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Treatment of systemic and asymmetric risk in NZCC PSE4 consultation paper

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COMPETITION ECONOMISTS GROUP

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1 Executive summary

1. There is a 1.22% (122bp) differential between AIAL's modal target return of 8.73% and the NZCC's Scenario 2 midpoint post-tax WACC of 7.51%. This differential is substantially (more than fully) accounted for by making the following two (three) adjustments to the NZCC Scenario 2 midpoint post-tax WACC:

   - **49bp:** being the lower bound estimate of the annualised cost of asymmetric cash-flow risk - which can be characterised as either:
     - an increment to the WACC (which is, by definition, a mean expected return) to convert it into a modal (most likely) return (allowing a like-for-like comparison to AIAL's modal target return); or
     - a decrement to AIAL's modal target return to convert it into a mean expected return (allowing a like-for-like comparison to a WACC estimate).
   - **63bp**: the impact of correcting for coding errors affecting the 2023 IM.
   - **49bp**: adopting the sample selection criteria from the 2016 IM rather than the 2023 IM for the purpose of estimating the pre-COVID asset beta (given that the change in sample selection criteria was unrelated to incorporating pandemic risk). This raises the corrected pre-COVID asset beta from 0.65 to 0.73.

2. Accepting all three adjustments makes the adjusted Scenario 2 return 9.12%, which is 39bp higher than the AIAL's target return (8.73%). Clearly, targeting a return that is lower than the benchmark should not raise excessive profitability concerns.

3. Accepting only the first two adjustments results in an 8.63% benchmark return which is 10bp below AIAL's target return. Arguably this does not raise any concerns given:

   - It is a relatively small difference (just the 53rd percentile WACC); and
   - PSE4 has heightened risk indicators (with AIAL and the NZ economy coming out of COVID-19 and high levels of capital expenditure for AIAL).

4. Even adopting a cost of asymmetric risk estimate of 31bp[1] (resulting in a benchmark return of 8.45%), the difference only rises to +28bp, which is at the 57th percentile (less than the 65th percentile applied to electricity businesses by the NZCC).

5. On this basis, I do not consider that there is a strong case for finding AIAL is targeting an excessive level of profitability.

6. Figure 1-1 and Table 1-1 summarise the estimates described above.

[1] Based on the UKCAA precedent without adjusting for higher AIAL risk and not including the 14bp associated with the ex post Heathrow RAB increase.

Figure 1-1: Summary of estimates

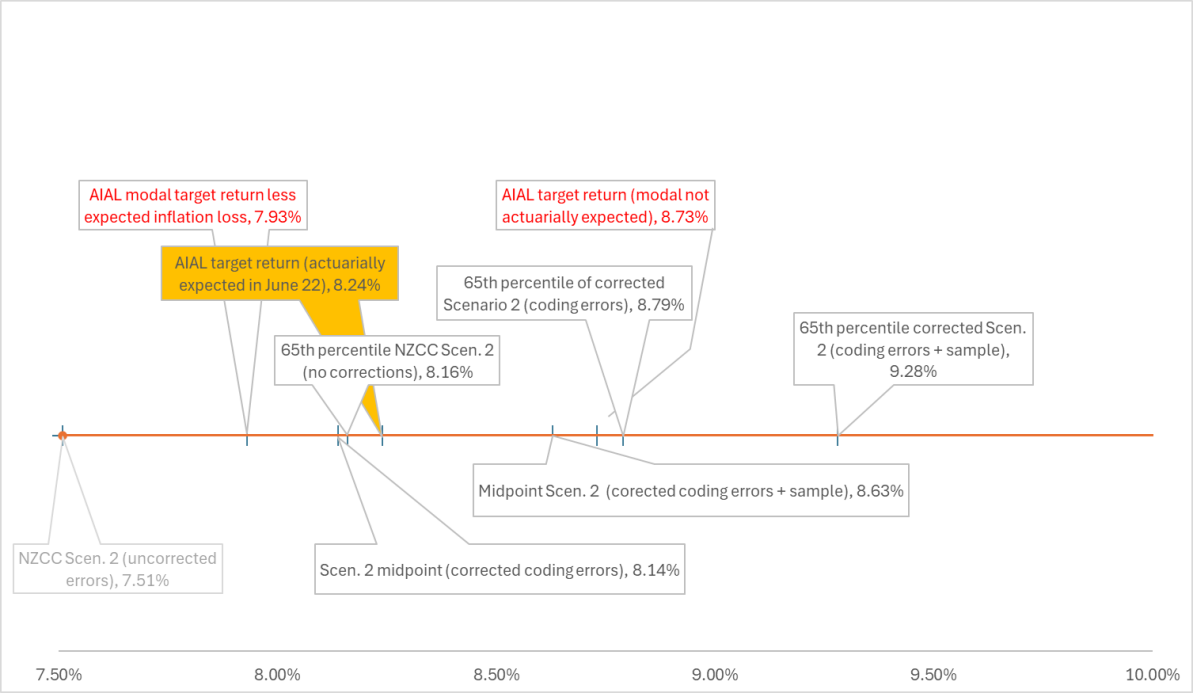

Table 1-1: Summary of calculations

	Expected return* midpoint (range)	Modal return* midpoint (range)
NZCC scenario 2 (2023 IM)	7.51%	8.00%
AIAL actuarially expected (June 2022) target return	8.24%	8.73%
Midpoint NZCC scenario 2 (2023 IM) corrected for coding errors	8.14% (7.86% to 8.42%)	8.63% (8.35% to 8.91%)
65th percentile of NZCC scenario 2 (7.51% + 0.65%)	8.16%	8.65%
65th percentile corrected for coding errors	8.79% (8.51% to 8.07%)	9.28% (9.00% to 9.56%)
Midpoint NZCC Scenario 2 corrected for coding errors and using 2016 IM sample selection method	8.63% (8.35% to 8.91%)	9.12% (8.84% to 9.40%)
65th percentile of NZCC Scenario 2 corrected for coding errors and using 2016 IM sample selection	9.28%% (9.00% to 9.56%)	9.77%% (9.49% to 10.05%)

* The difference between "expected return" and "modal return" is 0.49bp – which is my lower bound estimate of the cost of asymmetry in expected cash-flows (how much lower expected returns are than most likely returns).

2 Introduction

7. I, Tom Hird of [redacted] Victoria, have been engaged by AIAL to provide an independent expert response on the Commerce Commission's review of AIAL's proposed WACC (excluding TAMRP) for PSE4.[2]

8. I have been asked by Auckland International Airport Limited (AIAL) to provide a review of the New Zealand Commerce Commission's (NZCC) consultation paper's treatment of AIAL's PSE4 pricing event.[3] I have been asked to:

   a) update the 2016 IM parameter estimates for asset beta and leverage to reflect new data including in relation to the impact of exposure to pandemic risk;

   b) advise on reasonable estimates of the annualised cost of asymmetric cash-flow risks; and

   c) to consider whether there are any reasons to believe PSE4 falls within a period of unusually high economic uncertainty/risk for AIAL.

9. In relation to "a" above, I have been asked to assume that the methodology described in the NZCC 2023 IM decision for dealing with COVID-19 is appropriate.[4] I have been asked to use that methodology to update the 2016 IM asset beta and leverage parameters to account for the impact of COVID-19. I have been asked to exclude from my analysis any changes in the 2023 IM methodology that are unrelated to capturing new information provided by the experience with COVID-19.

10. This report has the following structure:

    - Section 3 addresses the estimates of asset beta and leverage updated from the 2016 IM to take account of new COVID-19 data;
    - Section 4 addresses the expected annualised cost of exposure to asymmetric cash-flows;
    - Section 5 addresses the relative uncertainty of PSE4 compared to some concept of an "average" price setting event.

11. I hold the following qualifications:

    - Bachelor of Economics (Honours First Class), Monash University (1989); and
    - PhD in Economics, Monash University.

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2 NZCC, Review of Auckland Airport's 2022-2027 Price Setting Event, Consultation Paper, 17 July 2024. In this report, I adopt a TAMRP of 7.0% proposed by the NZCC under scenario 2, paragraph 2.79.

3 NZCC's Review of Auckland Airport's 2022-2027 Price Setting Event

4 This assumption shouldn't be taken as acceptance that the 2023 IM is appropriate.

12. From 1990 to 2000 (both prior to, during and after the completion of my PhD in economics) I was employed by the 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 many cases specialising in finance theory.

13. 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, the United Kingdom and New Zealand.

14. In completing this report, I have received assistance from my colleague at CEG, Samuel Lam. Notwithstanding this assistance, all the opinions expressed in this report are my own.

15. 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.

3 Critique of asset beta used in NZCC consultation paper WACC Scenarios

3.1 My previously expressed views

16. I have written two previous reports for AIAL in relation to its approach to targeting returns for PSE4. The key conclusions of those reports were:[5]

    i. AIAL's estimate of the WACC needed to capture compensation for exposure to systemic risk associated with pandemic like events. The 2016 IM parameters did not include compensation for this risk and, therefore, they needed to be amended/updated.

    ii. The best methodology to do so would be to update the 2016 IM methodology to estimate asset beta using the available data at the beginning of the PSE4 and to consistently apply this method in PSE5 and beyond.[6]

        - The alternative to the best methodology would be to attempt to use the most recent COVID-19 affected data to in order to "reweight" the effect of COVID-19 to better reflect a similar pandemic's actuarially expected frequency within the PSE4 asset beta estimate. This is what has become known as the Flint approach based on the estimation method used by consultants to the UKCAA. I explained that this approach was overly complicated, biased and error prone.

    iii. Whatever WACC AIAL estimated, it needed to target a higher modal (i.e., "most likely") return in order to have an actuarially fair (i.e., mean) expectation of achieving the WACC. This is because, in the presence of asymmetric cash-flow risks (including, but not limited to, pandemic risk) the mean return is below the most likely return. That is:

        - AIAL needed to target a modal return that was above WACC (by the actuarially fair expected cost of asymmetric shocks); and/or

5 Tom Hird, AIAL asset beta and WACC estimates for PSE4, February 2023. Tom Hird, Review of feedback on AIAL WACC estimates for PSE4, May 2023.

6 Specifically, applying the 2016 IM asset beta sample, asset beta estimation method and gearing methodology using the 10 years of data up to the beginning of PSE4 (as well as updating risk free rate and debt risk premium estimates consistent with the 2016 IM methodology). I argued that consistently updating the asset beta using rolling 10 year estimation periods would ensure that all events (including COVID-19) would be weighted consistent with their actuarially expected frequency and severity.

- The actual WACC (mean expected return) being targeted by AIAL needs to be interpreted as the modal return being targeted *less* the actuarially fair expected cost of asymmetric shocks.

3.2 The NZCC consultation paper position

17. The New Zealand Commerce Commission's (NZCC's) 17 July Consultation Paper[7] reaches the conclusion that:

> *We understand why Auckland Airport has updated the equity beta estimate in the 2016 IMs. The equity beta is normally a relatively stable estimate over time and the estimate made at the IM review would be expected to be applicable for the period of the IMs. However, the COVID-19 pandemic has had a disruptive effect on airports which may have caused the equity beta estimate in the 2016 IMs to be out of date.* ***We therefore accept that Auckland Airport had legitimate reasons for departing from using the 2016 IMs for their calculation of the equity beta.*** [Paragraph 2.46, emphasis added]

18. This is consistent with my previously expressed conclusion, summarised in section 3.1 above. Namely, that it was necessary for AIAL to depart from the 2016 IM asset beta parameter in order to account for the impact of COVID-19.

19. However, the NZCC and I differ in relation to how this update should be performed. I previously argued that the 2016 IM methodology should be reapplied including COVID-19 affected data. This was the approach that AIAL adopted. However, the NZCC consultation paper argues that this would overweight pandemic related risk relative to an actuarially fair assessment of pandemic risks effect on beta over PSE4.[8]

20. The NZCC concludes that:

> *While the method Auckland Airport has used is the method we previously used to calculate equity beta, the purpose of the equity beta is not to provide compensation for historical events. Instead, the equity beta is a forward-looking estimate of the relative risk from holding an airport company in a diversified portfolio of investments compared to holding the market share index. The equity beta that should be applied to the WACC for PSE4 is the market's view of the equity beta over the PSE4 period, which we discuss further in the next section. We consider that such a calculation would help to ensure the objectives in s 52A(1)(a) to (d) are promoted.*

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7 NZCC, Review of Auckland Airport's 2022-2027 Price Setting Event, 17 July 2024 ("NZCC Consultation Paper")..

8 NZCC Consultation Paper paragraphs 2.48 to 2.49.

> *In comparison, Auckland Airport's calculation of the equity beta places considerable weight on the period of the COVID-19 pandemic when equity betas were the highest. In effect, Auckland Airport is assuming investors consider that the prospect of another COVID-19 type event will result in the average equity beta for PSE4 being equal to the average equity beta over the 10-years to 30 June 2022.*

21. The NZCC posits the view that the entirety of the 2023 IM final decision provides the best methodology for arriving at an updated estimate of the impact of pandemic risk on AIAL's asset beta. The 2023 IM is described as the NZCC's "best estimate of the methods that would be used by investors, market analysts and companies to determine the WACC for airports in the context of the COVID-19 pandemic" (paragraph 2.70).

> *An alternative is to use the outcomes of the 2023 IM review. Even though these outcomes were not available to Auckland Airport when it set its prices, the outcomes are our best estimate of the methods that would be used by investors, market analysts and companies to determine the WACC for airports in the context of the COVID-19 pandemic. As such these are the (benchmark) values that we consider reasonable if the asset beta, leverage (and TAMRP) were estimated at the relevant time.*

22. The NZCC includes two scenarios (Scenarios 1 and 2) against which it compares AIAL's target rate of return. Scenario 1 is simply adopting the 2016 IM asset beta and leverage parameters. Scenario 2 is adopting the 2023 IM asset beta and leverage parameters (and, implicitly, all aspects of the 2023 IM methodology).

3.3 Response to the NZCC scenarios

23. Scenario 1 is, in my view, irrelevant to assessing AIAL's PSE4 target returns. It is based on the 2016 IM asset beta and leverage which are themselves based on data ending in March 2016. The NZCC acknowledges, and I agree, that the 2016 IM parameters do not provide a reasonable reflection of the best estimate of asset beta risk over PSE4 (including in relation to pandemic beta risk).

24. In relation to Scenario 2, the 2023 IM adopted the Flint approach to estimating the effect of pandemic risk on asset beta. For the reasons set out in my previous reports, and as summarised in section 3.1, I do not consider that adopting the Flint approach is sensible regulatory policy. The Flint method involves a number of arbitrary assumptions (about the duration and length of future pandemics) and these will inevitably be wrong. In my view, the only way to accurately compensate for pandemic risk (and all other systemic risks) actually experienced by investors is to use a 10-year asset beta estimation window updated at the time of each PSE – which was consistent with the 2016 IM method.

25. Nonetheless, consistent with my instructions, for the purpose of this report I adopt the NZCC position that the best way to adapt the 2016 IM's to new data (including COVID-19 data) is to attempt to re-weight the pandemic using what has become known as the "Flint approach" - which is the approach the NZCC adopted in the 2023 IM.

26. Nonetheless, I consider that Scenario 2 of the consultation paper is problematic for two reasons:

    - First, there were two coding errors that result in the 2023 IM published estimates not giving effect to the 2023 IM stated methodology. Correcting these raises my estimate of the pre-COVID asset beta from 0.63 to 0.65 and raises my estimate of the Flint method pandemic asset beta uplift from 0.04 to 0.07 to 0.15 (i.e., an increase of 0.03 to 0.11); and
    - Second, the NZCC's 2023 IM change to the asset beta sample selection criteria are for reasons unrelated to updating the parameters for revealed pandemic risk. Indeed, the 2023 sample is only used to estimate a pre-COVID-19 asset beta and, therefore, cannot be said to be a response to COVID-19. I therefore include a sensitivity in which I use the 2016 IM asset beta comparator sample selection methodology rather than the 2023 IM sample. This results in my estimate of the pre-COVID-19 asset beta rising from 0.65 (inclusive of coding correction) to 0.73.

3.3.1 Coding errors in the 2023 IM

27. In April 2024, a joint expert report was provided to the NZCC explaining that the experts (of which I was one) believed that there were two unambiguous coding errors affecting the NZCC's 2023 IM asset beta estimate.[9]

> *This report outlines two unambiguous coding errors in the NZCC R code used to derive asset beta values consistent with the reasoning in the 2023 IM final decision.*
>
> ***Error#1.*** *The NZCC intended to calculate the "pre-COVID" asset beta by averaging the weekly and four-weekly pre-COVID asset betas. However, the code only averaged the weekly asset betas. This correction will change the pre-COVID asset beta from 0.63 to 0.65.*
>
> ***Error #2.*** *The NZCC sought to apply the "Flint method" to inform its judgment in determining an appropriate level of pandemic adjustment. The Flint method was to apply a Weighted Least Square (WLS) regression for calculating equity betas (which are then transformed into asset betas)*

[9] Joint report of CEG, Incenta and Houston Kemp, Responding to Coding errors made by NZCC, 1 April 2024, p. 2

where COVID affected data is given less weight than non-COVID affected data in line with an assumed lower ex ante probability of a future pandemic. This use of WLS was also explicitly recommended by TDB and Dr. Lally.

The NZCC code incorrectly implemented the WLS which resulted in the regression coefficients having no meaningful economic interpretation. The closest interpretation possible is that the regression is actually modelling a one in 660 year pandemic when it is trying to model a one in 50 year pandemic. The correct implementation of the WLS regression changes the range of the pandemic premium for AIAL's weekly asset beta from the reported 0.02-0.08 range in the final decision to 0.07-0.15.

28. Correcting that coding error raises the draft decision pre-COVID asset beta to 0.65. Correcting the coding errors in implementing the Flint estimate for a pandemic uplift changes the Flint uplift to a range of 0.07 to 0.15 (0.03 to 0.11 higher than the NZCC's estimate of 0.04).

Table 3-1: Asset beta and WACC after correcting coding errors (not correcting sample selection)

Reference point	Asset beta	Mid-point post-tax WACC
2023 IM errors corrected – lower bound uplift	0.72	7.86%
2023 IM errors – upper bound uplift	0.80	8.42%
2023 IM errors corrected – midpoint	0.76	8.14%

3.3.2 Use of 2016 IM sample selection methodology

29. I also estimate the pre-COVID-19 asset beta using the 2016 IM sample selection method. I do this because PSE4 should otherwise be covered by the 2016 IM and the only reason for departing from the 2016 IM parameter values is due to updated data, including from COVID-19. It follows that the only relevant changes in methodology between the 2016 and 2023 IMs are those that were required to incorporate new data (including COVID-19 affected data).

30. The adoption of the Flint method to estimate pandemic risk and the estimation of a "pre-COVID" asset beta using an estimation window ending in February 2020 are both responses to new data and reflect changes in methodology necessary to implement the NZCC's response to COVID-19.

31. However, by definition, the NZCC's pre-COVID-19 asset beta estimate relies solely on pre-COVID-19 data. It follows that the decision to change sample selection method used to estimate a pre-COVID-19 asset beta cannot be said to be an adaptation

necessary to reflect the effect of COVID-19. By definition, the NZCC does not use pandemic data from the comparators to estimate the pre-COVID asset beta. Only AIAL's COVID-19 data was used to estimate Flint method the pandemic uplift and AIAL is selected as a comparable under both the 2016 and 2023 IM methodology. Therefore, the estimated impact of COVID-19 on asset beta would be identical with and without the change in sample selection.

32. If I retain the 2016 IM sample selection criteria but adopt all other elements of the 2023 IM asset beta estimation methodology, I estimate a pre-COVID sample average asset beta of 0.73 (see Appendix A for the full sample used). This is 0.08 higher than the 0.65 asset beta that results from the (correct) implementation of the 2023 IM method to the 2023 IM sample (noting that the 2023 IM reports a value of 0.63 but this involves a coding error that when corrected raises this value to 0.65 – see discussion in section 3.3.1).

Table 3-2: Asset beta and WACC using 2016 IM sample selection and pre-COVID asset beta of 0.73 (but still using incorrect 2023 IM 0.04 Flint uplift estimate)

Reference point	Asset beta	Leverage	Mid-point post-tax WACC
2016 sample methodology – 0.04 IM published pandemic uplift	0.77	16%	8.14%

3.3.2.1 Step by step description of change in IM sample selection

33. I have already noted that the pre-COVID-19 sample is only used to estimate a pre-COVID-19 asset beta – and so changes in selection criteria cannot be attributed to dealing with COVID-19. Moreover, the 2023 IM steps through its reasoning and is explicit that changes to the sample selection method were not in response to new information unveiled by COVID-19. The 2023 IM sample selection criteria go through four steps not in the 2016 IM method:[10]

    i. First step, remove firms with negative leverage due to:

    *"…our concerns about some of the firms using negative leverage to offset risks specific to their particular market (**even outside of the Covid period**)"*

    ii. Second step, remove firms that are relatively illiquid.

[10] NZCC, Cost of capital topic paper Part 4 Input Methodologies Review 2023 – Final decision, 13 December 2023, paragraph 4.157-4.164.

> *We also consider it appropriate to* ***remove firms that are relatively illiquid****.*

34. The first and second steps remove 11 out of 24 firms. This is due to a change in sample selection criteria that cannot be (and was explicitly stated not to be) specific to the COVID-19 period (and would be illogical if it was specific to the COVID-19 period given that no data from this period was used to estimate the pre-COVID asset beta). Relative to the sample based on the 2016 IM selection criteria, these exclusions lower the pre-COVID asset beta by 0.04 (from 0.73 to 0.69, and raises the leverage from 16% to 24%) lowering the midpoint post tax WACC by 0.20% (for example, from 8.63% (see Table 3-3 below) to 8.43% based on the corrected midpoint Flint uplift).

35. Of the remaining 13 firms:

    iii. Third step: remove firms with country stock market classifications that are lower than "advanced emerging" (GMRI and Malta);

    iv. Fourth step: remove firms that have high asset beta variability (Malaysian Airports and Grupo Aeroportuario del Centro from Mexico).

36. These additional 4 exclusions reduce the sample from 13 to 9 firms. None of the rationales for these exclusions are based on the sample needing to change in response to COVID-19.

37. That said, the final decision does include the following non-sequitur in relation to why Malaysian Airports and Grupo Aeroportuario del Centro from Mexico were excluded:[11]

> *There was criticism in submissions that we should not use country risk premium as an indicator because a firm's asset beta is relative to the market it is traded on, and all markets have an average equity beta of 1.0. This is a reasonable point.* ***However, we are also endeavouring to establish a sample that can be used to understand the effects of the pandemic, and firms in countries that are not classified as developed or advanced emerging tend to have greater volatility in their asset beta estimates****. Instead of using country risk premium, it may be more appropriate to remove firms with relatively high beta variability.* ***On this basis,*** *there are grounds for excluding the firms from* ***Malaysia and Mexico****, and we have decided to do so.*

38. The reference to "a sample that can be used to understand the effects of the pandemic" is a non-sequitur because the NZCC does not use the final sample of 9 firms to estimate the effect of the pandemic. The NZCC only uses AIAL's data to estimate the effect of the pandemic. Including or excluding Malaysia and Mexico from its final sample would have no impact on the NZCC's estimate of the effect of

[11] Ibid, paragraph 4.163.

the pandemic. Excluding firms with "relatively high beta variability" from the sample used to estimate the pre-COVID-19 asset beta can have no rationale link to the experience of COVID-19 (which was completely excluded from the pre-COVID-19 asset beta estimate).[12]

39. In summary, the new criteria adopted in the 2023 IM were open to the NZCC to apply in the 2016 IM and would have had a similar effect at that time. The NZCC did not adopt those criteria at that time.

40. Of course, it is true that:

- the effect of the NZCC's 2023 decision to apply new selection criteria is to lower the estimated pre-COVID estimated asset beta (relative to the 2016 IM sample selection method) by around 0.08; and
- this more than offset the effect of providing a pandemic uplift using the Flint method and COVID-19 data (incorrectly estimated by the NZCC to be 0.04 but correctly estimated to be 0.07 to 0.15).

41. However, to note that these effects "cancel out" is not the same as to argue that the latter COVID-19 uplift played a causal role in the NZCC's former decision (to change the sample selection criteria). There is nothing in the NZCC reasoning to suggest that this is the case and, indeed, if there were evidence of such a causal link this would be highly problematic.

3.3.3 Combining corrected uplift and corrected sample

42. The following table estimates the asset beta and WACC impacts of correcting both sample selection (i.e., using the 2016 IM selection criteria) and coding errors in the pandemic uplift estimate.

Table 3-3: Asset beta and WACC using 2016 IM sample selection method (0.73 pre-COVID asset beta)

Reference point	Asset beta	Leverage	Mid-point post-tax WACC

[12] Simply put, the NZCC 2023 methodology has two objectives. First, select a sample that provides the best estimate of the base asset beta pre-COVID-19. Second, select a sample that provides the best estimate of the effect of COVID-19 (for the purpose of estimating a pandemic uplift). These two samples do not need to be the same and, indeed, were not the same in the 2023 IM (9 firms in the first sample and only 1 firm (AIAL) in the second). If the reason why the two Malaysian and Mexican firms were excluded from the first sample is because they were unfit for inclusion in the second sample then that would be a serious error in the final decision (noting that 8 other firms were included in the first sample despite being deemed unfit for the second sample).

0.73 + 0.07 lower bound pandemic uplift	0.80	16%	8.35%
0.73 + 0.15 upper bound pandemic uplift	0.88	16%	8.91%
Midpoint	0.84	16%	8.63%

4 Adjusting WACC for asymmetric risk to compare with modal target returns

43. The NZCC consultation paper states (emphasis added):

> *The mid-point WACC represents our starting point when assessing returns for profitability analysis, but we accept that there may be legitimate reasons for an airport to target returns that are different to our midpoint WACC estimate.*[21]
>
> *If the airport has departed from our mid-point WACC estimate, what are each of the parameter values used? Has the airport applied an uplift to its mid-point cost of capital (**eg, due to asymmetric risks**), and if so, what adjustment is made?*

4.1 What is asymmetric risk to cash-flows?

44. The Actuaries Institute defines asymmetric risks as follows:[13]

> *Asymmetric risks arise where cash flows or values have an asymmetrical statistical distribution. Common examples include a skewed distribution where the dispersion of outcomes is greater for negative results than for positive ones and an embedded option which generates a "kinked" payoff. Where the outcome function is non-linear, the outcome from a deterministic projection of the mean assumption values may misstate the mean value of the outcome function.*

45. AIAL's pricing model does not include any compensation for the actuarially expected cost of asymmetric risk exposure within operating costs. As a result, and as I noted in my May 2023 report for AIAL:[14]

> *…AIAL will be under-compensated so long as it does not include in its cost build up the actuarially expected cost of these asymmetric shocks. AIAL's proposed wash-up mechanism limits, but far from eliminates, AIAL's exposure to extreme negative shocks to revenues (such as from future pandemics). AIAL has not proposed such direct compensation for asymmetric risk exposure and this is the basis for my conclusion that AIAL is under-compensated for risk.*

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13 Actuaries Institute, Life Insurance Practice Committee, Information Note: Asymmetric Risks, September 2021

14 CEG, Review of feedback on AIAL WACC estimates for PSE4, May 2023, paragraph 68.

46. This means that AIAL's 8.73% target return in PSE4 needs to be interpreted as a target modal return. This is the "most likely" return that AIAL will receive. This is above the actuarially expected return for PSE4 after accounting for asymmetry in expected cash-flows.

4.1.1 Sources of asymmetric risk to AIAL

47. A pandemic is one, but only one, potential source of asymmetry in cash-flows. During PSE3 passenger numbers fell to around 5 million pa over FY21 and FY22 compared to forecasts of around 22 million. This is an asymmetric event because it is infrequent and there is no offsetting "opposite of pandemic" event that would have passenger demand doubling for several years relative to business-as-usual forecasts (and even if demand did suddenly double relative to forecast it is highly unlikely that AIAL and airlines could raise capacity sufficiently to accommodate that demand).

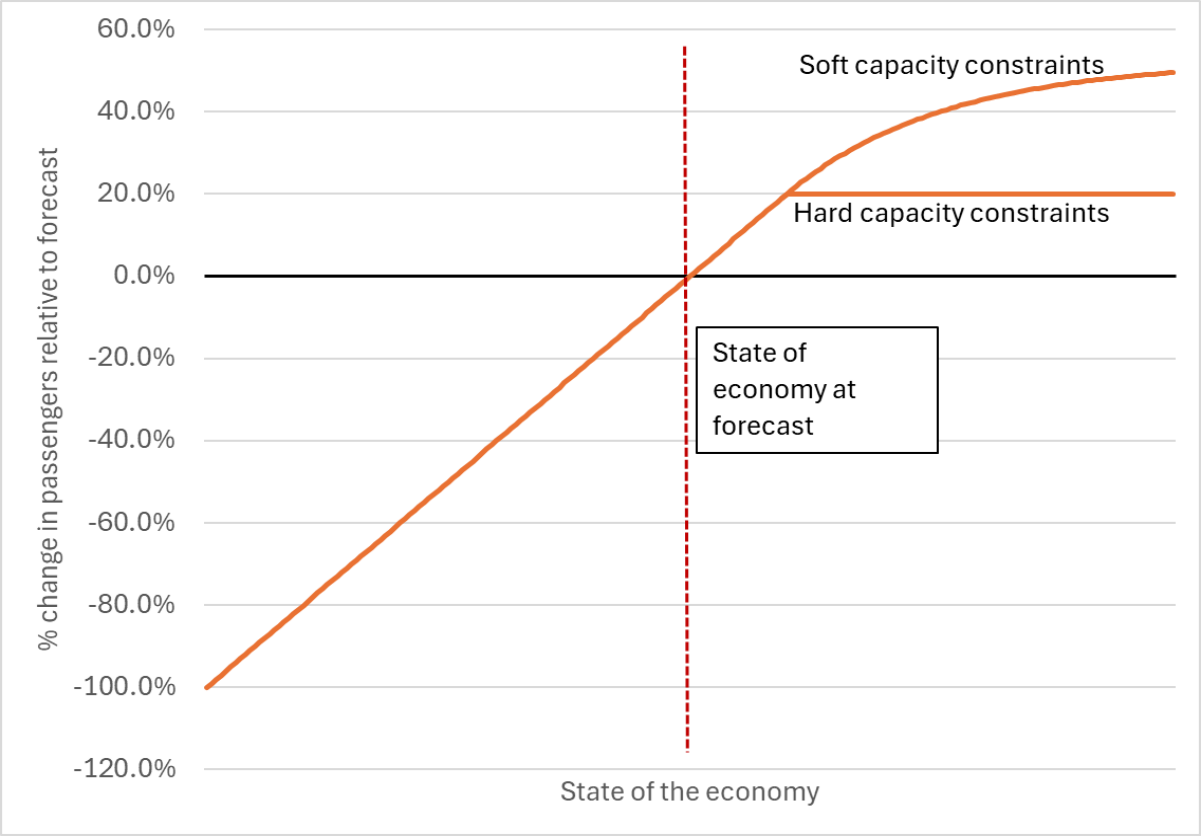
48. Other asymmetric risks that AIAL is exposed to include natural disasters (such as earthquakes), terrorism, wars, airline insolvency, labour conflict, financial crises and inflation outbreaks. These might affect AIAL directly or airports that AIAL provides connections to. Such asymmetric events can have effects on demand but also on costs incurred by AIAL (e.g., an earthquake in Auckland may affect AIAL's passenger numbers and its expenditures).

4.1.1.1 Asymmetry in distribution of passenger numbers

49. Moreover, as alluded to above, even if volatility in demand for flights (passenger willingness to pay to fly to/from AIAL) was not asymmetric there are capacity constraints in the airport/airline system that means that symmetrical demand volatility will still translate into asymmetry in the distribution of actually flown passenger numbers.

50. Put simply, there is nothing stopping airlines and airports from adapting to a large fall in passenger demand (planes can easily be grounded as they were during in COVID-19). But constraints on airport and airline capacity means that a large increase in passenger demand will be at least partially choked off by capacity constraints (at AIAL, at other airports AIAL connects with and/or at airlines who fly from AIAL). This role for capacity constraints is illustrated in the figure below.

Figure 4-1: Illustration of asymmetrical passenger number volatility



51. As illustrated in the chart above, the red dotted line shows the expected state of economy at the time of forecast. Actual passenger numbers are assumed to vary linearly with variations in the state of the economy from forecast. If there are negative shocks to the economy, passenger numbers would fall accordingly until reaching zero in the worst-case scenarios (-100% of forecast number).

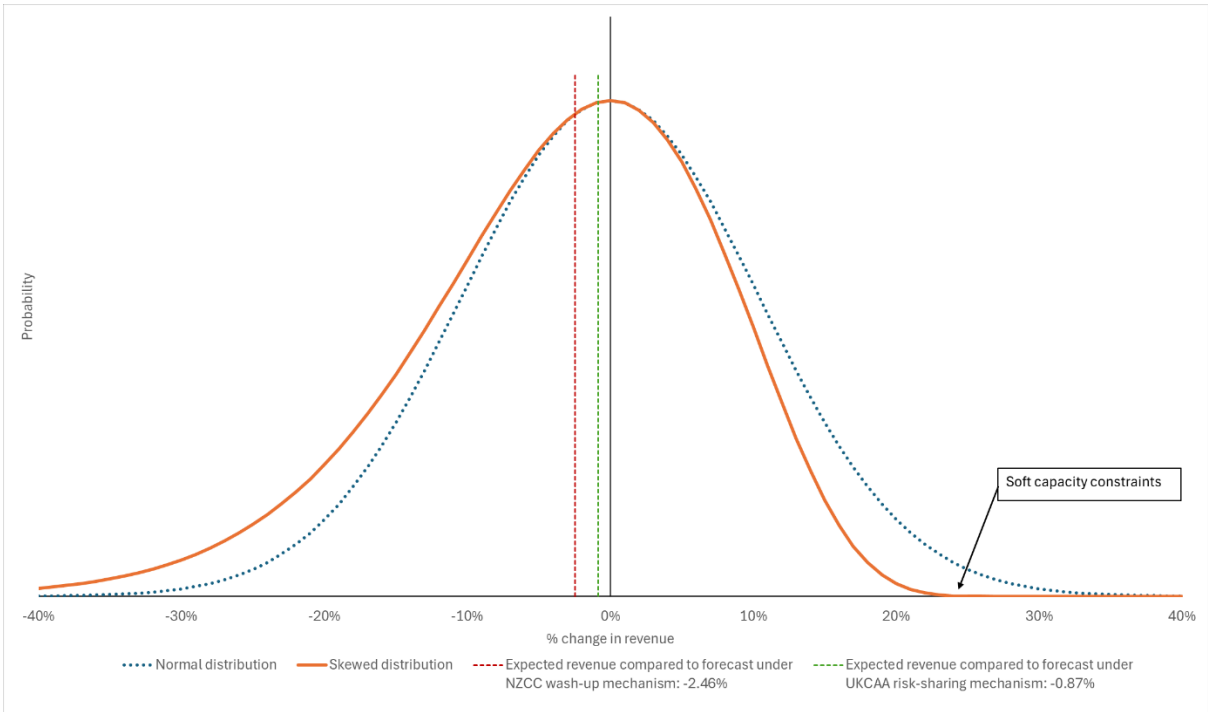
52. However, due to the capacity constraints, the positive shock to the economy will have limited effect to the passenger numbers. In the illustration above I show both a "hard cap" and a "soft cap" that begins to bind at 20% above the forecasted passenger numbers. In reality, capacity constraints (for airports and airlines) are more likely to show up in gradual "soft constraints" rather than having a hard kink.

53. Figure 4-2 below compares a symmetric normal distribution with an asymmetric distribution for passenger numbers (with the horizontal axis being the deviation from the most likely (modal) forecast and the vertical axis being the probability of that event occurring). The blue dotted line represents the idealised symmetrical normal distribution for passenger numbers. By contrast, the orange line describes an asymmetrical distribution of passenger numbers.

54. Under the normal distribution the positive variations to passenger numbers are the same as the negative variations (e.g., the probability of being 50% above forecast is

the same as the probability of being 50% below forecast). Under the normal distribution, the mean (actuarially expected) number of passengers is the same as the most likely (modal) forecast. Therefore, the mean deviation from the modal forecast is zero (0%). Under the orange distribution, the mean (actuarially expected) number of passenger numbers is 3.4% below the modal (most likely) forecast.

Figure 4-2: Illustration of skewed distribution of asymmetric risks



55. Under the asymmetric distribution there are more scenarios leading to a decrease in passenger numbers (as low as zero in the most extreme cases such as a devastating earthquake) than there are for large increases in revenue even absent capacity constraints.

56. I will return to this figure when discussing the UKCAA's allowance for the annualised cost of asymmetric cash-flow risk in section 4.3 below.

4.1.1.2 Asymmetry in exposure to inflation risk

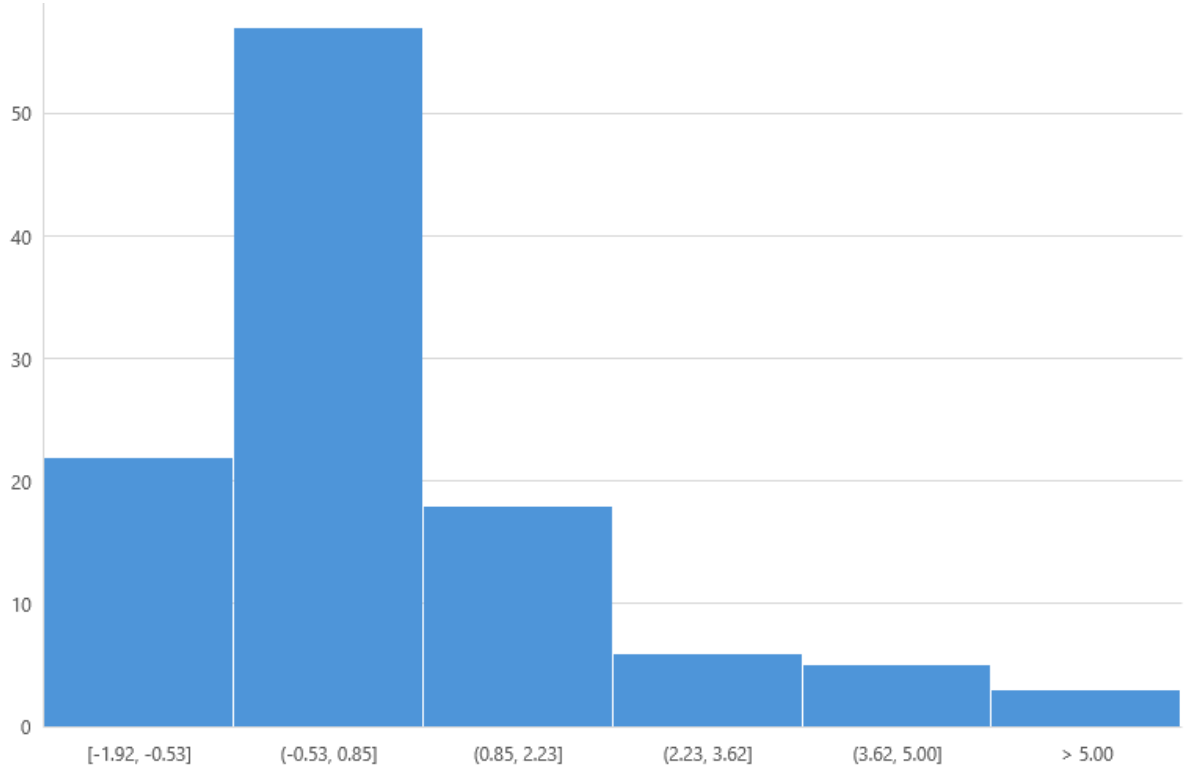
57. A further important source of asymmetric risk for AIAL is exposure to inflation risk. I note that AIAL is negatively/positively exposed to positive/negative deviations from expected inflation. This is because AIAL's regulated asset value is not indexed to actual inflation and its PSE4 target return is nominal.

58. AIAL is compensated for expected inflation that is built into the nominal risk free rate that is used to set target WACC at the beginning of the PSE. However, if actual

inflation is above/below that level then AIAL's real return (which is what matters to investors) will be below/above target real return built into that risk free rate estimate.

59. If the probability of large positive deviations from expected inflation is higher than the probability of large negative deviations, then this is a source of asymmetric risk for AIAL. There are good theoretical and empirical reasons to believe that this is the case. Firstly, the below histogram shows that annual deviations from RBNZ 2% target inflation since 2000 have a longer right-hand tail than left-hand tail (i.e., positive deviations from target are higher than negative).

Figure 4-3: Actual inflation less RBNZ target from 2000



Source: RBNZ August Monetary Policy Statement (MPS) August 2024, from year ended March 2000 onwards. There is one observation for each year ending in each quarter of the year (i.e., for observations for each calendar year).

60. This results in the average deviation from RBNZ target inflation of +0.5% over the last quarter century. This is a reasonable estimate of the average cost to AIAL of exposure to asymmetric inflation risk.

61. This historical experience is as predicted by modern macroeconomic theory and central bank policy. Central banks and governments recognise that deflation can be very damaging to the economy and is typically associated with large levels of unemployment (the last major deflationary episode for developed economies was the Great Depression).

62. Central banks and Governments will rationally do "whatever it takes"[15] to avoid such catastrophic outcomes from negative inflation. By contrast, Central banks will tend to respond less aggressively to above target inflation: balancing the need to reduce inflation against the risk of inadvertently pushing the economy into recession. The experience of most western countries, including New Zealand, in the wake of COVID-19 is an illustration of this approach.

63. I discuss this further in section 5.2, where I note that the currently expected level of inflation over PSE4 is 0.8% per annum above the level expected at the beginning of PSE4 and built into the PSE4 risk free rate (3.1% actual and forecast based on RBNZ August 2024 MPS vs 2.3% forecast based on RBNZ May 2022 MPS). This means that AIAL is expected to earn a real return that is, other things equal, 0.8% less than its target real return. This 0.8% reduction in real return is greater than the 0.5% average asymmetry in actual inflation relative to RBNZ target estimated above.

64. That is, the current best estimate is the asymmetric cost of exposure to inflation risk (0.8% per annum) over PSE4 is above the historical average estimate since 2000 (0.5%).

4.2 Asymmetric risk gives rise to both systemic risk and self-insurance costs

65. The existence of asymmetric risks means that the expected cost of self-insurance against those risks, expressed as a per annum percentage of RAB, needs to either:

- be deducted from AIAL's modal target return before it can be meaningfully compared with a WACC estimate; or
- be added to a WACC estimate before it compared with AIAL's "target return".

66. I note that it has been naively, and incorrectly, argued that because some compensation for risk exposure is already included in the asset beta it is unnecessary to also compensate for the expected cost of exposure to that risk. For example, the NZCC Consultation Paper quotes BARNZ as follows:

> *"…the asymmetric risk wash-up attempts to compensate the airport company for risk taken. BARNZ considers that compensation for risk exists in the calculation of the airport's target WACC – according to the Commission's Input Methodology. If the WACC methodology generates a return which already compensates for risk taken, BARNZ asks whether the asymmetric risk wash-up twice-compensates AIAL?"*

67. This is simply wrong. The CAPM WACC includes compensation for systemic risk. It does not include an estimate of, let alone compensation for, events that cause cash-

[15] https://www.ft.com/content/82c95514-707d-11e7-93ff-99f383b09ff9

flow asymmetries. For example, there is no compensation in a business' WACC for the cost of insurance against a fire destroying its factory. Just because we use the word "risk" to describe systematic and asymmetric risks does not mean that all costs for the latter are covered in the former.

68. The NZCC has recognised this elsewhere. For example, for Chorus, the NZCC allowed a 10bp premium on the CAPM WACC (along with other measures) to compensate for the asymmetric impact on cash-flows of asset stranding:[16]

> *"Summary of final decisions*
>
> *For regulated providers subject to PQ supplying regulated FFLAS, our final decisions are as follows.*
>
> - *Compensation for Type I asymmetric risks that are uninsured,[1127] such as earthquakes, can be provided ex-post as part of specifying the PQ paths (including reconsideration of an existing price-quality path).*
> - *Compensation for Type II asymmetric risk associated with asset stranding will be provided by a combination of the following: retaining assets in the RAB in regulated markets, allowing for the possible shortening of asset lives (or alternative depreciation profiles) and a modest ex-ante allowance.*
> - *The ex-ante allowance:*
>   - *will be specified in the asset valuation IM and have a quantum of 10 basis points;*
>   - *will not be implemented through the WACC, but rather through cash flows at the time of setting a PQ path;*
>   - *relates to the whole RAB, where the 10 basis points is applied to the allocated RAB (including accumulated losses) to derive a stranding allowance, which is included in the allowed revenue; and*
>   - *is not applied retrospectively in calculating the losses in the pre-implementation period.*
> - *Consistent with the provision of an ex-ante allowance, regulated providers will bear some of the risk associated with asset stranding."*

69. To illustrate the naivety of asserting that the WACC compensates for all cash-flow risks, consider an investment of $1m where, after a year's time, the investor has a 50% chance of losing their $1m and 50% chance of earning $Xm if the investment is successful. Let the CAPM discount rate on this investment be 50% (suggesting extremely strong correlation between project success/failure and the return on the market). What is the required pay-off (value of $X) if the project is successful?

[16] NZCC, Fibre input methodologies: Main final decisions – reasons paper, 13 October 2020, p. 541.

70. If BARNZ were correct, then the required value of $X would be $1.5m - because BARNZ asserts that all the necessary compensation for failure is captured in the (high) 50% discount rate. But this is obviously wrong because if $X=$1.5m the expected return is negative 25% (-100% return with 50% probability and +50% with 50% probability).

71. The correct answer is that $X=$3m delivering an expected return of 50% (-100% with 50% probability and 200% with 50% probability).

72. This illustrates a general distinction between the impact of risk on actuarially expected cash-flow and on discount rates. Both effects must be separately accounted for. This is obvious in the above example where there is a 50% probability of success/failure. But it is equally true dealing with lower probability and/or less catastrophic events.

73. Equation 1A below provides a general formula that describes how WACC and compensation for asymmetric cash-flow affect the modal cash-flow necessary to deliver an expected return equal to WACC. [17]

[17] By way of further numerical illustration imagine that there is a $100 investment that will generate $X ± 20% in cash flow in 95% of future years. But in 5% of years the investment will generate $0 in cash-flow (when an unpredictable asymmetric event occurs). In the nomenclature of Equation A, this means that Z=X and, therefore, Equation B can be used.

Let the CAPM risk associated with cash-flow (including any beta risk attached to the asymmetric event) be 10%.

What value should a regulator set for $X (the modal cash-flow) in order that the present value of cash-flows equals the cost of investment ($100)? If all compensation for asymmetric risk is already included in the 10% discount rate, then the answer is $X=$10 because $10 = $100×discount rate=$100×10%. But this is clearly wrong because the present value of $10 pa 95% of the time and $0 pa 5% of the time is $95 (at a 10% discount rate). The correct modal cash-flow to target is 10.52% (=I*WACC/(1 - α %) = 100*10%/(1-5%)) calculated in accordance with Equation 1B) below. Only then will the actuarially expected cash-flow equal the required return. This is a special case of the more general Equation 1A.

Equation 1: Correct calculation of modal cash-flow (return)

A) $X = I \times WACC + \alpha \times Z$; where

X = Modal cash-flow necessary to deliver an expected return equal to WACC;
I = Investment value;
WACC = the CAPM discount rate (required actuarially expected return)
α = probability of asymmetric event
Z = negative effect of the asymmetric event on cash-flow

In the special case where Z=X then rearranging formula A) gives:

B) $X = I \times WACC/(1 - \alpha)$;

Equation B) is the formulae that is used to derive $X=$3m in paragraph 71 above.

If Z is instead expressed as a percentage (γ%) of the investment value then rearranging formula A) gives:

C) $X = I \times (WACC + \alpha \times \gamma)$

It follows that the impact of exposure to asymmetric risk on the required modal cash flow can be decomposed into α×γ and the impact of exposure to the asymmetric risk on WACC.

D) Impact of asymmetric risk exposure on modal cash-flow required to target WACC $= \Delta X = I \times (\Delta WACC + \alpha \times \gamma)$

74. In the rest of this report, I will use $\alpha \times \gamma$ from Equation D) to refer to the annual expected cost of asymmetric events (expressed as a percentage of the project investment value). The value of $\alpha \times \gamma$ must be subtracted from a modal return to derive the actuarially expected return that can then be compared with an estimate of the CAPM WACC (of "WACC" in the above formulae).

75. In the context of Equation D, the "Flint method" is used to estimate the $\Delta WACC$ associated with exposure to pandemic risk. However, it is also necessary to estimate of actuarially fair cash-flow compensation (α×γ) associated with pandemic risk.

76. This is why my 6 February 2023 report for AIAL I explained that

It is important not to conflate:

- *the compensation required for the expected cost of an event; with*
- *the compensation required due to undiversifiable risk ("asset beta" risk) associated with that exposure.*

4.3 Estimating the expected cost of cash-flow asymmetry

4.3.1 UKCAA compensation for cash-flow asymmetry

77. The UKCAA provided two different sources of *ex ante* compensation for asymmetric risk in its 2023 final decision for Heathrow.

> *In the Final Proposals, we proposed to include two adjustments in relation to symmetric risk:*
>
> - *a shock factor of -0.87% applied to the passenger forecast, in relation to non-pandemic downside shocks; and*
> - *an asymmetric risk allowance to compensate HAL for low frequency, high impact shocks that cause major disruption to traffic (we use the term "pandemic-like events" as shorthand for these shocks in the discussion below).*

78. The shock-factor adjustment is equivalent to a 0.88% (1/(1-0.87%)) increase in prices above those necessary to recover costs in the modal (most likely) scenario. For AIAL this would be the equivalent of a **15bp (i.e., 0.15% of post-tax WACC) on PSE4 RAB in compensation for "non-pandemic downside" events**.[18] The "shock factor" adjustment was intended to compensate for the impact of relatively small (non-pandemic like) events.

> *We continued to consider that the application of a shock factor to cover temporary and difficult-to-predict non-economic shocks (such as adverse weather, major volcanic eruptions, terrorism events, or wars) to air travel was appropriate.*

79. The UKCAA dismissed airline claims that passenger numbers were not affected by material negative asymmetrical events.

> *We note that airlines have disputed the existence of asymmetric risk, even though such asymmetry is readily observable in the data and is, therefore, effectively a statement of fact. The shocks on which the shock factor are based each resulted in a loss of traffic that have not been matched by equivalent "positive" shocks of similar magnitude in any single year. It is also self-evident that there have been no "positive" shocks of similar magnitude or duration to the pandemic.*

[18] AIAL PSE4 Price Setting Disclosure Schedules, p. 10. This is calculated with a post-tax revenue uplift of 0.88% x (1-28%) = 0.63% for each of the five years in PSE4. The resulted forecast post-tax IRR as at 1 July 2022 is 8.88%, which is 15bp higher than the 8.73% IRR without uplift.

80. In addition, the UKCAA provided £25m pa in compensation to Heathrow for exposure to large "pandemic like" asymmetric events. It is important to understand that this £25m pa compensation factored in the existence of the very significant risk sharing embedded in the UKCAA Traffic Risk Sharing mechanism (TRS).

> *We disagree that the TRS mechanism provides "full protection" to HAL in the event of future pandemic-like events. Indeed, the asymmetric risk allowance is directly based on the potential residual losses to which HAL is exposed, even after the TRS has been taken into account, if a pandemic-like event were to materialise. We estimate these losses could be up to £900 million.*

81. The UKCAA's £25m per annum compensation is based on a 3.5% annual probability of a pandemic like event (and, implicitly, a mean loss for such events of £714m). I note that the Institute for Progress currently estimates that the probability of H5N1 is around 4% per year and the likely severity would be larger than for COVID-19.[19]

> *The chance of H5N1 or one of its descendants causing a pandemic is slim, but the impact would probably be more severe than COVID-19.*
>
> *A reasonable forecast that H5N1 causes a pandemic as bad as or worse than COVID-19 beginning in the next year is ~4%, which means the expected cost in terms of potential harms to the U.S. is at least $640 billion.*

82. The Institute for Progress assessment of probability and severity would be consistent with choosing compensation for pandemic risk (both in the Flint uplift and for asymmetric costs) at the upper range of estimates.

83. In any event, if the UKCAA £25m pa (NZD53m) compensation were applied directly to AIAL it would be the equivalent of an 1.96% uplift on post-tax WACC.[20] Of course, Heathrow is a much larger airport than AIAL and, other things equal, the compensation for AIAL would be lower to account for AIAL's smaller scale. One way to make this scale adjustment is to use the UKCAA compensation as a percentage of RAB. £25m pa for Heathrow is equivalent to **a 16bp compensation on RAB for "pandemic like" events** (i.e., 0.16% higher than WACC return) given Heathrow's £16bn RAB.[21]

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19 https://ifp.org/what-are-the-chances-an-h5n1-pandemic-is-worse-than-covid/

20 AIAL PSE4 Price Setting Disclosure Schedules, p. 10. This is calculated with a post-tax revenue uplift of $53m x (1-28%) = $38.16m for each of the five years in PSE4. The resulted forecast post-tax IRR as at 1 July 2022 is 10.69%, which is 196bp higher than the 8.73% IRR without uplift.

21 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

84. The UKCAA also provided HAL a one-off increase in its RAB of 1.88% (£300m) which provided partial compensation for *ex-post* asymmetric risk associated with COVID-19. A 1.88% increase in RAB is equivalent to a **14bp** increase in post-tax WACC.[22]

85. However, differences in scale are not the only differences between Heathrow and AIAL. As discussed below, AIAL's risk sharing mechanism provides much lower levels of protection against asymmetric risk than Heathrow's TRS. Moreover, there is good reason to believe that the underlying exposure to asymmetric shocks is higher for a smaller non-hub airport such as AIAL.

86. Nonetheless, if I ignore the latter differences and only adjust for scale, then the UKCAA precedent would imply modal compensation for asymmetric cash-flow risk of **45bp** (=15bp+16bp+14bp). If I exclude the 14bp from the £300m RAB uplift this falls to **31bp**.

Table 4-1: UKCAA asymmetric risk compensation adjusted for scale differences between Heathrow and Auckland

Source	Heathrow adjustment	AIAL scale adjusted above WACC return
Non-pandemic like events	0.88% price uplift	15 bp
Pandemic like events	£25m pa	16 bp
Post COVID-19 RAB adjustment	1.88% RAB	14 bp

4.3.2 Adjusting UKCAA precedent for differences in risk sharing (and risk exposure)

87. The difference between the two distributions shown in Figure 4-2 above has been deliberately calibrated to generate a 0.87% difference between mean and modal

(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. The UKCAA also modelled the impact that a future repeat of a COVID-19 type shock would have on HAL's profitability.

[22] Assuming the pre-adjustment post tax-WACC is 7.5%, noting that 1.88%×7.5%=0.14%. See UKCAA financial model caa-h7-pcm-v2-11-7mar-fds.xlsm. 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. 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 midpoint WACC of 7.19% this is equivalent to a 0.16% permanent uplift to the WACC.

revenues under the assumption that the UKCAA traffic risk sharing mechanism (TRS) for Heathrow is put in place. That is, the difference in these distributions would justify the UKCAA's 0.87% "shock factor" adjustment to modal forecasts (and a 0.88% increase in modal revenues).

88. I have described this mechanism in detail elsewhere.[23] However, the key element of the TRS is that Heathrow is only exposed to 50% of traffic volume variations from forecast within a 10% band (plus and minus the fore forecast). Outside the 10% band Heathrow is completely protected against variations.

89. Absent the TRS and any other risk sharing mechanism, the difference between mean and modal revenue is 3.4%. This means that, absent any risk sharing, prices would need to be set 3.4% above costs in the modal (most likely) scenario in order to provide actuarially fair compensation for costs across all possible outcomes.

90. That said, AIAL does have a risk sharing mechanism in place in PSE4. However, this provides much less protection than the UKCAA's TRS for Heathrow. Thus, the compensation for asymmetric risk consistent with the UKCAA precedent would need to be somewhere between 0.87% and 3.4% higher prices (i.e., higher than if based on the modal forecast).

91. Under AIAL's risk sharing mechanism, AIAL bears 100% of the risk within a 15% band around the modal forecast (compared to 50% risk within a 10% band under the TRS). When I replace the UKCAA TRS with the AIAL risk sharing provisions then the relevant price compensation is 2.46%. This is close to the midpoint between the required compensation under the UKCAA TRS and a regime with no risk sharing (2.42% is 63% of the distance between 0.87% and 3.4%).

92. A 2.46% price uplift for PSE4 is equivalent to **43bp above WACC return for "non-pandemic downside" events** over PSE4 (i.e., 43bp for AIAL vs 15bp for Heathrow) events.[24] If I apply the same 2.9 times ratio (2.9=43/15) to adjust the UKCAA 16bp compensation for "pandemic like" events I arrive at **46bp above WACC compensation for "pandemic like" events** for AIAL.

93. Adding 43bp, 46bp 14bp results in a **1.03%** "UKCAA equivalent" compensation for AIAL. If I do not include the 14bp associated with Heathrow's RAB increase then the result is **89bp**.

23 Tom Hird, Critique of 2023 IM Draft Decision on Asset Beta for NZ Airports, July 2023, section 7.2.1.

24 AIAL PSE4 Price Setting Disclosure Schedules, p. 10. This is calculated with a post-tax revenue uplift of 2.46% x (1-28%) = 1.77% for each of the five years in PSE4. The resulted forecast post-tax IRR as at 1 July 2022 is 9.16%, which is 43bp higher than the 8.73% IRR without uplift.

94. I note that I previously estimated that the UKCAA's asymmetric risk compensation for HAL would imply 1.94% compensation for AIAL.[25] This was at a time when AIAL's then proposed risk sharing mechanism exposed it to greater risk. My lower estimate in this report reflects that fact.

Table 4-2: UKCAA asymmetric risk compensation adjusted for scale and risk sharing differences between Heathrow and Auckland

Source	Heathrow adjustment	AIAL scale adjusted	AIAL scale and risk adjusted
Non-pandemic like events	0.88% price uplift	15 bp	43 bp
Pandemic like events	£25m pa	16 bp	46 bp
Post COVID-19 RAB adjustment	1.88% RAB	14 bp	14 bp
Total		45 bp	103 bp
Total ex RAB adjustment		31 bp	89 bp

95. I also note that Heathrow is not exposed to inflation risk due to the inflation indexation of its RAB. Therefore, there is a strong case that AIAL's compensation for asymmetric risk should be circa 50bp above the estimates in Table 4-2 above.

4.3.3 ΔWACC sets a minimum value for $\alpha \times \gamma$

96. As a rule of thumb, the cash-flow shock of exposure to asymmetric risk ($\alpha \times \gamma$) will be larger than the discount rate effect ($\Delta WACC$) because the latter is a second order consequence of the former. For example, imagine that pandemic exposure causes an expected annual loss of 1.0% of the investment value per annum (e.g., if α=5% pa probability and γ =20%) then the $\Delta WACC$ associated with this can be expected to be much less than 1.0%. If $\Delta WACC$ was greater than 1.0% then this would imply that investors' required modal cash-flows increase by more than 2% (i.e., more than double the actuarially expected cost of pandemics).

97. I note that the corrected range for the estimate of $\Delta WACC$ from pandemic risk in the NZCC 2023 IM is 0.49% to 0.77%.[26] On the basis of the above paragraph, 0.49% is an estimate of the minimum reasonable self-insurance costs of exposure to pandemic risk. Of course, pandemics are just one of the many asymmetric risks that airports are exposed to (others include earthquakes, terrorism, wars, airline insolvency,

[25] Tom Hird, Critique of 2023 IM Draft Decision on Asset Beta for NZ Airports, July 2023, Table 11-3.

[26] This is based on a 0.07 minimum (0.11 maximum) uplift to asset beta for pandemic risk which translates to a 0.49% (0.77%) uplift to WACC at a TAMRP or 7.0%.

labour conflict and financial crises). On this basis, I adopt 0.49% as the minimum reasonable estimate of total self-insurance costs for AIAL for all asymmetric risks.

4.4 Summary of estimates of α×γ

Table 4-3: Estimates asymmetric cash-flow compensation expressed as a percentage of RAB per annum ($\alpha \times \gamma$)

	Annualised cost of cash-flow asymmetry $\alpha \times \gamma$
UKCAA precedent adjusted for scale but not risk/risk sharing differences between AIAL and Heathrow	31-45 bp
Lower bound (equal to the lower bound corrected NZCC estimate of ΔWACC for pandemic risk with zero attribution for inflation risk or any other factors)	49 bp
Better estimate (UKCAA precedent adjusted for differences in scale)	89-103 bp w/o inflation risk 139-153 bp with inflation risk
Corrected midpoint	>0.62%

5 Other factors influencing the relevant range above the midpoint WACC

98. This section sets out my views on other considerations the Commission should consider when assessing Auckland Airport's target return – including the extent to which a range above the midpoint WACC should be adopted.

5.1 Promoting investment

99. There is a common presumption in regulatory economics that it is better to err on the side of allowing a return that is more likely to be above the true (but unobservable) return demanded by investors than it is to be below that return. This is because, the costs of encouraging more than optimal investment are typically believed to be lower than the costs of encouraging less than optimal investment.

100. This is the rationale for the NZCC in using a 65th percentile WACC for electricity businesses in the 2023 IM. In the same decision, the NZCC reduced the target percentile for gas businesses from the 65th to the 50th percentile. However, this decision was in the context of projected declines in gas usage (implying less need for (and value from) new investment) as well as the fact that the NZCC applied a 0.05 asset beta uplift for gas businesses relative to electricity businesses.

101. Like electricity businesses, but unlike gas businesses, airports are expected to experience long term demand growth which will require airports to investment to meet that demand growth. On this basis, a general presumption exists for targeting a mean expected return above the midpoint WACC (in PSE4 and in future pricing events).

102. However, I note that the NZCC considerations used to arrive at a 65th percentile for electricity businesses is peculiar to the electricity sector (associated with the costs of blackouts). Consequently, a presumption of the 65th percentile does not necessarily follow automatically to airports.

5.2 Heightened uncertainty for PSE4

103. There were unusually high levels of uncertainty surrounding PSE4 which are relevant to assessing the reasonableness of PSE4 WACC. These heightened levels of uncertainty reflect, in part, the recovery of the economy from the impacts of COVID-19.

104. In particular, I have already noted that AIAL is exposed to asymmetric inflation risk – reasonably estimated at an annualised cost of around 50bp. However, this risk was elevated in the recovery from COVID-19. Globally, the impact of COVID-19 stimulus,

along-side supply chain disruption, has led to high and volatile inflation. AIAL bears all inflation risk because its RAB is not indexed for inflation.

105. By way of illustration AIAL's risk free rate was measured in June 2022 and, applying the NZCC method for estimation expected inflation, that risk free rate would have included compensation for 2.3% pa expected inflation.[27] However, updating for actual inflation (including 6.0% over FY2023) and current RBNZ forecasts, the best estimate of average inflation over PSE4 is currently 3.1%.[28] This implies an inflation loss to AIAL due to unexpectedly high inflation of 0.8% pa over PSE4.

106. Note that this 0.8% pa loss is the reduction in AIAL's real return even if AIAL can meet its nominal expenditure forecasts exactly. That is, even if the higher-than-expected inflation in the economy does not raise AIAL's nominal operating costs. According to AIAL's 2023 Information Disclosure, AIAL's total operating expenditure in the first year of PSE4 was $19m (14%) higher than forecast (which is equivalent to 1.1% of the 2023 opening investment value). To the extent this was due to higher-than-expected inflation this is a loss to AIAL in addition to the 0.8% pa loss calculated in the previous paragraph.

107. Similarly, the recovery from COVID-19 posed heightened levels of uncertainty around passenger volume forecasts as well as cost inflation. Over FY2023 AIAL's regulatory incomes is $10m (3%) below forecast.

108. Combined cost and revenue impacts has resulted in regulatory profit before (after) tax being $32m ($8m) lower or 35% (12%) lower than forecast.

109. To put this in context, the NZCC's scenario 2 (corrected for coding errors) midpoint WACC is 8.14% and this is associated with a 65th percentile of 8.80% (using the 2023 IM standard error of 1.69%). AIAL's modal (not actuarially expected) return is 8.73% (less than the 65th percentile of 8.80%).

110. However, once expected losses of 0.80% pa due to higher (uncompensated) inflation over PSE4 are factored in, AIAL is "on track" for a return of 7.93% (i.e., less than the corrected midpoint WACC). This is before factoring in the impact of lower-than-expected profits in FY23 and any impact from below forecast passenger numbers over the remainder of PSE4.

111. Despite targeting a modal return above the (coding error adjusted) Scenario 2 midpoint (but below the 65th percentile) WACC, AIAL is on track to earn a materially below midpoint real return. This is, of course, perfectly consistent with AIAL bearing *ex ante* risk (on passenger volumes and inflation). However, the fact that AIAL

27 Source: RBNZ May 2022 SMP.

28 Source; RBNZ August 2024 SMP

appears likely not to earn the midpoint WACC does provide at least some support for the conclusion that its modal target return was not unreasonably high to start with.

5.3 Operating leverage

5.3.1 Updating NZCC's previous analysis of operating leverage for AIAL

112. Operating leverage refers to the level of fixed versus variable costs/expenditures. Operating leverage is the proportion of costs/expenditures that are invariant with sales/revenues. Just like financial leverage, operating leverage raises the risk to equity investors because the existence of fixed costs (be they in the form of salaries or interest payments) meaning that if sales revenues falls by X% due to some sort of demand shock then profits will fall by more than X% because there will be no offsetting reduction in fixed costs.

113. In its review of AIAL's PSE3, the NZCC provided analysis on AIAL's operating leverage.[29] The NZCC's conclusion mainly relied on the analysis of the "degree of operating leverage" metric published by Bloomberg to determine that AIAL's operating leverage was in-line with the comparator set used in measuring the asset beta.

114. This section has the following structure:

- Replicate and summarise NZCC's analysis on operating leverage;
- Update NZCC's analysis on operating leverage, and;
- Adjust the metric in light of limitations in the Bloomberg measure.
  - The adjusted metrics we present use essentially the same data and concept as the Bloomberg measure. They simply deal with edge cases, such as near zero EBIT, in a way that avoid giving rise to outliers.

5.3.1.1 Replicate and summarise NZCC's analysis on operating leverage

115. For each financial year, the NZCC obtained the "degree of operating leverage" directly calculated from Bloomberg, which is described as below:[30]

> *"To get a more accurate picture of the Auckland Airport's operating leverage relative to the comparator sample, we have collected data on the "degree of operating leverage", sourced from Bloomberg, for each of the*

[29] NZCC, Review of Auckland International Airport's pricing decisions and expected performance (July 2017 – June 2022) | Final report, 1 November 2018 (NZCC final review of AIAL PSE3), paragraph A81-A180.

[30] NZCC final review of AIAL PSE3, paragraph A88.

companies in the comparator sample. The degree of operating leverage is measured as: Degree of operating leverage $= \frac{\%\Delta EBIT}{\%\Delta revenue}$*"*

116. The two sets of charts below replicate Figure A3 and A4 in NZCC's final review, with the second set of charts only showing companies in the 2023 IM final decision sample.

Figure 5-1: Replication of NZCC final review of AIAL PSE3 Figure A3 & A4

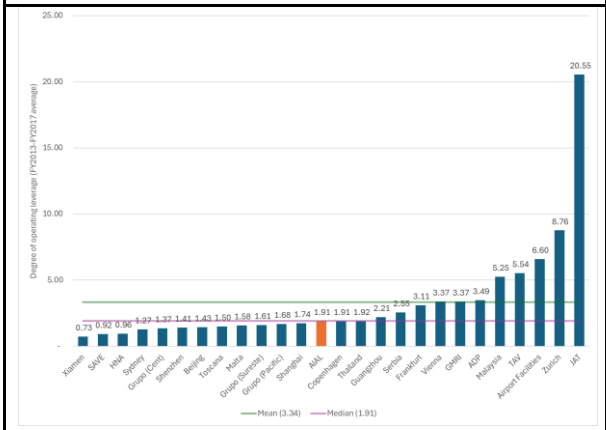
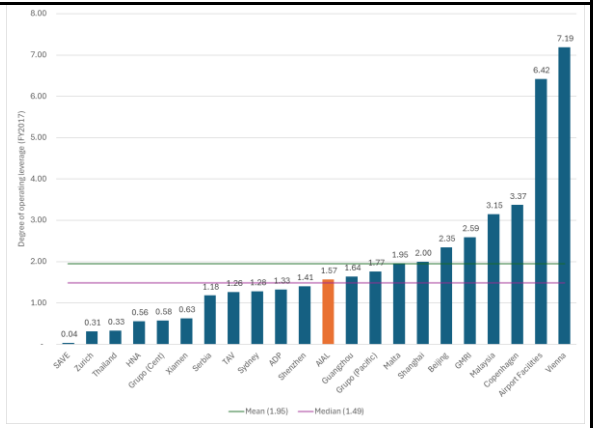
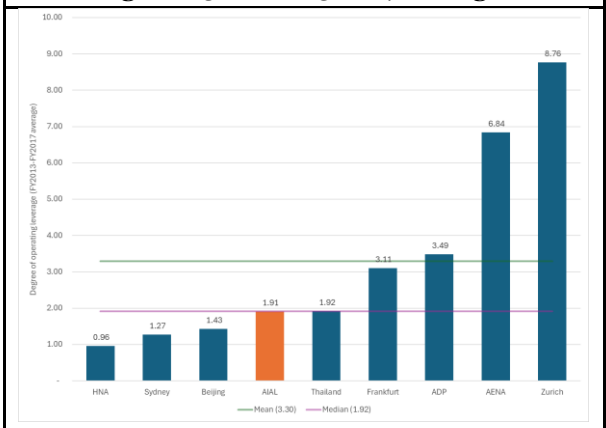
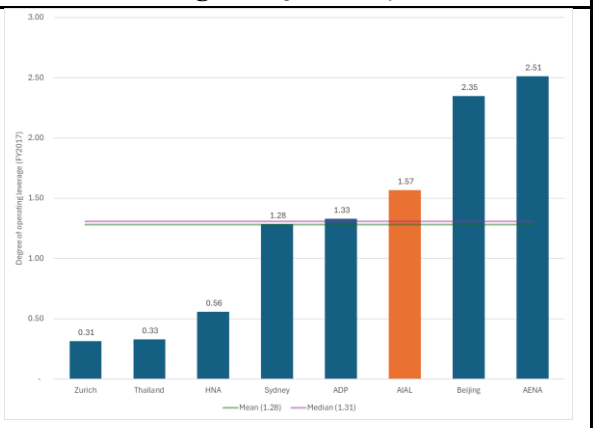
Figure A3 (FY 2013-2017 average)	Figure A4 (FY2017)
	

Figure 5-2: Replication of NZCC final review of AIAL PSE3 Figure A3 & A4 with only 2023 IM final decision sample

Figure A3 (FY 2013-2017 average)	Figure A4 (FY2017)
	

Note: a higher number generally means higher operating leverage.

117. The replications are slightly different to Figure A3 & A4 from NZCC's final review because some values have since became available on Bloomberg. However, the conclusions from these charts, including the second set of charts with 2023 IM final

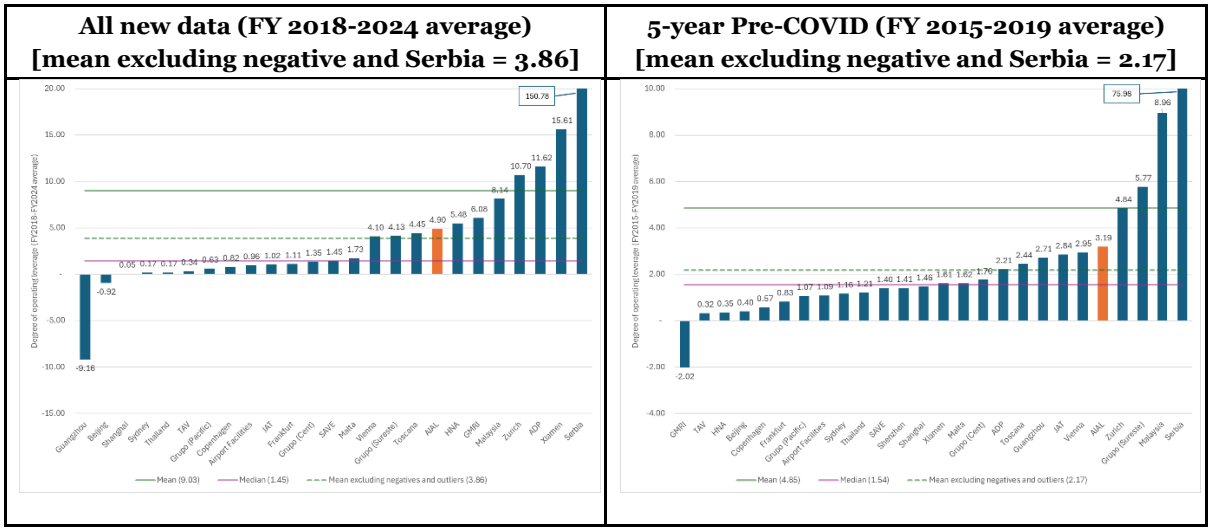
decision sample, remain broadly the same; with AIAL's degree of operating leverage around the median of the samples.

5.3.1.2 Update NZCC's analysis on operating leverage

118. The two sets of charts below update NZCC's analysis on the degree of operating leverage. The periods adopted are:

- All new data (FY 2018-2024 average);[31]
- 5-year Pre-COVID (FY 2015-2019 average).[32]

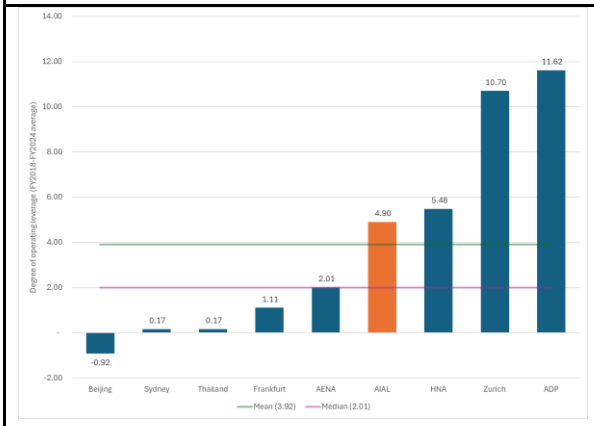
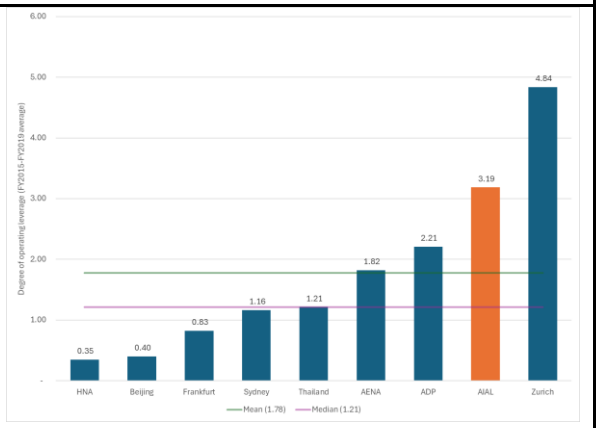
Figure 5-3: Updated analysis with 2016 IM sample



31 Note that at the time of writing, only three firms, including AIAL, have FY2024 number available.

32 This is to measure the period that is not affected by COVID-19.

Figure 5-4: Updated analysis with 2023 IM final decision sample

All new data (FY 2018-2024 average) [mean excluding Beijing, Zurich and ADP = 2.31]	5-year Pre-COVID (FY 2015-2019 average)
	

119. The above analysis shows that AIAL's degree of operating leverage are above both the mean and median of both samples.

120. However, I note that there are some limitations in the Bloomberg measure which I explain below.

5.3.1.3 Adjust the metric in light of limitations in the Bloomberg measure

121. The three key limitations with the Bloomberg metric are:

- It uses GAAP accounting measures of EBIT and revenue which can be heavily affected by abnormal items;
- The use of percentage change in EBIT in the numerator is problematic given that EBIT can be very close to zero in some years causing extreme outliers (e.g., if EBIT is $1,000 in one year and $1m in the next then the percentage change in EBIT is 99,900%);
- The Bloomberg metric treats years in which both EBIT and revenue fell as "negative" even though falling EBIT and falling revenue are entirely consistent with positive operating leverage.

122. The adjustments to the Bloomberg metric I present below use essentially the same data and concept as the Bloomberg measure. They simply reduce the potential for outliers to unduly influence the results.

123. The three changes I applied to improve the estimation to deal with these limitations are as follows:

- Use Bloomberg adjusted EBIT and revenue (to remove the impact of abnormal items);
- Use OPEX instead of EBIT, where OPEX is calculated as Revenue less EBIT; and
  - Bloomberg defines Revenue less EBIT as "OPEX". This means "OPEX" as defined by Bloomberg (and in most accounting practices) includes operating expenditures and depreciation. In the rest of this report, when I use the term "OPEX" I am using the Bloomberg definition (i.e., inclusive of depreciation).
- Treating double negatives (negative % changes in both the denominator and numerator) as positive value instead of negative.[33]

124. The first gives us a more stable and comparable metric.[34] Bloomberg describes this adjustment as follows:[35]

> *"Adjusted to reclassify certain one-time and abnormal expenses and/or gains from operating and non-operating sections. Bloomberg considers the following list of items as abnormal or one-time in nature: Acquired In-Process R&D, Merger Expense, Disposal of Assets, Asset Write-Down, Impairment of Goodwill, Impairment of Intangible Assets, Sale of Business, Legal Expense, Restructuring Expense, Insurance Settlements, Debt Valuation Adjustment, Credit Valuation Adjustment, Non-Hedging Derivatives, Early Extinguishment of Debt, Sale of Investments, Unrealized Investments and Other Abnormal Items."*

125. The use of OPEX rather than EBIT deals with the limitations associated with near zero values of EBIT leading to outlier results. For example, imagine a firm with two years of data:

- Year 1 EBIT= $1, Revenue= $50m, and;
- Year 2 EBIT= $1m, Revenue = $51m.

126. The Bloomberg measure of degree of operating leverage here would be an extremely high (one million %/2%= 50million degree of operating leverage).

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33 I note that in footnote 343 of the final review NZCC did identify this issue, but for simplicity, did not make any adjustment. And consistent with Bloomberg, if the % changes are in opposite signs, then the values are ignored.

34 I note that the NZCC considered similar adjustment in paragraph A95 of its final review. Although the adjustment NZCC made was different to using the Bloomberg adjustment. The Bloomberg adjustment is, in my view, a simpler and more consistent way that can be applied to all airports at once.

35 This is provided in the description of the field FA_Adjusted. The adjustment is applied by adding an option "FA_adjusted=Y".

127. Using OPEX deals with this limitation because OPEX are much less likely to approach zero than EBIT. The % change in OPEX divided by the % change in Revenue (with OPEX = Revenue – EBIT).

128. Note that under this metric, the lower the value, the higher the operating leverage (i.e., the lower the value the more inelastic is OPEX in relation to the change in revenue).

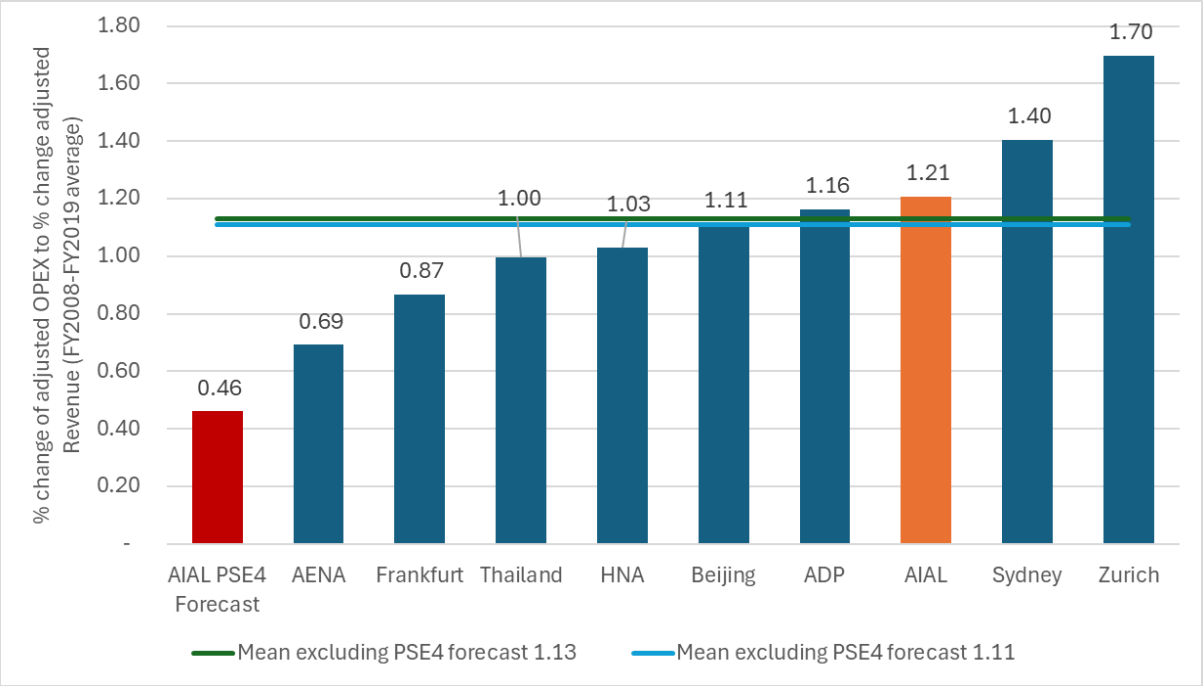
129. That is, if OPEX do not change at all when revenue changes (as is the case in the illustration at paragraph 125), the metric would return zero, implying high "fixed costs" and therefore high operating leverage.

130. Finally, I consider that treating double negatives as positives (i.e., OPEX falling when Revenue falls is treated the same as OPEX rising when Revenues rise) makes the most economics sense. For example, two firms with their OPEX/Revenue profile "flipped" should return comparable operating leverage.

    - Firm A with the following profile:
        - Year 1 OPEX = $10m, Revenue = $50m;
        - Year 2 OPEX = $20m, Revenue = $80m, therefore;
        - Operating leverage = 100%/60% = 1.67.
    - Firm B with the following profile:
        - Year 1 OPEX = $20m, Revenue = $80m;
        - Year 2 OPEX = $10m, Revenue = $50m, therefore;
        - Operating leverage = -50%/-37.5% = 1.33 (instead of -1.33 as calculated with Bloomberg's method).

131. The chart below shows the analysis with the above described adjustments applied. The period shown is consistent with NZCC's definition of pre-COVID (Oct 2007 to Feb 2020, i.e., FY 2008-2019) when estimating the asset beta for airport in the 2023 IM final decision. The firms shown are also consistent with the sample in the 2023 IM.

Figure 5-5: Operating leverage (FY 2008-2019 average)



Note that under this metric, the lower the value, the higher the operating leverage (OPEX is more inelastic in relation to the change in revenue).

132. In the pre-COVID period in question, AIAL[36] has close to average operating leverage. However, when I calculate the overall operating leverage for AIAL PSE4 forecast (only regulated activities), it has a material higher operating leverage (lower value) than the sample.[37]

133. I also note that there are more stable results compared to the previous analysis with the Bloomberg's degree of operating leverage (no obvious outliers).

134. This suggests that according to this metric, AIAL did not have unusually high operating leverage in the pre-COVID period. However, the operating leverage for

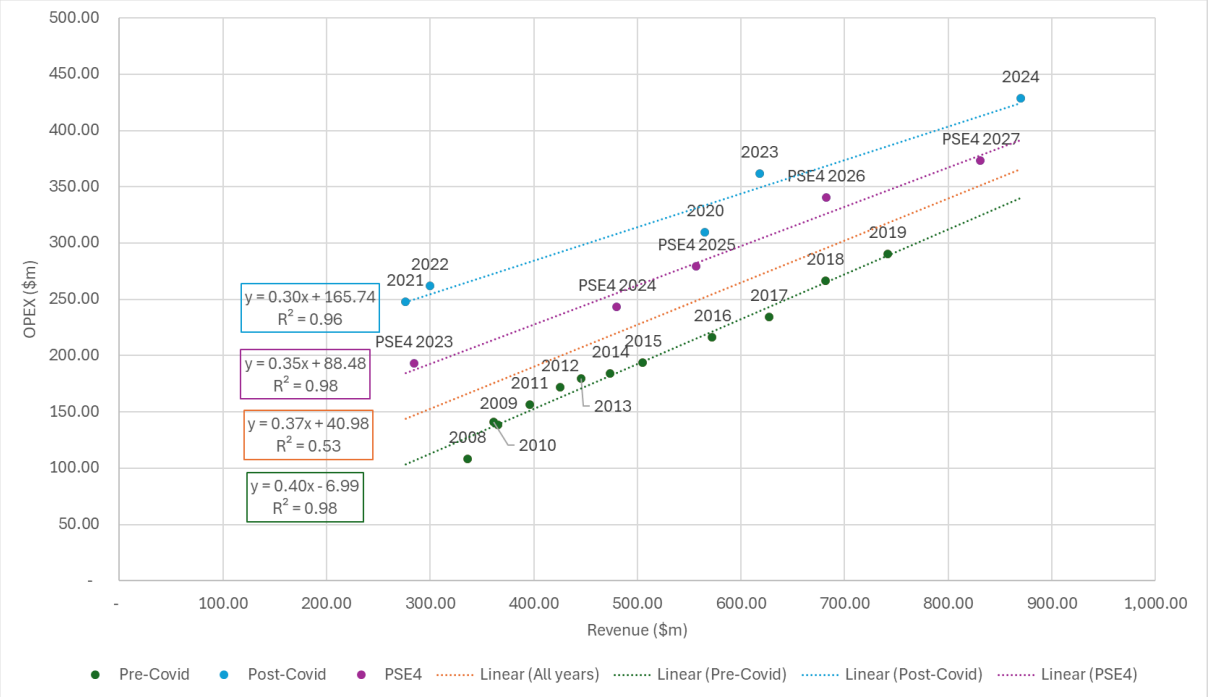
[36] The who company, including non-aeronautical activities

[37] The operating leverage and percentage changes for PSE4 forecast are calculated by comparing the total AIAL's PSE4 forecast OPEX/Revenue to the total PSE3 actual values (i.e., the entire price setting period is treated as a whole). All these values are obtained in the price setting disclosure published on AIAL's website (https://corporate.aucklandairport.co.nz/investors/regulation). For PSE4, Revenue is the "Forecast total revenue requirement (excluding assets held for future use revenue)" in schedule 18 (vi) and OPEX = "Forecast operational expenditure" + "Forecast depreciation" – "Forecast revaluations". For PSE3, the relevant items are taken from schedule 2(a) Regulatory Profit for each disclosure year, with Revenue being "Total regulatory income", and OPEX = "Total operational expenditure" + "Regulatory depreciation" – "Total revaluations".

AIAL's PSE4 forecast is materially higher (lower value) than the sample (in fact, the highest) and to the pervious price setting events.

135. It is also possible to perform a regression based on absolute values rather than simply reporting the average ratios of percentage changes. The chart below plots the relationship between OPEX and Revenue for AIAL between FY2008-2024 alongside each year of the PSE4 forecast.

Figure 5-6: relationship between OPEX and Revenue for AIAL between FY2008-2024 alongside each year of the PSE4 forecast (aeronautical only)



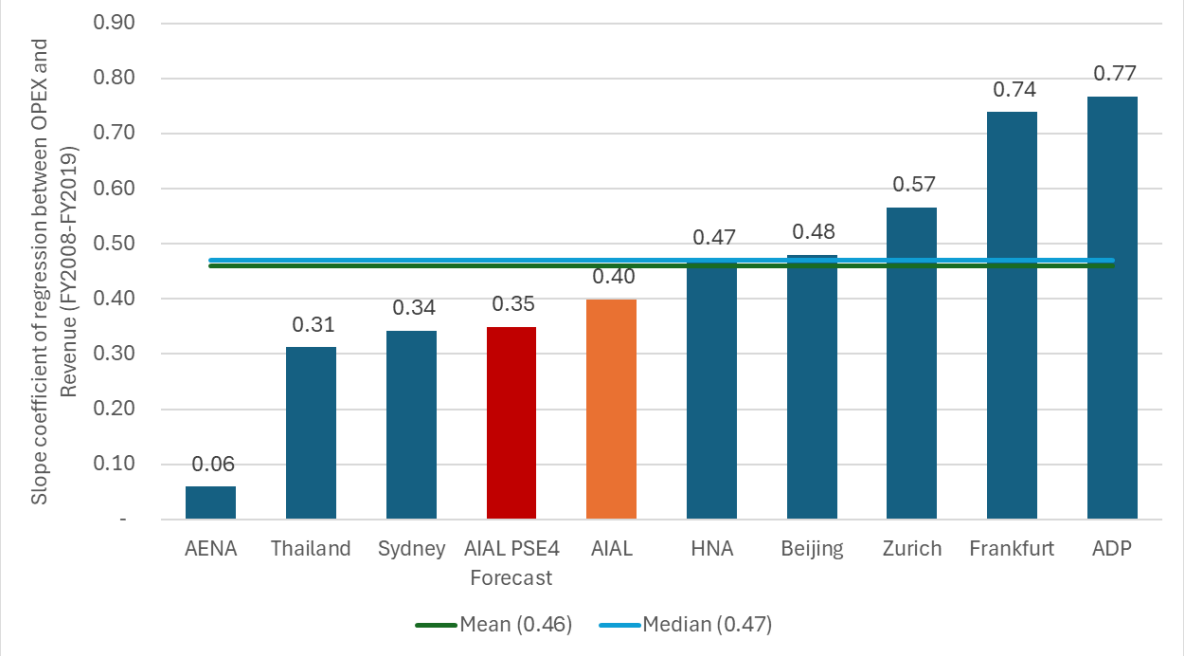
136. In the analysis above, the slope coefficient is the metric that tells us how sensitive OPEX are to Revenue (a low value (flat line) implies high operating leverage). It shows that the relationship between OPEX and Revenue has a discontinuity around COVID. That is, growth between FY2008 to FY2019 is along a tight straight line, but when COVID hit, the series breaks, and a new trend is formed.

137. When using all the years (FY2008-2024), the model predicts that an increase of $100m in revenue will lead to an increase in $37.3m in OPEX (orange regression line with a slope coefficient of 0.37). However, the slope for pre-COVID is 0.40 (the green regression line) and the slope for post-2019 (the blue regression line) is 0.30. This shows that the model implies a higher operating leverage post-2019. This is consistent with economic expectations given that as an airport (or any business) grows smoothly over time its fixed costs (costs that are not avoided when volumes temporarily fall) will tend to rise.

138. Furthermore, AIAL's PSE4 forecast has a lower slope (0.35 slope for the purple regression line) than the pre-COVID (green regression line), suggesting that PSE4 has higher operating leverage than previously/pre-COVID. This is also consistent with (but higher than) the AIAL (whole of business) post-2019 slope (0.30).

139. The charts below perform the same regression analysis with the 2023 IM sample. They summarise the slope coefficient of the regression for each airport between FY2008 and FY2019.

Figure 5-7: Slope coefficient of regression between OPEX and Revenue (FY2008-FY2019)



140. Using this metric, AIAL (whole of business pre-COVID) and PSE4 (aeronautical only) have lower slopes (higher operating leverage) than the sample average. Meaning that for every $100m increase in Revenue, AIAL's OPEX increase on average, by a smaller amount than most of the other airports.

141. AIAL PSE4's slope is at the 26th percentile (i.e., 74th percentile when in reverse order) This analysis is consistent with the previous analysis suggesting the PSE4 operating leverage is elevated relative to the comparators used to set the base asset beta in in the 2023 IM.

142. I note that there are two differences between the PSE4 estimates and the other estimates that it is being compared with. The PSE4 estimate is for aeronautical operations only and the PSE4 estimate is a post-COVID estimate. It may be that some, or all, of the higher operating leverage for PSE4 is being driven by these factors.

143. If so, then the conclusion of high operating leverage for PSE4 compared to other airports might change if post-COVID aeronautical only estimates for these airports were higher than pre-COVID whole of business estimates. However, this would not alter the conclusion that PSE4 has higher operating leverage than the airports used by the NZCC to set the base asset beta in the 2023 IMs. That is, this possibility does not detract from the evidence supporting a higher risk for PSE4 than embodied in the 2023 IM's asset beta estimates. It may, however, indicate that operating leverage was underestimated for all airports in the asset beta set by the NZCC.

5.3.2 Increased CAPEX leading to higher operating leverage

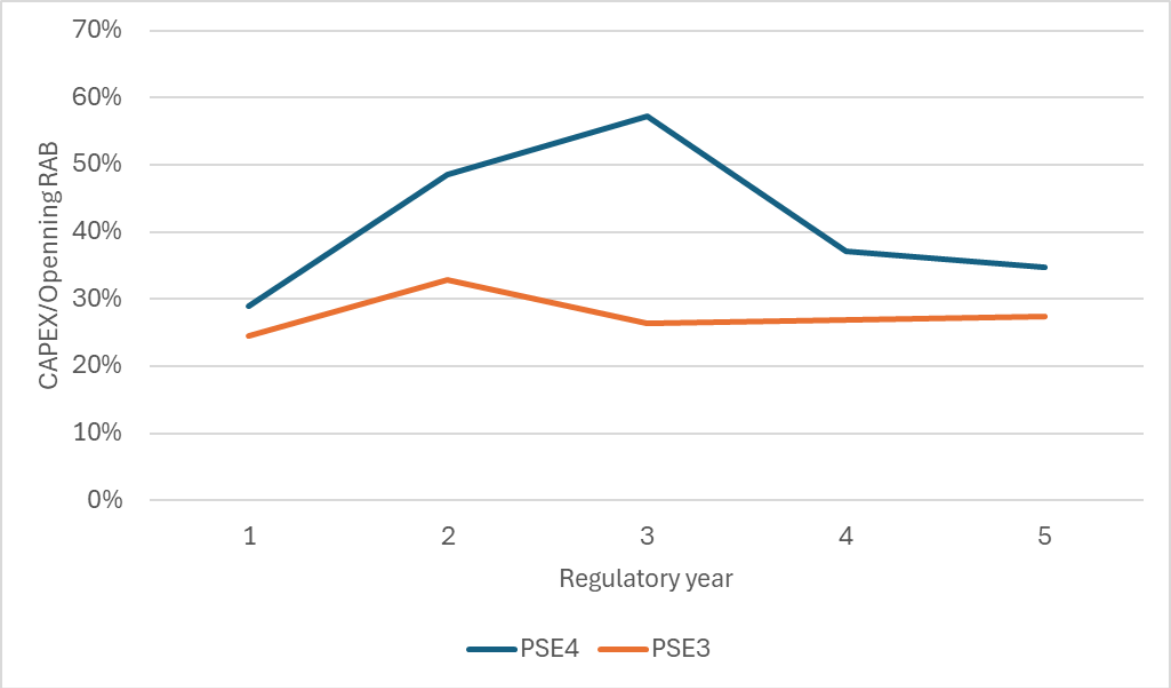
144. The NZCC has previously agreed that high forecast capital expenditure over PSE3 raised operating leverage:[38]

> *"Conceptually, we agree that Auckland Airport's* ***significant capital expenditure programme is likely to increase its operating leverage****, and that this may increase its exposure to systematic risk. This could justify an uplift to our estimated cost of equity and in turn,* ***justify a target return above our mid-point WACC****."*

145. PSE4 has considerably higher capital expenditure (as a percentage of RAB) than even PSE3. As can be seen in Figure 5-8, PSE4 forecast capex to RAB ratio is 47% higher than PSE3 forecast capex to RAB.

[38] NZCC, Review of Auckland International Airport's pricing decisions and expected performance (July 2017 – June 2022) | Draft decision, 26 April 2018, para X19.

Figure 5-8: PSE4 vs PSE3 forecast capex as a % of RAB



Source: Price setting disclosure settings for PSE3 and PSE4.

5.3.3 Regulatory precedent of acknowledging the risk in operating leverage

146. Australian regulators typically include operating leverage as a determinant of intrinsic risk.

- The Australian Energy Regulator states: "*Intrinsic risk describes how the business cycle impacts on a firm's sales and operational risk relates to a firm's operating leverage (the proportion of fixed to variable costs)*"[39]
- The Queensland Competition Authority states that "*Firms that have a high level of operating leverage will find it difficult to cut costs in the event of an economic downturn, in response to a potential reduction in demand from customers.*"[40]

147. Examples where regulators have explicitly relied on estimates of differences in operating leverage to adjust their WACC estimate include:

- In the 2016 tariff determination for electricity transmission network operators, the French energy regulator CRE, used the upper bound of the asset beta

39 AER Draft Rate of return guidelines Explanatory Statement July 2018

40 https://www.qca.org.au/wp-content/uploads/2021/11/rate-of-return-review-final-report-1.pdf

estimate in response to the higher operating leverage that RTE faced compared to its comparators. [41]

- In its 2010 and 2015 determinations for the water sector appeals, the UK Competition and Markets Authority (CMA) decided to apply an upward adjustment to the asset beta based on a difference in operating leverage between Bristol Water and its peer group.[42]
- In the RIIO-1 price controls, the UK energy regulator Ofgem considered companies with a higher operating leverage to be more exposed to cash flow risks than those with smaller capex programmes. Ofgem used the operating leverage analysis in its relative risk assessment to select the appropriate beta estimate.[43]

5.4 Conclusion

148. Based on the considerations covered in this section, it is reasonable (and in the long-term interests of passengers using Auckland airport) for AIAL to target a mean (actuarially expected) return that is above the midpoint WACC over PSE4. Exactly how much above the midpoint WACC is less obvious. However, the NZCC's decision to allow electricity businesses to target the 65th percentile is a relevant point of comparison (especially given elevated risks for PSE4). I therefore report 65th percentile WACC estimates in section 6 below.

41 CRE, Délibération de la Commission de régulation de l'énergie du 19 octobre 2016 portant projet de decision sur les tarifs d'utilisation des réseaux publics d'électricité dans le domaine de tension HTB, 19 octobre 2016, p. 53; Frontier Economics, Audit Des Demandes De RTE Sur Le Cadre De Remuneration, 1 July 2016, p.46. Frontier argued, and the CRE accepted, that "*… RTE's operating leverage is positioned for the three operating leverage indicators in the upper half of the range of ratios calculated for the rest of the sample. This could be taken into account in the positioning of the beta value within the range of values, by choosing a value that falls between the midpoint and the upper bound of the range*."

42 Competition Commission (2010): Notice of Reference: Determination of Adjustment Factor for the period 2010-2015, Appendix N, paragraph 129, Competition Commission (2010) Water Services Regulation Authority Water Industry Act 1991, Section 12 Bristol Water plc Notice of Reference: Determination of Adjustment Factor for the period 2010-2015, Appendix N paragraph 137 & CMA (2015): Bristol Water plc A reference under section 12(3)(a) of the Water Industry Act 1991, Appendix 10.1, paragraph 124.

43 Ofgem (2012): RIIO-GD1: Final Proposals - Finance and uncertainty supporting document, para. 3.17, 3.44.

6 Summary and conclusion

6.1 Conclusion

149. There is a 1.22% (122bp) differential between AIAL's modal target return of 8.73% and the NZCC's Scenario 2 midpoint mean WACC of 7.51%. This differential is substantially (more than fully) accounted for by making the following two (three) adjustments to the NZCC Scenario 2 mean WACC:

    - **49bp:** being the lower bound estimate of the annualised cost of asymmetric cash-flow risk - which can be characterised as either:
        - an upward adjustment to the NZCC mean expected return to convert it into a modal return (allowing a like-for-like comparison to AIAL's target return); or
        - a downward adjustment to the AIAL modal return to convert it into a mean expected return (allowing a like-for-like comparison to a WACC estimate which is, by definition, a mean expected return).
    - **63bp**: which is the impact of correcting for the impact of coding errors in the 2023 IM asset beta estimates.
    - **49bp**: which is the impact of adopting the 2016 IM asset beta sample selection criteria rather than the 2023 sample selection criteria (given that the change in sample selection criteria was unrelated to incorporating pandemic risk).

150. Accepting all three adjustments makes the adjusted Scenario 2 return (9.12%), which is 39bp higher than the AIAL's target return (8.73%) and this should not raise concerns over excessive profitability.

151. Accepting only the first two adjustments (i.e., 8.63%) results in a +10bp gap (relative to Scenario 2 not adjusted for sample selection). However, arguably this does not raise any concerns given:

    - It is a relatively small difference (associated with just the 53th percentile WACC given the 2023 IM standard error estimate of 1.69%); and
    - PSE4 is associated with heightened risk indicators (AIAL and the NZ economy coming out of COVID-19 and high levels of capital expenditure for AIAL).

152. I note that even if the NZCC were to adopt a lower cost of asymmetric risk estimate of, say, 31bp (i.e., a modal return of 8.45%),[44] then the +10bp gap only rises to +28bp,

[44] Based on the UKCAA precedent without adjusting for higher AIAL risk and not including the 14bp associated with the ex post Heathrow RAB increase.

which is at the 57th percentile (less than the 65th percentile uplift applied to electricity businesses by the NZCC).

153. On this basis, I do not consider that there is a strong case for finding AIAL is targeting an excessive level of profitability.

6.2 Summary of calculations and ranges

6.2.1 Removing asymmetric costs from AIAL's modal

154. Table 6-1 summarises calculations described in previous sections. The highlighted row of this table (8.24%) is AIAL's target modal return (8.73%) less my lower bound estimate of the expected cost of asymmetric cash flow risk (0.49%).

155. It is important to emphasise that AIAL's modal expected return (8.73%) must not be compared directly with the other WACC estimates in this table because these other estimates are estimates of mean (actuarially expected) returns. Some adjustment is required for asymmetric cash-flow risk before these estimates can be compared.

156. I have chosen to remove the expected cost of asymmetric cash flow risk from AIAL's modal return in order to turn it into an actuarially expected return (allowing an "apples for apples" comparison). It would be equally valid to add the expected cost of asymmetric cash flow risk to the WACC estimates in order to turn these into modal returns (allowing an "oranges for oranges" comparison).

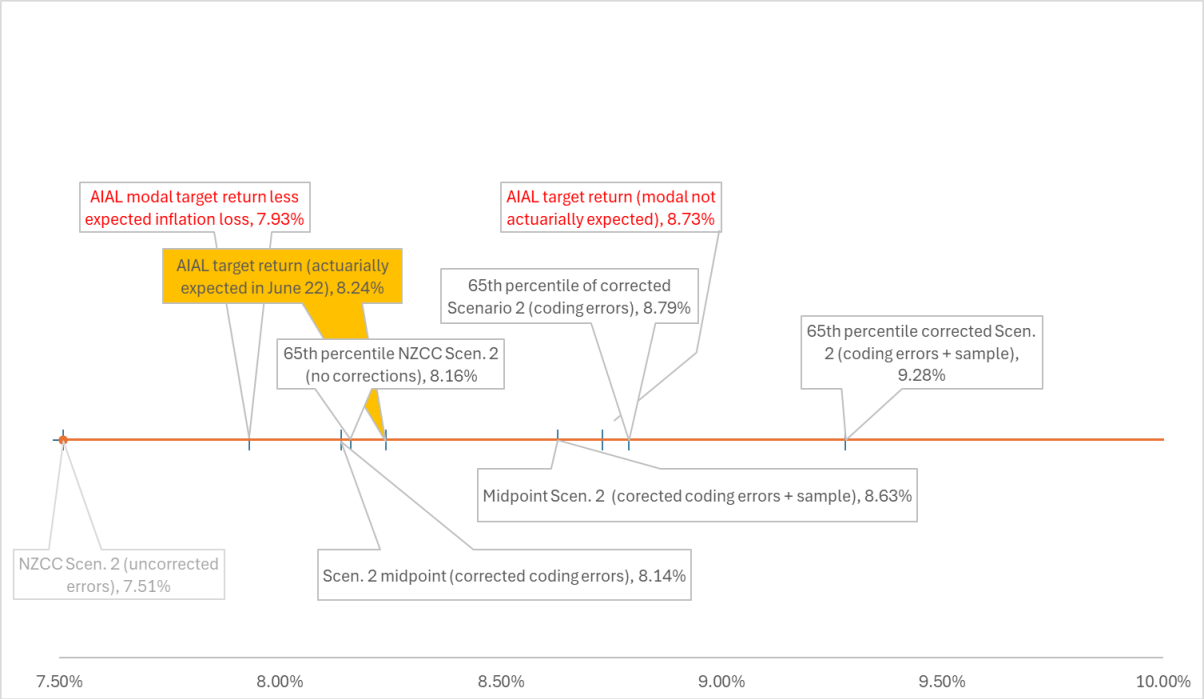
Table 6-1: Summary of calculations

	Expected return* midpoint (range)	Modal return* midpoint (range)
NZCC scenario 2 (2023 IM)	7.51%	8.00%
AIAL actuarially expected (June 2022) target return	8.24%	8.73%
Midpoint NZCC scenario 2 (2023 IM) corrected for coding errors	8.14% (7.86% to 8.42%)	8.63% (8.35% to 8.91%)
65th percentile of NZCC scenario 2 (7.51% + 0.65%)	8.16%	8.65%
65th percentile corrected for coding errors	8.79% (8.51% to 8.07%)	9.28% (9.00% to 9.56%)
Midpoint NZCC Scenario 2 corrected for coding errors and using 2016 IM sample selection method	8.63% (8.35% to 8.91%)	9.12% (8.84% to 9.40%)
65th percentile of NZCC Scenario 2 corrected for coding errors and using 2016 IM sample selection	9.28%% (9.00% to 9.56%)	9.77%% (9.49% to 10.05%)

* The difference between "expected return" and "modal return" is 0.49bp – which is my lower bound estimate of the cost of asymmetry in expected cash-flows (how much lower expected returns are than most likely returns).

157. Figure 6-1 below summarises the various estimates described above in a single chart.

Figure 6-1: Summary of estimates



158. The highlighted estimate of 8.24% is AIAL's target modal return (8.73%) less the lower bound estimate of the cost of self-insurance against asymmetric risk (0.49%). This deduction of 0.49% converts AIAL's model target into an actuarially expected target return. Only the actuarially expected target return can be validly compared with estimates of the WACC (which are estimates of an actuarially expected return – not modal return).

159. AIAL's 8.24% target actuarially expected return is:

- 0.24% higher than the 8.00% midpoint of the 2023 IM WACC once corrected for coding errors in the 2023 IM.
- 0.08% higher than the 8.16% 65th percentile of the 2023 IM midpoint even if there are no corrections for coding errors or sample selection applied to that midpoint.
- materially lower than the:
  - 8.63% midpoint estimate of WACC estimated using the 2023 IM corrected for coding errors and using 2016 IM sample selection method;
  - 8.79% (9.28%) 65th percentile for the 2023 IM midpoint with coding errors corrected (and with 2016 IM sample selection used).

160. Also shown on the chart for reference are the following values:

- 7.51% being the NZCC's Scenario 2 midpoint without any correction for coding errors (this call out is in faded text to represent its unsuitability as a starting point estimate of the WACC);
- 7.93% which is the AIAL modal return (8.73%) making a single adjustment to reflect currently expected lower real returns (-0.80% pa) due to higher than expected inflation over PSE4 (noting that this does not include the effect of higher expected inflation driving higher expected nominal expenditure and nor does it reflect lower than target nominal returns in FY2023). This value is highlighted in red text as it is not its target actuarially expected return; and
- 8.73% which is AIAL's target modal nominal return. This value is highlighted in red text as it is not its target actuarially expected return.

Table 6-2: Summary of calculations

Reference point	Mid-point post-tax WACC	Plus: Minimum 0.49% self-insurance for asymmetric risk	[65th] percentile – post-tax WACC/+asymmetric risk
2023 IM errors corrected – midpoint	8.14%	8.63%	8.79%/9.28%
2016 sample methodology - midpoint	8.63%	9.12%	9.28%/9.77%

Appendix A Sample selection

Table 6-3: Sample selection and airport code

Code	Name	NZCC 2016 IM Sample (with new firms, i.e. AENA, Vietnam and Bologna)	NZCC Final decision
000089 CH Equity	Shenzhen	In	Out
357 HK Equity	HNA	In	In
600004 CH Equity	Guangzhou	In	Out
600009 CH Equity	Shanghai	In	Out
600897 CH Equity	Xiamen	In	Out
694 HK Equity	Beijing	In	In
8864 JP Equity	Airport Facilities	In	Out
9706 JP Equity	JAT	In	Out
ACV VN Equity	Vietnam	In	Out
ADB IM Equity	Bologna	In	Out
ADP FP Equity	ADP	In	In
AENA SM Equity	AENA	In	In
AERO SG Equity	Serbia	In	Out
AIA NZ Equity	AIAL	In	In
AOT TB Equity	Thailand	In	In
ASURB MM Equity	Grupo (Sureste)	In	Out
FHZN SW Equity	Zurich	In	In
FLU AV Equity	Vienna	In	Out
FRA GR Equity	Frankfurt	In	In
GAPB MM Equity	Grupo (Pacific)	In	Out
GMRI IN Equity	GMRI	In	Out
KBHL DC Equity	Copenhagen	In	Out
MAHB MK Equity	Malaysia	In	Out
MIA MV Equity	Malta	In	Out
OMAB MM Equity	Grupo (Cent)	In	Out
SYD AU Equity	Sydney	In	In
TAVHL TI Equity	TAV	In	Out
TYA IM Equity	Toscana	In	Out