggests a potentially greater ability to repay its debts, as its assets demonstrate higher profitability and generate improved cash flow.

261. Assuming that, in most cases, companies prefer to finance their assets with debt, it follows that firms with higher gearing, on average, experience a lower level of unlevered asset risk.

262. Table 5-4 shows the average gearings for AIAL, the NZCC draft decision sample excluding AIAL and the wider sample excluding AIAL in the two 5 year periods, 5 year to March 2018 and 2023.

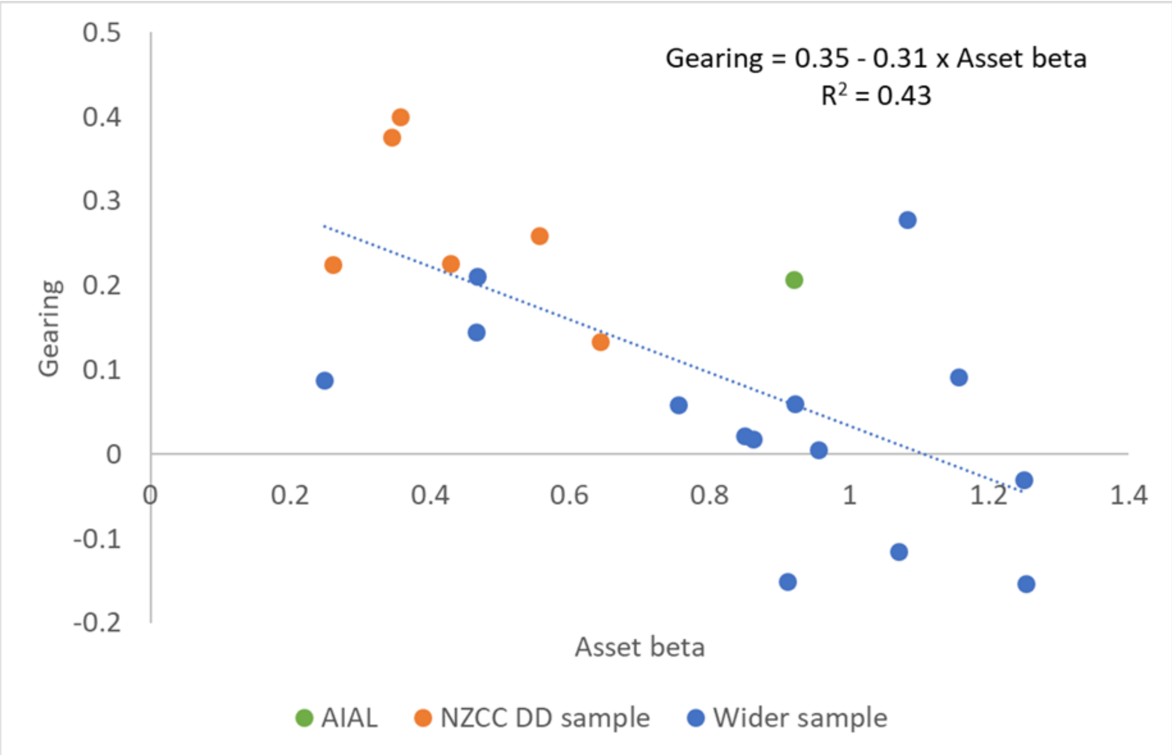
Table 5-4: Average leverage/gearing

Sample	5 year to March 2018	5 year to March 2023
Wider (2016 IM update) sample ex AIAL	11%	11%
AIAL	21%	15%
NZCC DD sample ex AIAL	27%	27%

263. The average debt levels in the draft decision sample (ex AIAL) are materially higher than for AIAL and the rest of the wider sample. This suggests that investors in these European airports view them as having more stable cash-flows able to sustain higher levels of debt.

264. A more direct approach is to utilise the asset beta, which estimates the unlevered systematic risk valued by investors. The Figure 5-15 below plots the average asset beta against the average gearing for the 5 year to March 2018 period.

Figure 5-15: Average asset beta vs gearing – 5 year to March 2018



265. Figure 5-15 shows that high gearing airports tend to have low asset betas. Instead of selecting firms that spread across the chart like the wider sample, the NZCC draft decision sample focuses on the top left quadrant with higher gearing and lower asset beta airports.

266. The same point can be made even more strongly when we look at the individual airports more closely.

267. Of all the companies in the 2016 IM sample only 5 had gearing levels in excess of 30% over the 5 years to March 2018 and the next highest was Malaysia with 28% leverage. These are set out in Table 5-5 below in descending order (up until Zurich and the remaining firms have leverage less than 10%). The NZCC draft decision sample are highlighted (noting AENA was not in the sample in this year).

Table 5-5: Average leverage over the 5 years to March 2018

Sample	Sample	18 Gearing
GMRI	Predominantly a land bank /construction company	78%
Fraport	High CUI constrained international hub	40%
Sydney	High CUI constrained international hub	38%
TAV	High CUI constrained international hub	37%
Airport Facilities	Revenues not dependent on pax throughput	33%
Malaysia	High CUI constrained international hub	28%
Beijing	High CUI constrained international hub	26%
ADP	High CUI constrained international hub	23%
Vienna	Low risk regulatory regime	22%
HNA	Medium risk small airport	21%
AIAL	Medium risk small airport	21%
Copenhagen	Low regulatory risk but small airport	14%
Zurich	Medium risk small airport	13%

Notes: Showing average gearing of 5 year to March 2018. The list includes all airports in 2016 IM up until Zurich (descending order by gearing) except for SAVE and AENA which do not have a full 5 year data between 2013 and 2018. Greyed rows are not in NZCC draft decision sample.

268. It can be seen that out of the 10 companies with gearing higher than AIAL:

- two were not, in fact, correctly characterised as airport companies (i.e., did not have a dominant link between passenger throughput and revenues);
- of the other 8:
  - i. five were included in the draft decision sample (Fraport, Sydney Beijing, ADP and Vienna); and
  - ii. the other firm (TAV) was partially owned (and is now 46% owned) by another firm (AdP) in the draft decision sample.
  - iii. Of all the firms in the wider sample excluded by the NZCC, only Malaysia and HNA have relatively higher gearing than AIAL.

269. This provides a strong indication that these are the lowest risk airports in the entire sample and materially lower risk than AIAL (gearing 21%) and Zurich (gearing 13%).

5.6 Bias in draft decision sample apparent from comparison of airport and airline asset betas

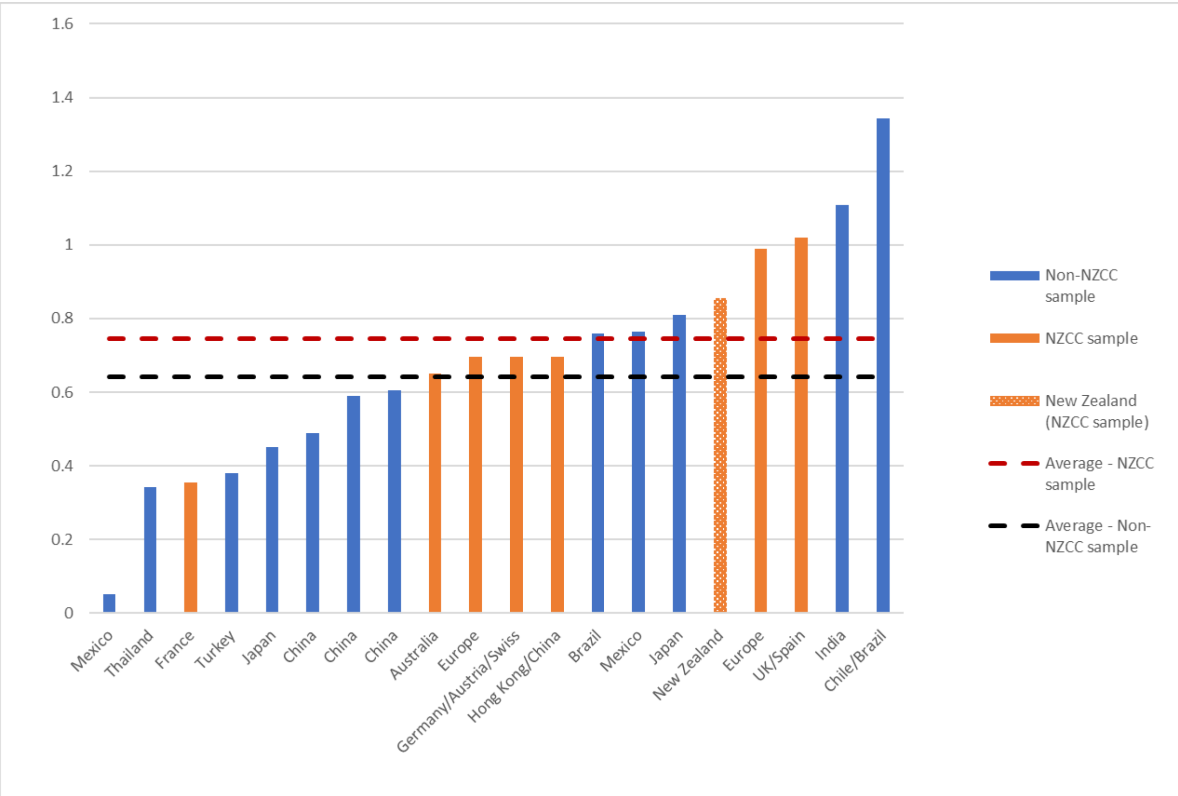
270. Based on the evidence surveyed above, the reason that the draft decision sample of airports (ex AIAL) have low asset betas is due to their low-risk operating environment (CUI and/or regulatory regime, and, in the case of AdP and Fraport, their extensive international operations).

271. The draft decision appears to posit a different explanation for why its sample has so much lower average asset betas than the wider sample. The explanation that the draft decision appears to be positing is that something about operating in a developed country lowers airport risk relative to operating in less developed countries.

272. This explanation is inconsistent with the fact that AIAL operates in a developed country and has a high asset beta. That is, AIAL, which has a high-risk operating environment (see sections 5.1, 5.2, 5.3 and 5.5 above), is strong evidence in favour of my explanation (that the NZCC sample has a low average asset beta because its airports are low average risk).

273. Further evidence against the draft decision proposition is that the **airlines** in the same countries as the draft decision sample (ex AIAL) do not have lower asset betas when compared to the airlines that operate in countries that the draft decision excludes (but were in the original wider sample). This can be seen from Figure 5-16 below which shows the 10 year asset betas for the airlines in each country where there is an airport company in the wider 2016 IM sample. It can be seen that the asset beta for airlines in the draft decision sample of developed countries are typically higher than the asset beta for airlines in the countries that the NZCC excludes.

Figure 5-16: 10 years to December 2019 asset betas for airlines

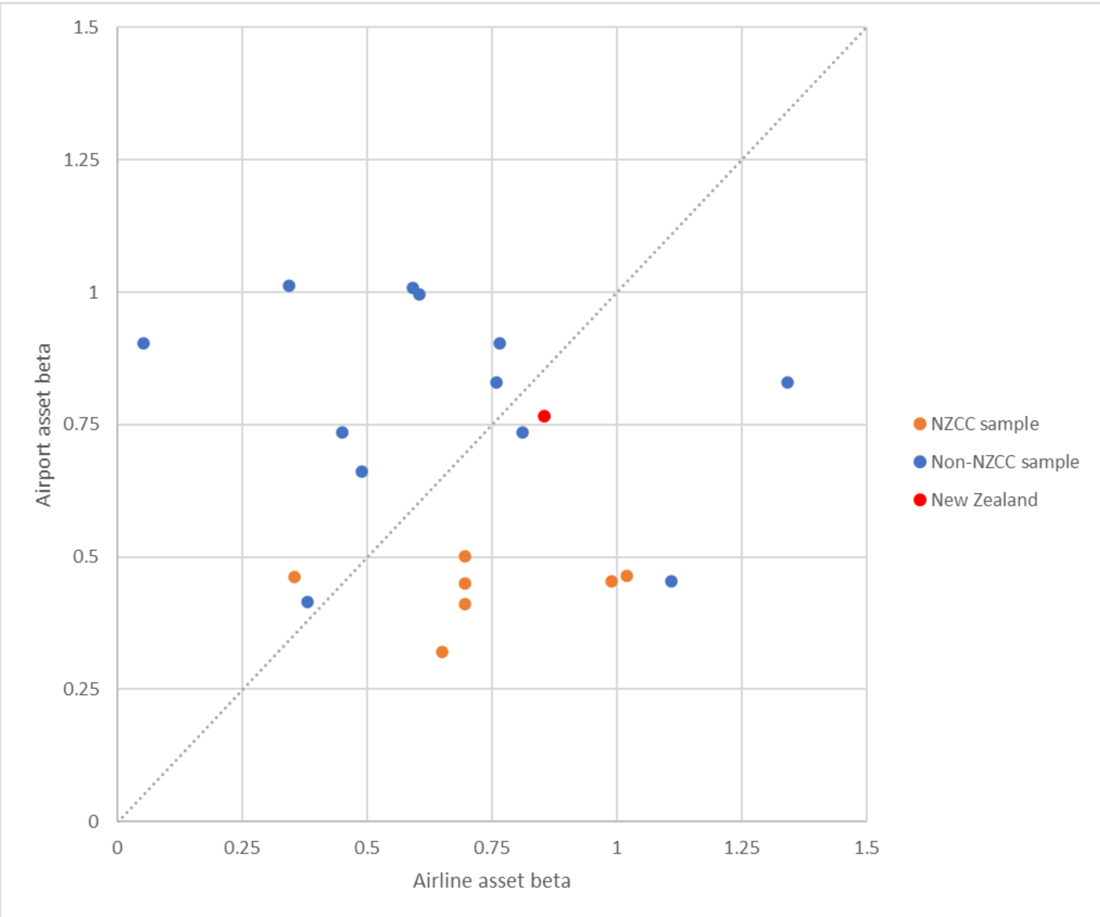


Source: Airline betas are measured using 10 years of data to February 2020 downloaded from Bloomberg using week end returns.

274. Given that airlines and airports in a country are fundamentally exposed to the same passenger demand risk, this result strongly suggests that it is not something about developed versus less developed countries that is driving the difference seen between the draft decision sample (ex AIAL) and the wider sample. That is, if exposure to passenger demand risk in less developed countries does not drive higher airline asset betas then it is not plausible that it does drive higher airport asset betas.

275. This strongly supports my conclusion that the NZCC has selected low risk airports, not low risk aviation markets. Separately, it is possible to compare on a scatter plot airline and airport betas in each country and this is done in Figure 5-17.

Figure 5-17: Airport asset beta vs airline asset beta



Airline betas are measured using 10 years of data to February 27, 2020. They have been downloaded from Bloomberg using week end returns. Airport betas follows the NZCC approach and are calculated for the same periods as the airline betas.

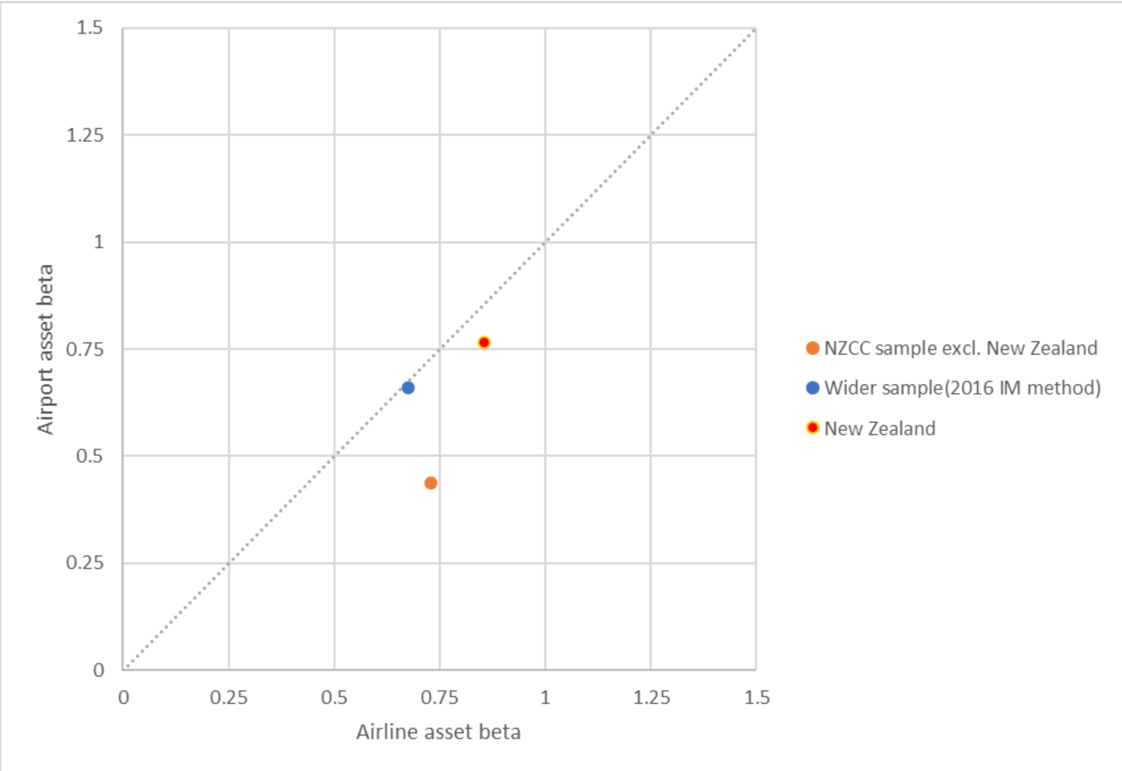
276. It can be seen that the full sample is fairly evenly distributed along the 45 degree line – suggesting that, on average, airports and airlines in the wider 2016 IM sample have similar asset betas. This is to be expected because they are exposed to the same underlying demand risk (passenger demand). (Arguably, airports which have more

operating leverage (higher fixed and lower marginal costs) should be expected to have higher betas than airlines (especially if they are not capacity constrained and set a fixed price for multiple years as is the case in New Zealand).

277. However, the draft decision sample (ex AIAL) draws almost exclusively from the airports that have materially lower asset betas than their corresponding airline (i.e., the airports are drawn almost exclusively from below the 45 degree line – with the only exception being France where AirFrance has the fourth lowest measured asset beta in this period).

278. The averages for the wider 2016 IM sample ex AIAL and the draft decision sample ex AIAL are shown in Figure 5-18 below.

Figure 5-18: Airline and airport beta relationship in draft decision sample vs wider sample



Airline betas are measured using 10 years of data to February 27, 2020. They have been downloaded from Bloomberg using week end returns. Airport betas follows the NZCC approach and are calculated for the same periods as the airline betas.

279. This further suggest that the airport sample selected by the NZCC have unusually low asset betas compared to their corresponding airline. However, in the wider (2016 IM method) sample the averages are almost on the 45 degree line (suggesting the same asset beta as the corresponding national carrier on average).

280. Table 5-6 below provides the correspondence between airlines and airports. Where more than one airline is indicated for an airport the average of the airline asset betas are used to derive the observation in the scatter plot for Figure 5-17.

Table 5-6: Correspondence between airline and airport

Airline	Country/region	Paired Airports
Air New Zealand	New Zealand	AIAL
Qantas Airways	Australia	Sydney
Air France-KLM	France	AdP
Deutsche Lufthansa	Germany/Austria/Swiss	Zurich, Vienna, Frankfurt
International Consolidated Air	UK/Spain	AENA
Air China	Hong Kong/China	Beijing
China Eastern Airlines Corp	China	Shanghai
China Southern Airlines Co	China	Shenzhen, Guangzhou
Hainan Airlines Holding Co	China	HNA
Japan Airlines Co	Japan	JAT
ANA Holdings Inc	Japan	JAT
Thai Airways International PCL	Thailand	Airports of Thailand
Latam Airlines Group SA	Chile/Brazil	Corp America airports
Azul SA	Brazil	Corp America airports
Controladora Vuela Cia de Avia	Mexico	Mexican airports
Grupo Aeromexico SAB de CV	Mexico	Mexican airports
Ryanair Holdings PLC	Europe	Zurich, Vienna, Frankfurt
easyJet PLC	Europe	Zurich, Vienna, Frankfurt, AENA
InterGlobe Aviation	India	GMRI

6 DD sample selection criteria are inconsistently applied

6.1 Draft decision sample selection criteria are unsound

281. The draft decision sample selection criteria are neither well explained nor well justified. The result of their application is a sample that is not fit for purpose as demonstrated in section 4. Technical details of my reasons for this conclusion are provided in **Error! Reference source not found.**. However, a summary of that analysis follows.

282. The entirety of the NZCC description of its criteria is provided in two paragraphs.

> *4.43 We broadly agree with Qantas' proposal and have used the following method to remove firms from the sample that we do not consider are comparable to a major airport trading in New Zealand.*
>
> *4.43.1 Remove firms that operate in markets that are substantively different to New Zealand. We have used the Financial Times Stock Exchange (FTSE) Equity Country Classification and market risk premium as indicators.*
>
> *4.43.1.1 CEG submitted that we should not consider the market risk premium of a country because equity beta estimates are standardised (the average risk firm in a market has an equity beta of 1). However, we consider the market risk premium is useful as an indicator of countries that may have a materially different risk profile, and therefore trading environment, to New Zealand. There is a strong correlation between the classification of countries in the FTSE Equity Country Classification and market risk premium (MRP).*
>
> *4.43.2 Remove firms that have unusually variable asset beta estimates. We have used bid-ask spreads, percentage of shares traded (free float %), and variability in asset beta across estimation method (daily, weekly and four weekly) as indicators.*
>
> *4.43.3 Remove firms that have unusual business financing structures that create anomalies when converting the observed equity betas to asset betas. We have used leverage as an indicator where an issue is highlighted if leverage is negative.*

> 4.44 *We have not used a mechanistic method (precise thresholds) when applying these indicators, but rather have applied judgement based on the information across the indicators when considering whether to exclude a firm from our comparator sample. We have provided a table in Appendix A to show how we have applied our judgment for each firm. We are balancing the risk of having a small sample with the risk of including firms that are poor comparators, while acknowledging that there is inherent error in measuring correlations across erratic share-market data.*

283. The actual application of this method is opaque. The NZCC states that it has "applied judgement based on the information across the indicators when considering whether to exclude a firm from our comparator sample" but Appendix A does not explain what that judgment was.

284. The only information that is provided is whether a firm is included or not and a short description of what criteria were relevant. There is no discussion of any applicable thresholds (consistent with the above quote).

285. This leaves the reader having to guess at what thresholds, if any, are implicitly being applied. It also leads to seemingly incongruous decisions. As explained in section 6.3, a consistent application of the NZCC criteria:

- would exclude Vienna, AdP, Fraport AG, and Beijing which the draft decision includes in its sample; and
- would include Japan Airport Terminal (JAT) which the draft decision excludes from its sample.

286. In any event, the NZCC criteria are not economically sound even if applied consistently.

6.1.1 Market comparability

287. It seems that the main driver of the NZCC sample selection is "market comparability". To assess this the draft decision uses as its proxy for MRP of each country the 2022 survey results from Fernandez et. al. The NZCC states that "there is a strong correlation between the classification of countries in the FTSE Equity Country Classification and market risk premium (MRP)."

288. However, as noted below, this is only true if Fernandez et al. 2022 is used and is not true if Fernandez et al. 2021 is used (noting the Fernandez et al. is an annual survey of market professionals and is, therefore, variable from year to year) or if other measures of MRP (e.g., from Bloomberg are used). Moreover, as noted in section 6.3.2.2, the FTSE Russell classification is a classification of the ease of operation for hedge funds and is not a measure of whether weekly or four weekly equity betas can be reliably estimated.

289. On the basis of the Fernandez et al. 2022 annual survey, the draft decision Appendix A identifies New Zealand as having an MRP of 5.7% whereas China is estimated as having an MRP of 8.7%. The inclusions and exclusions in Appendix A appear to determine that this means that Chinese airport operators are excluded due to "market comparability".

290. However, in 2021 Fernandez et al. assigned New Zealand and China an MRP of 6.0% and 6.2% respectively. Moreover, Spain (6.4%) and Australia (6.4%) had a higher MRP than China and the difference between New Zealand (6.0%) and Switzerland (5.2%) was larger than the difference between New Zealand and Malaysia (6.2%) and Mexico (6.4%).

291. That is to say, using the same Fernandez MRP source from one year earlier would have led (presumably) to the inclusion of China, Malaysia and Mexico as "comparable" (or, at a minimum, the exclusion of Switzerland as not "comparable").

292. In this context, I note that I explicitly included the 2021 Fernandez et al. MRP estimates in my February 2023 report for the New Zealand Airports Association.

293. In that report I also included analysis of MRP and total market return (TMR) estimates sourced from Bloomberg. In all of the illustrations I demonstrated that using Bloomberg MRP or TMR (averaged over 8 years) then there was actually a negative relationship within the sample between MRP/TMR and asset beta (i.e., high MRP/TMR countries tended to have low airport asset betas).

294. I included the following analysis specifically using Fernandez et al. 2021 estimates of MRP.[85]

> *Of course, there are other measures of MRP that will yield different results. For example, the Fernandez survey of academics and practitioners is a source of MRP estimates in 2021 for all countries other than Malta.*

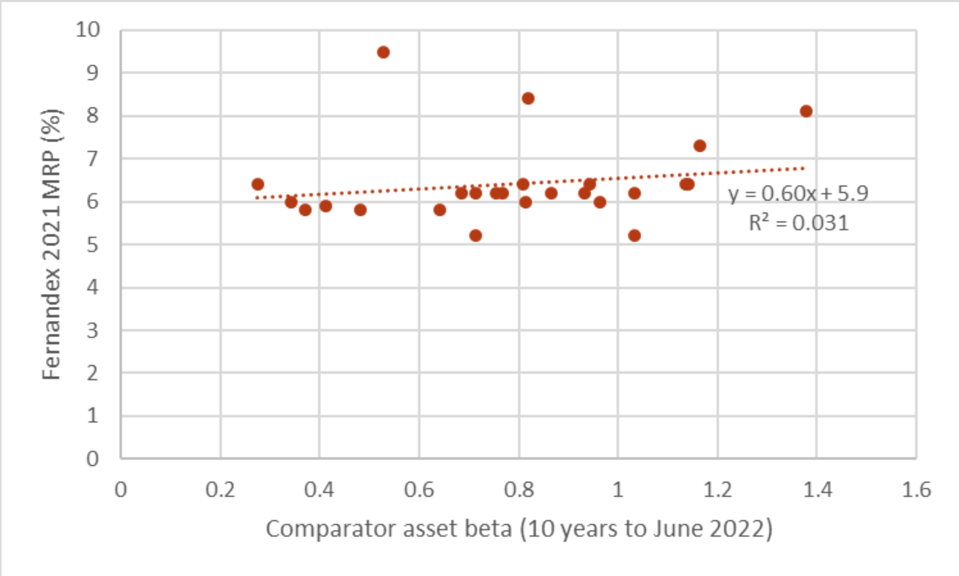
85 CEG, NZCC comments on asset beta estimates for airports, February 2023, pp. 50-51.

Table4-1: Fernandez 2021 survey MRP

Country	*MRP*
Japan	*5.2*
Switzerland	*5.2*
Denmark	*5.8*
France	*5.8*
Germany	*5.8*
Austria	*5.9*
Italy	*6.0*
NZ	*6.0*
Malaysia	*6.2*
China	*6.2*
Spain	*6.4*
Australia	*6.4*
Mexico	*6.4*
Thailand	*7.3*
Serbia	*8.1*
Vietnam	*8.4*
Turkey	*9.5*

New Zealand's MRP estimate in this sample is 6.0% with Switzerland and Japan being the lowest MRP (5.2%) while Turkey is the highest (9.5%). Once more, there is no significant relationship between asset beta and this measure of MRP.

Figure 4-10: Fernandez 2021 MRP vs comparator asset betas (10-years to June 2022)



However, most MRP estimates are tightly bounded within 2.1% (5.2% to 7.3% MRP). If that was adopted at the criteria then only TAV (9.5%), Vietnam (8.4%) and Belgrade (8.1%) would be excluded. The average asset beta would hardly change from 0.79 to 0.78 (noting that Malta is excluded from the analysis because it has no survey MRP which is why the full sample average is not 0.80). If only airports with an MRP of between 5.2% and 6.4% are included then that also would drop Airports of Thailand and the average asset beta would fall to 0.76.

All this serves to illustrate the arbitrary nature of any analysis that seeks to form a sample based on country MRP estimates (or TMR estimates or any other measure of country risk).

- *There is no conceptually valid reason to assume that country risk affects equity beta risk (which is a measure of relative risk within an equity market and must average to 1.0 by definition no matter what the country risk).*
- *There is no obvious or consensus measurement of "country risk";*
- *There is no obvious or consensus definition of "substantially different to New Zealand".*

*Ultimately, there is no way in which inclusions or exclusions from the sample can be rigorously determined based on such analysis. **To attempt to do so will invite gaming by parties submitting to the NZCC and the risk that investors perceive the regulatory environment as unpredictable**.*

295. In summary:

- I submitted that:
  i. there was not economically sound basis for believing airport asset betas would be systematically different in countries with different MRPs (higher or lower);
  ii. if Fernandez et al. 2021 and/or Bloomberg MRP estimates were used to narrow the sample then they would have little or positive effects on the sample average asset beta;
  iii. attempting to define a sample based on comparable country MRPs would simply invite regulatory gaming.
- The NZCC draft decision:
  i. with the exception of point i above, did not acknowledge this evidence;
  ii. used Fernandez et al. 2022 to sort its sample (noting that this was only posted to SSRN on 1 June 2023 – 13 days before the publication of the draft decision);
  iii. did not acknowledge my analysis using Fernandez et al. (2021) which produced diametrically opposed results.
  iv. did not discuss the risks of "regulatory gaming" in the selection of data sources to measure country risk.

296. It is particularly noteworthy that the NZCC used a document posted in June 2023 as its source for market comparability when the most recent data that the NZCC uses to estimate beta ends in September 2022 (and stretches back to October 2007). The NZCC does not explain this methodological choice.

297. I consider that the NZCC draft decision highlights the concerns I expressed about the potential for arbitrary data choices to materially and unreasonably affect the final sample.

6.1.2 Asset beta unreliability

298. The other criterion that appears to play an important role in the NZCC Appendix A sample selection is "asset beta unreliability" as evidenced by variability in asset beta estimates.

299. I submitted on this issue in my February 2023 report or the New Zealand Airports Association. The relevant section was entitled "Shrinking the sample based on "stability" of asset beta estimates". I provided detailed analysis of this and concluded:

> *In my view, it would be unwise and unprincipled to develop a regulatory methodology in which such arbitrary decisions would play a critical role.* ***This is especially the case given that there is no sound conceptual***

basis for wanting to exclude comparators with "unstable" asset beta estimates.

300. The draft decision did not acknowledge or respond to this analysis.

301. I refer the NZCC to my analysis of this criteria in that report. I repeat my position that there is no conceptual basis for inferring unreliability from variability in measured asset betas.

302. I further note that, now the draft decision has adopted a specific measure of "beta reliability" I can usefully comment on that specific measure.

303. The NZCC describes its measure as "variability in asset beta across estimation method (daily, weekly and four weekly)". However, it can be discerned from the NZCC's Appendix A that this is the maximum less the minimum of:

   a. Daily asset betas;

   b. The average of 5 weekly asset betas;

   c. The average of 20 four weekly asset betas;

   d. All measured over the same 5-year period being either:

      i. 2012 to 2017; and

      ii. oddly, 2017 to 2022 (oddly, because the NZCC does not use this 5 year period to estimate its asset beta because it regards it as abnormally affected by the pandemic).

304. The NZCC includes Beijing which has variability according to this measure of 0.16 and 0.18. It would appear that variability under 0.18 does not trigger this criteria. Interestingly, Grupo Aeroportuario del Sureste has variability of 0.07 and 0.21 (lower than Beijing on average and only 0.03 higher in the 2017 to 2022 period). However, the NZCC categorises it as "beta estimate unreliable". I note that if only the first period pre-pandemic is included then the following excluded firms would have lower variability than Beijing:

- Shenzhen (0.09 vs 0.16);
- Guangzhou (0.12 vs 0.16);
- Xiamen (0.02 vs 0.16);
- Airports of Thailand (0.02 vs 0.16);
- Grupo Aeroportuario del Sureste (0.07 vs 0.16); and
- Grupo Aeroportuario del Pacifico (0.14 vs 0.16).

305. Moreover, because weekly and four weekly asset betas are already averaged (and therefore variability within those measures is already averaged out) it follows that the NZCC criteria is largely a test of variability of daily asset betas. It is unclear why the

NZCC would use variability in daily asset betas as a metric when the NZCC does not place weight on daily asset betas to estimate the asset beta for comparators in the sample. This is even more peculiar when one recognises that the reason the NZCC does not give weight to daily asset betas is a view that they are less reliable because they are more affected by differences in liquidity of individual stocks versus the market.

6.1.3 Liquidity

306. It is reasonable to exclude companies that are illiquid. However, the lack of clarity from the NZCC on how it actually measures illiquidity is problematic.

6.1.4 Negative leverage

307. The NZCC states that it will:

> *Remove firms that have unusual business financing structures that create anomalies when converting the observed equity betas to asset betas. We have used leverage as an indicator where an issue is highlighted if leverage is negative.*

308. This is unjustified. There is nothing anomalous about an airport company having more liquid assets on hand than debt (i.e., negative leverage). This is a perfectly sensible business strategy. This is especially true if the airport owners consider that their business has high demand variability – as all airports did during COVID-19. Having more liquid assets than debt is an entirely rational business strategy in the context of managing pandemic risk.

309. Indeed, there would be a stronger case for arguing that heavily geared airports such as Fraport AG and Sydney are anomalous (e.g., associated with unusually low risk perceptions for an airport). In the most recent 5 year period Fraport AG had leverage 3 times that for AIAL (48% versus 16%). An airport with leverage of, say, -5%, would be more similar to AIAL than AIAL is to Fraport AG.

310. There is no fundamental reason why any company must use debt finance to fund its assets. Indeed, consistent with the foundation stone of modern financed, the Modigliani-Miller theorem states that the cost of capital is largely invariant to capital structure. In the current context, this means that the cost of capital is invariant to low or negative net debt versus high levels of net debt. There is no reason to describe one or the other as "anomalous".

311. I note that the NZCC refers to "*unusual business financing structures that create anomalies when converting the observed equity betas to asset betas*". This appears to be referring to the use of a leverage formula that assumes a constant and zero debt beta. This is also sometimes referred to by the NZCC as the "leverage anomaly".

312. I describe this mathematically below.

Leverage anomaly

WACC= $(r_f + \beta_e \times MRP) \times (1 - L) + r_d \times L$

Substituting the leverage formula $\beta_e = \frac{\beta_a - L \times \beta_d}{1-L}$ for β_e

WACC=$(r_f + \frac{\beta_a - L \times \beta_d}{1-L} \times MRP) \times (1 - L) + r_d \times L$

Assuming that β_d is independent of leverage (L), then taking the derivative of WACC with respect to leverage (L) gives:

$$\frac{\partial WACC}{\partial L} = -r_f + r_d = DRP$$

313. That is, starting from the correct asset beta but incorrectly assuming that debt beta is independent of leverage, higher leverage will lead to a higher WACC. As described in the above formula, a one percentage point increase in leverage (say, from 40% to 41%) will increase the WACC by 0.01×DRP.

314. This is the “leverage anomaly” because we know, as a result of the Modigliani Miller theorem, that the WACC should be more or less invariant to the financial structure of a firm (over most of the range of “normal” structures). The NZCC has previously recognised that this “anomaly” exists and is caused by the simplifying assumption that the debt beta is zero and invariant to leverage.

315. In reality, higher leverage raises the risk transferred to debt holders per unit of debt (raises β_d). The NZCC’s simplifying assumption fails to pick this up and, consequently, the estimated return on equity increases “too fast” with leverage because the formula (with zero debt beta) fails to recognise that some equity like risk is transferred to debt holders as leverage increases. Consequently, the estimated WACC rises with leverage when it should, according to the Modigliani Miller theorem, stay constant.

316. However, the mathematical corollary of the above “leverage anomaly” is that it is firms with *high* leverage and *high* debt betas that will have their asset betas *underestimated* due to the adoption of a (simplifying but not accurate) assumption that debt beta is zero and constant with leverage.

317. This suggests that it is firms with unusually high gearing (such as Fraport AG and Sydney) that “*create anomalies when converting the observed equity betas to asset betas”*. This is consistent with these airports having unusually low estimated asset

betas. If a debt beta of 0.10, consistent with UK regulatory practice,[86] was applied to Fraport AG its asset beta would be 0.05 higher in the most recent 5 year period.

$$\beta_a = \beta_e \times (1 - L) + L \times \beta_d \; = \beta_e \times (1 - 48\%) + 48\% \times 0.10 = \beta_e \times (1 - 48\%) + 0.048$$

318. That is, the relevant anomaly is the underestimate of the asset beta for heavily leveraged airport companies (primarily Fraport AG and Sydney). It would not be rational to rely on the leverage anomaly to:

- exclude the firms that are not affected by the anomaly (i.e., firms with low or negative levels of net debt who, therefore, do have zero debt betas (consistent with the assumptions underpinning the NZCC leverage formula); and
- in doing so, give more weight to the firms that are affected by the anomaly.

319. Nonetheless, this would be the effect of the filtering the sample to exclude firms with low (negative) net debt rather than high net debt.

6.2 NZCC reliance on TDB advice

320. The NZCC received expert advice from TDB, on behalf of BARNZ, who advised the NZCC that they should focus on small standalone airports similar to the New Zealand airports.

> *On balance, we would prefer that a smaller sample of more comparable firms be used. We suggest that, in the Commission's current sample, the **smaller operators that have primary responsibility for just one airport are likely to be more similar to their NZ counterparts** than the very large, and often regional or even national, operators that are also included in the sample.*

321. Under the heading "*New evidence for step 1: identifying a sample of comparator firms*" the draft decision cites TDB analysis as the trigger for it reviewing its sample set.[87]

> *We were advised of a potential problem with our existing method in the submission by TDB Advisory for the BARNZ in response to our Process and issues paper.*

322. However, rather than following TDB's advice to choose smaller standalone airports, the NZCC narrowed its sample to:

86 See Table 3.1 of CEPA, Considerations for UK regulators setting the value of debt beta, Report for the UK Regulators Network, 2 December 2019.

87 NZCC draft decision, paragraph 4.32.

- be dominated by mega airport companies like Fraport, AdP, AENA and Beijing (see section 5.3); and
- give one quarter weight to Fraport AG and AdP whose operations are dominated by airports in countries other than Germany and France (and almost exclusively in less developed countries).

323. That is, after citing TDB's submission as a trigger for reviewing its sample, the draft decision does the exact opposite of what TDB advised (without any discussion of why it did not follow TDB's proposed solution).

324. Following TDB's submission would lead to a sample of:

- Two (AIAL and Zurich) if the sample was restricted to close comparators from developed countries as explained in section 6.4. The average asset beta would be **0.86** (two five years to March 2023);
- Around 10 airport companies from the wider sample (based on a criterion that individual companies should not have more passengers than the total across the three major New Zealand airports. Applying this criterion, the:
  1. sample would be: in order of size: Grupo Sureste, Zurich, Copenhagen, Xiamen, HNA, Grupo Centro, AIAL, Bologna, Toscana and Malta;
  2. average asset beta would be **0.82** (two five years to March 2023).

6.3 On the NZCC's own criteria Vienna, Frankfurt, AdP and Beijing should be excluded and JAT included

6.3.1 Vienna

325. The NZCC has excluded a range of firms on the basis of not being sufficiently liquid, seemingly on the basis of a bid-ask spread above 0.5%. One of the firms that is excluded is HNA. However, HNA is clearly more liquid than Vienna (smaller bid ask spread and larger float and lower average "asset beta variability").

Figure 4-1: Replication of draft decision Table A1

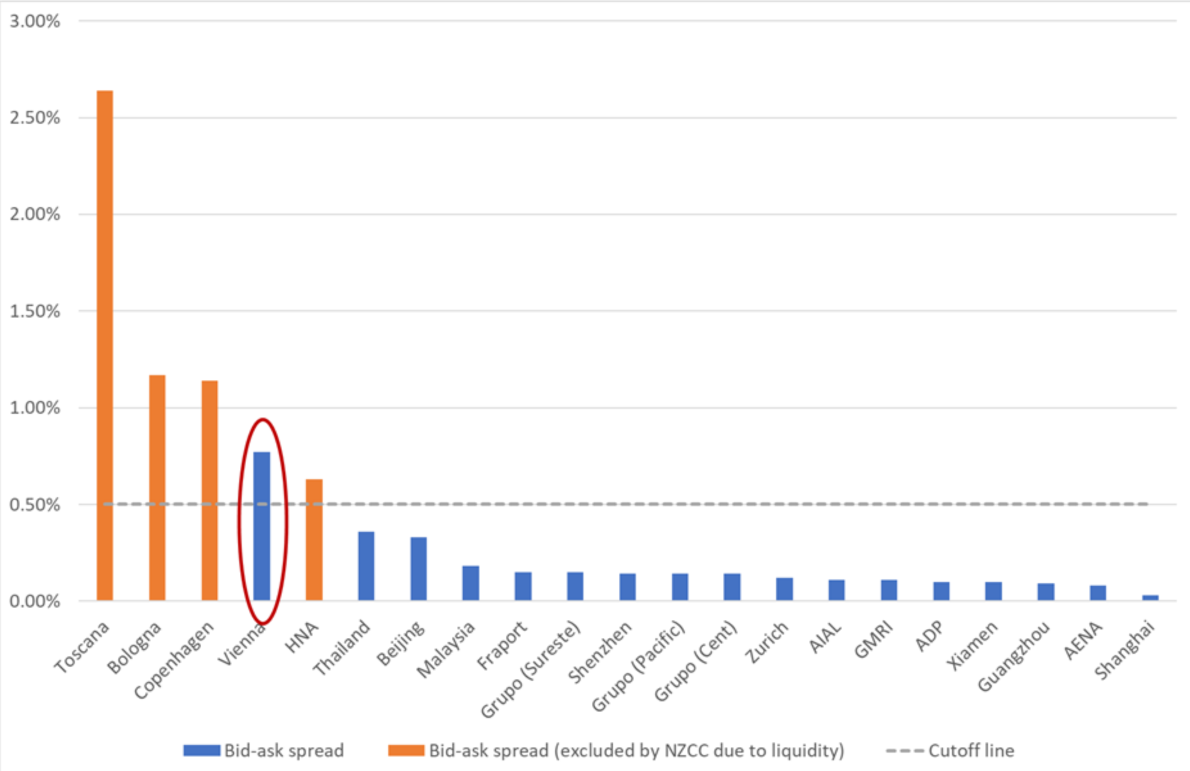
Ticker	Name	Asset beta variability 2012-2017	2017-2022	Bid-ask spread	Free float	Leverage	MRP	Country classification	Reason for inclusion/exclusion
FLU AV Equity	Flughafen Wien AG	0.10	0.05	0.77%	10.00%	0.09	5.8%	Developed	No reason to reject
357 HK Equity	HNA Infrastructure Company Ltd	0.02	0.11	0.63%	77.31%	0.22	6.5%	Developed	Liquidity

326. Vienna should be excluded from any narrow sample based on the evidence surveyed above. However, even putting no weight on these the NZCC's own criteria support its exclusion.

6.3.1.1 Liquidity

327. The NZCC excluded four airports (Bologna, Toscana, HNA and Copenhagen) which are identified as having a liquidity problem. One of the features that these four airports have in common is that they have bid-ask spread larger than 0.5%, per NZCC's calculation.[88] This is illustrated in the figure below.

Figure 6-1: Bid-ask spread based on NZCC DD's calculation in Table A1

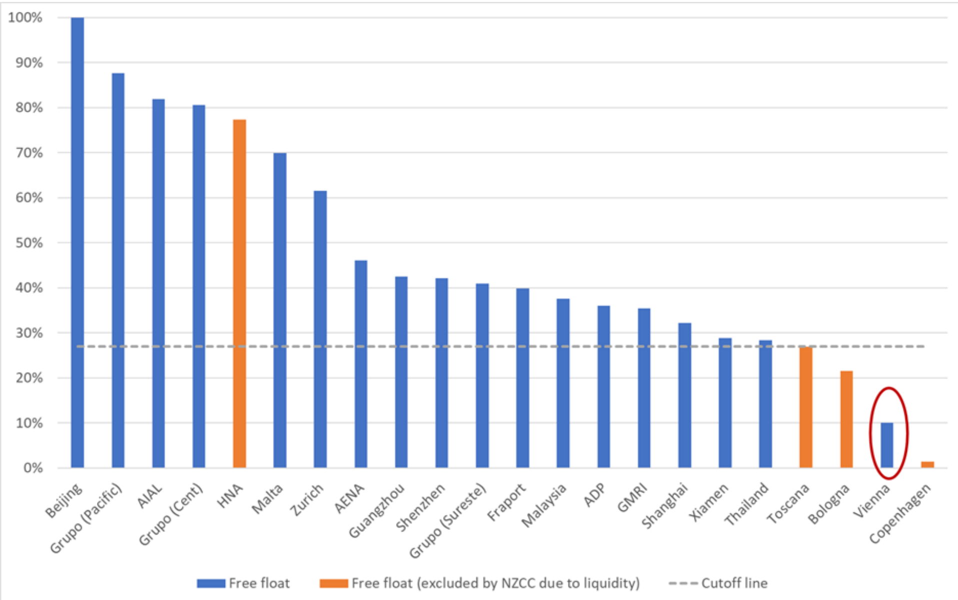


328. As shown in the above figure, Vienna has a higher bid-ask spread than HNA and the cutoff line of 0.5%. However, it is not excluded in the NZCC draft decision sample.

88 It is unclear which period and what the duration that the NZCC used in arriving this calculation.

329. Another metric that the NZCC used in determining the liquidity of an airport's stock is the percentage of shares traded (free float percentage).[89] I replicated the values provided by the NZCC into the following chart.

Figure 6-2: Free float percentage based on NZCC DD's calculation in Table A1



330. From the chart above, it is unclear why HNA, which has a free float percentage of 77% is excluded and Vienna, with a free float percentage of 10%, is considered sufficiently liquid.

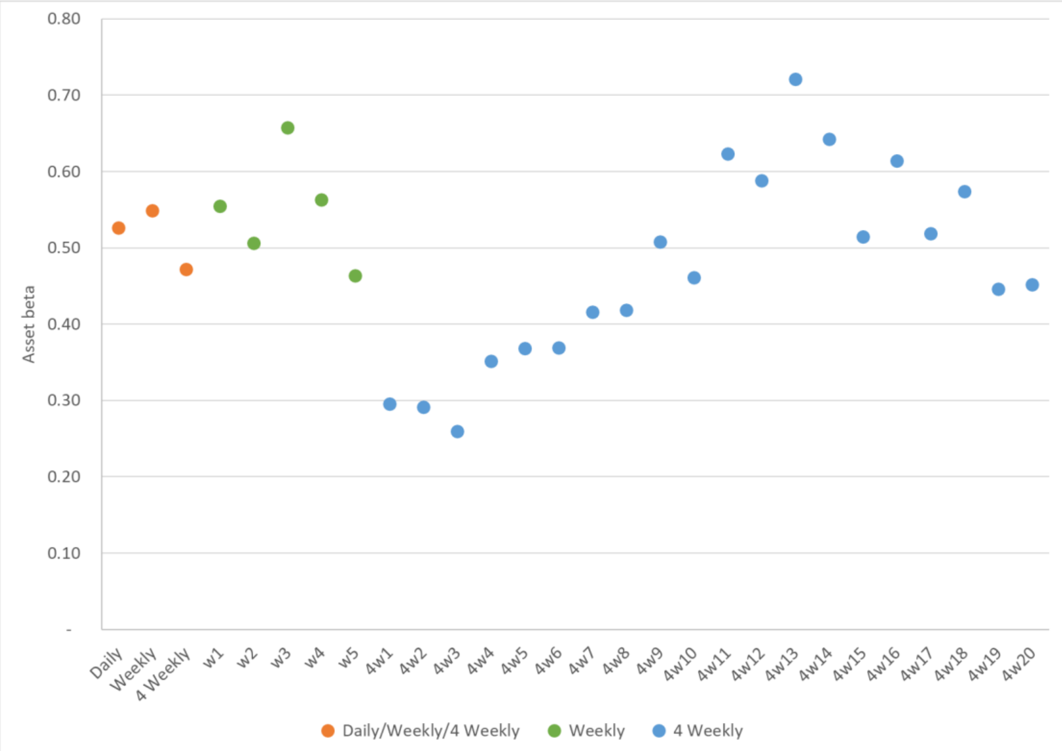
6.3.1.2 Reliability of the beta estimate

331. Vienna's asset beta estimate is considered reliable by the NZCC due to its low discrepancy between daily, weekly and four-weekly estimate of the asset betas (0.10 for the 2012-17 estimate and 0.05 for the 2017-22 estimate).

332. However, a more robust measure of the asset beta variability is to look at the individual betas within weekly and four-weekly estimates. The chart below plots all the individual betas within weekly and four-weekly estimates next to the daily, weekly and four-weekly averages.

89 The data appears to be obtained from Bloomberg under the ticker EQY_FREE_FLOAT_PCT and on a date around 31 Jan 2023.

Figure 6-3: Vienna airport: 28 asset beta estimates for the 5 years ending 31 March 2023 (no COVID-19 exclusion)



333. As demonstrated, the variations within the weekly, and particularly the four-weekly, estimates are very high. The low variations between daily, weekly and four-weekly estimates, in which the NZCC relied on, are simply "coincidence".

334. I survey other evidence on the variability of Vienna's asset beta estimates in Appendix E. I demonstrate that the only reasonable conclusion is that Vienna's asset beta estimates are much more variable than the airports that the NZCC deemed have unreliable asset betas due to high variability.

335. I note that, as explained in section 6.1.2, I do not accept that asset beta variability is *per se* evidence of unreliability. However, if the NZCC does apply this filter to arrive at a narrow sample it would be inconsistent not to also exclude Vienna. This is especially in the context where the low liquidity of Vienna (high bid-ask spread and low free-float) provide some grounds to believe that the observed variability may be driven, at least in part, by illiquidity.

6.3.1.3 Vienna conclusion

336. In summary, on almost all of the NZCC criteria (bid ask spread, free float and beta volatility) Vienna would be excluded. This is even before consideration of the radically different and lower risk regulatory regime Vienna Airport operates under.

6.3.2 AdP, Fraport AG and Beijing

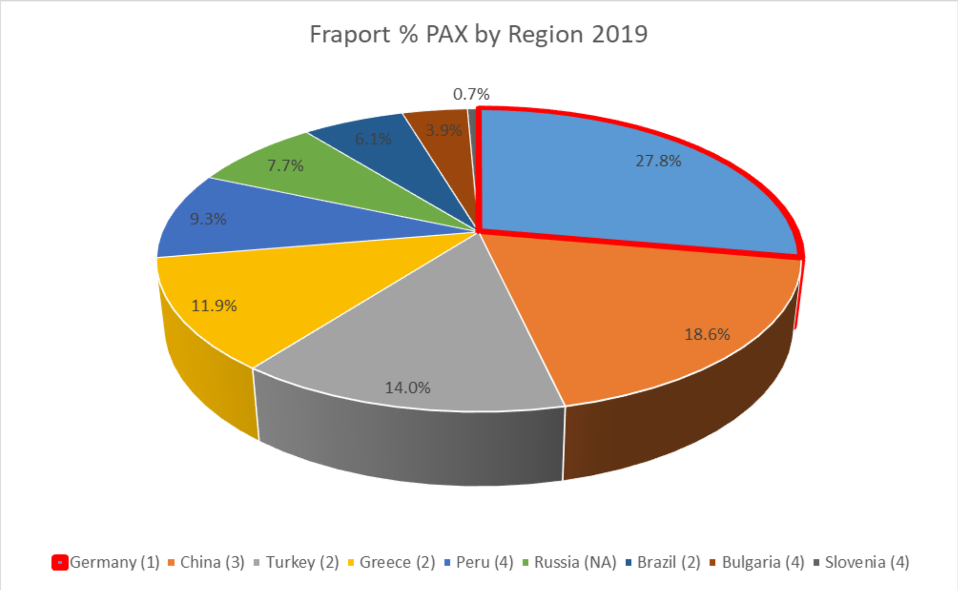
6.3.2.1 Fraport AG & AdP

337. When a company has a diverse portfolio of airports internationally, they are less exposed to country specific risk. Importantly, New Zealand airports exclusively control airports within New Zealand. While they are shielded from market shocks overseas (with the exception of global shocks) their operations are wholly vulnerable to domestic shocks. Fraport AG and AdP are examples of companies included in the draft decision sample that have significantly lower risk to New Zealand airports due to their internationally diversified operations.

338. Almost one quarter of Fraport AG's total passenger traffic is from its Frankfurt airport with the remaining passengers from airports it owns in Peru, Turkey, Russia, China, Greece, Slovenia, Bulgaria, India and Brazil. None of these countries are classified as "developed" by FTSE Russell. In other words, almost 75% of Fraport AG's total operations are in countries with FTSE Russell classifications that the NZCC has deemed "not comparable" to New Zealand and where the NZCC has excluded airports from its sample on this basis.

339. The percent of passengers at each location in 2019 is summarised in the chart below.

Figure 6-4: Percent of PAX by country for Fraport owned Airports, 2019

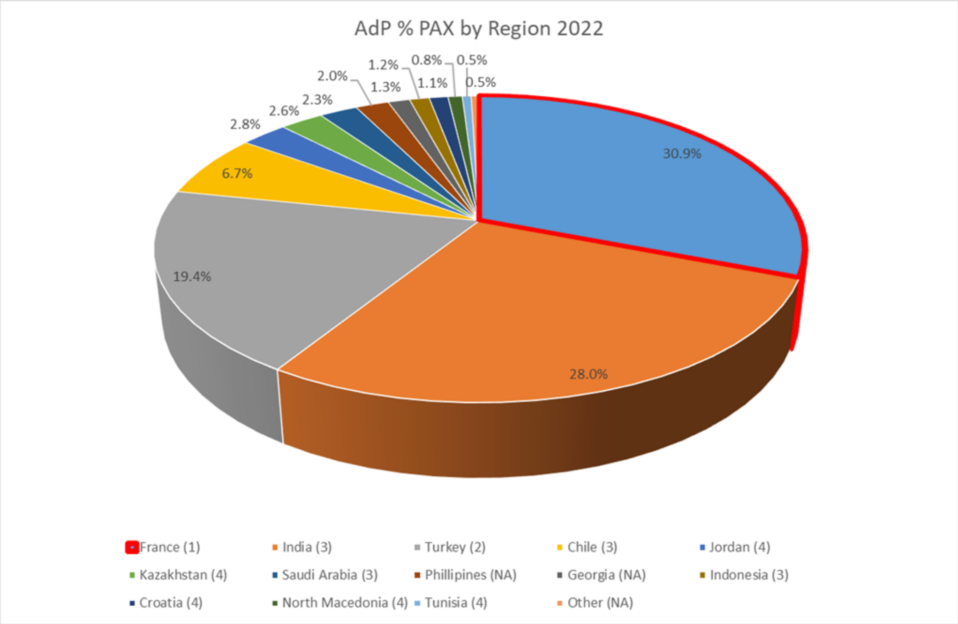


Source: PAX calculated from Fraport Annual Report 2019, page 64. Note that (1) = Developed, (2) = Advanced Emerging, (3) = Secondary Emerging, (4) = Frontier & NA is not on the FTSE index.

340. All of the same issues apply, with similar force, to AdP. In 2022 over two thirds of AdP's passengers were in airports outside of France. AdP's airport companies are spread around the world including Turkey (where AdP has a 46% stake in TAV which itself owns airports outside of Turkey in Georgia, Latvia, Croatia, Macedonia, Saudi Arabia and Kazakhstan), India, Jordan, Chile, Netherlands, Belgium, Croatia, Guinea, Saudi Arabia, Madagascar and Mauritius.

341. The percentage of passengers at each location in 2022 is summarised in the chart below.

Figure 6-5: Percent of PAX by country for AdP owned airports, 2022



Source: AdP Financial Release Full-Year 2022 Results.[90]
Note that (1) = Developed, (2) = Advanced Emerging, (3) = Secondary Emerging, (4) = Frontier & NA is not on the FTSE index.

342. Below is a table of the FTSE classification of all countries with airports by Fraport AG and AdP.

90 Groupe AdP (2023), Financial Release Full-Year 2022 Results , available at https://www.parisaeroport.fr/docs/default-source/groupe-fichiers/finance/relations-investisseurs/information-financi%C3%A8re/r%C3%A9sultats-et-chiffre-d'affaires/2022/adp-sa-2022-full-year-results.pdf?sfvrsn=36b09084_2.

Table 6-1: FTSE Classification of Fraport and Adp

Airport	Country	FTSE Classification
Fraport AG		
Frankfurt	Germany	Developed
Ljubljana	Slovenia	Frontier
Fortaleza, Porto Alegre	Brazil	Advanced Emerging
Fraport Greece	Greece	Advanced Emerging
Lima	Peru	Frontier
Twin Star, Burgas, Varna	Bulgaria	Frontier
Antalya	Turkey	Advanced Emerging
St. Petersburg	Russia	NA
Xian	China	Secondary Emerging
AdP		
New Delhi, Hyderabad	India	Secondary Emerging
Cebu	Philippines	NA
Medan	Indonesia	Secondary Emerging
Almaty	Kazakhstan	Frontier
Antalya, Ankara, Izmir, Bodrum, Gazipasa	Turkey	Advanced Emerging
Medinah	Saudi Arabia	Secondary Emerging
Tunisia	Tunisia	Frontier
Georgia	Georgia	NA
North Macedonia	North Macedonia	Frontier
Zagreb	Croatia	Frontier
Paris CDG/Orly	France	Developed
Santiago de Chile	Chile	Secondary Emerging
Amman	Jordan	Frontier

Source: FTSE Russell (2023)[91]

343. To conclude, the high proportion of foreign ownership in AdP and Fraport's Airport portfolios will put a downward bias on their asset betas and make them inappropriate for inclusion in a smaller sample of "close comparators" for New Zealand airports.

6.3.2.2 Beijing

344. The NZCC draft decision excludes most Chinese airports on the basis of "market comparability". I disagree with this exclusion, however, if it is to be implemented it should be implemented consistently. It appears that Beijing Airport is an exception

91 FTSE Russell (2023), FTSE Country Classification of Equity Markets, updated 30 March 2023, viewed 30 June 2023, available at https://research.ftserussell.com/products/downloads/matrix-of-markets_latest.pdf.

because the NZCC has assigned Beijing airport a FTSE Russel Country Classification of “Developed” while Shenzhen Airport is assigned “Secondary Emerging”.

Figure 4-11: Replication of draft decision Table A1

Ticker	Name	Asset beta variability 2012-2017	2017-2022	Bid-ask spread	Free float	Leverage	MRP	Country classification	Reason for inclusion/exclusion
694 HK Equity	Beijing Capital International	0.16	0.18	0.33%	100.00%	0.13	6.5%	Developed	No reason to reject
000089 CH Equity	Shenzhen Airport Co	0.09	0.19	0.14%	42.17%	-0.02	8.7%	Secondary emerging	Market comparability, negative leverage

345. This difference appears to be based on the where the stock is listed and not where the airport is actually located. Beijing Airport is listed on the Hong Kong stock exchange while Shenzhen Airport is listed on the Shenzhen stock exchange. The NZCC has applied the FTSE Russel “Country Classification” for Hong Kong to Beijing Airport rather than the FTSE Russel Country Classification for China. However, both airports operate in China and are exposed to identical levels of any “country risks” that might exist for Chinese airports.

346. The FTSE Russell classification system is not, in fact, based on the level of development of the country but, rather, the ease of operation for equity fund managers such as whether: [92]

- “Settlement - Free delivery is available”;
- “Stock lending is permitted”;
- “Short sales are permitted”;
- “There is a developed stock derivative market”;
- “Of exchange transactions are permitted”;
- etc.

347. These are not factors relevant to determining the reliability of beta estimates using weekly and four weekly returns. They are relevant the ease of operations of hedge funds and some equity fund managers, but they are simply not important to deriving accurate estimates of equity beta measured over weekly and 4-weekly intervals.

348. Moreover, many large non-US companies, including many of the airports in the NZCC wider sample (e.g., AoT), are traded in US markets as American Depositary Receipts (ADRs). It would be equally non-sensical to say that estimating betas using US ADR’s were “comparable” because they were traded on a “developed” stock exchange.

92 FTSE Russell | FTSE Equity Country Classification Process, v2.6, March 2023.

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6.3.3 Japan Airport Terminal (JAT)

349. JAT passes all of the NZCC criteria. The only reason CEPA originally excluded JAT was based on a high percentage of non-aeronautical revenues (circa 75%). However, this is because JAT owns its own airport terminal retail outlets and most of that revenue share represents cost of goods sold (e.g., food and beverage) which scale proportionally with sales. When measured on a share of profit basis, JAT has low non-aeronautical operations relative to the draft decision sample – as can be seen Table 6-2.

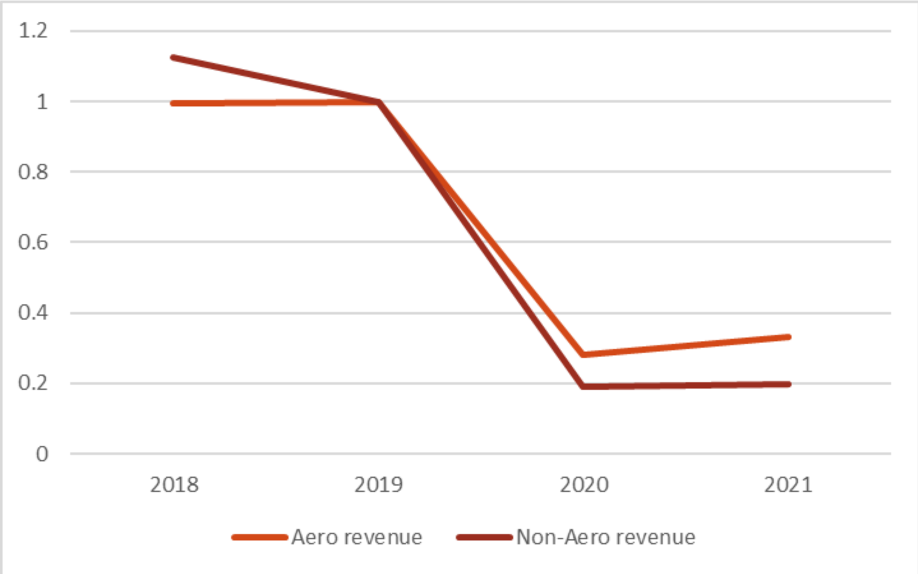
Table 6-2: Non-aero revenue share vs profit share where available

	JAT	Frankfurt	AENA	AIAL	AdP
Non-aero revenue	75%	57%	30%	51%	38%
Non- aero EBITDA	36%	33%	38%	55%	55%
Non-aero EBIT	55%	68%	NA	NA	65%

Source: Annual reports and CEG analysis. JAT reports for three segments. I estimate aeronautical revenues as Facilities Management segment revenue less Rental revenue. I estimate non-aeronautical revenues as the sum of Merchandise and Food and Beverage Segments plus Rental revenue. Similarly, I remove/add Rental revenue net of Rental expenses from/to aeronautical/non-aeronautical profits (EBIT and EBITDA).

350. Clearly, share of profit basis is the most relevant basis for determining the importance of non-aeronautical operations influencing stock prices and beta. Moreover, JAT aeronautical and non-aeronautical revenues move very closely (because they both depend equally on passenger throughput) but aeronautical profits are more volatile precisely because non-aeronautical cost of goods sold scale with revenues while aeronautical operations have higher levels of fixed costs.

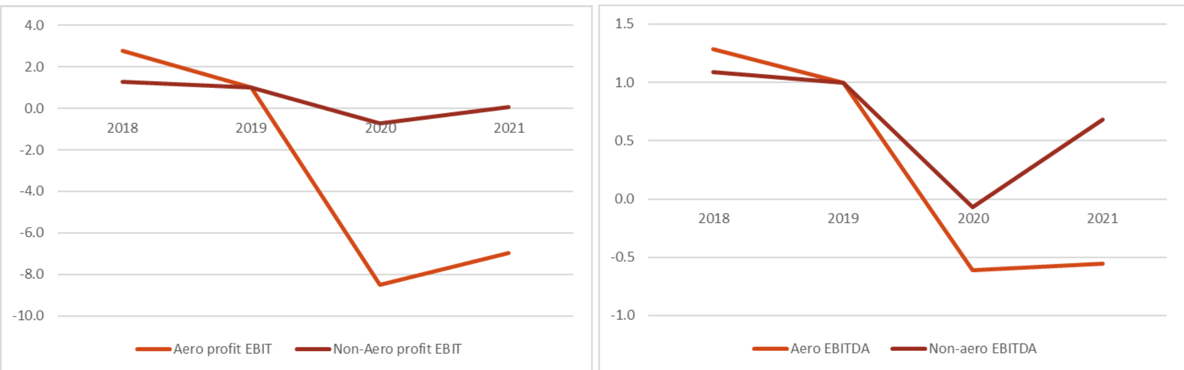
Figure 6-6: Time series of aero vs non-aero revenues (2019 =1)



Source: CEG analysis and JAT segment data and annual reports. Non-Aero revenue is calculated as the sum of Sale of Merchandise, Sale of Food and Beverage and Rent revenue. Aero revenues is total revenue less non-aero revenue. Note that JAT's financial year ends in March. Consistent with JAT's description each year named for the calendar year in which 9 months fell. So 2020 relates to the 12 months ending March 2020.

351. It is true that non-aeronautical revenues fall by slightly more (in percentage terms) than aeronautical revenues – but the difference is small. Moreover, this difference is dramatically reversed if EBIT or EBITDA is examined.

Figure 6-7: Time series of aero vs non-aero EBIT and EBITDA (2019 =1)



Source: CEG analysis and JAT segment data and annual reports. Non-aero profit is calculated as the sum of Sale of Merchandise, Sale of Food and Beverage segment profits plus rental revenue less rental expenses. Aero profits is proxied by the facilities management segment less the net value of rental revenue less rental expenses.

352. Moreover, the NZCC's draft decision that there is no compelling evidence for difference in risk between aero and non-aero operations means that, even putting aside the above facts, there is no reason to exclude JAT[93].

6.4 If a narrow sample is to be adopted, AIAL and Zurich should be the primary comparators

353. Zurich and AIAL are the most similar to New Zealand airports in terms of both regulatory regime and operating environment (capacity utilisation (CUI), standalone airport, airport size, country size and topography, passenger volatility measures including demand beta).

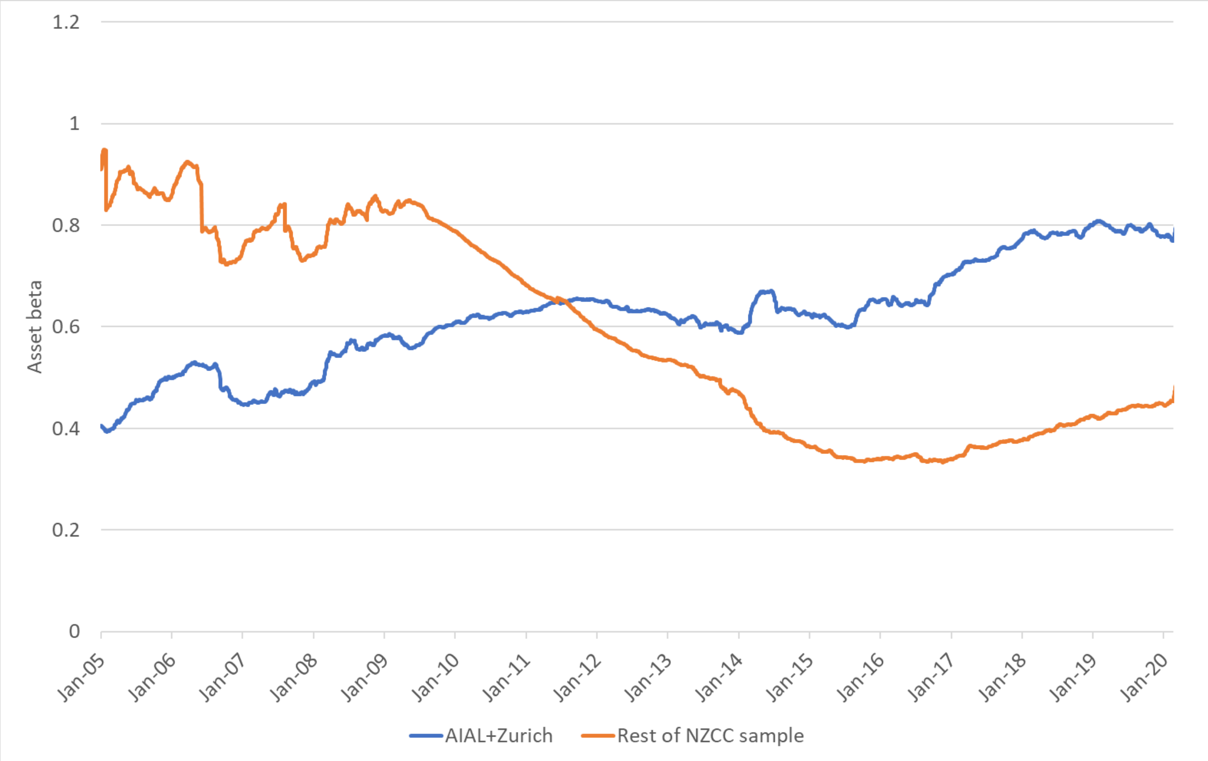
354. The next most comparable airport company on these criteria is AENA and, potentially, Sydney Airport. AENA has a similar regulatory environment to New Zealand, but its major airports (Madrid and Barcelona) are very different (high levels of CUI and much larger). Sydney airport similarly has significantly higher capacity utilisation and its exposure to volume risk depend on the non-transparent contracts it negotiates with airlines.

355. JAT similarly has a non-transparent regulatory regime and is a much larger and capacity constrained airport than the New Zealand Airports and, therefore, would not be included in a narrow sample of comparable airports.

356. Figure 6-8 demonstrates that the average of AIAL and Zurich Airport asset betas has been remarkably stable relative to the rest of the draft decision sample.

93 NZCC draft decision, page 75.

Figure 6-8: Asset beta of AIAL + Zurich vs the rest of draft decision sample between Jan 2005 and Feb 2020



357. If a narrow "developed world" comparable sample was to be used it would include just AIAL and Zurich. This sample has historically outperformed the draft decision sample on the criteria of:

   a. Stability (much more stable than draft decision sample):

      - 16% vs 34% coefficient of variation between Jan 2005 and Feb 2020;

   b. Closer to AIAL historically than draft decision sample

      - AIAL is 0.77, AIAL+Zurich is 0.62 and draft decision sample is 0.59.

6.5 Summary of estimates for various samples

358. Table 6-3 shows the sample average asset betas using data from the last 10 years to 31 March 2023. We report values with and without the exclusion of an 18 month COVID-19 period (18 months is the period COVID-19 affected data as identified by the NZCC draft decision).[94]

94 NZCC draft decision, paragraph 4.62.3.

359. For the reasons described in section 9, I do not consider that there should be any exclusion of COVID-19 data. However, I report results excluding COVID-19 data in order to compare with the NZCC draft decision estimate of a COVID-19 free asset beta of 0.53.[95]

360. The use of the last 10 year of data to March 2023 is the most consistent with the NZCC 2016 IM and also Bela's advice to the NZCC to rely predominantly on the most recent data to estimate asset beta.

Table 6-3: Summary table average beta (two 5 year periods ending 30 March 2023 with and without 18-month COVID-19 exclusion starting 21 Feb 2020)

Sample	Observation	Simple average	Simple average ex COVID
NZCC sample [96]	Not appropriate even on NZCC criteria	0.64	0.54
AIAL, Zurich, Sydney and AENA	Maximum size of narrow sample of closely comparable airports	0.77	0.67
As above + JAT. (NZCC criteria correctly applied)	Consistent with NZCC stated criteria	0.84	0.75
AIAL and Zurich	Best narrow sample of closely comparable airports	0.86	0.71
Wider (2016 IM updated) sample	Best sample	0.81	0.72

361. In my view, 0.81 is the best estimate of asset beta for the 2023 IMs based on the wider sample with no exclusion for COVID. This is slightly below the narrow sample that is consistent with NZCC stated criteria of 0.84.

362. A number of other observations can be made:

- Including COVID-19 data tends to raise the average asset by between 0.09 and 0.15 depending on the sample;
- It is notable that the AIAL and Zurich sample has an average asset beta similar to the wider sample when COVID-19 is excluded.
- The draft decision sample average is materially lower than all of the other narrow and wider samples.

[95] We define the start of COVID-19 to be 21 February 2020 rather than 28 February because 28 February is after the stock market began to fall precipitously on news of international travel restrictions.

[96] Sydney is excluded from the second period because there is almost two years of data missing after the deal announcement date – see C.1.3. If Sydney is included in the second five year period, simple average incl COVID/ simple average excl COVID = 0.63/ 0.52.

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7 Unreasonable to lower asset beta in the wake of COVID-19

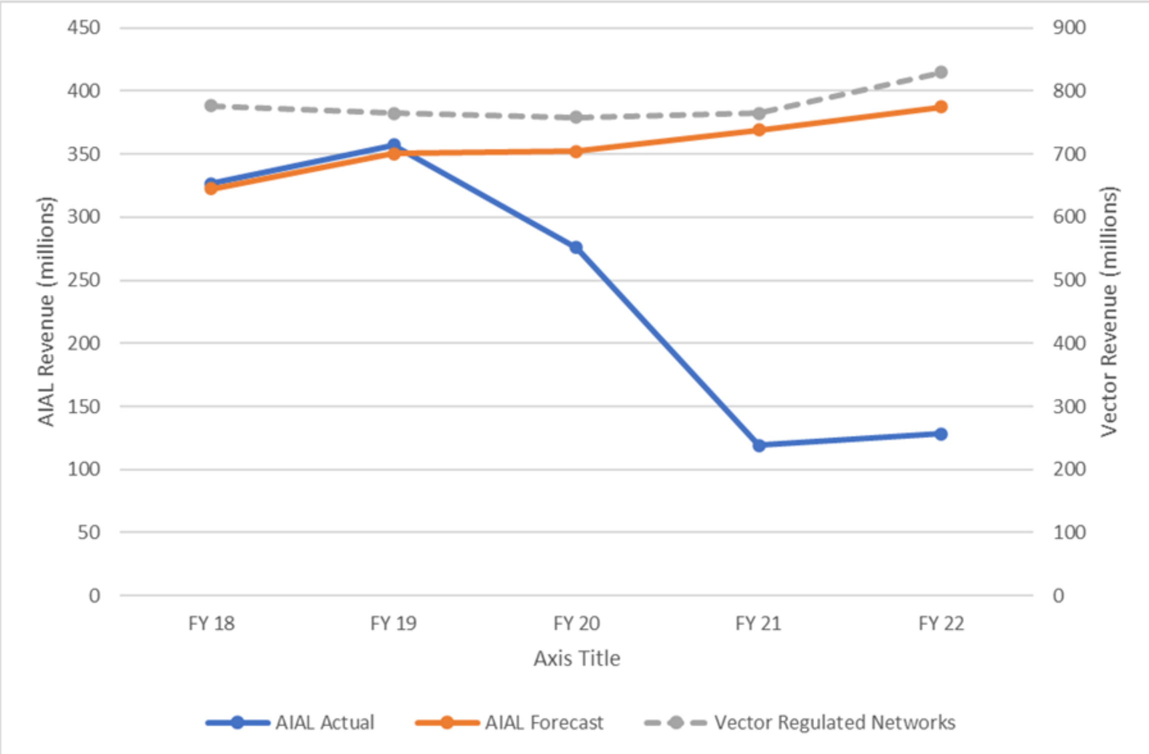
7.1 New information since the 2016 IM points to materially higher asset beta risk

363. The COVID-19 pandemic is clearly the most important new evidence on the risk of airport companies since the 2016 IM was determined. Airport companies suffered very large and unexpected real revenue and profit shocks. Consistent with these real world impacts, measured asset betas for airport companies rose materially as can be seen in Figure 2-2 above.

364. By way of illustration, AIAL's passenger numbers and revenue dropped to 25% of forecast levels in 2021 and 2022. Moreover, given the uncertainty about the path of demand and the onerous consultation process for any change in prices (see section 5.1.1) AIAL deferred price changes for PSE4 by a year (beginning FY2024). I am instructed that AIAL's losses in PSE3 are not recovered in PSE4 or beyond.

365. Figure 2-5 shows the impact of the pandemic on AIAL revenues (right hand axis) which fell by more than two thirds. For reasons that will become clear below, I also show the impact of the pandemic on Vector's (New Zealand's largest electricity distributor) regulated revenues.

Figure 7-1: AIAL (and Vector) revenue impact of pandemic



Source: Auckland Airport, Annual Information Disclosure for the years ended 30 June 2018-2022, available at https://corporate.aucklandairport.co.nz/investors/regulation. Vector data comes from Annual reports 2018/20/22, available at https://www.vector.co.nz/investors/reports.

7.2 The UKCAA and CAR responded proportionately

7.2.1 UKCAA response to COVID-19

366. The UKCAA ultimately concluded that the COVID-19 pandemic should raise asset beta via two changes in its method:

- First, higher risk comparators should be included in its sample of comparators; and
- The sample average asset beta should be raised above the pre-COVID-19 measured asset beta for that sample.

367. The total sum impact of the UKCAA's changes was to raise the midpoint asset beta by 0.115. Given that the UKCAA adopts the midpoint WACC this can also be regarded as the uplift in the UKCAA final asset beta estimate.

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Table 7-1: Summary of Flint and UKCAA assumptions and findings

	Low impact	High impact	UKCAA mid-point estimate
Pre pandemic asset beta	0.000	0.000	0.5000
Frequency of major pandemics	1 in 50 years	1 in 20 years	
Duration of pandemic	17 months	39 months	
COVID-19 impact via change in comparator set	0.000	0.100	0.050
COVID-19 impact via higher asset beta for individual comparators	0.020	0.110	0.065
Sum of COVID-19 uplifts	0.020	0.21	0.115
% impact of COVID-19	4%	42%	23%
UKCAA TRS adjustment to asset beta*	(0.08)	(0.09)	(0.085)
% impact of COVID-19 relative to post TRS asset beta	5%	51%	28%

Source: UKCAA, Economic regulation of Heathrow Airport Limited: H7 Final Proposals, Section 3: Financial issues and implementation, June 2022. Table 9.2.

368. Having applied a midpoint COVID-19 uplift of 0.115 to HAL's asset beta, the UKCAA then reduces this by 0.085 to reflect a dramatic shifting of passenger volume risk from HAL to airline customers. This is achieved via a new Traffic Risk Sharing (TRS) mechanism. This mechanism shifts 50% of all traffic variations less than 10% from forecast from HAL to users. It also shifts 105% of (i.e., more than fully compensates HAL for) the risk of higher than 10% variation from forecast.

369. It is relevant to note that the 0.115 asset beta uplift (i.e., before the TRS decrement) is a very material increase in asset beta which should, if the logic is applied consistently, result in a permanent uplift to asset beta of this magnitude in all future determinations.

370. Moreover, the above direct uplift to the asset beta is not the only way in which the UKCAA has provided compensation for pandemic risk. The UKCAA also:

- Added £300m to HAL's regulatory asset base in 2018 prices from 2021 onwards;[97]

97 UKCAA, CAP2524D, Economic regulation of Heathrow Airport Limited: H7 Final Decision Section 3: Financial issues and implementation paragraph 10.74.

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- Provided £25m per annum in all future years to compensate for the expected costs to HAL of a pandemic (based on an assumed frequency and length of a pandemic as set out in the last column of Table 11-2 above).
- Adopted a 0.87% lower forecast of passenger numbers than the UKCAA's "most likely" estimate.

371. It is relatively simple to express each of these changes in an "asset beta uplift" equivalent manner. That is, to calculate the asset beta uplift that would provide the same compensation to New Zealand airports as the above policies provide to HAL (adjusting for differences in scale between HAL and AIAL and also differences in risk sharing mechanisms in place). When I do this (see Appendix F for details) I estimate that the UKCAA policies outlined above would, if applied to New Zealand airports, be **equivalent in value terms to a 0.28 permanent uplift in asset beta for NZ airports**.

372. Combining the 0.115 direct uplift in asset beta and the 0.28 asset beta equivalent uplift in compensation results in a **0.40 permanent** asset beta equivalent uplift in compensation by the UKCAA to HAL as a result of the COVID-19 pandemic.

7.2.2 Irish CAR responded proportionately

373. The only other airport regulator that sets out detailed reasons for its asset beta estimate is the Irish Commission for Aviation Regulation (CAR). The CAR was advised by Swiss Economics and the evolution of their thinking on asset beta can traced through Swiss Economics' advice:

- An asset beta of 0.45 estimated in Swiss Economics' 2019 draft report;[98]
- An asset beta of 0.60 estimated in Swiss Economics' 2022 final report. [99]

374. This represents a 33% increase in asset beta estimate post pandemic.

375. Finally, in terms of the absolute level of the CAR asset beta it must be emphasised that Swiss Economics:

   a. Proposed that the WACC should also include a 50bp "aiming up" uplift. This is equivalent to a 0.15 uplift to asset beta;[100] Therefore, it is reasonable to view the final compensation for equity investors to be equivalent to:

[98] Swiss Economics, Dublin Airport Cost of Capital for 2019 Determination, Draft Report, March 2019, page 48. 0.45 is the point estimate of equity beta (0.84) divided by the leverage multiplier (1.88).

[99] Swiss Economics, Dublin Airport Cost of Capital for 2022 Interim Review Final Report, December 2022, page 54.

[100] Swiss Economics, Dublin Airport Cost of Capital for 2022 Interim Review Final Report, December 2022, Table 32 on page 53. 0.5% uplift to the WACC is equivalent to a 1.0% uplift to the cost of equity at 50%

i. 0.60 pre-pandemic (=0.45+0.15); and

ii. 0.75 post pandemic (=0.60+0.15).

b. Would have applied a higher uplift for pandemic risk but for the fact that CAR had intervened in pricing and allowed a:

> *Waiver of global price cap compliance in 2020 only, allowing for an increase of approx. 40% in tariffs per passenger compared to the originally planned price cap for 2020. Current interim review of price caps, which implies a full risk reset for the final years of the 2019 Determination's regulatory period.* [101]

Such that Swiss Economics explicitly argued against a higher uplift for Dublin airport on the basis that CAR had demonstrated that its regulatory response would lower the risk exposure to such events for Dublin airport relative to other airports.

> *...among a large range of remedial efforts by the relevant authorities, CAR's intervention has been among the most decisive, making observations for comparator airports less relevant. This further suggests that CAR would be similarly enabled to again amend the price control in the event of another similar incident over 2023-26, reducing Dublin Airport's relative exposure to such a shock.* [102]

c. Even before the pandemic, Dublin was materially capacity constrained. The SEO report discussed in section 5.2.1 estimated Dublin had a CUI of 0.74 (compared to the AIAL/New Zealand average of 0.64/0.58). Swiss Economics was cognisant of this capacity constraint in its final decision where it determined that capacity constrained HAL was a reasonable comparator to Dublin.

> *In relation to demand structure, HAL is possibly less capacity constrained over the coming years during economic recovery than before the pandemic. Overall, HAL's demand risks should be comparable to Dublin Airport's. An Asset Beta within but closer to the top of the range for HAL's Asset Beta seems reasonable given the two airports' risk profiles.* [103]

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gearing. A 1.0% cost of equity is equivalent to a 0.15 uplift to the asset beta for an ERP of 6.71% (0.15=1.0%/6.71%).

101 Swiss Economics, Dublin Airport Cost of Capital for 2022 Interim Review Final Report, December 2022, Table 12 on page 32.

102 Swiss Economics, Dublin Airport Cost of Capital for 2022 Interim Review Final Report, December 2022, page 28.

103 Swiss Economics, Dublin Airport Cost of Capital for 2022 Interim Review Final Report, December 2022, page 53.

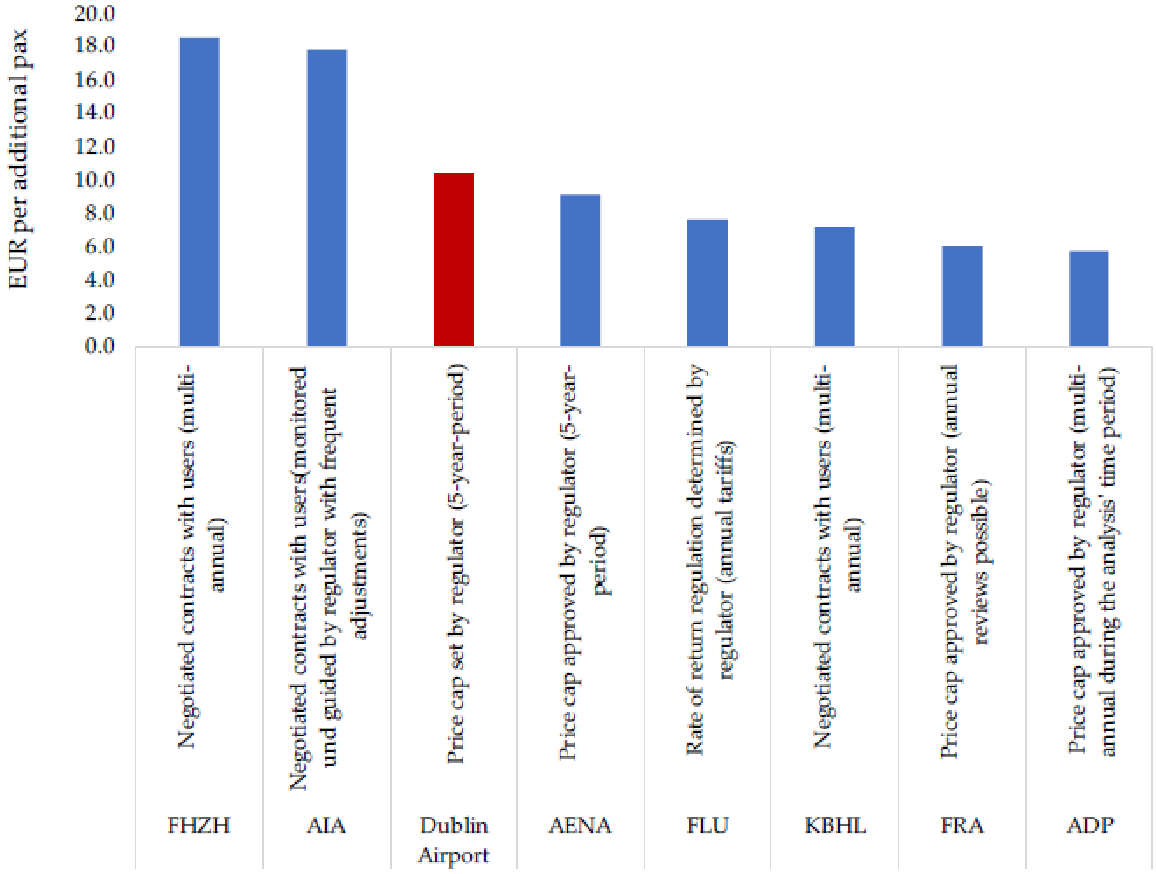
376. In this context, I consider that the level of the asset beta estimated by Swiss Economics (0.60/0.75 depending on whether the cost of equity uplift is included) is broadly consistent with the 0.81 asset beta I estimate for New Zealand airports who:

- Have higher risk operating environments; and
- Where there was no regulatory intervention to allow prices to rise (circa 40%) in the immediate aftermath of COVID-19.

377. Finally, I also note that Swiss Economics included the following relative risk assessment for Dublin airport versus other airports – six of which are in the NZCC draft decision sample (the missing firms are Sydney and Beijing).

Figure 7-2: Swiss Economics comparison of relative risk

Figure 9: Linear effect (in EUR) of an Additional Passenger on Peer Airport Operators' EBITDA



Note: The estimated linear effect of an additional passenger on EBITDA is estimated using the Ordinary Least Squares Method. As explanatory variable, we use the aggregate number of passengers across all airports from 2015 to 2019 in the portfolio of the airport operator as reported in the relevant annual reports. As explained variable, we use reported EBITDA in local currencies of the airport operators over the same period. AIA, FHZN and Copenhagen Airports (KBHL) were converted to EUR using the respective exchange rate as of 14 November 2022.

Source: Swiss Economics based on airport operators' annual reports.

378. The analysis suggests that AIAL and Zurich had much higher risk exposure than Dublin and more than double the average of the AENA, Vienna, Fraport AG and AdP. This is consistent with my conclusion, in section 6.4, that if a narrow sample was to be relied on it should be restricted to AIAL and Zurich.

7.3 Adherence to the 2016 IM would have resulted in a reasonable response to COVID-19

379. The COVID-19 pandemic is clearly the most important new evidence on the risk of airport companies since the 2016 IM was determined. The UKCAA response to the COVID-19 pandemic is, in my view, entirely proportionate to the importance that the new evidence that the pandemic revealed about the risk of airport companies.

380. Adherence to the 2016 IM 10 year sampling period methodology to include COVID-19 would have resulted in an upward adjustment of around 0.09 (0.10) to the asset beta adopting the 2016 IM (2023 draft decision) method for estimating the sample of comparators.[104] That is, adherence to the 10 year estimation window would have resulted in a very similar direct asset beta uplift to that provided by the UKCAA (0.115). Moreover, it is important to note that the UKCAA uplift is permanent in all future decisions while adherence to the 2010 and 2016 methodology would have resulted in only a temporary uplift.[105]

381. By contrast, the 2016 IM decision set a 0.65 asset beta for airport companies in New Zealand (from which the NZCC deducted 0.05 to arrive at its risk of aeronautical operations). In the post COVID 2023 draft decision, the NZCC has determined that airport companies in New Zealand have an asset beta risk of 0.55 (and has determined that aeronautical and non-aeronautical operations have the same risk).[106]

382. In effect, the draft decision estimated 15% *lower* risk attached to airport companies in New Zealand than the 2016 IM decision (0.55 vs 0.65). Moreover, the 2016 IM methodology would have resulted in a 0.81 asset beta. Relative to adherence to the 2016 IM methodology, the draft decision arrived at a 0.26 (or 32%) reduction in estimated asset beta risk.

383. It follows that there must be a very significant error in the NZCC asset beta decisions. Logically, this error must be infecting either:

- the past 2010 and 2016 IM decisions; or
- the current 2023 IM draft decision.

104 I calculate this 0.09 (0.10) uplift as the difference between the asset betas estimated using the full 10 years of available data to March 2023 versus the asset beta estimated using the same data but excising the 18 months of data from 21 February 2020 (noting the draft decision states that the asset beta was elevated for "about 18 months" with these values can be found in Table 8-4 below. The NZCC draft decision states asset betas were elevated for about 18 months at paragraph 4.66.4.

105 Applied only so long as COVID-19 is included in the estimation window). In addition, this comparison of direct uplifts does not factor in the additional COVID-19 related compensation provided by the UKCAA.

106 NZCC draft decision, page 75.

7.4 Two simple cross-checks suggest the draft decision is at error

7.4.1 Low risk Heathrow gets a higher asset beta than high risk NZ airports

384. The draft decision states:[107]

> Our estimate of a pre-COVID-19 asset beta of 0.53 is similar to the CAA's pre-COVID-19 asset beta of 0.5.

385. The draft decision seems to present the UKCAA precedent for Heathrow Airport (the most capacity constrained airport in Europe) as supportive of it adopting a similar asset beta for the substantially different New Zealand airports. It is, therefore, useful to explore the basis of the UKCAA decision for Heathrow and to ask whether it is, in fact, supportive of the draft decision.

386. Pre-pandemic the UKCAA correctly and consistently identifies Heathrow as being exposed to lower underlying demand risk than other airports. This is due to its position as a capacity constrained primary airport serving a major international city which is also served by a number of secondary airports. For example, the UKCAA's consultant, PwC, summarised the UKCAA's position in 2017 emphasising capacity constraints as a major determinant of low asset beta:[108]

> *In terms of HAL's relative risk compared to the market, the CAA found that there was little evidence to suggest a material change in relative risk.* ***The CAA view was that HAL remained a capacity constrained airport with excess demand*** *and that the asset beta range was logical when placed against broader regulated companies.*

387. This was reaffirmed in 2019 when PwC advised:[109]

> *"… in our view HAL's beta is towards the lower end of the proposed beta range* ***given that capacity constrained hub-airports, such as Heathrow, are likely to have lower betas than unconstrained airports****."*

107 NZCC draft decision, paragraph 4.59.

108 PwC, Estimating the cost of capital for H7 A report prepared for the Civil Aviation Authority (CAA) November 2017, pp.13-14.

109 PwC, Estimating the cost of capital for H7 -Response to stakeholder views A report prepared for the Civil Aviation Authority (CAA) February 2019, page 71.

388. In early 2020 CEPA states:[110]

> *"Furthermore, **capacity constraints are only one factor shielding HAL from volume risk**. It also benefits from the following traffic market features:*
>
> - London's profile as a major global city provides balanced outbound and inbound demand;
> - greater exposure to intercontinental long-haul traffic, with long-term prospects for demand from emerging markets; and
> - transfer traffic, with traffic tending to concentrate towards hubs during downturns."

389. HAL itself, share precisely these views in its communications to investors. For example, HAL states: [111]

> *"Catchment area and hub characteristics provide enviable demand resilience*
>
> - *Heathrow has been operating at close to its permitted capacity for many years*
>   - *unfulfilled demand reduces traffic volatility*
> - *Significantly greater exposure than peers to intercontinental long haul traffic*
>   - *long term emerging market growth driving increased propensity to fly*
> - *Countercyclical transfer traffic*
>   - *traffic has tended to concentrate towards hub airports in economic downturns*
> - *London's profile as a major global city*
>   - *balanced outbound and inbound demand*

390. On the basis of these considerations the UKCAA estimated a pre-pandemic asset beta for Heathrow of 0.50 (see Appendix F for details).

391. By contrast, New Zealand airports:

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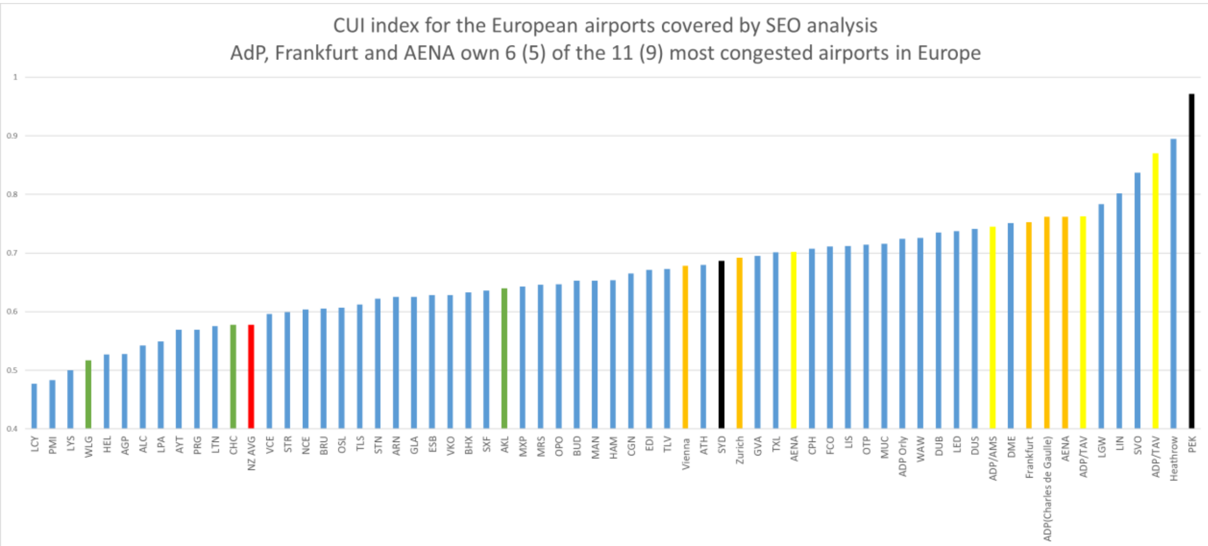
110 CEPA, H7 financial issues: CAP1876 response, 9 March 2020, page 31.

111 Heathrow Finance plc Roadshow Presentation (2019), November 2019, available at https://www.heathrow.com/content/dam/heathrow/web/common/documents/company/investor/reports-and-presentations/investor-presentations/2019-Investor_Deck_HFin_bond.pdf.

- Have much lower levels of capacity utilisation than Heathrow (or the other members of the draft decision sample). I provide data on this in section 5.2.1 but also reproduce it in Figure 7-3 below;
- Do not operate in cities with London's profile as a major global city provides balanced outbound and inbound demand;
- Have much less exposure to intercontinental long-haul traffic, with long-term prospects for demand from emerging markets. I provide data on this in section 5.2.3; and
- Do not have Heathrow's advantage of being the major airport for their city surrounded by smaller airports from which transfer will concentrate to them during downturns.

392. Figure 7-3 takes data from a report by SEO Amsterdam Economics measuring the Capacity Utilisation Index (CUI) at European Airports.[112] The bars are coloured orange if the airport is European and owned outright by one of the draft decision sample of companies and yellow if partially owned (by AdP). Green bars have been added for New Zealand airports, a red bar for the average of the 3 New Zealand airports and black bars for Sydney and Beijing. Beijing (PEK) is the most capacity constrained airport and Heathrow is the most capacity constrained in Europe.

Figure 7-3: The NZCC European "comparables" own the highest capacity utilisation airports in Europe



112 SEO, The impact of airport capacity constraints on air fares, 24 January 2017, Commissioned by ACI EUROPE.

2016 data for Auckland, Christchurch & Wellington (green) and Sydney & Beijing (grey) have been added to SEO's graph using data from Sabre. If the New Zealand average was weighted by flights, it would slightly increase but retain the same rank in the chart.

393. It can also be seen that the draft decision sample of companies own most of the highly capacity constrained airports and all of them are much more capacity constrained than AIAL or the average for New Zealand airports.

394. On the basis of its capacity utilisation and the other considerations set out above, the UKCAA estimated a pre-pandemic asset beta for Heathrow of 0.50.

395. By contrast, New Zealand airports have much lower levels of capacity constraints and have none of the other key risk reducing attributes described above.

396. Table 2-2 below compares the UKCAA and NZCC pre and post-pandemic asset beta estimates.

Table 7-2: UKCCA Heathrow versus NZCC draft decision New Zealand airport asset beta risk assessments

	UKCAA for Heathrow	NZCC draft decision for AIAL, WIAL and CIAL
Pre pandemic asset beta estimate	0.50	0.53
Post pandemic asset beta estimate (no risk sharing within 5 year regulatory period)	0.615	0.55
Post pandemic asset beta with most (of already small) traffic volatility risk shifted to airlines via TRS	0.53	NA

397. The first row of this table illustrates that, notwithstanding the evidence of much lower risk for Heathrow than New Zealand airports, the NZCC draft decision has estimated a pre-pandemic asset beta for Auckland, Christchurch and Wellington airports that is only 0.03 above that for Heathrow.

398. Having an asset beta estimate for New Zealand airports that is similar to that for the very different, and much lower risk, Heathrow suggests that the draft decision's estimate of the pre-pandemic asset beta for New Zealand airports is unreasonable.

399. The second row of this table compares the two regulators' post pandemic assessment of asset beta risk. Prior to adjusting for the traffic risk sharing (TRS) mechanism as explained in paragraph 401 below, the UKCAA raised its estimate of Heathrow's asset beta by 0.115 to 0.615 (based on a similar regulatory environment to New Zealand airports).[113] By contrast, the draft decision only raised the NZCC's estimate of post

[113] A 5 year regulatory period with no within period adjustments for deviations of traffic from forecast, i.e., before any change to reflect changes in traffic sharing risk.

pandemic asset beta risk by 0.02 to 0.55. The draft decision estimate (0.55) is 0.065 below the equivalent UKCAA estimate (0.615) of asset beta for Heathrow.

400. In my view, this is not a justifiable estimate of the relative risk of Heathrow versus Auckland, Christchurch and Wellington airports. Holding the regulatory regime constant across the airports, any reasonable estimate would have New Zealand airports with materially higher asset beta risk than Heathrow.

401. The UKCAA then introduced a traffic risk sharing (TRS) mechanism for Heathrow the effect of which was to compensate Heathrow for 50%/105% of all variations from forecast demand up-to/beyond 10% (see Appendix F, section F.1.1 for details). That is, the TRS halves all demand risk up to 10% variation from forecast and eliminates all demand risk beyond 10%. In recognition of the TRS, the UKCAA reduced the asset beta by 0.085 to 0.53. A 0.53 asset beta for Heathrow with almost zero passenger demand risk[114] makes the draft decision 0.55 asset beta for Auckland, Christchurch and Wellington airports appear even less justifiable.

402. I further note that, as an island nation with no significant road or ferry linkages to other countries, it is reasonable to assume that New Zealand is more likely than other countries to follow a policy of severe border controls in future pandemics (as was the case during the period prior to widespread availability of COVID-19 vaccines). This suggests that the uplift for New Zealand airports should be, if anything, higher than for most other airports.

7.4.2 NZ energy suppliers receive double (triple) the pandemic uplift provided to NZ airports

403. The draft decision estimates a 0.31 long run average asset beta for New Zealand energy suppliers and estimates a COVID uplift of 0.01 to arrive at a 0.32 estimate. This 0.32 estimate is arrived at in an equivalent manner to the 0.55 estimate arrived at:[115]

> *For a pre-COVID-19 asset beta of 0.31, with a weight of 92.5% and a COVID-19 asset beta of 0.60 with a weight of 7.5%, the weighted average is 0.33. This increase of 0.02 is considered an upper value. A mid-point adjustment would be 0.01.*

404. The fact that airports would be estimated as having only 0.01 higher pandemic asset beta exposure compared to energy suppliers is a remarkable conclusion given that pandemics have little effect on energy consumption and, in any event, electricity

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114 Noting that Heathrow still has all the benefits of low underlying demand volatility outlined above and now, with the traffic risk sharing mechanism, only bears 50%/0% of that volatility up-to/beyond 10%.

115 NZCC draft decision, paragraph 4.122.1.

businesses are regulated under a revenue cap (which means that they earn the same revenue irrespective of consumption shocks).[116]

405. Figure 7-1 above shows the relative impact of the pandemic on:

- AIAL's revenues (right hand axis) which fell by more than two thirds; and
- Vector's (New Zealand's largest electricity distributor) regulated revenues where there is no discernible impact.

406. Applying only a 0.01 higher pandemic uplift to airports is unexplainable in this context.

407. However, the draft decision goes on to ultimately conclude:[117]

> *Our options are the same as for the airports' asset beta decision. We note the calculation of the adjusted energy asset beta, **of 0.31 + 0.01 = 0.32 is less than the average asset beta of the last two five-year periods (0.36). However, the average for the last two five-year periods is the same as the value for 1 October 2021 to 30 September 2022 (0.36).***
>
> *As for the airports decision, the choice of asset beta for energy in the circumstances is a matter of judgement. **We have concluded that the asset beta is likely to fall in the range of 0.32 to 0.36 and our draft decision is to use a value of 0.35**. Given estimation error, we consider this value is not inconsistent with the various interpretations of the effect COVID-19 might have had on the asset beta, and particularly given the uncertainty associated with the extent that COVID-19 was a systematic event.*

408. In effect, the draft decision sets an asset beta for energy suppliers 0.04 above its estimated of the long run average (0.35 less 0.31) by virtue of using higher COVID-19 impacted data to form the top end of its range. For energy suppliers the final asset beta of 0.35 was chosen at the top of a range bounded by:

- 0.32 lower bound - being the estimated long run average pre-COVID plus pandemic uplift of 0.032 (=0.31+0.01)
- 0.36 upper bound based on the last 10 years of data (including COVID-19 data).

409. This difference in treatment is striking in the context of the relative dislocation that airports and energy suppliers had as a result of the COVID-19 pandemic. The NZCC has for:

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[116] NZCC, Revenue cap for electricity distribution businesses and COVID-19 related impacts, August 2020.

[117] NZCC draft decision, paragraph 4.124 to 4.125.

- energy suppliers, arrived at a higher estimate of asset beta than its long run average based on asset betas including COVID-19 by giving more weight to 2010 and 2016 IM precedent (choosing a value just 0.01 less than the most recent 10 years of data); but
- airports, given zero weight to 2010 and 2016 IM precedent (choosing a value (0.55) that gives zero weight to COVID-19 impacted data.

410. In effect, the NZCC energy supplier asset beta estimate incorporates a 0.04 uplift for pandemic risk relative to its long run average. This uplift is arrived at by estimating a long run average asset beta (0.31) and then choosing a value of 0.35 justified by its similarity to a 0.36 estimate of asset beta using 10 years of data that includes COVID-19.[118]

411. I further note that if the uplift is measured in percentage terms the energy pandemic uplift is more than three times higher 13% (=0.04/0.31) versus 4% (=0.02/0.53).

412. Energy consumption was not materially affected by the pandemic and, even if it were, electricity distribution businesses are regulated on the basis of a revenue cap (such that prices adjust automatically to variations in demand). Consequently, my expectation would be for a low or zero pandemic uplift for these businesses. I cannot understand an estimate of double (triple) the COVID-19 uplift for energy suppliers as airports (0.04 vs 0.02).

413. I contrast this outcome with the results of simply applying 2016 IM precedent in 2023.

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118 It might be claimed that the 0.36 upper bound value is actually based on the post-COVID "value for 1 October 2021 to 30 September 2022 (0.36)" which the draft decision also refers to in paragraph 4.124. The NZCC also notes in paragraph 4.66.3 that its 0.55 estimate for airports "…is similar to the asset beta calculated for the 12 months to September 2022 (0.56) which is consistent with the market assigning a small premium to the airports asset beta." But if this is the case it would be an even more ludicrous decision. Essentially, all of the discussion of long run average asset betas would be irrelevant that the NZCC would be adopting a value for airports and energy suppliers 0.01 lower than the single most recent year of data. Or, alternatively, the draft decision would be while solely on the most recent 10 years of data provided that it was the same as the most recent year and, if not, relying on data from 15.5 years earlier. There would be nothing to support such a methodology.

Table 7-3: Energy and airports draft decision versus 2016 IM precedent

	Pre-COVID	2023 post COVID	Pandemic uplift	Observation
		2023 draft decision		
Energy	0.31	0.35	13%	Not reasonable
Airports	0.53	0.55	4%	
	Application of 2016 and 2010 IM precedent for airport companies*			
Energy	0.35	0.36	3%	Rational
Airports	0.65	0.81	25%	

** The 2016 and 2010 IM methods estimate a different (0.05 lower) asset beta for aeronautical operations than for airport companies per se. An alternative comparison would be for aeronautical operations where the comparison would be 0.60 to 0.81 but this would reflect both the observed impact of COVID-19 and the impact of the NZCC accepting evidence that its 0.05 decrement for lower risk aeronautical operations was not well founded.*

414. Had the NZCC applied the same method as applied to energy businesses for arriving at a range for airports that range would have been, based on its own assumptions about sample and its own estimates of asset beta:

- 0.55 lower bound;
- 0.63 upper bound.[119]

415. Had the draft decision also, as it did for energy suppliers, chosen an asset beta that was 0.01 lower than the upper bound then its estimate for airports would be 0.62.

416. While less problematic than its 0.55 estimate, a 0.62 would still be unreasonably low.

417. It is also noteworthy that the NZCC arrived at a stable asset beta estimate for energy suppliers (0.35 in 2016 and 2023) by:

- applying “the same” method for airports to arrive at a long run pre pandemic asset beta (0.31); but
- applying an higher adjustment for COVID-19 affected data than for airports.

418. This stable estimate was, in my view, reasonable (although the asset beta should have been 0.36 based on the most recent 10 years of data). However, the means of achieving it was *ad hoc*. In my view, this is evidence for, and appears to be akin to an admission that, the NZCC method applied to airports is unreliable (i.e., it cannot be applied in the same decision to energy businesses to arrive at a reasonable estimate).

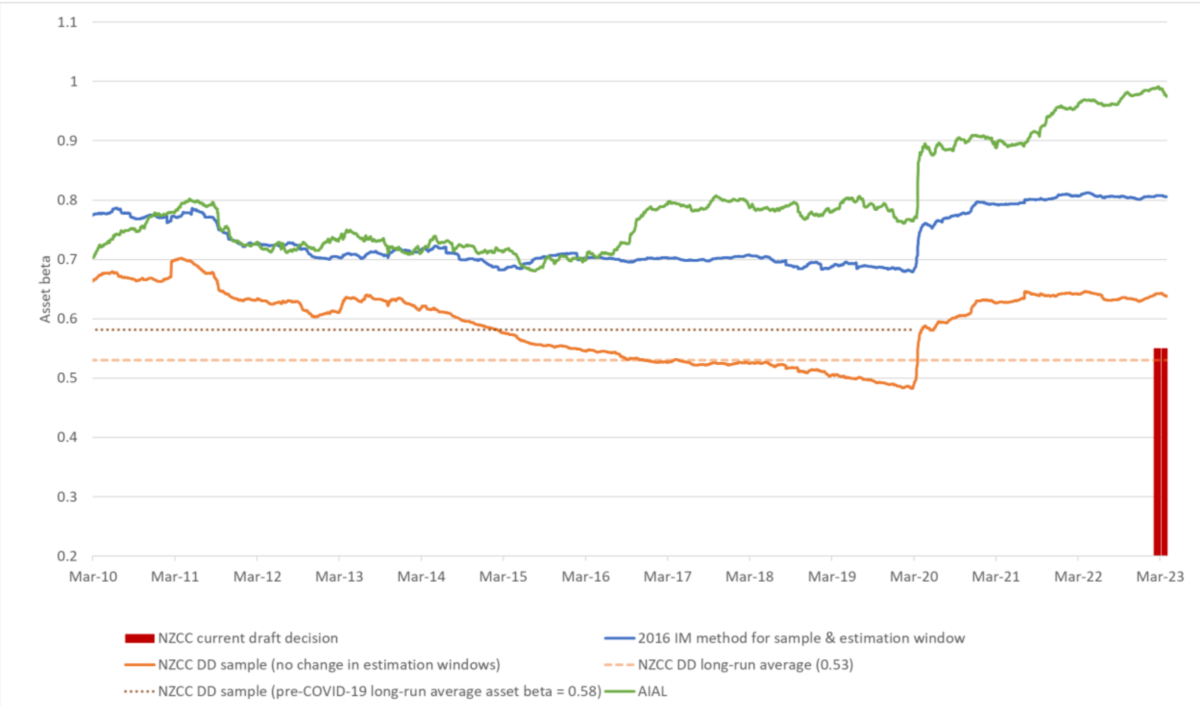
119 NZCC draft decision, table A2 on page 172. 0.63 is the average of weekly and 4 weekly asset betas for 2012-17 and 2017-22.

8 How the NZCC arrived at an unjustified COVID-19 adjustment

8.1 How the NZCC arrived at an unjustified low long run pre-COVID estimate of asset beta

419. Figure 3-2 I in section 3 (reproduced in Figure 8-1 below) compares the 2016 IM and the 2023 draft decision sample methodologies in time series form and also shows the draft decision estimate of a 0.53 long run average pre COVID-19 asset beta estimate (the dashed orange line).

Figure 8-1: 10 year (average of two 5 year) asset betas overtime (draft decision sample versus 2016 IM methodology sample)



Notes: I apply the CEPA sample +JAT & SYD less GMR which, relative to the 2016 IMs excludes some low beta firms (TAV, Airport Fac, Save and GMR) and one high beta firm (Aero). The time series are based on NZCC's 2023 R code. It is noted that the March 2016 number is around 0.05 higher than the 0.65 (sample average without applying 0.05 decrement) in the 2016 IM. This appears to be due to slight differences in the sample set and between NZCC's 2023 R code and its 2016 excel spreadsheet that are not discussed in the draft decision but which are outlined in Appendix C.1.4.

420. It can be seen that the height of the dashed orange line is below not just the COVID-19 affected part of the orange (draft decision sample) time series but also below orange time series on average since March 2010 to February 2020 (which covers data

from March 2000 to Feb 2020). That is, the NZCC "long term airport asset beta" can be seen to be materially below the pre-COVID average asset beta for its own sample.

421. Table 8-1 shows the four non-overlapping 5 year asset betas ending February 2020 using the draft decision sample and the wider (2016 IM) sample.

Table 8-1: 20 years of 5 year asset betas ending pre-COVID (using the NZCC 28 February definition for the start of COVID)

	2000-05	2005-10	2010-15	2015-20	Average
NZCC DD sample	0.61	0.72	0.43	0.55	0.58
Wider (2016 IM) samples	0.81	0.74	0.62	0.74	0.73

Notes: each period is the average of weekly and four-weekly asset betas between 1 March and end of February. Firms are included if they have at least 42 months of data (70% of 5 year, see Appendix C for more details).

422. It is noteworthy that the average asset beta for the draft decision sample over the 20 years pre COVID is 0.58.[120] This is materially higher than the NZCC estimate of a long run average pre-COVID asset beta for the same sample of 0.53. Even using the last 15 years the average asset beta is 0.57.

423. The draft decision arrived at a lower estimate of long run pre-COVID-19 asset beta (0.53). In doing so it made a series of, in my view difficult to justify, decisions that: a) give weight to older data that would not have been included following established regulatory precedent; and b) give zero weight to more recent data even though that data is unaffected by COVID-19. Specifically, the NZCC:

- excludes the 18 months the NZCC believes that COVID-19 elevated asset beta (February 2020 to August 2021);[121]
- excludes 5 months of data unaffected by COVID-19 from 1 October 2017 to 28 February 2018;
- excludes 19 months after the end of the 18 months the NZCC identified as having elevated asset betas; and
- includes data beginning in October 2007 which is 15.5 years before March 2023[122] rather than 10 years.

120 The reader should also note that this is not exactly the same as the average of the time series graphed visually – because that data is a rolling average and this table splits that data up into 4 discrete non-overlapping periods.

121 The NZCC draft decision states asset betas were elevated for about 18 months at paragraph 4.66.4.

122 The date that 2016 IM regulatory precedent would have resulted in the NZCC ending its data collection for the purpose of making its draft decision.

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424. In arriving at a 0.53 long run average asset beta estimate the NZCC made several unexplained, and difficult to rationalise, methodological choices. Specifically, I have the following questions that are not answered in the draft decision:

   a. why did the NZCC not simply take estimates for 5 year periods ending February 2020, 2015, 2010 and 2005 as I have done and as would have been most consistent with its past practice?

   b. why did the NZCC split up the pre-COVID period into two 5-year periods and a two year period?

   c. why did the NZCC leave a gap of data that is unused between 1 October 2017 to 28 February 2018?

   d. why did the NZCC not seek a long run estimate of both pre and post pandemic data?

425. I do note that the assumptions adopted by the NZCC result in an estimate of the "long term airport asset beta" for its sample that is below the 15- and 20-year averages using a method more consistent with past NZCC practice (5 year non-overlapping estimation windows with no gaps in data between them).

426. The result of these choices can be illustrated graphically by reference to Figure 2-2 above and noting that the NZCC's 0.53 (dashed light orange line) is almost always below the average asset beta for the NZCC sample (orange time series). The NZCC choices can also be illustrated graphically as per Figure 8-2 below.[123]

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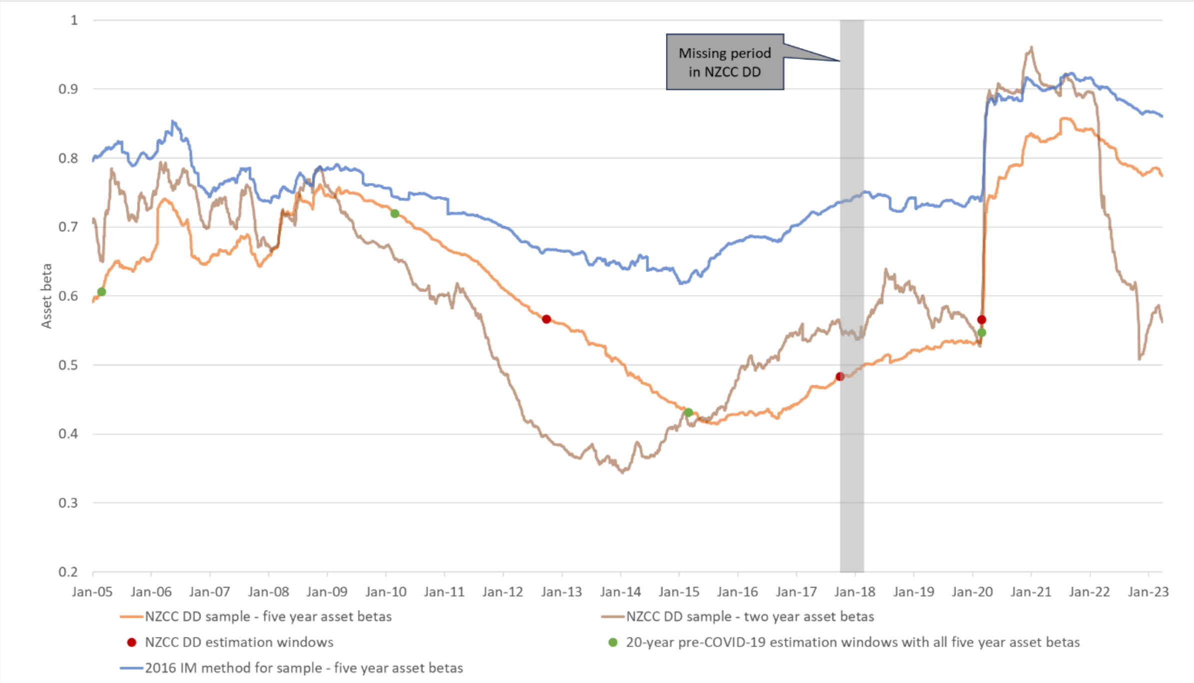
[123] The NZCC's 0.53 is the average of the three red dots in Figure 2-4 – with the right most dot (which is on a 2-year asset beta time series) receiving 2/5th of the weight of the other red dots. The 0.58 value in Table 2-1 is the equal weighted average of the four green dots. The 0.73 value in Table 2-1 is the equal weighted value of the points on the blue time series directly above the green dots. The shaded column in Figure 2-4 represents the data that the NZCC simply did not use to estimate its long run average asset beta of 0.53 (it is the gap between the end of the 5-year period ending September 2017 and the beginning of the 2 year period starting 28 February 2018).

Figure 8-2: 5 and 2-year asset rolling asset beta -with the 3 observations underpinning the NZCC's 0.53 estimate highlighted



427. In section 9.7 I explain that, using the statistical test recommended to the NZCC by Bela, that the Eurozone debt crisis (starting in 2012 and ending in 2014) is equally as statistically significantly different to other periods as is the COVID-19 period.

428. The unusually low asset beta estimates for the NZCC sample from 2012 onwards are depressed by the Eurozone debt crisis.[124]

429. I do not propose that the NZCC should remove the Eurozone debt crisis from any historical analysis on the basis that it is "abnormal". However, this is because I do not believe that the NZCC should make any such adjustments – including for COVID-19. However, if the NZCC does make an adjustment for COVID-19 it should also remove the Eurozone debt crisis.

430. When looking at the draft decision sample in Figure 8-1 and Figure 8-2, it is apparent that it is problematic to remove the post 2020 asset beta estimates (which are modestly above the pre-2012 asset betas) in order to focus the weight on the period where the NZCC sample has an abnormally low asset beta estimate. A reasonable

124 In this period financial stocks were highly volatile and the effect of this was that the financed industry betas were raised, and other industries betas were depressed – noting that equity beta always averages to 1.0 across all industries.

interpretation of Figure 8-1 and Figure 8-2 is that the 2012 to 2017 period is the period with the most "abnormal" asset betas.

8.2 The NZCC's inaccurate COVID-19 uplift adjustment

8.2.1 How the NZCC arrived at a 0 to 0.04 uplift

431. It is difficult to understand exactly how the draft decision pandemic uplift of 0.02 is arrived at. However, it appears to be based on three assumptions:

   a. An upper bound of 0.04: assuming that the next pandemic is actuarially expected to occur in 20 years and last 18 months;

   b. A lower bound: that the next pandemic is actuarially expected to occur in 50 years and last 3 months;

   c. Both upper and lower bound: that the next pandemic is expected to be the same as COVID-19.

432. Exactly how the NZCC arrived at these assumptions is not clear. The best assessment I have is as follows.

   a. The upper bound of 0.04 appears to have been taken from paragraph 4.62.3, 4.63 and 4.64. All of which profess to be based on a 7.5% per annum probability of a pandemic (in turn based on an 18-month duration and a frequency of one in 20 years). However, I note that 4.62.3 and 4.64 both arrive at an upper bound of 0.03 and not 0.04. Only 4.63 refers to an upper bound of 0.04 but this is arrived at by the NZCC adjusting TDB estimates to remove what "appears to be an outlier" of a 0.08 uplift.

      "We note that TDB Advisory's calculation of the upper bound of ***0.08 is based on monthly data and appears to be an outlier*** *compared to the daily and weekly results that TDB Advisory reported for the upper bound. The range* ***excluding the monthly data for the upper bound*** *scenario is* ***0.01 - 0.04****."*

      i. Why the NZCC believes 0.08 is "an outlier" despite noting in paragraph 4.60 that the UKCAA consultant Flint had estimated an uplift of 0.04 to 0.14 for Heathrow (average 0.09) is not explained.

      ii. The draft decision appears to believe it is following a method similar to the UKCAA based on paragraph 4.62. However, this is incorrect as I explain in section 8.2.2 below.

   b. The lower bound of zero appears to be calculated in paragraph 4.62.2

      "To calculate a lower bound adjustment, we assume a COVID-19-like event occurs every 50 years, and lasts for three months, which is the equivalent

of 0.5% of the time. For a pre-COVID-19 beta of 0.82 and a COVID-19 beta of 1.24, the asset beta would be only slightly higher than 0.82”

c. The NZCC states in paragraph 4.62.5 that these numbers should only be treated as indicative due to the use of asset betas calculated over short periods. However, the NZCC then goes on to use them with no adjustment to arrive at its midpoint uplift of 0.02 (=(0.04+0.00)/2).

433. I consider that this analysis has the following problems:

a. It proceeds as if the NZCC is following UKCAA methodology but it is not doing so. Instead, the NZCC is applying an incorrect time based weighting scheme which fails to correctly weight for periods of higher market volatility (as the UKCAA method does). This is:

i. explained in section 8.2.2 below;

ii. corrected in section 8.2.3 below.

b. The draft decision has arbitrarily adopted assumptions about the upper and lower bound frequency and duration of pandemics with little external support. There is the suggestion that these come from the UKCAA[125] but this is not correct.

i. The Flint/UKCAA method does adopt 1 in 50 and 1 in 20-year probabilities but it combines these with assumptions of 17 months and 39 months duration respectively. By contrast, the NZCC combines these with assumptions of 3 months and 18 months respectively.

ii. The NZCC assumptions are much more aggressive (lower duration leads to lower uplift) than the UKCAA assumptions which are, already, arbitrary. I discuss this more in section 9.5. The inevitable lack of rigor around these estimates is an important reason why I do not consider that an adjustment should be attempted (relying as it does on unknowable assumptions);

iii. Moreover, the NZCC method is internally inconsistent. If the NZCC were to adopt an assumption of a 3-month COVID-19 event then its long run pandemic-free average asset beta should be estimated by excising just 3 months of data. In which case, while its uplift would be smaller its long run average would be higher. The same applies to the 18-month duration assumptions.

c. The NZCC also does not discuss the other aspects of the UKCAA compensation for pandemic risk that would be equivalent to a 0.4 pandemic uplift to asset beta if applied to New Zealand airports. This is discussed in detail in Appendix F below.

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125 Paragraph 4.62 starts with a discussion of the Flint/UKCAA method. However, the assumptions that the NZCC goes onto adopt are not the same as the Flint/UKCAA method.

d. Section 8.4 provides the results of the UKCAA method for various samples.

8.2.2 Why the NZCC method is incorrect and the UKCAA method is correct

434. The following hypothetical illustration highlights the difference in the asset beta derived using the NZCC approach and the asset beta estimated using 20 years of data with 18 months of a COVID-like event.

435. In the example, 20 years of monthly returns are randomly generated.[126] The equity return is calculated assuming, for simplicity to have a perfect linear relationship to the market return (i.e., zero standard error) but that linear relationship has a:

- Slope (beta) of 1.00 during COVID-19 and this period lasts for 18 months (NZCC assumptions);
- Slope (beta) of 0.53 during outside the COVID-19 period and this period lasts for 18.5 years (NZCC assumptions);

436. Critically, the example also assumes that market volatility is 4 times higher during COVID-19 than outside COVID-19. The NZCC approach ignores the role of differences in market volatility on the 20-year asset beta.

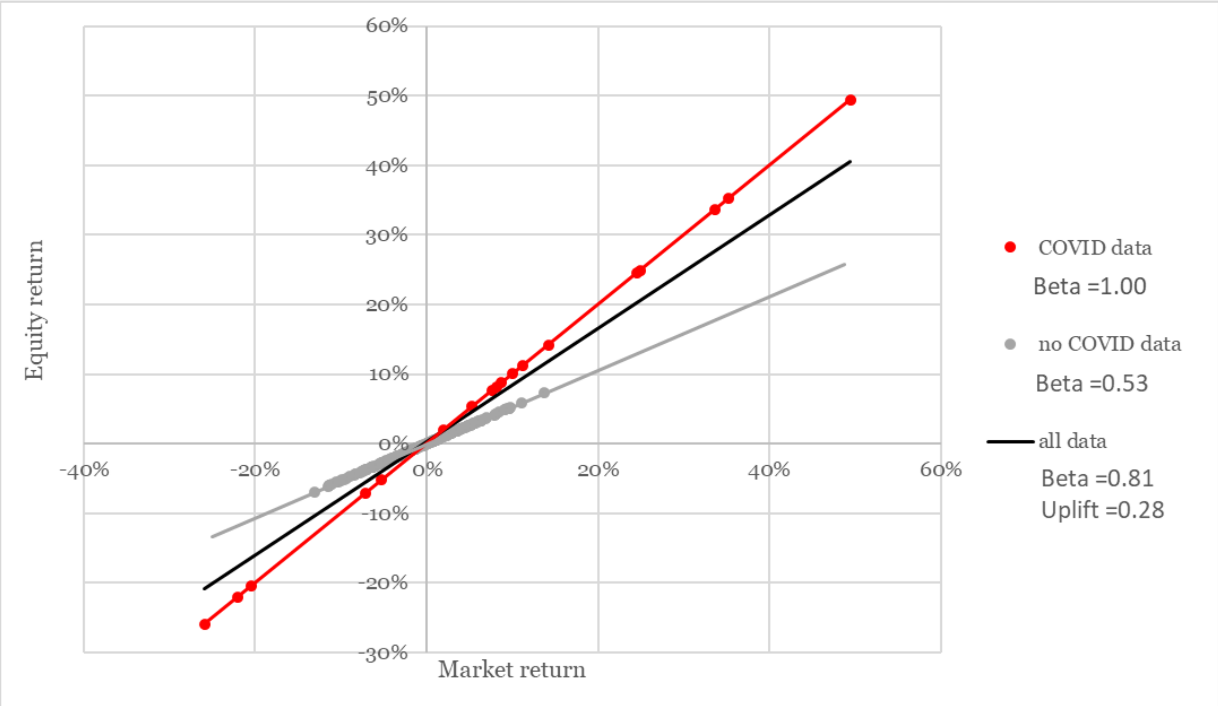
437. Based on these assumptions, the difference in asset beta during and outside of COVID period is 0.47 (1.0 minus 0.53). The NZCC method would apply a 7.5% weight to this difference to arrive at a COVID-19 uplift of 0.035.

438. However, if the asset beta is estimated using the full 20 years of generated monthly returns, the asset beta over the 20-year period is 0.81 (illustrated by the black line below). That is, the actual asset beta estimated over 20 years which includes both COVID-19 and no COVID-19 period is much higher than the time weighted average of 0.53 (weighted by 92.5%) and 1.00 (weighted by 7.5%).

439. In fact, the correct uplift for exposure to an 18-month COVID-19 event every 20 years is 0.28 (not the NZCC method estimate of 0.035).

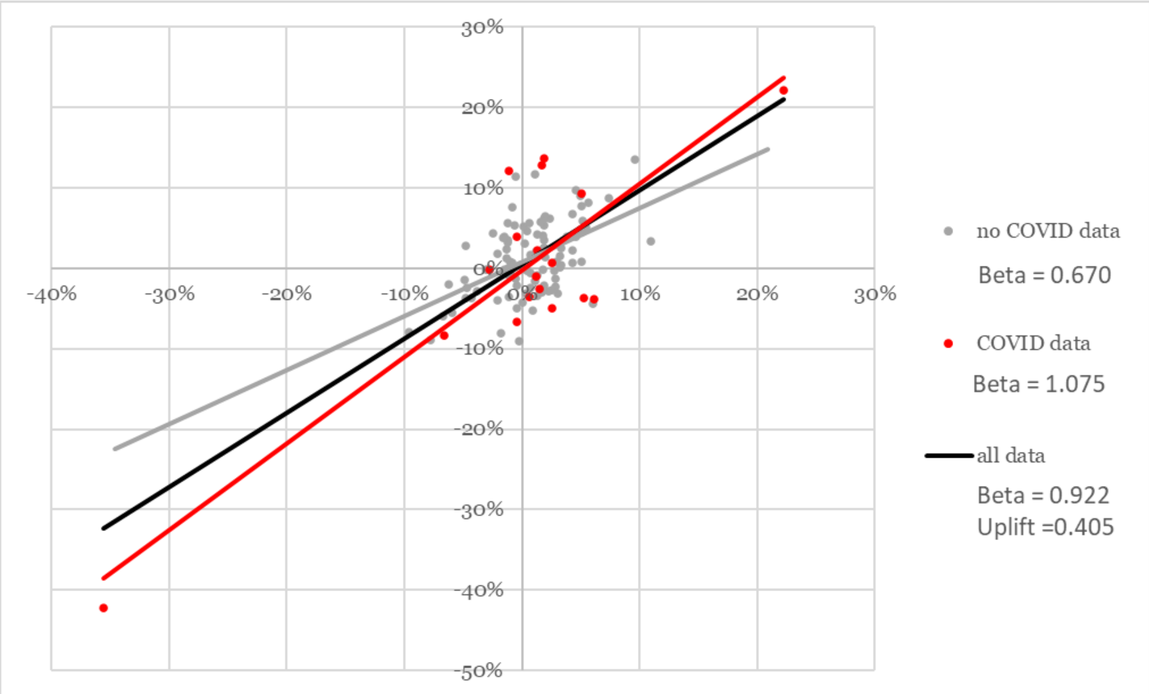
[126] The monthly returns assumes a normal distribution with mean 0% and standard deviation 5%.

Figure 8-3: Illustrative example



440. The same point can be made using actual rather than illustrative data. Figure 8-4 illustrates the four-weekly return of AIAL over a 10 year period.

Figure 8-4: Actual AIAL data using 10 years to 30 March 2023 (monthly data measured to Friday of the fourth week)



The shown market return incorporates Bela's approach in which it is adjusted by gearing. Therefore the slope of the trendline can be compared to asset beta rather than equity beta.

441. Understanding this chart:

- The grey dots represent non-COVID-19 data and the grey regression slope is the beta derived solely from non-COVID-19 data (beta = 0.67);
- The red dots represent the 18-month COVID-19 period from 21 February 2020. The red line is a regression of just the COVID-19 data (beta = 1.075);.
- The black line is a regression fitted through all of the data. The slope of this line is the beta measured over the whole period (beta = 0.922).

442. When the NZCC method assumes that the slope of the black line can be estimated by weighting the slope of the red and grey lines by the assumed fraction of time a pandemic like event occurs – in this case 18 months out of 10 years of data (or 15% and 85%).

443. That this is an error can be seen by virtue of the fact that the slope of the black line, informed by all 10 years of data, is much closer to the slope of the red line than the slope of the grey line – despite the red dots only accounting for only 15% of all the

data.[127] If the NZCC's weighting scheme (based solely on frequency) were correct the opposite would be true and the black line would be much closer (6.6 times closer) to the grey line than the red line.

444. The reason the NZCC method so significantly misestimates the impact of the pandemic on long run beta estimates is that it (implicitly) assumes that market volatility is the same in the pandemic as outside the pandemic. If this were correct then the NZCC time weighting method would correctly estimate the long run equity beta including pandemic impacts.

445. However, during COVID-19 the market volatility was much higher than "normal". Investors care much more about the protection from volatility a stock supplies during high market volatility than they do during "normal" volatility because in a "normal" period there is less volatility to be protected from.

446. It is useful to recall that "beta" is a measure of how much volatility holding a stock adds to the volatility of a diversified portfolio. High beta stocks are risky because they add more to the volatility of a diversified portfolio than lower beta stocks. It intuitively follows that, if market volatility is concentrated in certain time periods associated with large market shocks (e.g., financial crises or major pandemics) then the "beta" of a stock in those periods is more important to investors than the beta of stock during low risk "normal" periods.

447. Figure 8-3 and Figure 8-4 illustrate this fact. Market returns (horizontal axis) in the pandemic period are much more volatile than the non-pandemic period. This is reflected in the red dots having a much higher dispersion across the X-axis than the grey dots.

448. It is precisely when the market is highly volatile that it is risky to have stocks that are sensitive to the market return. In other words, the beta of a stock during high market volatility periods is a more important measure of risk to investors than the beta of the same stock in low market volatility periods. This is also plainly common sense.

449. To put this in the context of insurance, an airport wanting to insure its revenue stream against the losses from a pandemic would have to pay an annual premium that covers:

- The annual expected cost of the pandemic (which would be 7.5% times the annual cost of the pandemic if a pandemic occurred with the NZCC assumed frequency); plus

127 If one were to derive the beta for the full sample by weighting the separately estimated betas then one would have to give 61% weight to the COVID-19 beta and only 39% weight to the non-COVID-19 beta. This is despite the fact that the COVID-19 data accounts for only 15% of the data in the regression. That is, COVID-19 data gets an effective weight in the regression that is four times its share of the number of observations (four times its frequency weight). The reason for this is obvious when one looks at the Figure. The COVID-19 data is plainly more important than the non-COVID-19 data because it is associated with the largest variations in the market index.

- A large **risk premium** where the risk premium had to cover the insurer for having to make good on a claim in a period when the value of their (and their shareholders') portfolio of assets might be down by 30% or 40%.

450. Beta is intended to precisely inform this risk premium assessment, but the NZCC method fails to correctly account for it.

8.2.3 The correct UKCAA method

8.2.3.1 UKCAA method

451. The UKCAA method, based on advice from Flint Consultancy, demonstrates the correct way to weight COVID-19 (or any other infrequent large shock). Flint advised that, rather than removing COVID-19 from the non-COVID-19 data, the COVID-19 data should simply be given less weight than the non-COVID-19 data in the same regression.

452. In terms of Figure 8-4 above, this amounts to applying double the weight to the grey dots as to the red dots. (Noting that the red dots are 15% of all dots in the 10 year regression. Therefore, in order to bring them down to a 7.5% weight, we only need to double the weight of the grey dots).[128] This is equivalent to adding twice as many grey dots to the regression in precisely the same distribution that they already have.

8.2.3.2 UKCAA considered and rejected the approach used by the NZCC

453. Flint advised the UKCAA not to use naïve time based weighting and the UKCAA accepted that advice. The following table and passage is from Flint 2021.[129]

TABLE 6: COMPARISON OF RESULTS, COVID-ADJUSTMENT FOR EVENTS BETWEEN ONE IN 20 AND ONE IN 50 YEARS

	Preferred approach: Reweighting observations		Cross-check approach: Beta weighting	
	Minimum value	Maximum value	Minimum value	Maximum value
Lower bound	0.04	0.09	0.01	0.04
Upper bound	0.06	0.14	0.01	0.02
Overall	**0.04**	**0.14**	**0.01**	**0.04**

Source: Summary of Flint analysis.

The difference in results relative to our preferred approach arises due to differences in the underlying statistical features of each method. This alternative approach does not take account of the relative strength and

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128 Technically, the weight on the grey dots needs to be slightly more than doubled (multiplied by 2 plus 1/15) in order for the final weights to be 7.5% to COVID-19 and 92.5% to non-COVID-19 data.

129 Flint, August 2021, Support to the Civil Aviation Authority: Estimating Heathrow's beta post-COVID-19, pages 29 & 30.

> *influence of statistical relationship between observations within the beta, while our preferred approach does.*
>
> ***The data for the airport comparators during the COVID period reflects a series of unusual and extreme market and individual share price movements, observed consistently across the comparator set****. The non-COVID data, on the other hand, exhibits fewer such extremes – with most of the daily data characterised by more moderate effects. Because of this, when the datasets are combined, the COVID data is more influential in defining the observed systematic risk relationship described by the beta.* ***In simple terms, in the long-term beta calculation, the influence of the COVID data is amplified in line with its extremity. In the alternative approach, this effect is not present.***

454. This logic is consistent with the analysis set out in section 8.2.2 above.

8.3 Estimates of the uplift using the UKCAA method

455. Table 8-2 illustrates the difference in the final asset beta estimated using the UKCAA method versus the NZCC draft decision method applied to AIAL. It can be seen that the draft decision method underestimates the correct COVID-19 uplift by a factor of 3 (0.04 versus 0.11).

Table 8-2: AIAL illustration of correct UKCAA* COVID-19 uplift and incorrect NZCC uplift

Asset beta 13-18	Asset beta 18-23 ex COVID	18 mth COVID	Average of no COVID-19 betas	UKCAA uplift	NZCC uplift	Correct COVID-19 adjusted beta	Incorrect DD COVID-19 adjusted beta
0.92	0.72	1.20	0.82	0.11	0.04	0.94	0.86
			=(0.92+0.72)/2	described above**	=7.5%*(1.20-0.72)	=0.82+0.11	=0.82+0.04

* UKCAA uses 5 years of data to estimate their uplift based on advice from Flint. I follow this precedent and use the 5 years ended March 2023 to estimate an asset beta without 18 months of COVID and with 18 months of COVID but given only 7.5% weight in the regression. ** This 0.12 figure is the average uplift across all weekly and four weekly estimates.

456. The following table is the same as Table 8-3 with results for all of the airports in the draft decision sample.

Table 8-3: AIAL illustration of correct UKCAA COVID-19 uplift and incorrect NZCC uplift

Airport	18 mth COVID	Average of no COVID-19 betas	UKCAA uplift	NZCC uplift	Correct COVID-19 adjusted beta	Incorrect DD COVID-19 adjusted beta
AIAL	1.20	0.82	0.11	0.04	0.94	0.86
Zurich	1.09	0.61	0.09	0.04	0.70	0.65
Sydney	0.79	0.34	0.16	0.03	0.50	0.37
Fraport	0.57	0.43	0.02	0.00	0.45	0.43
AdP	1.01	0.52	0.09	0.03	0.61	0.55
Vienna	0.85	0.15	0.17	0.06	0.32	0.21
Beijing	0.92	0.66	0.01	0.01	0.67	0.67

8.4 Best estimates and COVID-19 uplifts for various samples

457. The following table shows the asset beta estimates for various samples on the basis of:

- Continuation of regulatory precedent in the use of a 10 year estimation window ending 31 March 2023; and
- The use of the correct UKCAA method to remove the impact of COVID-19 and then add back an uplift based on an assumed 50/20 year frequency[130] of a major pandemic and a duration of 18 months.[131]

458. Table 8-4 shows the average asset betas for the relevant samples identified above.

130 These are assumptions that the draft decision employs.

131 The draft decision estimates that COVID-19 lasted for 18 months. The draft decision also employs a sensitivity of 3 months for the duration of a pandemic. However, if this was the case for COVID-19 then we and the NZCC would only need to exclude 3 months of data as COVID-19 affected. This would materially raise the simple average asset beta excluding COVID-19. It might be thought that COVD-19 lasted for 18 months but the next pandemic might just last for 3 months. In my view, it would be unreasonable estimate a lower bound uplift on an arbitrary one-in-50 frequency and an arbitrary assumption that the next pandemic in 50 years will last for one 6th of the time that COVID-19 did. The one thing we do have is an estimate of the duration of COVID-19 and that duration should inform both our upper and lower bound estimates. Moreover, if a shorter duration of one 6th of 18 is used for the lower bound then a materially higher duration than 18 months should be used for the upper bound.

Table 8-4: Summary table average beta (two 5 year periods ending 31 March 2023 with 18-month COVID-19 starting 21 Feb 2020

Sample	Simple average incl COVID	Simple average ex COVID	COVID-19 uplift 50-20 year frequency	Average asset beta including COVID-19 uplift
NZCC sample [132]	0.64	0.54	0.03 - 0.07	0.57 - 0.61
AIAL, Zurich, Sydney and AENA	0.77	0.67	0.03 - 0.08	0.70 - 0.74
As above + JAT. (NZCC criteria correctly applied)	0.84	0.75	0.03 - 0.07	0.77 - 0.81
AIAL and Zurich	0.86	0.71	0.05 - 0.10	0.76 - 0.82
Wider sample	0.81	0.72	0.03 - 0.06	0.74 - 0.78

459. In my view the best estimate is associated with the wider sample (bottom row). This results in a 0.81 asset beta without any COVID-19 adjustment and a 0.74 to 0.78 asset beta if a COVID-19 adjustment is made to ex COVID data based on the (arbitrary) assumptions of a one-in-50 and one-in-20-year frequency of pandemics.

460. However, the logic of a COVID-19 adjustment would mean that a 0.03 to 0.06 adjustment would be applied not just in this IM but in all future IMs.

461. The reason I prefer not to apply any COVID-19 adjustment is because to do so requires an estimate of the unknowable future frequency of such events. Under my preferred approach the unadjusted (0.81) asset beta would be applied in this IM but would be temporary and would cease to be elevated as soon as the COVID-19 data fell out of the 10-year estimation window.

462. If the NZCC wider sample were rejected then the most comparable sample restricted to developed country airports should be AIAL and Zurich (which have similar regulatory regimes, size, capacity utilisation and operate in similar countries (population and terrain) as discussed in section 6.4). This would result in a slightly higher asset beta estimate when COVID-19 data is correctly de-weighted (0.76 to 0.82).

463. The next best sample is the sample formed by applying the draft decision criteria in a consistent and logical way (see section 6.1). This sample would include AIAL, Zurich, Sydney, AENA and JAT. The asset beta for this sample is slightly higher than for the

132 Sydney is excluded from the second period because there is almost two years of data missing after the deal announcement date – see C.1.3. If Sydney is included in the second five year period, simple average incl COVID/ simple average excl COVID/ uplift/ asset beta with uplift = 0.63/ 0.52/ 0.04-0.08/ 0.56-0.61.

wider sample. If JAT was (incorrectly) excluded from that sample then the asset beta would fall to 0.70 to 0.74.

464. If the NZCC were to disregard all of the evidence set out in this report and, inconsistent with its own sample selection criteria, continue to adopt the draft decision sample, it would still need to raise its estimate of the asset beta to 0.57 to 0.61 to correctly implement a COVID-19 adjustment. I note that this is still below the 20 year average asset beta for the draft decision sample including COVID-19 (0.64)[133] which is an alternative measure of the asset beta including COVID-19 with a one-in-20 year frequency.

133 Both the 20 and 10 year average asset beta including COVID-19 is 0.64.

9 Why no COVID-19 adjustment should be made

465. I have previously provided evidence to the NZCC detailing the complications and difficulties that would be involved in adjusting estimated asset betas for unusual events (such as COVID-19).[134] I explained that this would be close to impossible to do in a rigorous manner that was consistently applied overtime. I explained that doing so would have far reaching complications not just in this IM review but in all future IM reviews.

466. The draft decision did not address/evaluate that evidence. The only aspect of that advice that the NZCC addresses is my suggestion that the IMs be used to set the methodology for estimating asset beta and that methodology be applied at the beginning of each PSE. The draft decision addresses this advice in paragraph 4.66.5 and 4.69 where it is stated that the NZCC believes that having a single value for asset beta apply in all PSEs starting during the life of the IMs is more desirable than having a regime that:[135]

> *"We do not support the CEG proposal for the equity beta to be removed from the IMs and determined at the time of price reviews (option 5). We consider that specifying the equity beta in the IMs provides certainty for suppliers and that, on balance, this should be given more weight than determining an estimate of the equity beta that on average compensates suppliers for systematic risk over a long period of time."*

467. That may, or may not, be a reasonable position in response to my position that the asset beta should be updated at the beginning of each PSE. However, this provides no response to, or consideration of, the logic and problems that I explained exist with making a COVID-19 adjustment to asset beta.

468. The NZCC has either not considered that evidence or has considered it and rejected it without explaining why. Even if the later was the case, had the draft decision explained why it rejected my advice I would be in a better position to draft this report in a manner that is most useful to the NZCC and the consultation process generally.

469. The remainder of this section largely repeats the evidence already provided. However, each section is put in the form of a question that the draft decision did not answer but which it would have had to answer had the draft decision engaged with my report.

134 Section 3.3 and Appendix B of Hird, NZCC comments on asset beta estimates for airports, February 2023.

135 NZCC draft decision, paragraph 4.69.

9.1 My view of how to best deal with COVID-19

470. In my view it would be appropriate in general, and in the specific context of the COVID-19 pandemic, to estimate asset beta using the most recent 10 years of data[136] available either:

- at the start of each 5-year PSE (including PSE4 and future PSEs).
- at the time of each IM (although, as I noted in my report for New Zealand Airports, given that the IMs are based on a 7-year frequency a case could be made for using either 7 or 14 years to ensure that all data was equally weighted).[137]

471. At each update the older 5 (7) years of data in the estimation window would be dropped and replaced with newer data. The effect of this method is that the asset beta estimate in every PSE (IM) reflects the balance of systematic shocks that occurred in the previous 10 (14) years, but these shocks only influence the asset beta applied in PSEs (IMs) for a 10 (14) year period (while they remain in the 10 (14) year estimation window).

472. For example, if one were to (arbitrarily) define the COVID-19 pandemic shock as occurring in 2020 and 2021 then the COVID-19 shock would influence asset betas used in PSE4 and PSE5 (2023 and 2030 IM) but would drop out of the estimation window for PSE6 (IM 2037).[138]

473. The major advantage of the proposed approach is that, in the long run:

- all systematic shocks that actually occur are captured in the asset beta estimates actually applied in PSEs (IMs);
- each shock is assigned an impact that matches the actual severity of the shock; and
- each shock receives the exactly correct weight based on its actual frequency through time.

136 This is consistent with the NZCC IM asset beta methodology to date – which has been to retain a stable 10 year estimation window (made up of two 5 year estimation windows) and to set the asset beta based on whatever systematic shocks occurred during that window. No attempt has been made by the NZCC to adjust the asset beta based on a view that the shocks that occurred in the 10 year estimation window were not representative of the expected frequency of that form of shock. For example, the NZCC did not attempt to adjust for the impact of the global financial crisis in the 2016 IM update – even though this was a large systematic shock of the kind that arguably occurs less than once every 10 years. Nor did the NZCC attempt to adjust Chorus' estimated asset beta for the impact of COVID-19.

137 CEG, NZCC comments on asset beta estimates for airports, February 2023, section 1.2 paragraph 8d and section 3.4.

138 PSE6 is scheduled to begin on 30 June 2032. At which time a 10 year estimation window would only reach back to 1 July 2022.

474. The last two points are, in my view, critical. To elaborate on the last point, whatever the true frequency of a COVID-19 like pandemic, the proposed method will generate asset beta estimates that include such an event with that exact frequency. If a COVID-19 like event (or a global financial crisis etc.) is a one-in-fifty-year event then one 5 year (7 year) estimation window in 50 years will include such an event. But if the true frequency is one-in-twenty or one-in-100 the rolling update will ensure that the event is captured in one estimation window every 20 or 100 years – as appropriate.

475. There is no bias in the proposed methodology because that methodology will, on average and over time, accurately reflect and compensate for the scale and frequency of all shocks.

476. It is true that no 10- or 14-year estimation window will be truly representative of the perceived economic shocks that are (actuarially) expected over any given future period. For example, it was well understood that airport investors were exposed to the risk of pandemics over PSE1 to PSE3. That is, investors placed a non-zero probability on a major pandemic occurring over PSE1 to PSE3.

477. Nonetheless, asset betas applied in PSE1 to PSE3 provided no pandemic related asset beta compensation. This is because no major pandemic event occurred in the relevant period over which asset betas were estimated. Moreover, no stakeholders, including airlines or the NZCC, were advocating for an uplift to the estimated asset beta in the 2010 and 2016 IM asset betas to reflect the real *ex ante* (but unrealised historically) risk of a major pandemic.

478. The rest of this section explains why I previously advised that attempting to adjust data for unknown and unknowable "true" probabilities of abnormal shocks:

- Will be impossible to do accurately; and
- Will result in a regulatory quagmire **now** with:
  - ad hoc measures that disturb regulatory precedent in a manner that makes regulatory precedent have little value;
  - claims and counter claims about the unknowable "true probabilities" required to implement the ad hoc adjustments;
- Will result in a regulatory quagmire **in the future** because the:
  - uplifts for the "true" risk of a pandemic need to be consistent/amended for future events (e.g., what happens if the next pandemic occurs in 2038?);
  - there will be other abnormal shocks that some stakeholders will want the same treatment as COVID-19 applied to.

9.2 What will the estimation window be in the 2030 IM and beyond?

479. The 10-year estimation window has been a settled part of the IM methodology since the 2010 IMs. The draft decision has radically departed from that precedent and has instead:

- Estimated a long run pre-COVID-19 asset beta of 0.53 based data that that begins around 15.5 years ago (not 10 years ago consistent with past IM precedent)[139] and which excludes the most recent 3 years and one month of post-COVI-19 data and which excludes 5 months of pre-COVID data;
- Estimated a pandemic uplift for exposure to latent pandemic risk of 0.02 on a difficult to understand methodology.

480. This approach can reasonably be described as an ad hoc response to COVID-19 which I regard as having serious errors (as described in sections 4 to 8). Even if those problems did not exist, there remains the question of what this means for the 2030 IMs and beyond.

481. The draft decision implements an *ad hoc* departure from both the original 2010 IM and the 2016 IM that undermines the predictability of the regulatory regime. It moves away from allowing the most recent data to feed into the asset beta estimate and, instead, superimposes a new concept of:[140]

> *"...the long term airport asset beta of 0.53."*
>
> *"... the long-term pre-COVID-19 average of 0.53."*

482. The draft decision uses this value as the basis for its 2023 IM asset beta estimate (adding a very small uplift to it to arrive at the final 0.55 estimate). It is relevant to note that in past decisions the NZCC explained its use of a 10-year estimation window, rather than a longer estimation window using older data, as an appropriate trade-off between having enough data to reduce the impact of noise on the final estimate but not using data that was too old and no longer reflected the operating environment for airports.[141]

483. However, in this decision the NZCC has chosen to use data more than 15 years old. There was no need for the NZCC to depart from its past sampling periods and go back to 2007 to obtain data that was not affected by COVID-19.

139 This 15.5 years is relative to the 2010 and 2016 IM practice of using data to May and March respectively.

140 NZCC draft decision, paragraph 4.55 and 4.66.

141 NZCC, Topic paper 4: Cost of capital issues, 20 December 2016, paragraphs 299 to 300.

484. The NZCC could have used the last 10 years of data, excised the 18 months of COVID-19 affected data, and applied the UKCAA method to arrive at a pandemic uplift. This would have resulted in a "pandemic free" asset beta estimate of 0.54 using the NZCC draft decision sample (0.72 using the 2016 IM sample method). The uplift would be 0.07 (0.06) to arrive at a final asset beta of 0.61 (0.78). All of these values can be found in Table 8-4 above.

485. However, the draft decision instead reached back to 1 October 2007 to form an estimate of "*the long-term airport asset beta of 0.53*". This raises questions in relation to how the asset beta will be set in future IMs.

   a. Was this a conscious choice to abandon the past regulatory precedent of using the most recent data to estimate asset betas in favour of a new precedent to try and estimate "a long-term airport asset beta"? Or

   b. Is the 2023 IM estimation method to be considered an *ad hoc* response to COVID-19 and the 2030 IMs can be expected to revert back to 2010 and 2016 precedent?

486. If the latter:

   a. How will the 2030 IM deal with the fact that 10 years of data based on 2016 IM precedent will reach back to 1 April 2020 which may arguably include some impact of COVID-19?[142]

   b. Will the NZCC use a shorter estimation window to fully exclude what it regards as the COVID-19 affected period (e.g., two 4.25 year periods)?

   c. Will the NZCC do something else entirely which cannot be predicted with any accuracy in this IM?

487. If the first (point "a") is the case and the new precedent is that the NZCC will base its asset beta estimate on an estimate of "the long term airport asset beta", then how will this newly introduced concept actually be given life in future IMs?

   a. Will the NZCC update its estimate of the "long term airport asset beta of 0.53" by adding the most recent 10 years (or that part it determines is not COVID-19 affected) to the data it has used in this decision starting on 1 October 2007?

   b. Will the NZCC continue to use data that starts 15.5 years prior to the IM decision but excise 18 months of COVID-19?;

   c. Will the NZCC do something else that cannot be predicted with any accuracy now?

[142] The major COVID-19 related downward market movements in February and 20 March 2020 will be excluded as will from 20 March to 31 March 2020 but would still include some of the recovery from the February/March fall.

488. The answers to these questions are critical to whether the IMs provide regulatory certainty to suppliers. However, the draft decision does not address them in any way. It is, in my view a serious shortcoming of the draft decision that it adopted an *ad hoc* approach that discarded many aspects of valuable regulatory precedent and also did not discuss what its 2023 decision meant for future IM decisions.

489. In this regard I note the quote from the draft decision reproduced above to the effect that:[143]

> *"We consider that specifying the equity beta in the IMs provides certainty for suppliers and that, on balance, this should be given more weight than determining an estimate of the equity beta that on average compensates suppliers for systematic risk over a long period of time."*

490. I do not consider that this is a complete, or accurate description of the certainty that the IMs should, and until now largely have, provide. Suppliers and all stakeholders obtain little certainty from an IM number if that number is to be generated by an unpredictable process from one IM to the next. Similarly, stakeholders gain little in the way of certainty by fixing a number for asset beta in the IMs that is not an accurate estimate of asset beta.

491. For the IMs to provide certainty of value to stakeholders then that value must come from certainty about what the process will be for estimating asset beta and certainty about whether that process will deliver accuracy.

9.3 Why do airports and energy suppliers have different methodologies applied to them in the draft decision?

9.3.1 Energy suppliers receive double (triple) the pandemic uplift that airports receive

492. In section 7.4.2 I explain that the draft decision estimate of asset beta for energy suppliers provided an uplift of 0.04 to the NZCC's estimate of the long term average pre-pandemic asset beta. This is double the uplift that the NZCC provided to airports (triple if expressed in percentage terms). I explained that the way in which the draft decision arrived at that estimate was to:

- estimate a lower bound of 0.32 (based on a 0.31 long term average asset beta plus a 0.01 uplift);
- estimate an upper bound of 0.36 (based on the last 10 years of data including the COVID-19 pandemic).

143 NZCC draft decision, paragraph 4.69.

- adopt a point estimate of 0.35.

9.3.2 Airport asset beta would be 0.62 if the draft decision treated airports the same way as energy suppliers

493. Had the NZCC applied the same method for arriving at a range for airports that range would have been, based on its own assumptions about sample and its own estimates of asset beta):

- 0.55 lower bound;
- 0.63 upper bound.[144]

494. Had the draft decision also, as it did for energy suppliers, chosen an asset beta that was 0.01 lower than the upper bound then its estimate for airports would be 0.62.

9.3.3 Will the NZCC 2030 IM use the same upper and lower bound methodology for energy suppliers?

495. While the draft decision ultimately chose an energy supplier asset beta value close to the 10-year asset beta (top of the range), it also introduced the concept of a lower bound estimate based on the long run average asset beta. This is a radical change in methodology even if, in this decision, it did not lead to a radical change in asset beta value.

496. This raises important questions for the NZCC to answer in its final decision:

- Will the NZCC apply the same methodology to arrive at a range for energy suppliers' asset betas in the 2030 IM? Specifically, with:
  - one end of the range defined by a long run average; and
  - the other end of the range defined by the most recent 10 years of data?
- If so, how will the long run average be updated?
  - Will the NZCC continue to use data starting in October 2007 or will the beginning of the "long run" move forward in time and, if so, by how much (7 years?);
  - Will the NZCC continue to exclude 18 months of COVID-19 from that period?
- If the NZCC does not plan to apply the same methodology, why not? That is, why is the rationale and method for coming up with a range in the 2023 IM not applicable to the 2030 IM?

144 NZCC draft decision, table A2 on page 172. 0.63 is the average of weekly and 4 weekly asset betas for 2012-17 and 2017-22.

- If so, what will the NZCC do if the relative values are flipped, and the most recent 10 years of data are materially lower than the long run average?
  - Will the NZCC continue to give most weight to the most recent 10 years?; or
  - Will the NZCC continue to choose a value at the top of the range?
- Will the answers to the questions posed in section 9.1 above be the same for energy businesses and airports?

497. These questions might be difficult for the NZCC to answer – but the fact that the questions exist highlights that the value of the IM process for providing certainty will be materially undermined by the draft decision.

498. This is because the 2023 decision makes radical *ad hoc* departures from what was long-standing regulatory precedent. If the NZCC does not address whether these are likely to be retained in future IMs then it is impossible for stakeholders to form a view on the likely outcomes of the 2030 and beyond IM decisions.

499. By way of illustration airports and energy suppliers were able, using the stability of regulatory precedent from the 2010 and 2016 IMs, to make predictions about the level of long run compensation that they would receive on investments. However, the 2023 draft decision:

- more or less lines up with the predictions that energy suppliers would have been making; but
- radically departs from the predictions that airports would have reasonably been making.

500. Absent guidance now, the confidence that both energy and airport businesses can have in their future compensation (2030 and beyond) will be severely impacted.

9.4 Will the pandemic uplift be permanent?

501. The logic for an uplift to a pandemic-free estimate of asset beta is that there is always some latent risk of a pandemic that investors require compensation for even if the estimation window for asset beta is unaffected by a pandemic. It follows that any uplift must be permanent (or, at least, applied when there is no pandemic event in the asset beta estimation window).

502. However, the draft decision provides no discussion of this issue despite my raising it in my report for New Zealand Airports.

> "One might be tempted to argue that major pandemics occur less frequently than once in 10-years and, therefore, the 10 years to March 2023 are not "representative" of the true actuarially expected risk of pandemics for investors in airport companies. However:

- if a 10-year estimation window that includes a major pandemic over-weights (relative to a priori probabilities) pandemic type shocks; then
- a 10-year estimation window that **does not** include a major pandemic **under**weights (relative to a priori probabilities) pandemic type shocks.

  Once the second dot point is accepted as the logical corollary of the first, it can be easily seen that attempting to adjust the estimated asset beta to reflect some estimate of a shock's "a priori probability" creates more problems than it solves. Specifically, adjusting downwards the asset beta estimates affected by COVID-19 on the basis that COVID-19 type shocks are "overrepresented" in that period requires an offsetting upward adjustment to asset beta estimates derived from all other periods where COVID-19 type shocks are "underrepresented". This would include the historical PSE1 to PSE3 periods."

9.5 Will the final decision source epidemiological and aviation industry expertise as an input to its pandemic uplift?

503. The draft decision has arbitrarily adopted assumptions about the upper and lower bound frequency and duration of pandemics in order to arrive at an estimate of the pandemic uplift. As I explained in section 8, these assumptions are:

   a. An upper bound: that the next pandemic is actuarially expected to occur in 20 years and last 18 months;

   b. A lower bound: that the next pandemic is actuarially expected to occur in 20 years and last 3 months;

   c. Both upper and lower bound: that the next pandemic is expected to be the same as COVID-19.

504. These assumptions appear to have been arrived with no input from expert epidemiologists or other relevant experts. As I explained in section 8, these assumptions are more aggressive (lead to a lower uplift) than the UKCAA assumptions whose:

   - Lower bound estimate is based on a 17-month duration (compared to the draft decision assumption of 3 months); and
   - Upper bound is based on a 39-month duration[145] (compared to the draft decision assumption of 18 months).

[145] Flint provided the UKCAA two reports. The later report had a 39-month duration assumptoin.

505. The draft decision provides no discussion of why these are reasonable assumptions. Nevertheless, they are critical to its estimate of the risk to airports of pandemics (0.02 asset beta uplift).[146]

506. One of the main reasons I previously submitted that no adjustment should be attempted was because doing so would require assumptions about frequency and severity of pandemics that are very difficult to estimate (and are potentially unknowable). Referring to any attempt to estimate a pandemic uplift, I stated:

> *Of course, this could never be done precisely because the "true" frequency and severity of a COVID-19 like event (or, really, any major economic shock) is not known with any accuracy. Attempting to adjust for an unknown (and unknowable) true probability of an event is, in my view, likely to end in a regulatory quagmire of competing claims, all based on assertions that are not, and cannot be, robustly evidenced.*
>
> …
>
> *I would add that the future frequency and scale of pandemics [is] not only "unknown" but it is also "unknowable".*
>
> *This is a fundamental reason why I consider pursuing an alternative method is problematic. When an adjustment requires an estimate of an unknowable variable that adjustment should not be pursued unless it is absolutely required in order to correct a known bias.*
>
> *However, in the current case, there is no bias in my proposed methodology because that methodology will, on average and over time, accurately reflect and compensate for the scale and frequency of all shocks.*

507. The reference to "my proposed methodology" is that methodology set out in section 9.1 above. I went on to explain:

> *In order for an alternative to my proposed method to be accurate (which requires that it gives the same answer as my method on average over time), the alternative method needs to accurately estimate the frequency of pandemic events (i.e., needs an accurate estimate of "γ"). If the alternative method underestimates the true frequency then the method will apply too large/small a deduction/uplift to the COVID-19 affected/unaffected asset betas. That is, the average asset beta over repeated applications of the alternative method will be too low if "γ" is underestimated and too high if "γ" is overestimated.*

146 CEG, NZCC comments on asset beta estimates for airports, Feb 2023, paragraphs 76, 174 & 175.

TDB underlines the difficulty of estimating "γ" accurately when they state:[147]

> *"We note too that while the future scale and nature of pandemics is unknown, the risk of pandemics is not a surprise."*

I would add that the future frequency and scale of pandemics not only "unknown" but it is also "unknowable".

This is a fundamental reason why I consider pursuing an alternative method is problematic. When an adjustment requires an estimate of an unknowable variable that adjustment should not be pursued unless it is absolutely required in order to correct a known bias.

However, in the current case, there is no bias in my proposed methodology because that methodology will, on average and over time, accurately reflect and compensate for the scale and frequency of all shocks. An alternative method adjustment can only achieve the same result if the estimate of the unknowable variables "α" and "γ" are perfectly accurate. If not, as will invariably be the case, the alternative method adjustment will result in a biased estimate of asset beta on average over time.

Moreover, any bias associated with a misestimate "γ" is likely to be compounded by a misestimate of the impact of COVID-19 in the current estimation window (a misestimate of "α"). Disentangling the impact of COVID-19 from other factors affecting asset beta in the current estimation window is extremely contentious.

However, the key issue is that any attempt to estimate "α" would be an extremely contentious issue. One would need to identify, at a minimum:

a. *When the impact started;*

b. *When the impact ended; and*

c. *How the intensity of the impact varied over the relevant period?*

By way of illustration, the large and steep decline in equity market valuations in mid-February 2020 (associated with an around 20% fall for the NZSX 50) is probably the easiest to identify direct impact of COVID-19. However, this was short lived, with most of the fall regained by early April and all of it regained by the end of 2020. It is far from clear when one should assume the impact of COVID-19 has ended (or, indeed, if it has at all). Moreover, one should surely assume that the impact of COVID-19 on

[147] TDB Advisory Ltd, Process and Issues and Draft Framework Papers, May 2022, page 4.

data points in February and March 2020 was significantly greater than in any subsequent period.

508. These issues have not been addressed in the draft decision.

9.6 If the pandemic uplift will be permanent what will happen when the next pandemic comes?

509. In my previous report for New Zealand Airports, I explained that estimating asset betas as "normal" values plus uplifts for "abnormal" events would create an extremely complex (unworkable) asset beta estimate over time.[148]

> *But the real world will not be that simple. There will be future pandemics, but they will, likely, be very different in their impact than the COVID-19 pandemic. When they occur, they will require their own adjustments that are overlayed on the COVID-19 ongoing adjustment.*
>
> *The above is far from a full imagining of the complexity and "pandora's box" that is opened up when attempting to remove or re-weight data in an attempt to reflect the stakeholder's views about the "true probability" certain events happening. It is my view that this sort of analysis will ultimately result in a regulatory quagmire – both now and in future IM updates. With no clear and transparent basis for making any adjustments, stakeholders will be incentivised to engage in what ultimately ends in a "data-mining" exercise – choosing:*
>
> a. *what events to classify as happening inconsistent with their expected future frequency (noting that events such as the global financial crises have at least as much claim to this as does COVID-19);*
>
> b. *what period to classify as affected by those events (and which sub periods of that period are most affected etc);*
>
> c. *how to estimate the magnitude of the impact of the event on the estimated asset betas;*
>
> d. *what probability to put on that event occurring in the future in order to "add back" the amount necessary to arrive at an appropriately weighted probability of "event X" asset beta; and*
>
> e. *how to keep track of the impact of future "event X" like occurrences in order to also remove the impact of those (so that the "add back" from the*

148 CEG, NZCC comments on asset beta estimates for airports, section B.4.

previous step does not result in overweighting of "event X" like occurrences).

A good way to test whether this is a sensible regulatory path to go down would be to imagine having applied the same approach to the global financial crisis. For example, imagine that, in the context of PSE2 and PSE3, it was determined that the global financial crisis was a large systemic shock that of the kind that is expected to occur relatively infrequently (e.g., once every 25 years) and was, therefore, over-represented in its then estimation period (covering April 2006 to March 2016 inclusive).

Had this been done in the past, it would be necessary to now, in 2022/23, to:

a. Assess the extent to which a "financial crisis" type event was included in the current estimation period (June 2012 to June 2022). In doing so, it would have to grapple with whether the dramatic fall in stock valuations in February 2020, which were especially large for banks, was a "financial crisis". It would also have to consider the extent to which the period 2013 to 2015, which included the eurozone crisis, was a "financial crisis";

b. Remove any impacts of "financial crisis" from the estimated asset beta for June 2017 to June 2022 in order to arrive at a "financial crisis free" asset beta estimate;

c. Add back the financial crisis increment/decrement that was estimated in PSE3 to arrive at an appropriately weighted probability of "financial crisis" asset beta; and

e. Grapple with the overlay of new COVID-19 adjustments.

The more events that are adjusted for overtime the more complex the asset beta estimate will become. Ultimately, the asset beta estimate will comprise mainly of previously determined estimates of increments/decrements for certain events X, Y and Z added to an asset beta estimate that becomes ever more contentious as stakeholders argue over whether the new estimation period is affected by X, Y and Z like events and, if so, how the impact of those events should be removed.

510. The draft decision did not address/evaluate these issues.

9.7 Will other abnormal events receive the same treatment as COVID-19? (The case of the GFC?)

511. In my report for New Zealand Airports I explained that:[149]

149 CEG, NZCC comments on asset beta estimates for airports, February 2023, section B.3.

The logic for a pandemic adjustment is not peculiar to pandemics. If applied to a pandemic then it invites application to all large infrequent systematic shocks. For example, the following are examples of large systematic shocks of a kind that are also infrequent/unpredictable:

i. The war in Ukraine, and subsequent sanctions on Russia, is affecting global energy markets and global inflation and interest rates.

ii. The global financial crisis of 2008-09 and the subsequent Eurozone debt crisis of extending out to at least 2015 represented a large systemic shock;

iii. The decades long industrialisation of China, and associated reduction in global manufacturing costs and a global excess of savings, has had profound impacts on the structure of the world economy but which cannot be expected to be repeated in the future.[150]

iv. Etc.

In fact, any given 5 year estimation window for asset beta will be made up of a combination of shocks that are unlikely to reflect the "average" set of expected shocks. For example, New Zealand inflation is, at the time of writing, at a 32 year high of 7.2% pa.[151] *This is, by definition, a shock that is not expected to be repeated every 5 years. Therefore, the same logical case could be made for attempting to adjust measured asset betas that include this year in order to remove the effect of a 1-in-32 year record high inflation. However, going down such a path would make the IM's unworkable – as is discussed further below.*

512. The NZCC has not addressed these concerns. However, I note that Bela[152] advised the NZCC to perform a statistical test in order to find if the COVID-19 period was statistically significantly different to other data at a 1% significance. Only if this test was passed did Bela consider that any adjustment should be contemplated.

513. I have applied exactly the Bela test to the historical data that the NZCC uses to arrive at its long run average. I have found (see Table 9-1 below) that the period of the GFC (global financial crisis) satisfies Bela's statistical significance test as does the period of the Eurozone debt crisis. It follows that, if applied consistently the NZCC should:

- Remove the GFC (April 2007 to June 2009) and Eurozone (February 2012 to September 2014) periods from its long run "normal" asset beta estimate; and

150 Chinese GDP per capita grew at 10% pa from 1992 to 2012 inclusive and 6% pa for the next 10 years. Data from the World Bank (GDP per capita growth (annual %)).

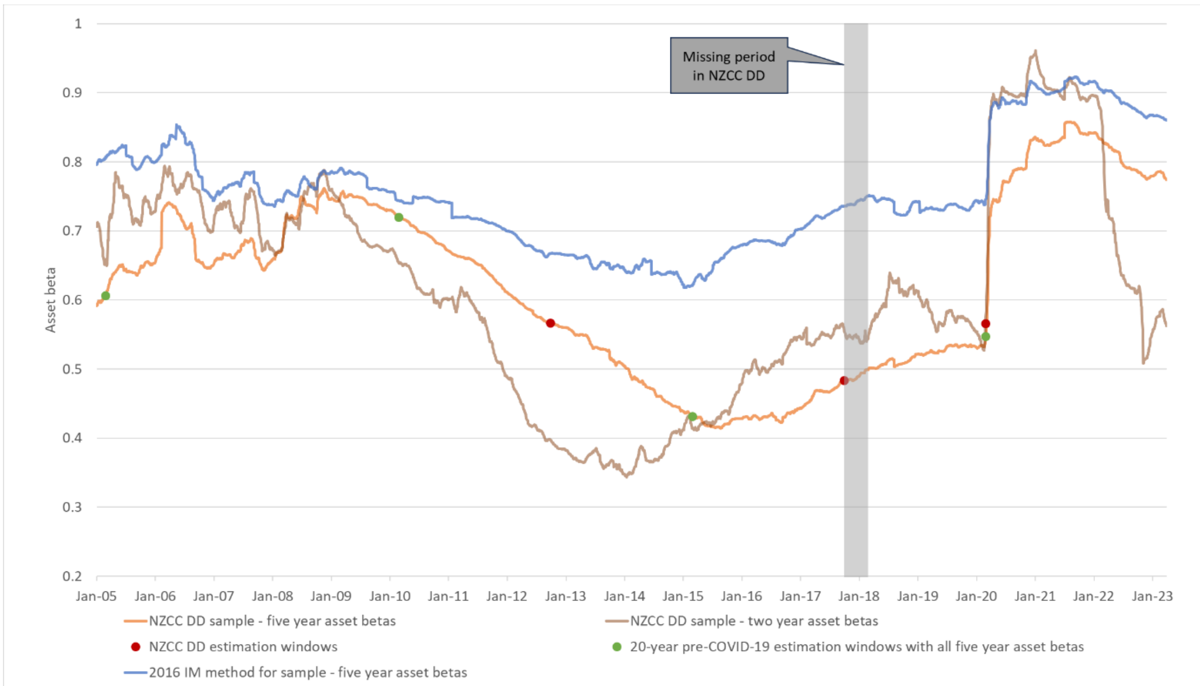
151 Stats NZ (2022), Annual inflation at 7.3 percent, 32-year high, 18 July 2022, available at https://www.stats.govt.nz/news/annual-inflation-at-7-3-percent-32-year-high.

152 Marshall, B, Nguyen, NH & Visaltanachoti, N (2023), Comment on the Auckland Airport Input Methodologies Submission, Bela Enterprises, paragraphs 33 & 34.

- Add back an uplift for a major global financial crisis and a decrement for a Eurozone currency/banking crisis.

514. I note that the Eurozone debt crisis corresponds to the 5 years ending September 2017 used in the draft decision (with a weight of 42%) to derive long run “normal” asset beta of 0.53. This is illustrated in Figure 2-4 which I reproduce below. The unusually low asset beta estimates for the NZCC sample from 2012 onwards are affected by the Eurozone debt crisis. (In this period financial stocks were highly volatile and the effect of this was that the financed industry betas were raised, and other industries betas were depressed – noting that equity beta always averages to 1.0 across all industries.)

Figure 9-1: NZCC’s 3 observations used to derive its 0.53 long run pre-COVID-19 asset beta (reproduction)



515. I do not propose that the NZCC should remove the Eurozone debt crisis from any historical analysis on the basis that it is “abnormal”. However, this is because I do not believe that the NZCC should make any such adjustments – including for COVID-19. However, if the NZCC does make an adjustment for COVID-19 it should also adjust for these other events.

516. As Figure 9-1 highlights that, when looking at the draft decision sample, it is highly problematic to remove the post 2020 asset beta estimates (which are modestly above the pre-2012 asset betas) in order to focus the weight on the period where the NZCC sample has an abnormally low asset beta estimate. A reasonable interpretation of

Figure 9-1 is that the 2012 to 2017 period is the period with the most "abnormal" asset betas.

517. Adopting the methodology proposed by Bela, in which major events are identified in the regression using dummy interaction terms,[153] I include additional tests for the GFC and Eurozone debt crisis. That is, I test if these events also had resulted in asset betas that are statistically significantly different at the 1% level from periods outside of the major events.

518. Hypothesis testing using this approach finds that the GFC and Eurozone debt crisis, similar to COVID-19 also resulted in a statistically different asset betas.

519. The results are shown in Table 9-1 below. The GFC is estimated to have resulted in an increase in estimated asset beta of the NZCC sample by 0.143 (weekly) and 0.156 (four weekly). The p-values indicates that the estimated is significant at the 5% (weekly) and 1% (four weekly) level. The Eurozone debt crisis is estimated to reduce the asset beta by 0.165 to 0.199. The Eurozone debt crisis results are statistically significant at the 1% level.

Table 9-1: Hypothesis test of impact of major events on estimated asset beta

Return type	GFC impact	P-value	Eurozone debt crisis	P-value	Covid	P-value
Weekly	0.143	0.028	-0.165	0.000	0.317	0.000
Four weekly	0.156	0.000	-0.199	0.000	0.310	0.000

P-value showing 0.000 implies P-values less than 0.0005. Robust standard error (HC1) is calculated with clustering for airport and year.

520. Both events resulted in an asset beta that differ significantly from the non-event periods. However, unlike COVID, the NZCC did not exclude these periods in the sample period for beta regression.

521. To estimate the impact of GFC and Eurozone debt crisis, I have adopted the formula proposed by Bela.[154] Bela proposed the following additional terms to address COVID-19.

$$\alpha_1 D_{i,t} + \beta_1 D_{i,t} LF_{i,t} M_{it}$$

Where

153 Marshall, B, Nguyen, NH & Visaltanachoti, N (2023), Comment on the Auckland Airport Input Methodologies Submission, Bela Enterprises, paragraph 23.

154 Marshall, B, Nguyen, NH & Visaltanachoti, N (2023), Comment on the Auckland Airport Input Methodologies Submission, Bela Enterprises, paragraph 23.

- $D_{i,t}$ is a dummy for COVID-19
- $LF_{i,t}$ is the value for leverage;
- M_{it} is the value for market returns;
- β_1 is the parameter that measures the impact of Covid on the asset beta;

522. The periods for the major events are shown in the table below.

Table 9-2: Time period for major events.

	Start		End	
GFC	2 April 2007	Largest mortgage lender in US files for bankruptcy[155] starting the sub-prime mortgage crisis	9 June 2009	End of US recession[156]
Eurozone debt crisis	1 February 2012	In February Greece enters loan deal with IMF[157]	30 Sept. 2014	In September, Greece returns to bond market and is forecast to grow[158]
COVID	28 February 2020	NZCC	27 August 2021	18 month timeline

523. The sample is constructed using daily observation of weekly or four weekly returns with the period from the start of the GFC to 31st of March 2023.

9.8 How will the NPV negative impact of the uplift be corrected?

524. If a COVID-19 uplift is only applied prospectively to regulatory decisions that start after the 2023 IMs are finalised, how will the failure to apply that uplift in the past be addressed? The following passage is taken from my report for New Zealand Airports. The term "α" refers to the severity of the pandemic shock and "γ" refers to its latent frequency. The uplift for exposure pandemic shocks is "α× γ". [159]

> *…the NPV compensation will be seriously biased downwards if one applies a zero pandemic increment to asset betas until a pandemic hits and, only then, begins the process of applying large decrement followed by small increments. Under this approach, a large decrement is applied in the first instance followed by a series of small increments. The average value of*

155 https://www.reuters.com/article/us-newcentury-bankruptcy-idUSN0242080520070403.

156 https://www.wsj.com/articles/BL-REB-11646.

157 https://www.theguardian.com/business/2012/mar/09/greek-debt-crisis-timeline.

158 https://www.abc.net.au/news/2014-09-07/greece-set-for-return-to-economic-growth/5725198.

159 CEG, NZCC comments on asset beta estimates for airports, February 2023, paragraph 183 onwards.

these may cancel out (if "α" and "γ" were estimated accurately) but the present value of these will be negative.

Such an approach would be the equivalent of a regulator:

- *providing zero compensation for insurance against earthquake damage over multiple regulatory periods that did not include an earthquake;*
- *waiting until the first major earthquake hit and damage was incurred and then deciding that:*
  - *earthquakes are a rare occurrence, and it is inappropriate to provide compensation for the damage just caused by the earthquake; but*
  - *in recognition of the fact that another earthquake may occur in the future, the regulator will provide a self-insurance premium to cover the expected cost of future earthquakes.*

Even if that self-insurance premium (α×γ) is perfectly accurately estimated it will only provide compensation for the expected cost of future earthquakes. It will leave the regulated business completely uncompensated for the cost of the earthquake that just occurred.

In the context of pandemics, the NZCC provided no asset beta uplift in the 2010 and 2016 IM asset betas. Notwithstanding that these risks were well understood to exist the NZCC did not apply an uplift to the estimated asset betas in 2011 and 2016 to reflect this risk. (Noting that this risk was not reflected in the 2011 IM and 2016 IM asset betas because no pandemic of similar scale to COVID-19 occurred in the respective asset beta estimation windows).

Having chosen not to adjust asset betas for this risk in the past, it would be unreasonable to only begin a process of adjustment in the first instance when the adjustment would be negative (i.e., in the first period immediately after a pandemic had actually occurred).

Indeed, the logic set out in this appendix clearly demonstrates that, if any asset beta adjustments for pandemics were to be contemplated, it would need to:

Make no adjustment in the 2023 IM to its method for estimating asset beta; but

- Signal that in all future IM's[160] that:

[160] Strictly speaking, in all future IM's using an estimation window that begins after March 2023.

- an uplift of "$\alpha \times \gamma$" will be applied if there is no pandemic in the estimation window; but
- a decrement of "$\alpha \times (1-\gamma)$" will be applied if there is a pandemic in the estimation window.

Only if this approach was adopted could the present value of the adjustments be expected to be NPV neutral (even if α and γ were estimated accurately). Of course, for the reasons set out above and below I do not recommend attempting any adjustment is appropriate.

525. I consider that this passage provides important questions that the NZCC should have answered but not in this draft decision. I attempt to organise these questions below in an attempt to make it easier for the NZCC final decision to respond and, in doing so, clarify its approach in future IMs to other abnormal shocks.

    a. Does the NZCC acknowledge that:

        i. If its prospective uplift for the impact of an "abnormal shocks" is perfectly accurate (in this case an asset beta uplift of 0.02);

        ii. If that uplift is only applied after the shock has occurred (in this case from 2023 after COVID-19 has occurred) then, on average over time, suppliers will be undercompensated for exposure to the risks of those shocks because they will have failed to receive the uplift in the past (including in the actual period the shock hit)?

    b. If the NZCC does acknowledge point "a" above, then:

        i. will it make a correction in an attempt to correct the NPV negative nature of its draft decision (e.g., along the lines at the bottom of the above quote or some other means)?; and

        ii. will the NZCC now, as part of the 2023 IMs, hold a process to estimate the type and latent required compensation to all other infrequent events and start providing compensation now for those latent risks not captured in its historical asset beta estimates? Such risks would include:

            - A war between the US and China over Taiwan;
            - A major financial crisis such as the Eurozone debt crisis and the GFC (as discussed in section 9.7);
            - A major volcanic eruption in New Zealand;
            - A major earthquake affecting operations in one of the three major city airports that the IM's apply to?
            - The escalation of the current war in Ukraine to the use of nuclear weapons of some kind;
            - Etc.

iii. if the NZCC will not begin providing compensation for exposure to these latent risks how will the NZCC deal with the negative NPV nature of its current approach to dealing with “abnormal events”?

10 Engagement with expert evidence

526. The draft decision implements the following departures from regulatory precedent without any expert evidence in support and, often, in conflict with the expert evidence it has received (including from its own experts).

- A radical change in the comparator sample to select a much smaller and lower risk set of airports (reducing the number of comparators to 8 comparators from 26 comparators in the 2016 IM (this is in contrast to 23-24 based on my and CEPA's application of the 2016 IM approach in 2023));[161]
- The unexplained decisions in terms of the data used to estimate an asset beta not affected by COVID-19 as described in section 8.1;
- The decision to attempt an *ad hoc* COVID-19 adjustment without describing how this would affect future applications of the IM methodology. Plausibly, the draft decision "COVID-19" methodology amounts to starting every future IM with a blank slate.

10.1 NZCC treatment of CEPA and Bela evidence

527. The NZCC received no external advice or support for the appropriateness of these departures from established precedent. What advice it did receive, from CEPA and Bela respectively, applied the 2016 IM sample selection method and the 2016 estimation window precedent. Their advice and approach are summarised below and compared with what the NZCC did.

[161] Ibid, page 7. There are 23/24 comparators if Sydney is excluded/included. My analysis adds JAT and removes GMRI to the sample leaving the same number of firms.

Table 10-1: CEPA and Bela advice to the NZCC

Advice	Draft decision treatment
CEPA applied the 2010 and 2016 sample selection method (page 6). CEPA did not raise any concerns with the use of this method.	The NZCC explicitly instructed CEPA to use the 2016 IM methodology. CEPA did so consistent with its instructions. The NZCC did not use CEPA sample and did not seek CEPA's advice on its alternative sample.
CEPA was asked to estimate 2 year asset betas to test the impact of COVID (page 12). CEPA compared two year asset betas ending February 2020 and February 2022. It found that asset betas were raised in the latter period by around 0.14 (0.89 vs 0.75 average of weekly and 4-weekly)	The NZCC did not use CEPA estimate of 0.75 immediately pre-pandemic asset beta. It instead arrived at an estimate 0.22 lower.
Bela advised that the NZCC should consider giving more weight to AIAL as the best comparator (paragraph 11).	The NZCC radically altered the sample to make the average asset beta much lower than AIAL's measured asset beta. The NZCC did not increase the weight to AIAL to offset this affect
Bela advised that the NZCC should test for the whether COVID data was statistically significantly different at the 1% level to the non-COVID data using a panel regression (section 3.2)	The NZCC did not perform any test of statistical significance (and did not discuss Bela advice)
Bela advised that data from April 2013 to March 2023 should be used consistent with established regulatory precedent (paragraph 30).	The NZCC departed from established regulatory precedent and used data back to October 2007 – 15.5 years old.
Bela advised that: "*Betas can be expected to vary over time so using the most* ***recent data is desirable****. However, small samples can result in estimation error, and data become noisier at higher frequencies so there is a trade-off.*" (Paragraph 9, emphasis added). See also paragraph 13 where Bela advised that using 10 years of data is defensible but using just the most recent 5 years may be appropriate.	The NZCC departed from established regulatory precedent and used data back to October 2007 – 15.5 years old.
Bela explicitly assume that regulatory precedent will be followed regarding the use of two 5 year periods "*We assume that the 2023 Input Methodology Update will involve asset betas being estimated for application in the April 2023 – March 2028 period (i.e., the new input period). This means that the first historical five-year period is defined as starting in April 2018 and ending in March 2023 and the second historical five-year period ranges from April 2013 to March 2018.*" (Paragraph 16.)	The NZCC departed from established regulatory precedent and used data back to October 2007 – 15.5 years old.
Bela advised that the non-COVID-19 period start from April 2013 and end on 19 March 2020 and restart on 27 February 2022 (paragraphs 29 to 30 and 41)	The NZCC began the non-COVID period on 1 October 2007 (– 15.5 years old) and did not include any post COVID data in its non-COVID assessment.

528. I acknowledge that Bela did advise the NZCC that: [162]

> *"We suggest that the objective should be to estimate the asset beta that is most likely to prevail in the new input period."*

162 Marshall, B, Nguyen, NH & Visaltanachoti, N (2023), Comment on the Auckland Airport Input Methodologies Submission, Bela Enterprises, paragraph 18.

529. This is the one piece of advice from Bela that the NZCC adopted (see paragraph 4.51 of the draft decision).

> *We sought advice from Bela Enterprises on how we should consider the asset beta in the context of COVID-19. Their advice was that we need to make the best estimate of asset beta for the next regulatory period, which involves identifying the extent that COVID-19 had a systematic effect on the asset beta, and also the likelihood that a similar event could happen in the near future.*

530. However, the NZCC did not explain why it did not follow the rest of Bela's advice on this issue. I note that I do not consider that Bela's advice to the NZCC was fully informed by the relevant regulatory context[163] as addressed by me in this report and especially in section 9. For these reasons my advice departs, in places, from Bela's advice. It would, nonetheless, have been informative if the draft decision explained why it did not follow the relevant aspects of Bela's advice.

10.2 No engagement with NZ Airports' evidence on COVID-19 adjustment

531. In section 9 of this report I repeat my analysis provided previously to the NZCC[164] where I explained why, in a regulatory context, the objective should be to design a risk compensation methodology that is stable and predictable and which, in the long run, will provide accurate compensation for beta risk. I explained that this objective is inconsistent with attempting to adjust asset beta data for every unusual event that occurs.

532. As noted in that section, the draft decision did not address that evidence.

[163] Bela are not regulatory experts. For example, in paragraph 16 Bela incorrectly assume that the IM asset beta will be "applied" for the 5 year to March 2028 when, in reality, the IM asset beta will only be replaced in December 2030 (based on current 7-year timetables) and will be "applied" in pricing periods that extend well beyond that (so long as they start prior to 2030).

[164] Section 3.3 and Appendix B of Hird, NZCC comments on asset beta estimates for airports, February 2023.

COMPETITION ECONOMISTS GROUP

11 Underinvestment in airport capacity leads to higher airline prices

533. The CUI index reported on in section 5.2.1 relies on data from a study by SEO Amsterdam Economics. The focus of that study was on the impact of CUI on air fares. There conclusions are summarised below (emphasis added).[165]

> *Economic **theory predicts that air fares at congested airports will be higher** when airport capacity is insufficient to accommodate all passenger demand, as that excess passenger demand allows airlines to increase their air fares. **Using econometric analysis, we find that higher levels of capacity utilisation are indeed associated with higher air fares**, all other things being equal.*
>
> *We estimate this total additional fare premium at congested European airports **at € 2.1 billion today**. Airport capacity shortages in Europe are becoming increasingly severe. Based on EUROCONTROL's 'Challenges of Growth' forecasts, **the total fare premium levied by airlines at congested airports is projected to reach € 6.3 billion by 2035**.*
>
> *In sum, it is **the European consumer who ultimately pays for insufficient airport capacity** in Europe. To reduce the negative impact of capacity shortages on consumer welfare, **not only continued investments in airport capacity are required, but also regulatory reform to remove the incumbent airline's disincentives to support capacity expansion**.*

534. To put this in context, the authors of the above study estimated that this fare premium amounted to €5.65 per return fare in 2014 and that this would rise to €10.42 in 2035. The corresponding values in New Zealand dollars at current market exchange rates (0.57) are $9.61 and $18.28.

535. In 2016 AIAL's CUI was around 0.64 – marginally above the 0.60 threshold identified by the authors as triggering higher airline prices.[166] That is, even though AIAL has low CUI compared to the draft decision comparators, it is still high enough to be of some concern regarding its effect on retarding competition between airlines. It is, therefore conceivable that a failure of AIAL to continue to expand capacity in line with

165 SEO, The impact of airport capacity constraints on air fares, 24 January 2017, Commissioned by ACI Europe, see page i.

166 SEO, The impact of airport capacity constraints on air fares, 24 January 2017, Commissioned by ACI Europe, see page 58.

growth in demand could lead to material medium to long-term effects on airline competition in New Zealand ($10 to $18).

536. Put another way, if the NZCC sets asset beta to compensate AIAL "as if" it is a low risk highly capacity constrained airport then AIAL will have an incentive to become exactly that. AIAL can plausibly do so by simply not investing in new capacity as demand grows. The effect of this would be to reduce the impact of aviation demand volatility on its revenues and profits (i.e., lower its risk). Of course, this would come at a disproportionate cost to the travelling public by virtue of both higher prices for, and less supply of, flights via Auckland.

537. In this context it is important to understand that airlines' and airline customers' incentives are not aligned in relation to setting the regulated WACC for airports. Airlines have a strong incentive to argue for a lower WACC (lower than the airport's cost of capital) because this benefits them in two ways:

- First, by undermining investment in new capacity, the airlines get to charge higher prices for flying through the airport; and
- Second, the airlines pay a lower price for using the capacity.

538. By contrast, customers lose in two ways:

- First, they have to pay the higher airline fares; and
- Second, they suffer a loss of amenity in the form of poorer terminal facilities and connections as well as more flight delays.

539. It should be kept in mind that there are very substantial costs of underinvestment in airport capacity. Unlike in the energy sector, underinvestment in airport capacity may be less likely to lead to catastrophic failure (i.e., total airports closures being the equivalent of black outs). However, failure to invest in airport capacity can still be expected to result is very significant costs to travellers.

Appendix A List of firms in narrow and wider samples

540. The following table lists the firms in the wider 2016 IM method sample and the NZCC's subset of those firms used for the draft decision. Also highlighted in yellow are the two firms that differ as per the firms that CEPA included (GMRI) and excluded (JAT) where I consider that application of the 2016 IM methodology would lead to a different conclusion.

Table 11-1: Wider 2016 IM sample (CEG and CEPA) versus narrow NZCC 2023 sample

Name	Ticker	NZCC 2016	NZCC DD	CEPA	Wider sample
Shenzhen	000089 CH	In	Excluded	In	In
HNA	357 HK	In	Excluded	In	In
Guangzhou	600004 CH	In	Excluded	In	In
Shanghai	600009 CH	In	Excluded	In	In
Xiamen	600897 CH	In	Excluded	In	In
Beijing	694 HK	In	In	In	In
Airport Facilities	8864 JP	In	Excluded	Excluded	Excluded
JAT	9706 JP	In	Excluded	Excluded	In
Vietnam	ACV VN	Not listed	Excluded	In second period	In second period
Bologna	ADB IM	Not listed	Excluded	In second period	In second period
ADP	ADP FP	In	In	In	In
AENA	AENA SM	Not listed	In second period	In second period	In second period
Serbia	AERO SG	In	Excluded	Excluded	Excluded
AIAL	AIA NZ	In	In	In	In
Thailand	AOT TB	In	Excluded	In	In
Grupo (Sureste)	ASURB MM	In	Excluded	In	In
Zurich	FHZN SW	In	In	In	In
Vienna	FLU AV	In	In	In	In
Frankfurt	FRA GR	In	In	In	In
Grupo (Pacific)	GAPB MM	In	Excluded	In	In
GMRI	GMRI IN	In	Excluded	In	Excluded
Copenhagen	KBHL DC	In	Excluded	In	In
Malaysia	MAHB MK	In	Excluded	In	In
Malta	MIA MV	In	Excluded	In	In
Grupo (Cent)	OMAB MM	In	Excluded	In	In
Save	SAVE IM	In	Excluded	Excluded	Excluded
Sydney	SYD AU	In	In	Excluded	In first period
TAV	TAVHL TI	In	Excluded	Excluded	Excluded
Toscana	TYA IM	In	Excluded	In	In

Appendix B Impact of COVID-19 on airport revenues and profits

541. The content of this appendix was previously contained in a report for NZ Airports where the focus of the analysis was on whether aeronautical non-aeronautical operations were worst hit by COVID-19. The conclusion was that aeronautical operations were worst hit.

542. For this report I am repeating the same results in order to demonstrate simply the magnitude of the COVID-19 pandemic on airport companies. This is in the context of the NZCC draft decision lowering its estimate of airport company risk by 18%:

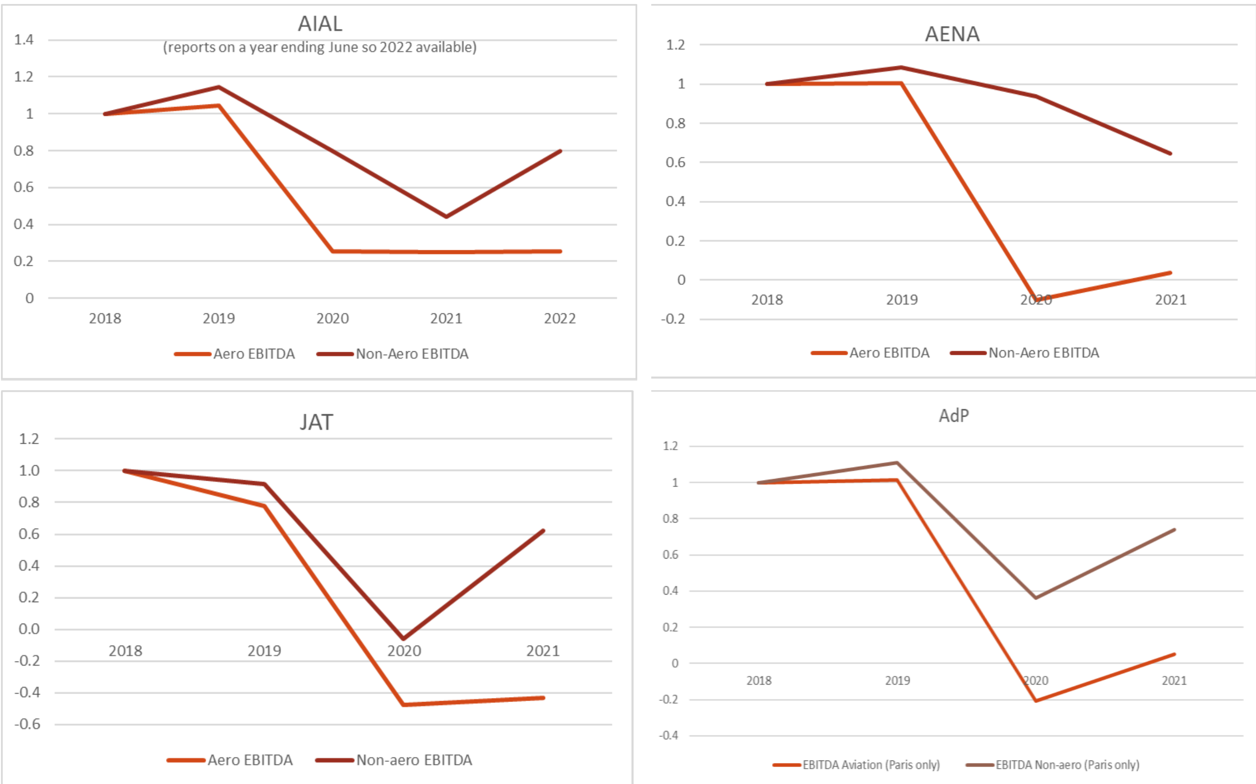
- from 0.65 in the 2016 IMs (before information from the COVID-19 pandemic);
- to 0.55 in the draft decision (after information from the COVID-19 pandemic);

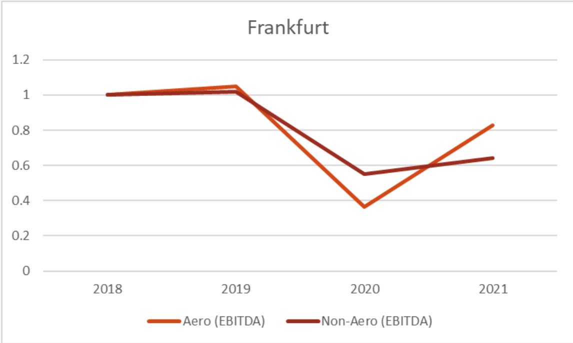
543. Five firms (AIAL, JAT, AENA, AdP and Frankfurt) provide EBITDA and/or EBIT on a segment basis. Figure 11-1 shows the time series for aeronautical and non-aeronautical profits at these airports.

Figure 11-1: EBIT and EBITDA time series for aero and non-aero (2018=1)

EBIT

EBITDA





Source: annual reports and CEG analysis.

544. It can be seen that in all cases, total profits fell (and aeronautical profits fell more) following the unexpected passenger shock due to COVID-19. AdP reports three segments for its Paris airports: aviation (aeronautical) and retail and real estate (both non-aeronautical

545. Most airports only report revenue (not profits) on a segment basis. I now report the results of the same analysis for all airports in the sample. It can be seen that in all cases total revenues fell materially and out of 26 airports, aeronautical revenues fell by more than non-aeronautical revenues at 24 airports.

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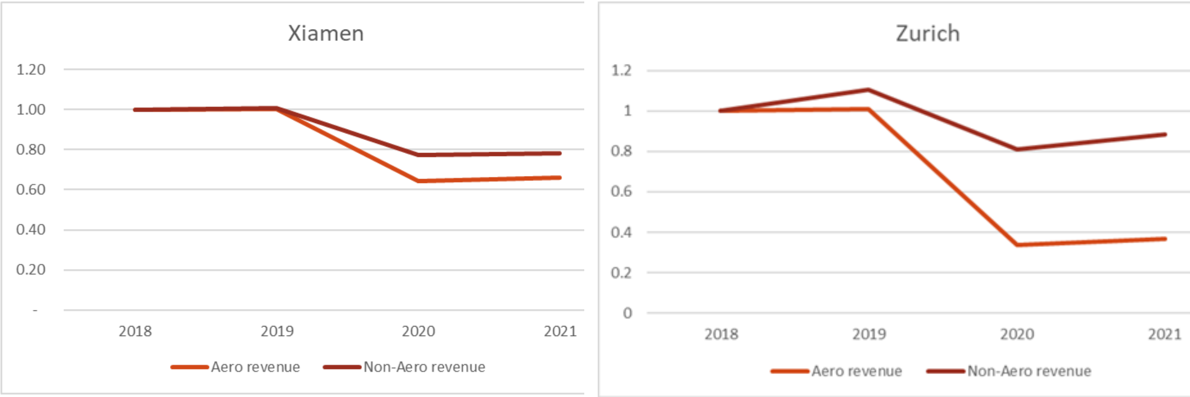
Figure 11-2: Revenue time series for aero and non-aero (2018=1)

Figure 2-5 continued: revenue time series for aero and non-aero (2018=1)

Figure 2-5 continued: revenue time series for aero and non-aero (2018=1)

Figure 2-5 continued: revenue time series for aero and non-aero (2018=1)



Source: annual reports and CEG analysis. .

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Appendix C Minor changes to the CEPA sample

546. I made a three minor adjustments to the CEPA sample which result in an 0.02 increase in asset beta. The adjustments are:

- The exclusion of GMRI;
- The inclusion of JAT (Japan Airport Terminals), and;
- The inclusion of Sydney Airport only in the first 5 year period (2013 to 2018).

C.1.1 Exclusion of GMRI

547. While GMRI has always had airport operations subject to the risk of fluctuations in passenger numbers, prior to its split/demerger on 11 Jan 2022, it had extensive non-airports related activities. The split separated the non-airports business into a newly listed entity GMR Power and Urban Infrastructure Limited. As reported, one of the key reasons for the split was to attract “sector-specific global investors”.[167]

548. In short, the listed GMR company is currently solely an airport operator but was, over much of the period, a diversified infrastructure conglomerate. This means GMRI prior to the split in January 2022, was predominantly a land bank/construction company with limited involvement in airport operations as a whole.

549. For this reason, data prior to 11 January 2022 should be excluded. Given that there would only be around 14 months of data up until March 2023, GMRI should be excluded in the 2023 IM.

550. However, if the NZCC maintains its regulatory methodology, it should then be included in the asset beta samples in future IMs when sufficient data is available.

C.1.2 Inclusion of JAT

551. A more elaborated analysis for the inclusion of JAT is performed in section 6.3.3, below is a summary of the analysis.

552. JAT passes all of the NZCC criteria. The only reason CEPA originally excluded based on a high percentage of non-aeronautical revenues (circa 75%). However, this is because JAT owns its own airport terminal retail outlets and most of that revenue share represents cost of goods sold (e.g., food and beverage) which scale

167 Indian Express: GMR group announces plan to split airports biz from other verticals (28 Aug 2020); GMR Infrastructure becomes India's first airport-only firm to be listed on stock exchange (12 Jan 2022).

proportionally with sales. When measured on a share of profit basis, JAT has low non-aeronautical operations relative to the draft decision sample – as shown in Table 6-2.

553. On close examination, although Japan Airport Terminals does not own the runway operations at the airports it operates at (they are owned by government), it does receive direct per passenger payments from the airlines that use those terminals (with the amount explicitly nominate on airline ticketing). Its terminal retail operations also have the same or similar per passenger demand exposure to aeronautical operations at the same site.[168]

554. Moreover, the NZCC's draft decision that there is no compelling evidence for difference in risk between aero and non-aero operations means that, even putting aside the above facts, there is no reason to exclude JAT[169].

C.1.3 Treatment of Sydney Airport

555. NZCC gave the below reason for the inclusion of Sydney Airport in its 8 comparator sample for both period:[170]

> *We agree with Qantas that Sydney airport should be included because it was **only delisted in March 2022** and it is from a market that has proximity and comparability to the New Zealand market.*

556. I do not oppose the inclusion of Sydney Airport in the first 5-year period. However, it should not be included in the second 5-year period ending March 2023.

557. Considering that NZCC's second 5-year period ends in September 2022, and its awareness of the delisting date, it may have perceived the absence of 6 months of data as a minor issue.

558. However, this assumption is incorrect for the following reasons:

- The final pricing date for Sydney Airport was 9 February 2022. By adhering to the regulatory precedent established in the 2016 IM, the cutoff date for the second 5-year period should be 31 March 2023. Consequently, the amount of missing data increases to approximately 14 months.
- Additionally, the acquisition was initially proposed on 5 July 2021, and officially announced/confirmed on 8 November 2021. These dates hold significance

168 In their recent financial report, Japan Airport Terminal Co., Ltd indicated that their business performance is heavy correlated to passenger volume. Financial Results for the Year Ended March 31, 2022 [J-GAAP], page 2, https://www.tokyo-airport-bldg.co.jp/files/en/ir/000012099.pdf.

169 NZCC draft decision, page 75.

170 NZCC draft decision, paragraph 4.47.

because any price movements subsequent to them would be heavily influenced by acquisition-related news.

559. The figure below depicts the price fluctuations on these dates.

Figure 11-3: Important dates for the acquisition of Sydney Airport

Source: Bloomberg.

560. As illustrated above, there is a notable surge in pricing on the proposal date and subsequently, a smaller increase on the announcement date, with the price remains relatively flat in the final few months.

561. Given this, I conclude that the reliable pricing data for Sydney Airport should end on 5 July 2021, which equates to missing 21 months of data.

562. In the 2016 IM, the airport with the minimum data that was included in a period was Toscana, with around 44 months of data. In consideration of the 2016 IM regulatory precedents, it is reasonable to "formalise" the inclusion criteria to include airports with at least 70% of data, hence, have 42 months of data or missing no less than 18 months of data.

563. With the amount of data loss for Sydney Airport (missing 21 months of data), it should be excluded in the second 5 year period.

C.1.4 Minor draft decision changes to IM estimation methodology

564. Below are some other unexplained and unmentioned technical deviation from the 2016 IM that I picked up when comparing the DD's R model with the 2016 IM asset beta spreadsheet.

565. However, for comparison purpose, I maintained the use of the R model the NZCC supplied for this report and did not adjust the changes mentioned below.

C.1.4.1 Effective regression start date

566. In the 2016 IM, the NZCC's asset beta spreadsheet applied the date filter to the data after calculating the stock and index return from the pricing data obtained from Bloomberg. However, in the DD's R model, the pricing data is filtered before calculating the return data, which is subsequently used to compute the betas.

567. This approach resulted in the absence of return data during the initial cycle of each calculated asset beta, specifically during the first week for weekly beta and the first four weeks for the four-weekly beta.

568. In other words, a methodology shift occurred, transitioning from using 5 years of return data into using 5 years of pricing data to estimate the asset betas.

C.1.4.2 Gearing and un-levering beta

Bloomberg field

569. NZCC has previously used the Bloomberg field "HISTORICAL_MARKET_CAP" (historical market capitalisation) for market capitalisation, which is part of the calculation of gearing. In this DD, it has shifted to use the field "CUR_MKT_CAP" (current market capitalisation) instead.

570. The difference between the historical and current market capitalisation is that the current one is calculated daily using the end of day (or current) price, while the historical is based on the value when the financial reports are published (usually once per quarter).

571. The transition from historical to current market capitalisation reflects the intention to incorporate the impact of fluctuations in day-to-day equity value on the calculation of gearing.

Gearing formula

572. When referring to gearing, there are often two forms of calculations commonly used.

- The first calculation involves dividing net debt (D) by total market capitalisation (E), expressed as D/E.

- The second calculation divides net debt (D) by the sum of net debt and total market capitalisation (V), represented as D/(D+E) = D/V.

573. Mathematically, when calculating the pretax asset beta, both calculations will yield the same answer:

- Asset beta = Equity beta / (1 + D/E), or;
- Asset beta = Equity beta * (1 - D/V).

574. However, it's important to note that this may not necessarily hold true when using the average D/E or D/V across time, as the ratios are usually not constant over time.

575. Previously in 2016 IM, the NZCC used D/V for both de-levering the beta and presenting the average gearing of each company as well as the sample.

576. In the current DD, the average D/E is used for de-levering the beta while D/V is used as each company's, as well as the sample's, gearing.

Un-levering beta

577. In the 2016 IM, only one gearing number is calculated for each company, and it was used across all weekly and four-weekly beta calculations.

578. In the current DD's R model, gearings are calculated separately across each weekly and four-weekly beta calculation before averaging, this gives slightly different results than the 2016 IM method.

579. Additionally, in the 2016 IM asset beta spreadsheet, the model treats all negative gearing as zero, whereas the current draft decision model does not. I am aware that the NZCC draft decision separately excluded all companies with negative gearing, which I elaborate in 6.1.4 regarding my rejection to this decision.[171]

[171] It is noted that if I treat negative gearings as zero, the average asset beta for the wider sample would be 0.79 instead of 0.81.

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Appendix D Home bias in investing in New Zealand

580. Home bias is the tendency of investors to overweight their investment portfolios in domestic equities given the range of possible global investment options.[172]

581. Despite ongoing financial integration in markets, including in common currency markets such as in the European Union, home bias remains a persistent phenomenon for two reasons.[173] The first is that investors are rationally trading off the benefits of investing outside their local market to increase diversification of their portfolios with the costs of doing so. There may be benefits to investors from diversifying out of their home country to avoid systemic risks in the local economy (systemic risks may be reduced by investing in foreign markets if they are not impacted by the same forces as the local economy. However, such diversification does not come without costs, particularly when investing in foreign markets is in different currencies (creating currency and domestic inflation risk for the investor).

582. The second reason is the investment universe considered by investors is narrowed by factors that drive them to invest locally such as familiarity, perceptions of lower risk, cultural factors and the availability of greater news on local investment options.

583. These two reasons are summarised in the economic literature in the following way [emphasis added]:[174]

> *The resilience of equity home bias to growing financial integration* ***may be due either to international portfolio diversification counterbalancing costs faced by fully rational investors or to a heterogeneity of bounded rational investors****. In the first case, investment models based on the representative agent framework would be appropriate. To preserve their assumptions of perfect rationality and common priors,* ***home bias must arise from frictions that lessen the benefits of international diversification, such as currency and domestic inflation risk, higher trading costs and any type of foreign country institutional risk*** *(Stulz, 1981; Glassman and Riddick, 2001; Aggarwal et al., 2005, Levy and Levy, 2014). In the latter case, the* ***bias could spring from factors undermining perfect rationality***

172 French, Kenneth; Poterba, James (1991). Investor Diversification and International Equity Markets. American Economic Review 81 (2): 222–226.

173 Geranio, M., & Lazzari, V. (2019). Stress testing the equity home bias: A turnover analysis of Eurozone markets. Journal of International Money and Finance, 97, 70–85.

174 Ibid.

***and common priors**, such as selective dissemination of price sensitive news, bounded rational decision rules, and presence of noise investors. Social proximity and slow moving news may cause information advantages (Bodnaruk, 2009; Baik et al. 2010; Coval and Moskowitz, 2001). Moreover, investors may prioritize the stocks more visible to them due to their limited capacity for attention and their behavioral perception of lower risk or information advantage arising from familiarity.*

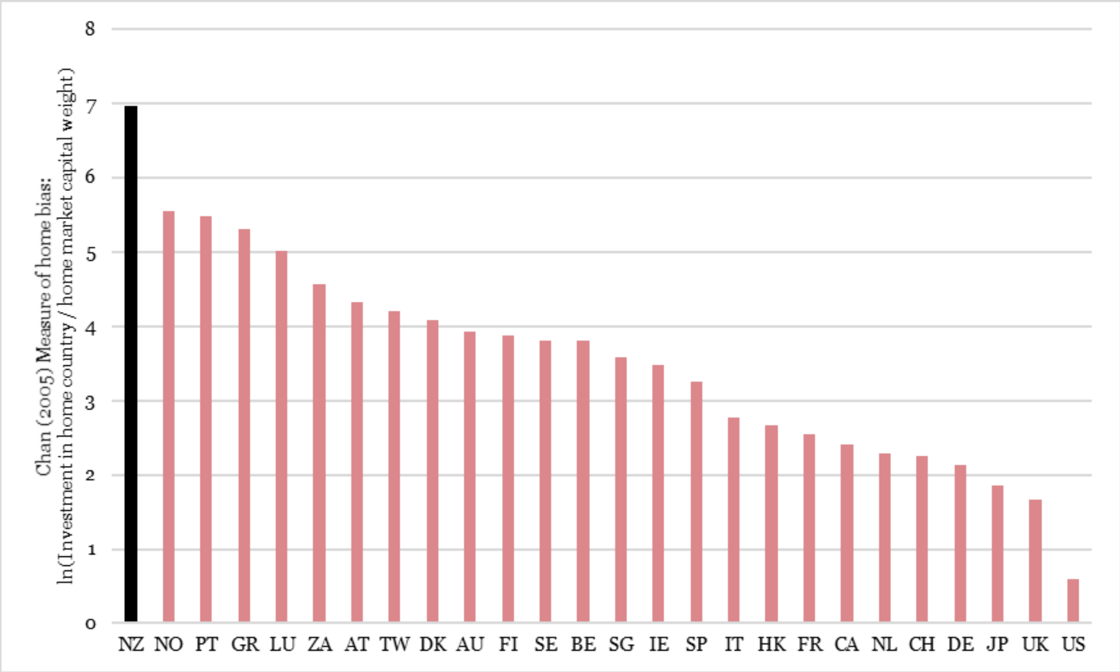
584. The level of home bias provides an indicator of the extent to which investors are diversifying into foreign markets. A strong home bias suggests that the costs involved in achieving diversification exceed the benefits. It is likely for this reason that regulators and finance practitioners observe home bias as a reason to use a local index.[175]

585. Home bias in New Zealand has historically been very high. The following chart shows the measured bias in equity investment in New Zealand relative to other countries, as reported in the academic literature. The measure shown is an index of the proportion of investment in each local country based on the local country weight of global investments.[176] The measured home bias in New Zealand is the highest in the sample.

[175] See for example the French airport regulator: Swiss Economic, Betas for French airports based on empirical and regulatory evidence, For the Autorité de régulation des transports, 14.02.2020.

[176] The index is calculated as the natural log ln(investment in home country/home market capital weight). A weighted measure is appropriate as it accounts for the size of the home market. For example, an unweighted measure would show a large home bias in US stocks. This would not be accurate as it doesn't account for the fact that US stocks represent a large proportion of global stocks.

Figure 11-4: Measure of home bias

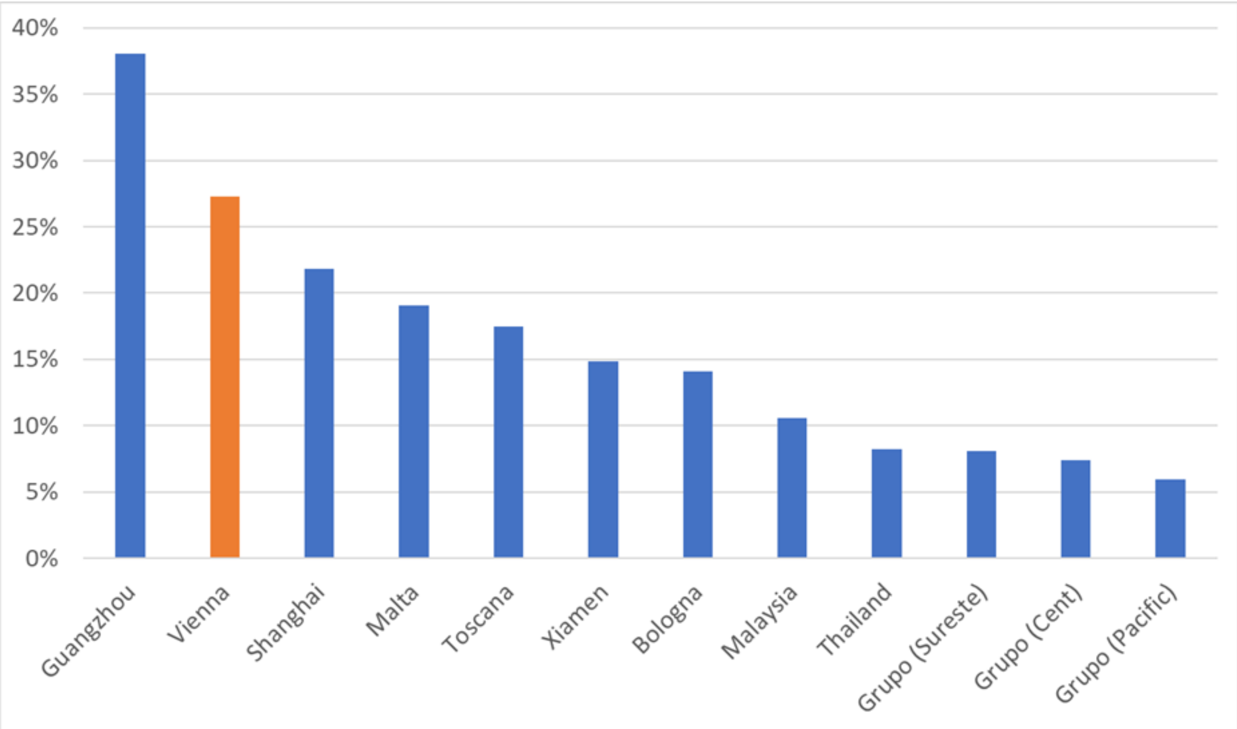


Source: Chan, K., V. Covrig, and L. Ng. 2005. What Determines the Domestic Bias and Foreign Bias? Evidence from Mutual Fund Equity Allocations Worldwide. Journal of Finance. 60 (3):1495–1534.

Appendix E Vienna asset beta variability

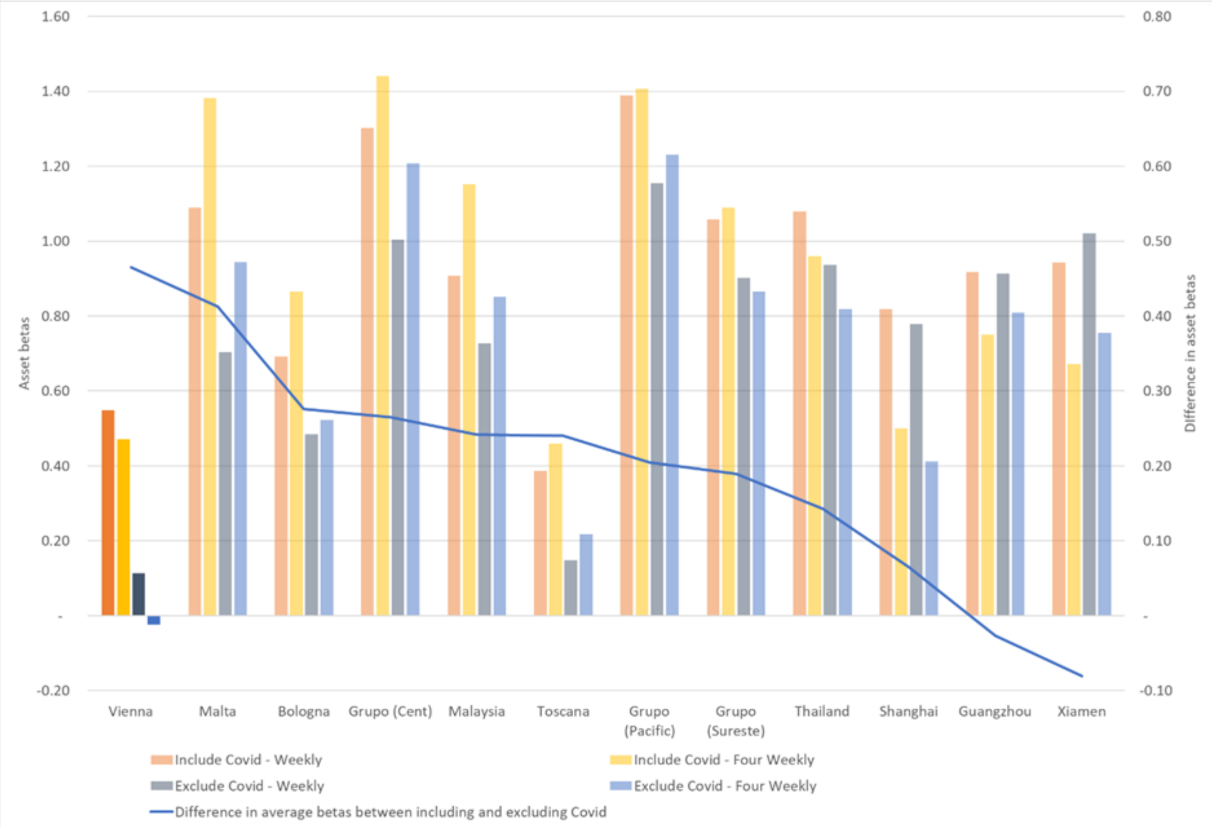
586. Figure 11-5 below compares the coefficient of variation of the 20 four-weekly betas (5 year to 31 March 2023) across Vienna airport and other airports that the NZCC excluded due to "unreliable beta estimates". Vienna's asset beta varies more than all but one of these companies, which reinforces my argument that the "low variability" is a result of "coincidence".

Figure 11-5: Coefficient of variation (SD/ mean) of the Four-weekly beta – Vienna and airports excluded by NZCC due to unreliable beta estimate



587. Further analysis which measures the impact of COVID by including and excluding the 18-month COVID period, further demonstrates the high variability in Vienna's beta estimate.

Figure 11-6: Asset beta variations between including and excluding COVID

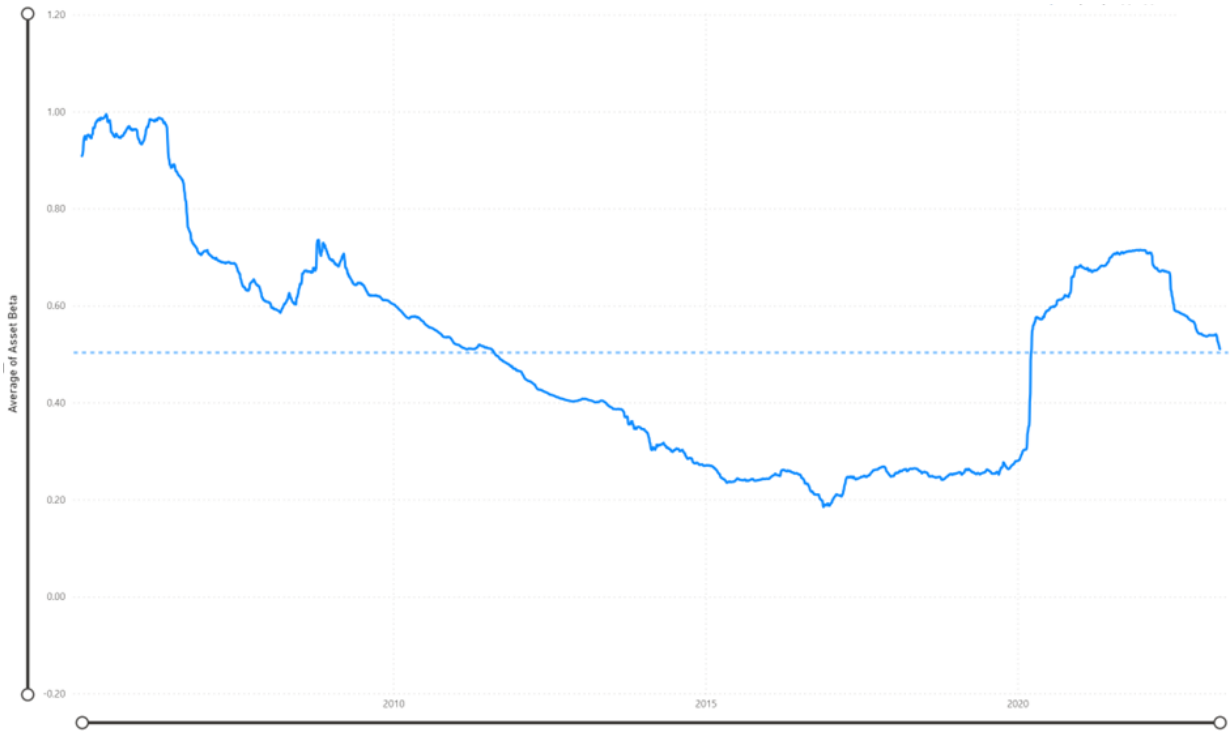


588. The chart above shows the variation of the 5 year to 31 Mar 2023 beta estimate when including and excluding the 18-month COVID-19 period (starting 21 Feb 2020). The axis on the left shows the level of asset betas (as shown in the bars) and the axis on the right shows the difference in asset betas with and without COVID-19 (the thin blue line).

589. This chart depicted that Vienna has the highest COVID vs non-COVID variability among all those excluded due to high asset beta variability. It also highlights that Vienna's excluding COVID-19 four-weekly beta is negative, which is not very convincing that its asset beta estimate is more reliable than the others.

590. Building upon the previous analysis, a time series analysis is illustrated in the following chart.

Figure 11-7: 5 year asset beta time series – Vienna



Note: Each point on the line is a 5 year asset beta for Vienna measured on the day.

591. Figure 11-7 shows volatility over time. Vienna had by far one of the largest percentage increases over the last two 5-year periods (260% increase) and the largest range from peak to trough (500%). I note, however, that Vienna Airport has only been subject to its current low risk regulatory regime since May 15 2012.[177] Therefore, only 5 year asset betas ending May 2017 onwards reflect the risk of Vienna Airport under its current regulatory regime.

592. The below two sets of charts highlight the high volatility and variation of Vienna's asset beta over time. With the first charts showing the (Max less Min)/Mean of the 5-year asset betas calculated in the described period; and the second charts showing the Coefficient of variation of the 5 year asset betas calculated in those periods.

177 Austrian Airport Charges Act (2012), Federal Law on the Determination of Airport Charges (Airport Charges Act – FEG), May 15 2012, available at https://www.ris.bka.gv.at/eli/bgbl/I/2012/41.

Figure 11-8: Vienna vs other airports excluded due to unreliable beta estimate - (Max-Min)/Mean

5 year betas between 1 Apr 2013 to 31 Mar 2018 **5 year betas between 1 Apr 2018 to 31 Mar 2023**

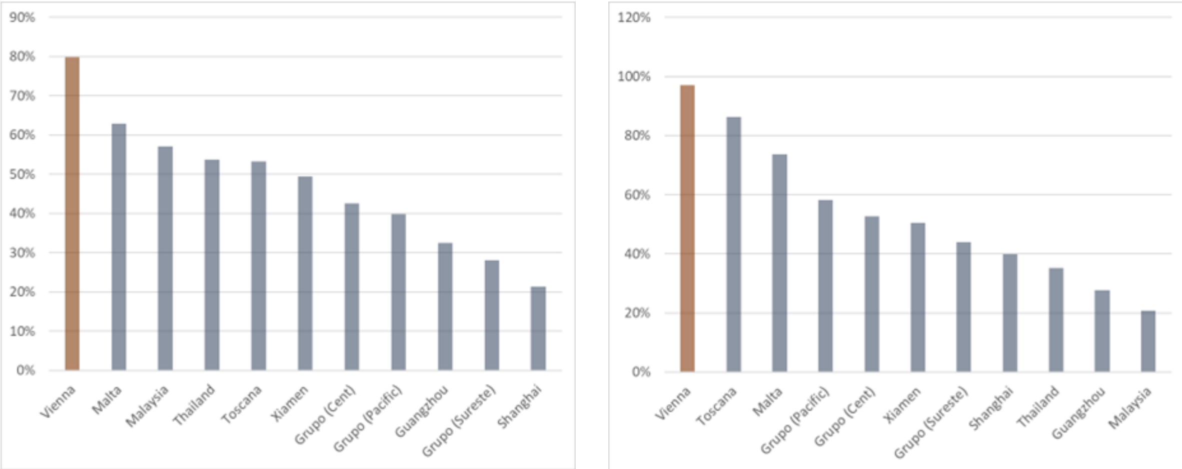
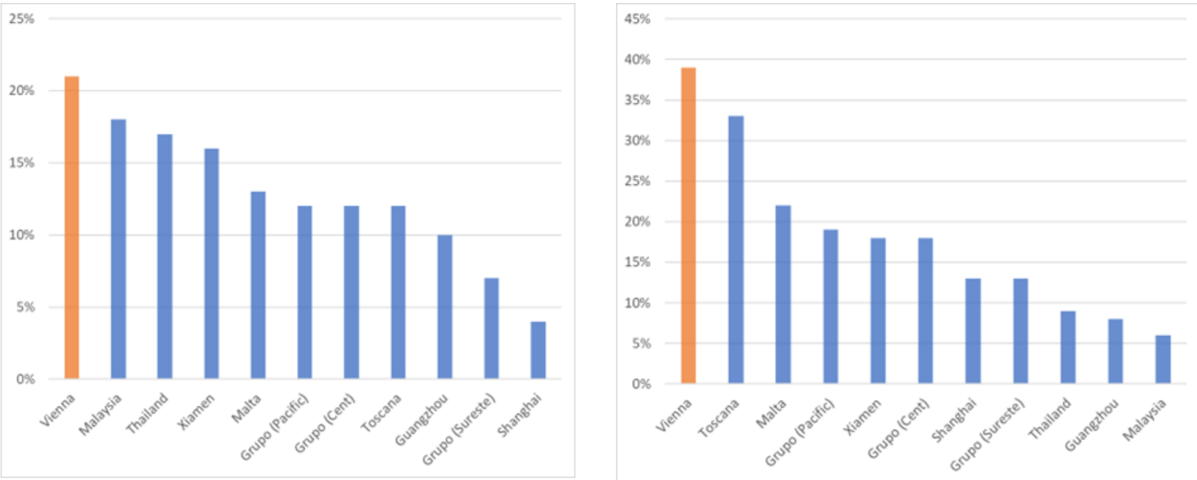


Figure 11-9: Vienna vs other airports excluded due to unreliable beta estimate - Coefficient of variation (SD/Mean)

5 year betas between 1 Apr 2013 to 31 Mar 2018 **5 year betas between 1 Apr 2018 to 31 Mar 2023**



593. The narratives portrayed in both sets of charts align with the rest of the analysis, affirming that Vienna exhibits significantly higher asset beta variability compared to those assets classified by the NZCC with unreliable beta estimates.

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Appendix F UKCAA uplifts for COVID-19

594. The UK Civil Aviation Authority (the UKCAA) recently set the asset beta for Heathrow airport below the asset beta that would have resulted had the UKCAA applied its standard approach of using the most recent 5 years of historical data to estimate asset betas.

595. In doing so the UKCAA relied on empirical analysis undertaken by Flint Group that applied an approach that de-weighted the impact of COVID-19. The UKCAA ultimately concluded that the COVID-19 pandemic should raise asset beta via two effects:

- First, higher risk comparators should be included in its sample of comparators; and
- The sample average asset beta should be raised above the pre-COVID-19 measured asset beta for that sample.

596. The total sum impact of these changes was to raise the UKCAA midpoint asset beta by 0.115. Given that the UKCAA adopts the midpoint WACC this can also be regarded as the uplift in the UKCAA final asset beta estimate.

Table 11-2: Summary of Flint and UKCAA assumptions and findings

	Low impact	High impact	UKCAA mid-point estimate
Pre pandemic asset beta	0.000	0.000	0.5000
Frequency of major pandemics	1 in 50 years	1 in 20 years	
Duration of pandemic	17 months	39 months	
COVID-19 impact via change in comparator set	0.000	0.100	0.050
COVID-19 impact via higher asset beta for individual comparators	0.020	0.110	0.065
Sum of COVID-19 uplifts	0.020	0.21	0.115
% impact of COVID-19	4%	42%	23%
UKCAA TRS adjustment to asset beta*	(0.08)	(0.09)	(0.085)

Source: UKCAA, Economic regulation of Heathrow Airport Limited: H7 Final Proposals, Section 3: Financial issues and implementation, June 2022, Table 9.2.

597. Having applied a midpoint COVID-19 uplift of 0.115 to HAL's asset beta, the UKCAA then reduces this by 0.085 to reflect a dramatic shifting of passenger volume risk from HAL to airline customers. This is achieved via a new Traffic Risk Sharing (TRS) mechanism. This mechanism shifts 50% of all traffic variations less than 10% from forecast from HAL to users. It also shifts 105% of (i.e., more than fully compensates HAL for) the risk of higher than 10% variation from forecast.

598. It is relevant to note that the 0.115 asset beta uplift (i.e., before the TRS decrement) is a very material increase in asset beta which should, if the logic is applied consistently, result in a permanent uplift to asset beta of this magnitude in all future determinations.

599. By contrast, the COVID-19 uplift that would result from application of the 2016 IM method is set out in Table 8-4. This can be calculated as the difference between asset betas estimated including and excluding the 18 months from 21 February 2020. So defined, the COVID-19 uplift is 0.10 using the wider sample and 0.12 using the draft decision sample.

- These are around the same or smaller than the UKCAA uplift (around 0.10 to 0.12 vs 0.115); and
- Are **temporary** (will fall to zero when COVID-19 falls out of the 10-year estimation window) while the UKCAA uplift is permanent (i.e., a permanent estimate of the expected impact of latent pandemic risk).

600. Moreover, the above direct uplift to the asset beta is not the only way in which the UKCAA has provided compensation for pandemic risk. The UKCAA also:

- Added £300m to HAL's regulatory asset base in 2018 prices from 2021 onwards;[178]
- Provided £25m per annum in all future years to compensate for the expected costs to HAL of a pandemic (based on an assumed frequency and length of a pandemic as set out in the last column of Table 11-2 above).
- Adopted a 0.87% lower forecast of passenger numbers than the UKCAA's "most likely" estimate.

601. It is relatively simple to express each of these changes in an "asset beta uplift" equivalent manner. That is, to calculate the asset beta uplift that would provide the same compensation to AIAL as the above policies provide to HAL (adjusting for differences in scale between HAL and New Zealand airports and also differences in risk sharing mechanisms in place). When I do this, I estimate that the UKCAA

178 UKCAA, CAP2524D, Economic regulation of Heathrow Airport Limited: H7 Final Decision Section 3: Financial issues and implementation paragraph 10.74.

policies outlined above would, if applied to AIAL, be **equivalent in value terms to a 0.28 permanent uplift in asset beta for New Zealand airports**.

602. In summary, continued application of the 2010 and 2016 IM method includes a temporary uplift in asset beta as a result of COVID-19 of around 0.10 which will apply only so long as COVID-19 data is included in the 10-year estimation window. By contrast, the UKCAA

- Implemented a **permanent** uplift of **0.115**;
- Applied three other policy **permanent** changes in response to the COVID-19 pandemic which are equivalent to further 0.28 uplift to asset beta for New Zealand airports;
- Combined, these are equivalent to a **permanent 0.395** uplift in asset beta.

603. It follows that continued application of 2016 IM methods can reasonably be characterised as involving a **temporary** uplift of 0.10 and that is around one quarter of the **permanent** compensation that would be consistent with the logic and calculations of UKCAA decision being applied to New Zealand airports.

604. The calculations that underpin my permanent 0.28 uplift in asset beta in the third dot point above are set out in Table 11-3 below.

Table 11-3: UKCAA non-asset beta policy changes expressed in asset beta uplift equivalent terms

	Expressed as a % of HAL RAB (£16bn)	Equivalent WACC uplift at HAL levels of risk exposure	NZ vs HAL risk exposure	Risk sharing adjusted WACC uplift	Equivalent asset beta uplift (WACC uplift divided by 7.5% TAMRP)
£300m RAB adjustment[179]	1.88%	0.135% (=1.88%*(AIAL WACC of 7.19%))	N/A (1 times)	0.164%	0.019
£25m pa for asymmetric pandemic risk[180]	0.16%	0.156%	10 times	1.563%	0.229
0.87% deliberate under-forecasting of median pax [181]	0.11%	0.109%	2 times	0.218%	0.031
Sum	N/A	0.43%		1.94%	0.279

Source: UKCAA, Economic regulation of Heathrow Airport Limited: H7 Final Proposals. CEG analysis.

605. Each row of this table can be explained as follows.

a. In consideration of the impact of COVID-19, a one-off permanent increase of £300m was applied HAL's regulatory asset base in 2018 prices from 2021 onwards. Any comparison to New Zealand airports should account for difference in scale of the airports. £300m represents around 1.88% of HAL's $16bn RAB.[182] A one-off 1.88% permanent increase in RAB is the equivalent, in dollar value terms, to a 1.88 percentage (not percentage point) increase in the WACC. Based on the draft decision midpoint WACC of 7.19% this is equivalent to a 0.16% permanent uplift to the WACC. This is equivalent **to a 0.019 (=0.135%/7.0%) permanent uplift in asset** (adopting the NZCC draft decision 7.0% TAMRP).

b. The UKCAA also modelled the impact that a future repeat of a COVID-19 type shock would have on HAL's profitability. The modelling assumed an annual probability of pandemic of 3.5% and that, if this occurred, revenue reductions in

179 UKCAA, CAP2524D, Economic regulation of Heathrow Airport Limited: H7 Final Decision Section 3: Financial issues and implementation paragraph 10.74.

180 UKCAA, CAP2524D, Economic regulation of Heathrow Airport Limited: H7 Final Decision Section 3: Financial issues and implementation, Table 11.2 at paragraph 10.36.

181 UKCAA, CAP2365D, Economic regulation of Heathrow Airport Limited: H7 Final Proposals Section 3: Financial issues and implementation, paragraph 10.31.

182 UKCAA financial model caa-h7-pcm-v2-11-7mar-fds.xlsm.

the following three years would be -73%, -76% and -32% respectively.[183] However, the losses to HAL that result from such a shock would be very largely offset by the traffic risk sharing (TRS) mechanism introduced by the UKCAA. Accounting for that risk mitigation and the low probability of a pandemic the UKCAA estimated that this asymmetric risk exposure required compensation of £25m per annum in all future. £25m per annum on a RAB of £16bn is equivalent to a permanent WACC uplift of 0.16% or a permanent asset beta uplift of 0.022 given a 7.0% TAMRP (=0.16/7.0%). However, the UKCAA TRS insulates HAL from the vast majority of traffic risk modelled by the UKCAA. New Zealand airports can reasonably be expected to be exposed to at least 10 times the risks from traffic loss for the same event (see Section F.1.1 below). Therefore, the internally consistent compensation for asymmetric risk would be 10 times higher for New Zealand Airports – **equivalent to a 0.23 asset beta uplift**.

c. Finally, the UKCAA adopted a 0.87% lower forecast of passenger numbers than the UKCAA's "most likely" estimate. This is intended to compensate for asymmetric risks that stem from non-pandemic events.[184] (The UKCAA has also permanently reduced its business travel forecast by 10%.)[185] Given annual revenues of around £2bn, a 0.87% reduction in passenger forecasts raises prices and expected revenues by around $17m or 0.11% of HAL's RAB. However, this is based on a risk sharing arrangement where HAL is exposed to only 50% of forecast error within a central band of 10%. Absent any similar risk sharing for New Zealand airports, compensation should be at least double HAL's. This implies a permanent revenue uplift of 0.22% (=2*0.11%) of RAB. This is equivalent to **0.031 permanent uplift** in asset beta (=0.22%/7.0%) with 7.0% TAMRP.

183 UKCAA, CAP2524D, Economic regulation of Heathrow Airport Limited: H7 Final Decision Section 3: Financial issues and implementation, paragraph 11.7. The Final Proposals set out the modelling in more detail than the Final Decision. The Final Proposal estimated £27m compensation per annum (not £25m pa). However, this difference appears to be due to changes in some of the baseline revenue allowances (not the actual modelling of pandemic events). The Final Proposals sets out that it has modelled a pandemic will "have an impact on passenger numbers over a three-year period" and "have an impact with a similar profile to that seen in and/or anticipated for 2020, 2021 and 2022: that is, precipitating a traffic reduction of -73%, -76% and -32% in each of the three years respectively." See CAP2365D H7 Proposals Section 3, paragraph 11.35 on page 116.

184 Ibid, see Chapter 11 and, specifically, paragraph 11.31.

185 "We decided to retain some long-term reduction of business travel in all but the most optimistic scenario, but to reduce that long-term impact from 20% to 10% in the most likely scenario for these Final Proposals. We decided not to alter our assumption on the associated impact of business travel demand on fares for these Final Proposals." (Section 1 paragraph 1.46, page 19).

F.1.1 HAL risk sharing versus a hypothetical "light handed" risk sharing mechanism

606. As noted above, the UKCAA proposes an extreme form of risk sharing. This is summarised in the quote below (emphasis added). [186]

> *The structure of our proposed TRS mechanism is very similar to that included in our Initial Proposals, with moderate risk sharing in a central band and stronger risk sharing in an outer band. As noted above,* ***the central band still covers differences of up to 10 per cent from CAA's passenger forecast*** *although, because of the new implementation method, this is assessed on a year by year basis rather than cumulatively over H7 as a whole. …*
>
> *Mindful of the need to strike a balance preserving HAL's incentives to facilitate traffic growth while also reducing the risk of significant gains or losses,* ***our Final Proposal is for a risk sharing rate of 50 per cent for the central band****. …*
>
> *Even if we were to set the risk sharing factor in the outer band at 100 per cent, therefore, which would effectively guarantee HAL's revenue from airport charges, it would still face an expected net loss of around £0.12 for every £1 reduction in airport charges that would have occurred in the absence of TRS. For this reason, we are proposing to adopt a risk sharing factor for the outer band of slightly more than 100 per cent. Even though this will more than compensate HAL for the loss of airport charges revenues, after taking account of the expected impacts on commercial revenues and opex we would still expect HAL to have a positive incentive to increase passenger numbers.*
>
> *On this basis,* ***our Final Proposal for the sharing rate for the outer band is 105%.*** *We estimate that this will protect HAL from between 91 and 94 per cent of the expected impact on its EBITDA of traffic changes in the outer band.*

607. In summary, HAL is insulated from at least 50% of variations in aeronautical revenues and is more than fully compensated for lost aeronautical revenues beyond 10% variation from forecasts. That means, by way of example, if passenger volumes fell to zero for a year, HAL would still receive 99.5% of forecast revenue (5% from the central band and 94.5% (=90%*1.05) from the outer band).

608. By way of comparison, the IM asset beta does not explicitly assume the existence of any risk sharing mechanism. To the best of my knowledge, the only listed New Zealand airport (AIAL) had no risk sharing mechanism in place during the pandemic.

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[186] See CAP2365B H7 Proposals Section 1, paragraphs 2.39 to 2.44 on pages 41 to 42.

Even if risk sharing mechanisms did exist, they would almost certainly be less protective than the HAL scheme which is, to the best of my knowledge, provides more protection to HAL than almost any other airport (with the possible exceptions of Copenhagen and Vienna airports – see Section 5.1 below).

609. For the purpose of illustration, I compare the HAL risk sharing regime with a "light handed" risk sharing regime where

- The airport has zero insulation from within the central band;
- The central band is at least a 50% wider (15% vs 10%) than HAL's;
- The central band is cumulative over a 5-year period – which means it is much less likely to be exceeded than HAL's which is assessed annually; and
- In the event that the central band is exceeded, the airport is compensated for *at most* 100% of the revenue loss beyond 15%.

610. Such an airport would have:

- zero insulation from normal fluctuations which result in 5-year revenues varying by less than 15% from forecast. By contrast, HAL is insulated from more than two thirds of a 15% variation (HAL is insulated from half of the first 10% variation and 105% of the next 5% variation).
- much less insulation than HAL from shocks to revenues that are larger than 15%. For example, a 60% shock to revenues would result in the airport suffering an at least 15% loss in revenues while HAL would suffer only a 2.5% loss in revenues (=0.5*10% less 0.05*(60%-10%)).

611. This is why I state, in paragraph 605.b that New Zealand airports are at least 10 times more exposed to the pandemic event that the UKCAA modelled when estimating compensation for asymmetric risk. I used this 10 times factor to scale up the "risk adjusted" UKCAA asymmetric compensation for exposure to a major pandemic event. The calculation of this 10 times factor is based on the following:

- Modelling the same magnitude pandemic event as the UKCAA models (a 3 year impact where traffic volumes are depressed by -73%, -76% and -32% respectively).
- HAL's TRS examines each year independently and HAL will suffer losses in each year respectively of annual forecast revenue multiplied by:
  - 1.85% (=0.5*10%-0.05*(73%-10%));
  - 1.70% (=0.5*10%-0.05*(76%-10%));
  - 3.90% (=0.5*10%-0.05*(32%-10%));
  - The sum of these losses across 3 years is 7.45% of annual revenue.

- By contrast, the *minimum* loss that the hypothetical airport with a light handed risk sharing mechanism can suffer is 15% of PSE revenue. That is 75% (=5*15%) of annual revenues.
- 75% is more than 10 times 7.45% which is the derivation of the 10 times factor.

612. Of course, this conclusion that of one tenth the insulation as HAL is only relevant to a large shock of the kind modelled here. For smaller shocks that do not trigger the central band threshold, the airport has zero insulation compared to at least 50% insulation for HAL. Thus, on average, the level of insulation provided is much less than one 10^{th} the level of insulation afforded HAL.