COMPETITION ECONOMISTS GROUP

AIAL asset beta and WACC estimates for PSE4

Dr. Tom Hird
February 2023

COMPETITION ECONOMISTS GROUP

Table of Contents

1 Introduction 5

1.1 Key conclusions 5

1.2 Report structure 7

2 What is asset beta? 8

3 Appropriate asset beta estimates for PSE4 and beyond 11

3.1 Estimated asset betas reflect the shocks that hit the economy in the specific estimation period 11

3.2 Rolling 10 year estimation windows updated at the beginning of every 5-year PSE provide actuarially fair asset beta compensation 12

3.3 Must the estimation window be 10 years? 16

3.4 Conclusion 20

4 Asset beta sample 21

4.1 A large geographically diverse sample with estimation over a long period (a decade) is desirable 21

4.2 Exclusions proposed by AIAL, CEPA and NZCC cover letter to the CEPA report 25

4.3 Proposed sample 33

5 Asset beta estimates 34

5.1 Asset beta estimation method 34

5.2 Implementation 34

6 Adjustment for aero vs non-aero 40

6.1 Conceptual framework 40

6.2 NZCC past analysis 43

6.3 Empirical analysis 44

7 Asymmetric risk exposure 49

7.1 Exposure to extreme events requires compensation for expected costs separate, and in addition to, asset beta compensation 50

7.2 Does AIAL's third proposal affect its best asset beta estimate? 52

8 WACC 58

Appendix A There is no workable alternative method that could accurately adjust asset beta for COVID-19 or other economic shocks 60

A.1 Applying an adjustment only after the first pandemic is NPV biased 62

A.2 Any reasonable estimate of "γ" is currently elevated above its long term average 63

A.3 The logic does not stop at pandemics 64

A.4 Unworkable complexity 64

Appendix B Mathematical expression of beta risk 68

B.1 Asset returns measured using the CAPM 68

Appendix C Sources for relative risk 70

Appendix D Curriculum Vitae 71

List of Figures

Figure 4-1: Vienna airport: 28 asset beta estimates for the 5 years ending 30 June 2022 22

Figure 4-2: Time series of aero vs non-aero revenues (2019 =1) 30

Figure 4-3: Time series of aero vs non-aero EBIT and EBITDA (2019 =1) 31

Figure 5-1: 2022 estimation period 37

Figure 5-2: 2017 estimation period 38

Figure 6-1: EBIT and EBITDA time series for aero and non-aero (2018=1) 46

Figure 6-2: EBITDA and EBIT time series for AdP's three segments (2018=1) 47

List of Tables

Table 3-1: Sample average asset betas (CEG estimates and sample).....11

Table 4-1: Non-aero revenue share vs profit share where available.....32

Table 5-1: Sample average asset betas estimated by CEG, AIAL (LJK) and CEPA.....35

Table 5-2: CEG asset beta estimates.....39

Table 6-1: Relative risk of aeronautical vs airport wide cash-flows.....43

Table 6-2: Asset beta vs % non-aero revenue.....45

Table 7-1: Risk factors for airports.....54

Table 8-1: AIAL WACC.....58

Table 8-2: Sources for length of pricing periods.....70

1 Introduction

1. I, Tom Hird of [redacted] have been engaged by AIAL to provide an independent expert opinion on the asset beta and WACC for AIAL in the context of PSE4.

2. I hold the following qualifications:

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

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

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

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

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

1.1 Key conclusions

7. The key conclusions in this report are as follows:

   a. The asset beta for PSE4 for AIL should be estimated using data up to June 2022 (the beginning of PSE4) and should follow the New Zealand Commerce Commission's (NZCC's) 2016 Input Methodologies (IM) approach and reasoning with the exception that there should be no presumption that aeronautical asset betas are lower than non-aeronautical asset betas.

   b. Consistent with the 2016 IM approach, a 10 year estimation window should be used to estimate asset beta (broken into two separate 5-year periods). There should be no variation to the estimation window designed with the purpose of reducing the weight given to the period impacted by COVID19. To do so would result in either:

i. Average asset beta compensation in the long run being deliberately set below the level of realised asset beta risk for investors; or

ii. Require some positive upward adjustment to all future asset betas which would be impossible to accurately implement.

c. The sample of comparators should be the same as the sample used in the 2016 IM with the only exceptions being that:

i. airports that have been delisted/newly listed are removed/added to the sample; and

ii. Airport Facilities and GMR Industries are removed on the basis that the majority of their operations and revenue streams are unaffected by passenger volumes.

d. CEPA and I agree regarding the exclusion of Airport Facilities. CEPA did not discuss GMR Industries. (However, GMR has spun off its non-airport business leaving a pure play GMR Airports and should be included in future samples). CEPA also proposed the exclusion of Aero SG, TAV, and Japan Airport Terminal Co (JAT). I disagree about the exclusion of TAV and JAT and consider that CEPA's rationale for exclusion is erroneous. While I also consider that Aero SG should be included, I consider that reasonable minds may differ on this.

e. I consider that it would be a serious error for the NZCC to move away from its 2016 IM method and attempt to shrink the size of sample by excluding comparators that do not have "stable" asset betas and/or operate in countries with market risk premiums that are "substantially different to the market risk premium for New Zealand". These criteria have no sound conceptual basis and, if applied, would:

i. introduce arbitrary definitions of "stability" in asset beta estimates (and measurement of MRP) across airport companies (countries);

ii. introduce arbitrary thresholds for what is "stable enough" and "substantially different";

iii. would make the final estimate less reliable by reducing the size and geographical diversity of the final sample.

f. In my view, should the Commission pursue a uniquely small sample size for the airport sector or to try to exclude "unstable asset beta companies" or, similarly, lengthen the sample period exclusively for the airport sector, there is a strong risk that both such adjustments are seen by investors to be *ad hoc* adjustments to achieve what the Commission has predetermined to be the "right outcome". There is the potential for such changes to be perceived as an illustration of asymmetric regulatory risk. That is, an ad hoc change attempting to dilute a period of realised high risk when a period of realised low risk would be unlikely to elicit a similar response

g. I estimate a sample average asset beta of 0.80 which is consistent with estimates from CEPA and LJK consulting (for the same sample). The sample average leverage is 14% (15% in the five years to June 2017 and 13% in the 5 years to June 2022).

h. I conclude that AIAL's proposed mechanism for reducing asymmetric risk may also have a small effect on AIAL's systemic risk (reducing asset beta). However, the best evidence is that most airports in the sample already have lower systemic risk than AIAL (based both on estimated asset betas and also characteristics of the regulatory/price setting regime). AIAL's proposed changes would make its asset beta more similar to the sample average (not less similar). Therefore, it remains reasonable to apply the sample average asset beta to AIAL for PSE4.

1.2 Report structure

8. The remainder of this report is structured as follows:

- **Section 2** provides a conceptual discussion of asset beta risk;
- **Section 3** describes how I consider asset beta should be estimated for PSE4 and for future PSEs in order to ensure accurate compensation for systemic risks actually borne by airports;
- **Section 4** describes and explains my proposed asset beta sample;
- **Section 5** sets out my asset beta estimates and compares them to AIAL's and CEPA's estimates;
- **Section 6** explains why I do not make any adjustment for difference in risk between aeronautical and non- aeronautical operations**;**
- **Section 7** discusses asymmetric risk exposure and AIAL's proposals to mitigate these and specifically, their implementation should not alter AIAL's method for estimating asset beta;
- **Section 8** addresses estimating the WACC consistent with the asset beta estimated I the rest of the report.
- **Appendix A**: provides detailed analysis in support of the conclusions reached in section 3;
- **Appendix B** provides a mathematical description of asset and demand beta definitions.
- **Appendix C** provides sources for section 7.2;
- **Appendix C** is my curriculum vitae.

2 What is asset beta?

9. The risk associated with investing in an asset can be classified into two broad categories:

   - diversifiable (idiosyncratic) risk from shocks that are specific to the asset; and
   - non-diversifiable risks that derive from shocks that affect the asset and the broader economy.

10. Asset beta measures sensitivity of the value of expected profits at a company to economy wide shocks (i.e., shocks that affect the average expected value of future profits across the economy).

11. In what follows I use the term "shock" to describe any impact, large or small, that causes a deviation in economic activity away from its expected level. An intense weather system hitting the South Island and disrupting economic activity is an example of a relatively small idiosyncratic shock (in the context of the entire economy). A large slowdown in the global economy that lowers the demand for a broad range of New Zealand export products is an example of a non-diversifiable shock that is likely to affect a broad range of assets in the New Zealand economy (both directly and indirectly).

12. Investors can 'smooth out' the impact of diversifiable shocks by investing a small amount in many companies/assets. Consequently, when one asset is experiencing a negative idiosyncratic shock other assets are likely to be experiencing positive idiosyncratic shocks – with the effect that the overall impact on the investor's wealth/income from all idiosyncratic shocks is negligible across a broad portfolio of assets (i.e., the risk is diversified away).

13. An example of a negative diversifiable shock for aeronautical assets might be a drop in passenger numbers due to a pilot strike. While this shock would be bad for investments in airports and airlines, it is not obviously related to a system wide shock to the economy. While airport and airline assets might perform worse than expected there would likely be other assets in a diversified portfolio performing better than expected such as alternative transport operators and assets that are performing better than expected for completely unrelated reasons – with little net effect on the overall performance of the diversified portfolio.[1]

[1] It is worth noting that idiosyncratic shocks are often of the nature that one asset will benefit from that shock while another will suffer. For example, a change in consumption patterns from, say, beer to wine. Having investments in both beer and wine businesses can diversify this risk. However, the concept of idiosyncratic risks is broader than this and encompasses random idiosyncratic shocks that are purely bad (or purely good). There are many *unrelated* shocks continuously hitting the economy (a storm hitting the South Island, better than expected harvest conditions, a drop in demand for hotels from international

14. By contrast, a non-diversifiable shock is one that tends to have system wide (systemic) effects on the economy. Holding a diversified portfolio cannot protect against the effect of such shocks on wealth/income because, by definition, these shocks affect a large number of the assets in a diversifiable portfolio simultaneously.

15. An example of a negative undiversifiable shock for aeronautical assets might be a drop in passenger numbers due to a pandemic or a recession caused by some other event (e.g., an oil price shock). This shock would not just be bad for investments in airports and airlines but would also be bad for most investments in the diversified portfolio.

16. Because of their undiversifiable nature, investors demand higher returns from assets where the return is highly sensitive to the overall state of the economy. This is what the asset beta measures – the relative sensitivity of assets to shocks that systematically affect the overall economy. A higher asset beta implies a higher sensitivity of that asset's returns to system wide shocks to the economy (positive and negative).

17. Brealey, Myers and Allen, *Principles of Corporate Finance*, is a leading finance text-book. When explaining the determinants of asset betas, the authors first describe cyclicality in demand:[2]

> ***What Determines Asset Betas?***
>
> ***Cyclicality*** *Many people's intuition associates risk with the variability of earnings or cash flow. But much of this variability reflects diversifiable risk. Lone prospectors searching for gold look forward to extremely uncertain future income, but whether they strike it rich is unlikely to depend on the performance of the market portfolio. Even if they do find gold, they do not bear much market risk. Therefore, an investment in gold prospecting has a high standard deviation but a relatively low beta.*
>
> *What really counts is the strength of the relationship between the firm's earnings and the aggregate earnings on all real assets. We can measure this either by the earnings beta or by the cash-flow beta. These are just like a real beta except that changes in earnings or cash flow are used in place of*

tourists, stronger than expected demand for new cars, weaker than expected demand for fast fashion etc etc.). So long as these shocks are *unrelated* (i.e., do not have a common cause that drives correlation between them) then they can be expected to approximately cancel out on average over a diversified portfolio. By contrast, if there is a shock that affects all, or most assets, in the same direction (such as a global recession or a global boom) then this type of shock will not 'cancel out' even in a diversified portfolio. That is why these shocks give rise to "undiversifiable" volatility/risk even in a diversified portfolio.

[2] Brealey, Myers and Allen, Principles of Corporate Finance, 10th Edition, McGraw-Hill Irwin. 2011, p. 222.

rates of return on securities. We would predict that firms with high earnings or cash-flow betas should also have high asset betas.

This means that cyclical firms—firms whose revenues and earnings are strongly dependent on the state of the business cycle—tend to be high-beta firms*. Thus you should demand a higher rate of return from investments whose performance is strongly tied to the performance of the economy. Examples of cyclical businesses include airlines, luxury resorts and restaurants, construction, and steel. (Much of the demand for steel depends on construction and capital investment.) Examples of less-cyclical businesses include food and tobacco products and established consumer brands such as J&J's baby products.* (Emphasis added.)

3 Appropriate asset beta estimates for PSE4 and beyond

3.1 Estimated asset betas reflect the shocks that hit the economy in the specific estimation period

18. The estimated asset beta in any estimation period is determined by the types of economy wide shocks that occur in that estimation period. For example, asset betas estimated over the period 2007 to 2014 were strongly influenced by the global financial crisis – especially for European companies. Companies involved in financial markets (especially banks and the lenders to banks) had materially higher estimated asset betas in that period because their expected value was strongly affected by the economy wide shock to the financial system.

19. Similarly, companies that were less exposed to the financial system would have had lower asset betas in that same period. This is because the average equity beta (from which asset betas are derived) is, by definition, always 1.0. This is because equity beta is a measure of relative risk. Consequently, if financial companies' equity betas were raised then other companies' equity betas must fall – so that the average equity beta remains at 1.0.

20. The same logic applies to the COVID-19 pandemic. This was an economy wide shock that strongly affected a range of companies including airports. As will be seen in the data presented section 5 (but foreshadowed below) the average estimated asset beta for airports is around 0.18 higher in the most recent 5 year period ending June 2022 that includes the effects of the COVID-19 pandemic than in the earlier period ending June 2017 that does not.

Table 3-1: Sample average asset betas (CEG estimates and sample)

Weekly 2017	4 Weekly 2017	2017 average	Weekly 2022	4 weekly 2022	2022 average	Average of both periods
0.68	0.73	**0.71**	0.90	0.88	**0.89**	**0.80**

21. This is an unsurprising phenomenon. Airports, being reliant on air travel, were materially affected by travel restrictions (both government and customer driven) due to the spread of the COVID-19 virus. Similarly, the COVID-19 pandemic had widespread negative effects on the economy (in large part driven by restrictions on travel and other forms of social mobility).

3.2 Rolling 10 year estimation windows updated at the beginning of every 5-year PSE provide actuarially fair asset beta compensation

22. In my view it would be appropriate in general, and in the specific context of the COVID-19 pandemic, to estimate asset beta using the most recent 10 years of data available at the start of each 5-year PSE (including PSE4 and future PSEs).[3]

23. At each future PSE, the older 5 years of data in the estimation window would be dropped and replaced with newer data. The effect of this method is that the asset beta estimate in every PSE reflects the balance of systematic shocks that occurred in the previous 10 years but these shocks only influence the asset beta applied in PSEs for a 10 year period (while they remain in the 10 year estimation window).

24. For example, if one were to (arbitrarily) define the COVID-19 pandemic shock as occurring in 2020 and 2021 then the COVID-19 shock would influence asset betas used in PSE4 and PSE5 but would drop out of the estimation window for PSE6.[4]

25. The major advantage of the proposed approach is that, in the long run:

    - all systematic shocks that actually occur are captured in the asset beta estimates actually applied in PSEs;
    - each shock is assigned an impact that matches the actual severity of the shock; and
    - each shock receives the exactly correct weight based on its actual frequency through time.

26. The last two points are, in my view, critical. To elaborate on the last point, whatever the true frequency of a COVID-19 like pandemic, the proposed method will generate asset beta estimates that include such an event with that exact frequency. If a COVID-19 like event (or a global financial crisis etc.) is a one-in-fifty year event then one 5-year estimation window in 50 years will include such an event. But if the true

[3] This is consistent with the NZCC IM asset beta methodology to date – which has been to retain a stable 10 year estimation window (made up of two five year estimation windows) and to set the asset beta based on whatever systematic shocks occurred during that window. No attempt has been made by the NZCC to adjust the asset beta based on a view that the shocks that occurred in the 10 year estimation window were not representative of the expected frequency of that form of shock. For example, the NZCC did not attempt to adjust for the impact of the global financial crisis in the 2016 IM update – even though this was a large systematic shock of the kind that arguably occurs less than once every 10 years. Nor did the NZCC attempt to adjust Chorus' estimated asset beta for the impact of COVID-19.

[4] PSE6 is scheduled to begin on 30 June 2032. At which time a 10 year estimation window would only reach back to 1 July 2022.

frequency is one-in-twenty or one-in-100 the rolling update will ensure that the event is captured in one estimation window every 20 or 100 years – as appropriate.

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

28. The proposed method is largely the same as the existing NZCC IM method except it is applied once every 5 years, instead of every seven years, so as to apply at the start of each of Auckland Airport's PSEs.

29. It is true that no 10 year estimation window will be truly representative of the perceived economic shocks that are (actuarially) expected over any given PSE. For example, it was well understood that airport investors were exposed to the risk of pandemics over PSE1 to PSE3. That is, investors placed a non-zero probability on a major pandemic occurring over PSE1 to PSE3.

30. Nonetheless, asset betas applied in PSE1 to PSE3 provided no pandemic related asset beta compensation. This is because no major pandemic event occurred in the relevant period over which asset betas were estimated. Moreover, no stakeholders, including airlines or the NZCC, were advocating for an uplift to the estimated asset beta in the 2011 and 2016 IM asset betas to reflect the real *ex ante* (but unrealised historically) risk of a major pandemic.

31. The obvious reason for not applying an uplift in PSE1 to PSE3 for the risk of a pandemic was that to do so would have been extremely informationally difficult. In order to impute into an asset beta estimate the risk of a shock that did not occur in the estimation window one needs a robust and credible estimate of both:

    - The probability of that shock occurring in any given period; and
    - The likely impact of that shock on asset betas.

32. For example, an analyst considering the asset beta for PSE1 to PSE3 could, conceivably, have gone through the following logical thought process:

    i. I know a major pandemic did not happen in my asset beta estimation window (i.e., a realised *ex post* zero probability of a pandemic in the estimation window);

    ii. But I also know that the *ex ante* probability of a major pandemic is not zero (call this probability "γ" (where 0<"γ" <1));

    iii. When (if) a major pandemic shock occurs I assess that it will have positive asset beta risk for airports and will raise estimated asset betas by a specific amount (call this amount α);

    iv. I therefore will set my asset beta for PSE1 to PSE3 equal to the observed asset beta in my estimation window plus "$\alpha \times \gamma$" being my estimate of the expected systemic risk (not realised in my estimation window) of a major pandemic.

33. While there is nothing conceptually wrong with the above logical thought process, the obvious implementation problem is that neither the analyst nor anybody else would have any idea what the correct values for α and γ are. Indeed, having now experienced a major pandemic we are not really any better placed to assess the likely frequency and severity of such events.[5] Either way, no such adjustment was applied in PSE1 to PSE3.

3.2.1 Adjusting the PSE4 asset beta to "de-weight" the impact of the pandemic

34. The fact that asset betas in PSE1 to PSE3 did not include an uplift for (unobserved) pandemic risk is an illustration for why it would be a mistake to argue that the asset beta for the asset beta for PSE4 should be adjusted downward to remove some part of the (observed) pandemic impact on asset betas.

35. One might be tempted to argue that major pandemics occur less frequently than once in 10 years and, therefore, the 10 years to June 2022 are not "representative" of the true actuarially expected risk of pandemics for investors in airport companies. However:

- if a 10 year estimation window that includes a major pandemic overweights (relative to *a priori* probabilities) pandemic type shocks; then
- a 10 year estimation window that **does not** include a major pandemic **under**weights (relative to *a priori* probabilities) pandemic type shocks.

36. Once the second dot point is accepted as the logical corollary of the first, it can be easily seen that attempting to adjust the estimated asset beta to reflect some estimate of a shock's "*a priori* probability" creates more problems than it solves. Specifically, adjusting downwards the asset beta estimates affected by COVID-19 on the basis that COVID-19 type shocks are "overrepresented" in that period requires an offsetting upward adjustment to asset beta estimates derived from all other periods where COVID-19 type shocks are "underrepresented". This would include the historical PSE1 to PSE3 periods.

37. The difficulty and complexity of attempting to do so is described in detail in Appendix A. However, by way of simple illustration, note that by this logic:

a. the asset betas applied in PSE1 to PSE3 were all underestimated because there was no major pandemic effect in the estimation windows used to derive that estimate;

5 While we do have some data on the effect of the COVID-19 pandemic it is not possible to disentangle the effect of COVID-19 from other events occurring during the same period. Similarly, we don't know that a future pandemic shock will take the same form.

b. the 5 year estimate ending June 2017 will be underestimated because there was no major pandemic during those 5 years;

c. all future asset beta estimates (e.g., for the 5 years ending June 2027 and beyond) will be underestimated if their estimation window does not include a major pandemic.

38. Put simply, if one were to argue that the estimated asset beta for the 5-years ending June 2022 overstates the actuarial probability of a pandemic, then a direct corollary is that the asset beta estimated in all other periods (without major pandemic shocks) understate that probability. That is, any downward adjustment in the 5-years to June 2022 should be offset by upward adjustments in other periods.

39. By definition, the net effect of these changes should be zero. That is, in order to be conceptually sound, one would need to mostly, but not fully, remove the impact of an infrequent event from the period in which it falls and then smear that removed effect across all other periods that are unaffected by the infrequent event. If done accurately, the net effect on average asset betas through time would be zero.

40. Of course, this could never be done accurately because the "true" frequency and severity of a COVID-19 like event (or, really, any major economic shock) is not known with any accuracy. Attempting to adjust for an unknown (and unknowable) true probability of an event is, in my view, likely to end in a regulatory quagmire of competing claims all based on views that are not, and cannot be, robustly evidenced.

41. These issues are discussed further in Appendix A where I also explain that any argument for a pandemic adjustment is not peculiar to pandemics. If applied to a pandemic then it invites application to all large infrequent systematic shocks. For example, the following are examples of large systematic shocks of a kind that are also infrequent/unpredictable:

i. The war in Ukraine, and subsequent sanctions on Russia, is affecting global energy markets and global inflation and interest rates.

ii. The global financial crisis of 2008-09 and the subsequent Eurozone debt crisis extending out to at least 2015 represented a one in 100 year financial crisis and systemic shock;

iii. The decades long industrialisation of China, and associated reduction in global manufacturing costs and a global excess of savings, has had profound impacts on the structure of the world economy but which cannot be expected to be repeated in the future.[6]

iv. Etc.

42. In fact, all estimation windows for asset beta will be made up of a combination of shocks that do not reflect the "average" set of expected shocks. For example, New Zealand inflation, like inflation globally, has experienced a 32 year high of 7.2% pa.[7] This is, by definition, a shock that is not expected to be repeated every 5-years. Therefore, the same logical case could be made for attempting to adjust measured asset betas that include 2022 in order to remove the effect of a 1-in-32 year record high inflation. However, going down such a path would make asset beta estimation unworkable.

43. This is an example of the regulatory quagmire raised above. With no clear and transparent basis for making any change in estimation methodology, stakeholders will be incentivised to engage in what ultimately ends in a "data-mining" exercise – choosing:

    a. what events to classify as happening inconsistent with their expected future frequency (noting that events such as the global financial crises have at least as much claim to this as does COVID-19);

    b. what period to classify as affected by those events (and which sub periods of that period are most affected etc);

    c. how to estimate the magnitude of the impact of the event on the estimated asset betas;

    d. what probability to put on that event occurring in the future in order to "add back" the amount necessary to arrive at an appropriately weighted probability of "event X" asset beta.

    e. how to keep track of the impact of future "event X" like occurrences in order to also remove the impact of those (so that the "add back" from the previous step does not result in overweighting of "event X" like occurrences).

44. The more events that an estimation methodology seeks to adjust for overtime the more complex the asset beta estimate will become. Ultimately, the asset beta estimate would comprise mainly of previously determined estimates of increments/decrements for certain events X, Y and Z added to an asset beta estimate that becomes ever more contentious as stakeholders argue over whether the new estimation period is affected by X, Y and Z like events and, if so, how the impact of those events should be removed.

3.3 Must the estimation window be 10 years?

45. The rational for my proposed approach is that the same length estimation window is applied at the beginning of every PSE and that estimation window is a multiple of the

length of the PSE. My proposed adoption of a 10 year estimation window fits these criteria in that:

- 10 years is a multiple of 5 years; and
- 10 years estimation windows have been standard practice in New Zealand regulation and are what I am informed asset betas in PSE1 to PSE3 were based on.

3.3.1 Why the estimation window must be a multiple of the PSE length

46. The estimation window must be a multiple of the length of the PSE because that ensures that all historical periods have the same weight in setting the asset beta actually applied in PSEs over time.

47. By way of illustration, imagine that the estimation window was only two years and this was updated every 5 years (at the beginning of each PSE). Then only two out of 5 years of historical data would receive any weight in determining the asset betas applied in future PSE's. If the estimation window was 7 years a similar issue would exist. Under this scenario, every year of historical data receives some weight in setting asset betas for future PSEs. However, two out of every 5 years (being the two years immediately preceding each PSE) would receive twice the weight as the other three years. For example, a 7 year estimation window would mean that 2023 to 2025 would only be used to set asset betas for PSE5. However, 2026 and 2027 would be used to set asset betas for both PSE5 and PSE6.

48. By failing to give all historical periods the same weight in setting future asset betas one cannot be sure that the asset betas estimated and applied over time will reflect the true (realised) frequency and severity of economic shocks that apply over time. For example, if a 7 year estimation window had been consistently applied in the past and in the future then 1 July 2020 to 30 June 2022 would be over-represented in AIAL's PSEs (being used to determine asset beta in PSE4 and PSE5) while 1 July 2017 to 30 June 2020 would be underrepresented (being only used to determine asset beta in PSE4).

3.3.2 Implication of lengthening the asset beta estimation window from 10 to 15 years

49. The historical practice to date in New Zealand has been to adopt a 10 year estimation window. Therefore, continuing with that practice will continue to give every year of historical data the same weight in determining asset betas applied in PSEs.

50. However, the Commerce Commission (in the context of IM asset betas) has stated that:[8]

> *In relation to our calculation of asset beta, at the last review we focussed on asset betas from the two most recent five-year periods (2006-2011 and 2011-2016); however, we also had regard to earlier periods. The economic consequences of COVID have resulted in an increase in asset betas for airport services, as indicated in CEPA's calculation of the average asset beta for the 2020-22 period compared to the average asset beta for the periods 2012-2017 and 2017-2022.* ***We are considering whether we should use a term for airports that is either longer or shorter than the last two five-year periods****. For energy, CEPA's findings indicate there does not appear to be a need to vary the sampling timing we used last time; however, we welcome views on this.*

51. The NZCC does not provide any further context for what such reform would look like and I note that the IM asset beta is not the same as the asset beta that should be applied in PSE's (although I do consider that the IM methodology as it currently stands is a reasonable basis for estimating the asset beta at the beginning of each PSE).

52. In the context of the analysis set out above, if the estimation window to be applied at the beginning of each PSE was changed it would either need to be:

- Shortened to 5 years; or
- Lengthened to 15 years.

53. Applied consistently on a forward looking basis, either of these approaches would satisfy the criteria that all future years receive the same weight in setting asset betas for PSEs. However, there would be transitional effects in that:

- Moving to a 5 year window would mean that the 5 years to June 2017 would be underweighted relative to other 5 year windows;[9]
- Moving to a 15 year window would mean that the 5 years to June 2012 would be overweighted.[10]

---

8 8 December 2022 letter accompanying the release of the CEPA report. "CEPA report on aspects of the cost of capital Input Methodologies for the 2023 review"

9 This period would only used in the context of informing one PSE and that would be in a context where those 5 years were only one half of the data (i.e., this 5 years of data would be given half the weight for a single 5 year PSE).

10 This period would be used to determine asset beta in 3 PSEs but in two of those it would have 50% weight instead of on third weight.

54. I think it is reasonable to rule out the first option. This would only serve to make the asset beta used in PSE's more volatile and even higher in PSE4 than it would otherwise be. This does not seem consistent with the Commerce Commission's seeming concern over the increase in asset betas even when using a 10 year estimation window.

55. This leaves consideration of a 15 year estimation window. Applied consistently in all future periods, this can be expected to:

- Lower the asset beta estimate in PSE4 and PSE5 by virtue of "diluting" the pandemic shock by adding more data pre-pandemic (by adding data from 1 July 2007 to 30 June 2012 to PSE4 and adding data from 1 July 2012 to 30 June 2017 to PSE5); but
- Raise the asset beta in PSE6 by including the pandemic shock (in the 1 July 2017 to 30 June 2022 period) into the estimation window that would otherwise have been dropped with a 10 year estimation window.

56. If the period being overweighted due to the change (1 July 2007 to 30 June 2012) is in some sense "normal", then the net effect of the changes on the average asset beta applied overtime should be zero. All that is happening is that instead of recovering the revealed pandemic asset beta risk over 10 years this is being recovered over 15 years.

57. However, there are a number of concerns about *ad hoc* changes in standard practice.

- First, while the average PSE asset beta will not be changed, the time path for the PSE asset beta will be. That is, airports will need to wait for longer to be compensated for the realised impact of pandemic risk on asset beta (i.e., will suffer a time value of money loss);

58. Second, the period 1 July 2007 to 30 June 2012 is clearly not "normal" (and no individual period ever really will be). This period captures the worst of the global financial crisis and the subsequent Eurozone crisis which likely depressed European airport stock betas.[11]

- ; and
- Third, there is the potential for such a change to be perceived as an illustration of asymmetric regulatory risk. That is, an ad hoc change attempting to dilute a

[11] During the Eurozone crisis, the Eurozone/European sovereign debt crisis (with the threatened exist of Greece Spain and Portugal from the Eurozone "Grexit") financial sector shocks spread throughout the economy as financial institutions, threatened by insolvency, found it difficult to maintain prior levels of lending. However, the effect was largest in the finance sector and this acted to raise the measured equity betas for financial institutions and depress measured equity betas for other industries on average. While global in its impact, these shocks were most strongly felt in the US and Europe whose banking systems were placed under the greatest strain.

period of realised high risk when a period of realised low risk would be unlikely to elicit a similar response.

59. Finally, and for the absence of doubt, any change to the estimation window must be permanent. It would be entirely unreasonable to:

- Adopt a 15 year estimation window for PSE4 and PSE5; and
- Revert to a 10 year estimation window for PSE6.

60. This would leave the realised asset beta pandemic risk undercompensated in absolute terms.

3.4 Conclusion

61. Any methodology for setting compensation for systemic risk across multiple PSEs must seek to ensure that the estimated asset beta applied across PSE's will, over the long run, reflect the average systemic risks observed in equity markets for airports. The best, and likely only realistically manageable, way to achieve this is if:

- The asset beta is updated at the beginning of each PSE;
- Each update uses the same estimation window; and
- The estimation window is a whole number multiple of the length of the PSE (e.g., if the PSE is 5 years then the estimation window is 5, 10, 15 etc years).

62. Historically 10 years has been used to estimate the asset beta in New Zealand and, consistent with the second dot point, I consider that 10 years should continue to be used. If, nonetheless, a longer period (e.g., 15 years) was adopted it should continue to be applied in all future PSEs.

4 Asset beta sample

4.1 A large geographically diverse sample with estimation over a long period (a decade) is desirable

63. The "true asset beta" for a company needs to be distinguished from "the empirically estimated asset beta" for that company. The true asset beta reflects investors' expectations of how volatile (and how correlated with the rest of the equity market) a company's returns will be in the future (given an actuarial assessment[12] of what events the future might hold). The empirically estimated asset beta represents an estimate of how volatile (and how correlated with the rest of the equity market) a company's returns have been over some specific finite past estimation period. An empirically estimated asset beta is only a very noisy proxy for the true asset beta.

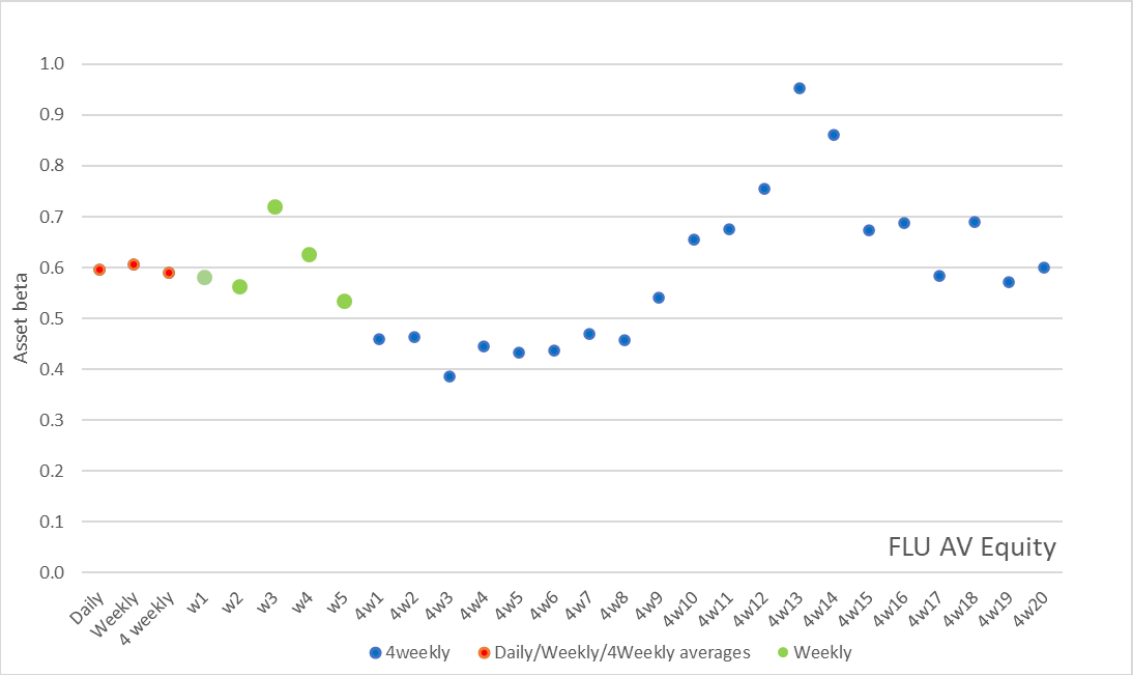
64. I regard the NZCC's 2016 IM methodology as highly robust. The most important fact that a robust methodology must deal with is the high levels of noise in asset beta estimates. These include noise in:

- Asset beta estimates for the same firm over the same time period but using different sampling periods (e.g., weekly asset betas estimated over the same 5 year period but defining the week as starting on Monday instead of Tuesday etc);
- Asset beta estimate for the same firm estimated over different time periods (e.g., 5 years ending June 2022 vs 5 years ending June 2017);
- Asset beta estimates for different firms in different geographical locations over the same period.

65. To see this, consider the 28 asset beta estimates for Vienna Airport for the 5 years ending 30 June 2022. There are 5 different estimates of weekly asset betas and 20 different estimates of monthly asset betas. There is also one estimate of daily asset betas and two estimates of the average weekly (average of 5 estimates) and average four weekly (average of 20 estimates).

[12] That is, a probabilistic assessment of all the possible shocks that might hit the economy while the asset is being held. This includes low probability but high impact events – such as the global pandemic that actually did hit the global economy in 2020.

Figure 4-1: Vienna airport: 28 asset beta estimates for the 5 years ending 30 June 2022



66. This chart clearly illustrates a problem with the idea, seemingly raised in the Commerce Commission's cover letter to the CEPA report that the Commission is:

> *... considering whether we should exclude companies that have a large variance in estimates based on daily, weekly and four-weekly data. We are concerned that companies that do not have a stable estimate of asset beta may not be suitable comparators.*

67. Vienna airport might have (by chance) very similar daily, average weekly and average four weekly asset betas. However, these obscure very large variations in asset beta estimates that make up the average weekly and average four weekly estimates. It is difficult to understand how one could argue that Vienna airport has a "stable" asset beta estimate on the basis of Figure 4-1.

68. Moreover, there is no basis for believing that volatility in asset beta estimates is a sign of unreliability in asset beta estimates. Airports are volatile companies and volatile companies have noisy asset betas. That is a why the NZCC practice has been to use 25 asset beta estimates for every company and to have a large sample.

69. I address this issue in more detail in a separate report for the New Zealand Airports Association.[13] In that report I explain that with different definitions of "stability" in estimates the sample average asset beta can either rise or fall dramatically if the "least

[13] CEG, NZCC comments on asset beta estimates for airports, January 2023.

stable" estimates are removed from the sample and if certain thresholds are set for that is "stable enough" for inclusion.

70. I explain that, in my view, it would be unwise to develop a regulatory methodology in which such arbitrary decisions would play a critical role. This is especially the case given that there is no sound conceptual basis for wanting to exclude comparators with "unstable" asset beta estimates.

71. Empirically estimated asset betas include a degree of "noise" in the beta estimated for each airport. Using a large sample will allow the noise in these individual empirically estimated asset betas to cancel out, giving a more reliable estimate of the true average asset beta for the sample. Using a small sample means this noise is less likely to cancel out.

72. That is why I consider that the NZCC 2016 IM methodology of adopting a large sample is best practice. A large sample ensures that the sample average that is being used is less affected by noise in the empirical beta estimation (as a proxy for the comparator's true asset betas). If there was good reason, based on a robust relative risk assessment, to believe that the regulated airport in question had risk that was different to the large sample average then some departure from the large sample average might be contemplated. However, that departure should be achieved by adding or subtracting an adjustment from the large sample average – not by removing comparators from the large sample average.

73. For example, there is evidence that AIAL's systemic risk is higher than the sample average (based both on comparison of regulatory regime and operating environment as well as estimated asset betas). AIAL is not seeking to adopt an asset beta that is higher than the sample average. However, if it were to do so my advice would be that AIAL should not seek to "shrink" the sample to only include higher risk airports. My advice would be for AIAL to estimate the difference in its asset beta risk versus the sample average and to seek to apply an adjustment on that basis.

74. It is also important to have a geographically diverse set of comparators because noise in the empirically estimated asset betas will often be geographically correlated. Different geographies are subject to different economic shocks at different times (e.g., European airport stocks were most affected (and asset betas likely depressed)[14] by the

[14] During the Eurozone crisis, the Eurozone/European sovereign debt crisis (with the threatened exist of Greece Spain and Portugal from the Eurozone "Grexit") financial sector shocks spread throughout the economy as financial institutions, threatened by insolvency, found it difficult to maintain prior levels of lending. However, the effect was largest in the finance sector and this acted to raise the measured equity betas for financial institutions and depress measured equity betas for other industries on average. While global in its impact, these shocks were most strongly felt in the US and Europe whose banking systems were placed under the greatest strain.

3 Consistent with this, the Western European airports tend to have lower than sample average asset betas when estimated over this period. One might be tempted to conclude that this suggests that the Western

financial turmoil surrounding the financial crisis of 2008-09 and the subsequent Eurozone crisis.

75. Focussing on one, or a limited, geography will increase the variance of the estimates because there will be a lack of diversity in the shocks being captured. These considerations point to the value of the NZCC sample having a diversified set of airports from many countries in order to maximise the effective diversity of economic shocks being analysed. Including airports from a large number of jurisdictions reduces the likelihood that our asset beta estimate is unduly influenced by specific shocks that were peculiar to a narrow set of economies during the estimation period.

76. Consistent with this logic, the NZCC 2016 IM methodology does not base its estimate of the true asset beta for Auckland Airport solely, or even primarily, on the empirically estimated asset beta for Auckland Airport. [15]

> *"Auckland Airport has provided information on its observed asset beta which indicates its asset beta is higher than what it was estimated to be by our comparator sample, and that the asset beta is increasing. Nonetheless, we do not consider this information can, by itself, justify a departure from our mid-point WACC estimate. In our view, asset beta estimates for a single company and over a limited period of time are not sufficiently reliable."*

77. This is true even though, by definition, Auckland Airport has exactly the same risk as Auckland Airport. If the task were to identify the single closest comparator in terms of risk relative to Auckland Airport and adopt that as the primary comparator then the NZCC would, obviously, have adopted Auckland Airport as the primary comparator. The NZCC did not do so for precisely the reasons that I have set out above. This approach would be unsafe and unreliable because every empirically estimated asset beta is a noisy estimate of the true asset beta for that comparator. Rather, the NZCC gave Auckland Airport's empirically estimated asset beta the same weight in its analysis as every other one of its comparators (one 26th weight in the 2016 IMs).

European airports have lower than average risk. However, an equally plausible explanation of this is that systemic shocks that hit Western European economies and equity markets over this period were dominated by financial shocks and this depressed the betas of non-financial stocks.

15 NZCC, Review of Auckland International Airport's pricing decisions and expected performance (July 2017 –June 2022) Final report –Summary and analysis under section 53B(2) of the Commerce Act 1986, 1 November 2018, p. 8.

4.2 Exclusions proposed by AIAL, CEPA and NZCC cover letter to the CEPA report.

78. Based on the analysis in section 4.2, I consider that companies should only be excluded from the sample if it can be shown that their cash-flows are either not primarily generated at an airport or are not primarily driven by passenger volumes.

79. AIAL has recommended removing Airport Facilities Co (8864 JP Equity) and GMR Industries (GMRI IN Equity) on the grounds that their activities are insufficiently related to (sensitive to) passenger volumes at the airports they own/operate at.

80. CEPA has recommended removing Airport Facilities Co and Japan Airport Terminal Co (9706 JP Equity) and Belgrade Nikola Tesla Airport (AERO SG Equity). CEPA's grounds for removing Airport Facilities Co are essentially the same as AIAL's reasoning:[16]

> *After a review of their business operations, we have not included it in our 2022 comparator sample. 79.3% of its net sales are attributed to its 'Real Estate Business' This involves the "leasing of real estate as multi-purpose general buildings, hangars, maintenance plants, apartments, and hotels in airports in Japan and abroad and regions along the railway line connected to the airport". The remainder of its revenues come from 'Area Heating & Cooling Business' and 'Water supply & Drainage Service and Other Business'. We do not consider these business operations relevant enough to the fee based, regulated aeronautical operations of the rest of our sample.*

81. CEPA's does not discuss GMR Industries. Its reasoning for removing Japan Airport Terminal Co is:

> *Japan Airport Terminal Co has a low percentage of its total revenue from aeronautical sources, just 23% in 2018. Approximately 60% of revenue comes from merchandise sales at stores in the domestic and international terminals. Aeronautical revenues of 23% are in line with other firms which we haven't included in our sample and which the Commission previously didn't include such as Esken (27%), Ferrovial (34%) and Atlantia (7%).*

82. CEPA's reasoning for removing Japan Airport Terminal Co is:

> *In 2018 the concession for Belgrade Nikola Tesla Airport (AERO SG) was granted to Vinci Airports. Under the agreement AERO SG still owns the airport assets but receives an annual concession fee from Vinci who is responsible for operating the airport.*

[16] CEPA, Review of Cost of Capital 2022/2023 New Zealand Commerce Commission 29 November 2022 FINAL p.7.

83. My view is that:

- Airport Facilities should be excluded as its revenues appear not to be linked to passenger throughput except tangentially;
- It is a reasonable judgement call to exclude GMRI from historical estimation period (including up to June 2022). However, GMRI has sold off its non-airport operations (now known as GMR Airports Infrastructure Limited) and should be included in future samples.
- It may be a reasonable judgement call to exclude AERO SG because the terms of the concession contract are unclear. However, it is clear that AERO SG still bears some form of passenger throughput risk under the terms of the concession contract and, therefore, reasonable minds may differ on the inclusion of this comparator;
- It is not reasonable to exclude Japan Airport Terminal Co because:
  - Japan Airport Terminal Co's non-aeronautical cash-flows are, like its aeronautical revenues, directly driven by passenger throughput and, therefore, have similar risk to aeronautical operations. However, although, as is explained below, aeronautical cash-flows are more sensitive to passenger numbers than non-aeronautical cash-flows.
  - Profit share for aeronautical services (Facilities Management in Japan Airport Terminal Co's accounts) is materially higher than revenue share due to the nature of the non-aeronautical operations at Japan Airport Terminal Co (where cost of goods sold in retail outlets is the vast majority of costs and these expenses vary automatically and proportionally with sales). In 2018, Facilities Management was 25% of revenues but 46% of operating profits.

4.2.1 GMR Industries

84. While GMR Industries has always had airport operations subject to the risk of fluctuations in passenger numbers, prior to its split/demerger on 11 Jan 2022, it had extensive non-airports related activities. [17] The split separated the non-airports business into a newly listed entity GMR Power and Urban Infrastructure Limited with

[17] According to a valuation by IDBI Capital (GMR Infrastructure Now Boarding: A Horse with a Wing! 16 March 2018 available here) prior to GMRI's restructure, Airports accounted for only 46% of capital employed with "power" 23%, "roads" 10% and "others" 20% (page 5). However, it is also relevant within Airports, Delhi and Hyderabad "land bank" provided a significant proportion of the "airport" valuation (at Delhi the land bank was valued at more than DIAL). "Land bank" related to the value of land around the airport that GMRI was gradually selling to third parties for development.

GMR renamed GMR Airports. As reported, one of the key reasons for the split was to attract "sector-specific global investors". [18]

85. In short, the listed GMR Industries company is currently focussed solely on airport operations but was, over the period pre-split, a diversified infrastructure conglomerate and landowner/developer. This means that while it may be reasonable to exclude GMR Industries prior to January 2022, GMR Airports should be included in asset beta samples beyond that date.

4.2.2 Airport Facilities

86. Airport Facilities, as its name suggests, provides rental and utility type services to airports (primarily Haneda airport). These services include heating and cooling, water and wastewater, and telecommunications, collection, transportation and treatment of general and industrial wastes.[19] The company also engages in land and building rental and construction activities. The company does not receive payments based on aeronautical passenger throughput nor does it have passenger sensitive retail operations.

4.2.3 Aero SG

87. CEPA is correct that in 2018 the concession for Belgrade Nikola Tesla Airport (AERO SG) was granted to Vinci Airports. Under the agreement AERO SG still owns the airport assets but receives an annual concession fee from Vinci who is responsible for operating the airport.

88. However, it does not follow that AERO SG should be excluded from the sample. That would only be the case if its revenues under the concession contract were not linked to passenger volume at Belgrade airport. AERO SG revenues under the concession contract are linked to passenger volumes – as is clear from the following passage of the annual report.[20]

---

18 Indian Express: GMR group announces plan to split airports biz from other verticals (28 Aug 2020); GMR Infrastructure becomes India's first airport-only firm to be listed on stock exchange (12 Jan 2022)

19 The key business segment identified by Airport Facilities Co., Ltd's annual report are 1) Real Estate Business 2) Area Heating & Cooling Business 3) Water Supply & Drainage Service and Other Business. Financial Results for the Year Ended March 31, 2022 [J-GAAP], p.3, https://www.afc.jp/english/ir/assets/pdf/FinancialResults_March2022.pdf

20 The annual report for the year 2020 (published under Article 50 of the Law on Capital Market ("Official Gazette of the Republic of Serbia", No. 31/2011, 112/2015, 108/2016 and 9/2020), and under the Rulebook on the content, form, and manner of publishing annual, semi-annual and quarterly reports of public companies ("Official Gazette of the Republic of Serbia", No. 14/2012, 5/2015 and 24/2017), Joint Stock Company Belgrade Nikola Tesla Airport publishes).

> *Due to the declaration of a virus epidemic, i.e. the application of a case of force majeure, in the period until December 31, 2020, the realized concession fee is at a level that implies a reduction in the number of passengers at Nikola Tesla Airport, which reflected on DPN's business during the observed period.*

89. Total 2020 revenues fell to a quarter of their 2019 level (from and 1,362,730 to 389,005). It appears clear that the concession contract did not transfer all passenger volume risk from Aero SG to Vinci Airports. This is consistent with the fact that the estimated asset beta[21] for Aero SG rose from 1.25 over the 5 years ending June 2017 to 1.50 over the next 5 years. This 0.25 increase in asset beta is larger than the average 0.16% increase across the sample (although in percentage terms it is smaller (20% vs 37%). If the concession had transferred all passenger risk from Aero SG then I would have expected a fall in asset beta rather than a rise.

90. Nonetheless, it is not obvious what the terms of that concession contract are and what ongoing exposure to passenger volumes will be borne by SG Aero. On this basis, reasonable minds might differ on whether to include SG Aero in the sample or not.

4.2.4 TAV

91. CEPA has also excluded TAV (TAVHL TI) which owns and operates a number of airports in Turkey including Istanbul Airport. CEPA explains its exclusion on the basis that ADP purchased a 46% stake in TAV and that the exclusion of TAV is:

> *Consistent with the Commission's approach to include only the 'most relevant' comparator between a parent and subsidiary in their energy sampling method.*

92. I do not consider that this is a sensible basis for exclusion of TAV. TAV remains, with and without the shareholding of ADP, a valid independent estimate of an airport asset beta for an airport group operating in Turkey and subject to the economic shocks that the Turkish economy is subject to. The increase in shareholding by ADP did not alter the relevance of the TAV asset beta estimate as an independent data point.

93. The increase in shareholding by ADP will make ADP's estimated asset beta marginally more similar to TAVs (by virtue of ADP being exposed to more of TAV's risks than before). However, this is an extremely marginal effect. In 2021, 75% of ADP revenue was from France and of its non-France revenue TAV only accounted for a fraction (around one third is from non-TAV airports including in Jordan and India).

94. ADP's operations are very different to TAVs operations and, therefore, their respective estimated asset beta are largely independent observations of an airport

[21] Average of weekly and four weekly average asset betas

company asset beta. Having both in the sample improves the diversity and reduces the potential for noise in estimation to influence the estimated sample average.

95. The logic that CEPA refers to for the exclusion of TAV would apply if ADP's main asset was TAV – in which case including both estimated asset betas would involve a significant level of "double counting" TAV. But this is clearly not the case, ADP's investment in TAV is a small fraction of ADP's overall investments. There is no material impact of "double counting" TAV and excluding TAV amounts to not using a relevant independent data point.

96. ADP's practice and stated business strategy is to grow by investing in a range of other airport companies, currently including:

- TAV (Turkey);
- GMR Airports (India);
- Royal Schiphol Group (Netherlands);
- AIG (Jordan);
- Liège Airport (Belgium);
- SNCP (Chile);
- MZLZ (Croatia);
- Société Guinéenne (Guinea);
- Matar (Saudi Arabia);
- ATOL (Republic of Mauritius); and
- Ravinala Airports (Madagascar).

97. Following this business strategy ADP could easily take large stakes in other airports in the NZCC sample (large in the context of the target company, not large relative to ADP itself). If ADP did so for, say, AIAL then CEPA's logic would imply AIAL should be excluded when, in my view, this would result in the loss of a valuable data point for no benefit.

4.2.5 Japan Airport Terminal Co

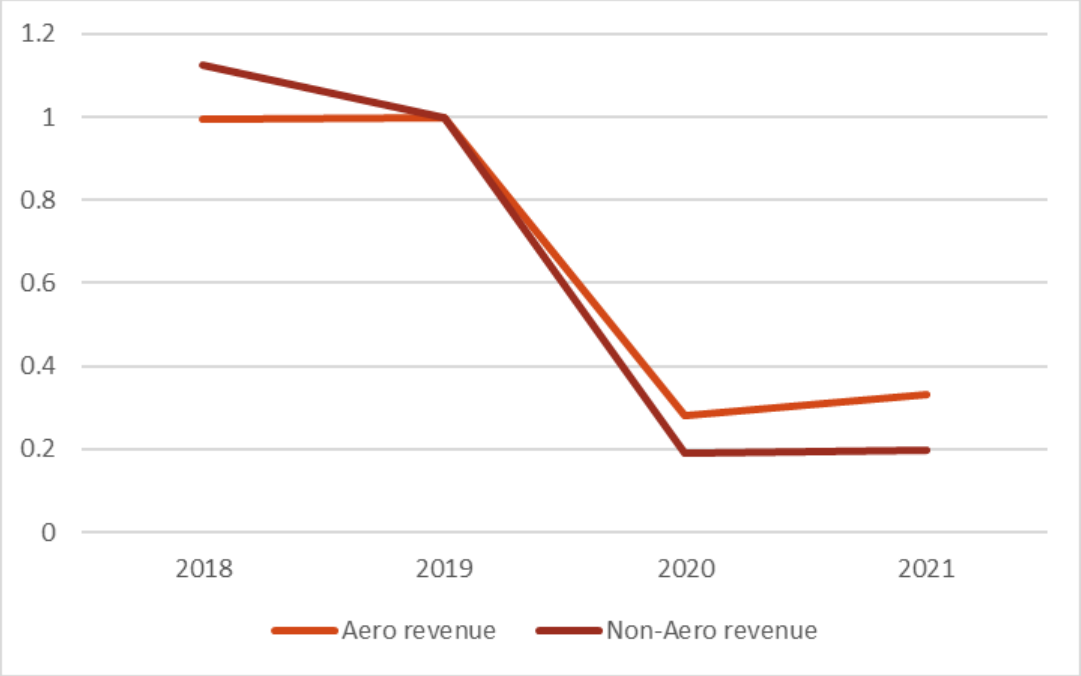
98. I do not consider that it is not reasonable to exclude Japan Airport Terminal Co. It is true that Japan Airport Terminal Co has a smaller percentage of aeronautical revenues than many other airports (although I estimate this at 25% in 2018 not

23%).[22] However, it is important to consider this in the context of what the non-aeronautical revenues are.

99. These are essentially all sales at retail outlets within terminals operated by Japan Airport Terminal Co. Thus, unlike GMR Industries and Airport Facilities, these revenues are very similar in their exposure to passenger volumes as is aeronautical revenues.

100. The best way to illustrate this is to compare a time series of aeronautical revenues and non-aeronautical revenues. Figure 4-2 illustrates this and it can be seen that the sensitivity of revenues to the passenger decline in the pandemic is very similar for aero and non-aeronautical revenues.

Figure 4-2: Time series of aero vs non-aero revenues (2019 =1)

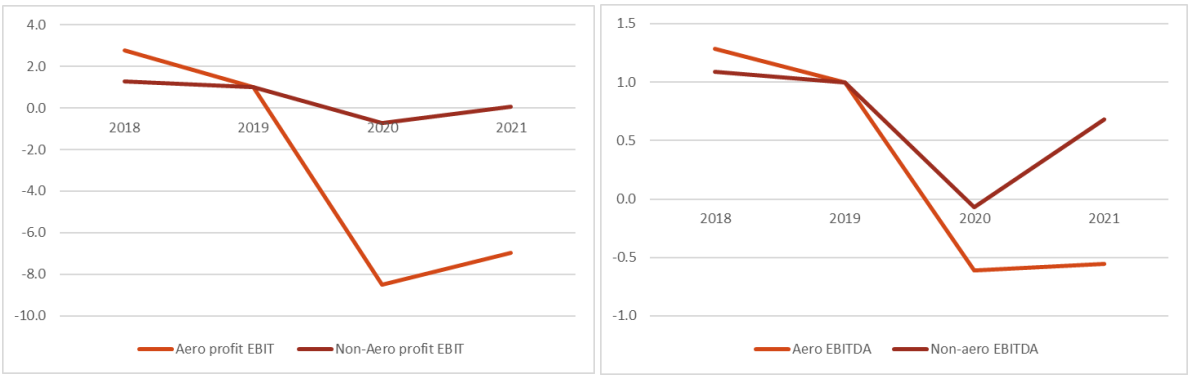


Source: CEG analysis and JAT segment data and annual reports. Non-Aero revenue is calculated as the sum of Sale of Merchandise, Sale of Food and Beverage and Rent revenue. Aero revenues is total revenue less non-aero revenue. Note that JAT's financial year ends in March. Consistent with JAT's description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

[22] Japan Airport Terminal Co reports revenue and operating profit for three segments. I estimate aeronautical revenues as Facilities Management segment revenue less Rental revenue. I estimate non-aeronautical revenues as the sum of Merchandise and Food and Beverage Segments plus Rental revenue.. Segment data is sourced from https://www.tokyo-airport-bldg.co.jp/en/ir/finance/financial_segment.html. Rental revenue is sourced from the annual 2019 (year ended March 2020) and 2021 (year ended March 2022) annual reports.

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

Figure 4-3: Time series of aero vs non-aero EBIT and EBITDA (2019 =1)



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

102. Japan Airport Terminal includes EBIT and EBITDA operating income on a segment basis. The Facilities Management segment includes aeronautical revenues plus rent. For the purpose of the above revenue analysis I have removed rental income from the Facilities Management segment and added it to the non-aero segment. For the purpose of the profit analysis I have removed the net value of rental income and rental expenses.

103. The reason that aeronautical profits are more sensitive to passengers, even though aeronautical revenues are less sensitive to passengers, is that Japan Terminal Co's non-aeronautical costs are dominated by variable costs including cost of goods sold. For example, cost of sales for Merchandise accounted for around two thirds of merchandise revenue in 2018 and 2019.[23] Cost of sales for Food and Beverage was around 50% of revenue in the same period. [24] Naturally, cost of sales falls in proportion to the number of items sold (e.g., merchandise cost of sales fell from 104bn yen in 2019 to 12bn yen in 2020). This automatic cost reduction naturally means that the fall in non-aeronautical profits is much less than the fall in revenues for the Merchandise and Food and Beverage segments. The same is less true for aeronautical profits which is why aeronautical profits are more sensitive to passenger volumes than non-aeronautical profits.

104. Consistent with this, in 2018 Japan Airport Terminal had a materially higher non-aeronautical revenue share than Frankfurt, AENA, AIAL and AdP. However, all of

[23] 2018 (2019) merchandise cost of sales was 121 (104) bn yen while revenue was 171 (148) bn yen.

[24] 2018 (2019) food and beverage cost of sales was 11 (10) bn yen while revenue was 20 (19) bn yen.

these companies also report profits (EBITDA and EBIT) on a segment basis. On a profit basis, Japan Airport Terminal had the smallest (EBIT) or second smallest (EBITDA) share of non-aeronautical profits.

Table 4-1: Non-aero revenue share vs profit share where available

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

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

105. It follows that if Japan Airport Terminal were to be excluded from the sample for having "too high" a proportion of non-aeronautical operations then so should Frankfurt, AENA, AIAL and AdP (all of which had the same or higher non-aeronautical profit shares in 2018). Clearly, this would be a problematic set of exclusions.

106. As explained in section 6 below and in my separate report for the New Zealand Airports Association, most airports only present revenues (not profits) on the relevant segment basis. This means that a sample wide analysis of the affect of non-aeronautical operations must be based on revenue shares for aeronautical vs non-aeronautical revenues. This shows a strong negative relationship between estimated asset betas and the percentage share of non-aeronautical revenues. When this is done Japan Airport Terminal appears to be an outlier in that it has a high measured asset beta relative to other firms with similarly high percentage shares of non-aeronautical revenues. However, this is precisely because, as explained above, comparisons on revenue share materially overstates the importance of non-aeronautical operations at Japan Airport Terminal compared to other airports.

107. The Supreme Court of Western Australia also confirmed the exclusion of Airport Facilities but the inclusion of Japan Airport Terminals in a judgment of a dispute between Perth Airport and Qantas delivered early this year.[25] This is mentioned in paragraph 267:

> *"As to the issue of the Japanese airports, Japan Airport Terminal Co Ltd and Airport Facilities Co Ltd, I accept PAPL's submission that the fact non-*

[25] Supreme Court of Western Australia, PERTH AIRPORT PTY LTD -v- QANTAS AIRWAYS LTD [No 3] [2022] WASC 51 (18 February 2022), p. 79, http://www.austlii.edu.au/cgi-bin/sign.cgi/au/cases/wa/WASC/2022/51

aeronautical services comprise a significant part of Japan Airport Terminal Co Ltd's operations is not a basis for excluding it as a comparator. Dr Hern's primary and Tier 2 comparators each earn a significant amount of their revenues from non-aeronautical activities. PAPL did not make the same submission in respect of Airport Facilities Co Ltd given it is in a position where almost all of its revenues come from non-aeronautical services, placing it in a different position from Japan Airport Terminal Co Ltd. I consider Airport Facilities Co Ltd should be excluded from the sample set, and that the preferred sample set is the remaining 19 airports."

4.2.6 Newly listed and delisted firms since the 2016 IMs

108. I include comparators in a sample if they are traded unaffected by corporate takeover activity for 4.5 of any 5 year period. On this basis I exclude from the 5 years to June 2022 Venice Airport (delisted in 2017) and Sydney Airport (announced November 2021) airports. Three newly listed airports are included in the estimation of 5 year asset betas to June 2022. These are:

- ACV VN Equity (Vietnam, Airports Corp of Vietnam JSC) first traded in November 2016;
- AENA SM Equity (Spain, AENA SME SA) first traded in 2015;
- ADB IM Equity (Italy, Aeroporto Guglielmo Marconi) first traded in 2015.

109. I also note that CAAP US Equity listed in January 2018 and, therefore, does not have 4.5 years of data at June 2022 but will likely be included in any future sample update.

4.3 Proposed sample

110. My proposed sample includes all airports identified by CEPA and AIAL excluding GMR Industries and Airport Facilities. I include Aero SG (Belgrade) in the 5 years ending June 2022 I consider that reasonable minds might differ about the inclusion of this observation due to the potential for the concession agreement with VINCI to alter the exposure of AERO SG to passenger volume risk.

5 Asset beta estimates

5.1 Asset beta estimation method

111. The 2016 IM method adopted the sample average of weekly and four weekly asset betas estimates over a 10 year period – where the 10 year period was broken into two estimation periods. For each comparator in the sample the:

- Weekly asset beta was an average of 5 different estimated weekly asset betas (each starting on a different day (e.g., Monday, Tuesday etc);
- Similarly, the four weekly asset beta was an average of 20 different estimated weekly asset betas (each starting on a different day).

112. The NZCC adopted this approach after submissions from CEG explaining that any single "weekly" or "monthly" asset beta estimate is highly sensitive to the start day (see para 290 of NZCC 2016 Topic Paper 4). This issue is illustrated in Figure 4-1 above. I consider that this method is an appropriate way to attempt to reduce the impact of the inherently noisy asset beta estimation.

5.2 Implementation

113. I have followed the estimation process set out by the Commerce Commission in the 2016 IMs. This was originally set out in an Excel spreadsheet published with the draft decision and I have amended that method consistent with descriptions of amendments detailed in the final decision (including amendments to correct errors identified by CEG).[26] I have used the statistical package R to implement this process and have tested this against the (corrected) NZCC 2016 spreadsheet and have replicated the results in both settings.

114. AIAL has asked us to estimate asset betas for the relevant comparators adopting the NZCC method and to advise on any differences to LJK Consulting's estimates. I have done so below for the 5 years to 30 June 2022. CEPA has also recently reported asset betas estimated for the 5 years to the 30th of September 2022 (i.e., a 3 month different estimation period). I have also compared my estimates to CEPA's estimates (noting that the difference in estimation windows will affect our estimates to some degree).

5.2.1 Comparing sample average asset betas

115. Table 5-1 demonstrates that my sample averages are very similar to those estimated by LJK and CEPA.

[26] See para 292 of NZCC Topic Paper 4).

Table 5-1: Sample average asset betas estimated by CEG, AIAL (LJK) and CEPA

	Weekly 17	Weekly 22	4 Weekly 17	4 weekly 22	Average asset betas	G17	G22	Average gearing
				CEG sample				
CEG	0.68	0.90	0.73	0.88	0.80	0.15	0.13	0.14
AIAL	0.67	0.89	0.72	0.87	0.79	0.14	0.13	0.14
CEPA	NA	NA	NA	NA	NA	NA	NA	NA
	CEPA sample (ex Sydney in 2022 but including 3 new airport companies)							
CEG	0.66	0.88	0.72	0.86	0.78	0.15	0.13	0.14
AIAL	0.68	0.88	0.73	0.87	0.79	0.15	0.14	0.15
CEPA (CEG)	0.65	0.83	0.72	0.83	0.76	0.17	0.15	0.16
CEPA (Reported)	0.67	0.84	0.74	0.84	0.78	0.17	0.15	0.16

116. CEG's estimates of asset beta are, on average 0.01 higher than AIAL(LJK)'s estimates using the CEG sample and 0.01 lower using the CEPA sample. CEG's sample average estimates are also within 0.01 of AIAL(LJK)'s estimates using the CEPA sample.

117. When I compare my estimates to the CEPA sample I am struck by a potential inconsistency. The relevant data table in the CEPA report is on page 60 (Airport sample setting leverage to zero – 5 year). When I calculate average asset betas from the individual comparators reported in that table I arrive at the averages shown in the "CEPA (CEG)" row. However, these are different from the reported averages in the bottom of the CEPA table which are shown in the "CEPA (Reported)" row above.

118. The average of the "CEPA (Reported)" asset betas is 0.78 which is the same as the average estimated by CEG. However, the "CEPA (Reported)" averages do not appear consistent with the individual comparator estimates reported in the CEPA table. These differences are larger than can be explained by rounding. In addition, I note a further anomaly in that, for the weekly 2017 estimate, CEPA reports an:

- "Average" of 0.67;
- "Average not including new airports" of 0.70; and
- "Average (including Sydney Airport)" of 0.68;
- A Sydney Airport asset beta of 0.32.

119. However, the first two dot points should be the same because the new airports were not listed for most of the 5 years to 2017 (and are not reported by CEPA in the table for this period). The third and fourth dot points only makes sense if the second dot point is correct (i.e., adding an observation of 0.32 to 20 observations that overage 0.70 results in a new average of 0.68). However, if the second dot point was correct then this would imply an even larger difference between the reported individual weekly 17 asset beta estimates (which add to 0.66 excluding Sydney) and the 0.70 in the second dot point. (The 2017 four weekly asset betas).

120. For the purpose of this report, I assume that the individual asset beta estimates reported by CEPA are correct and, therefore, the difference between CEPA's estimates and my own on average is 0.02. Of course, this can easily be explained by the slightly different estimation window (5 years to June 2022 vs to September 2022) and by rounding.

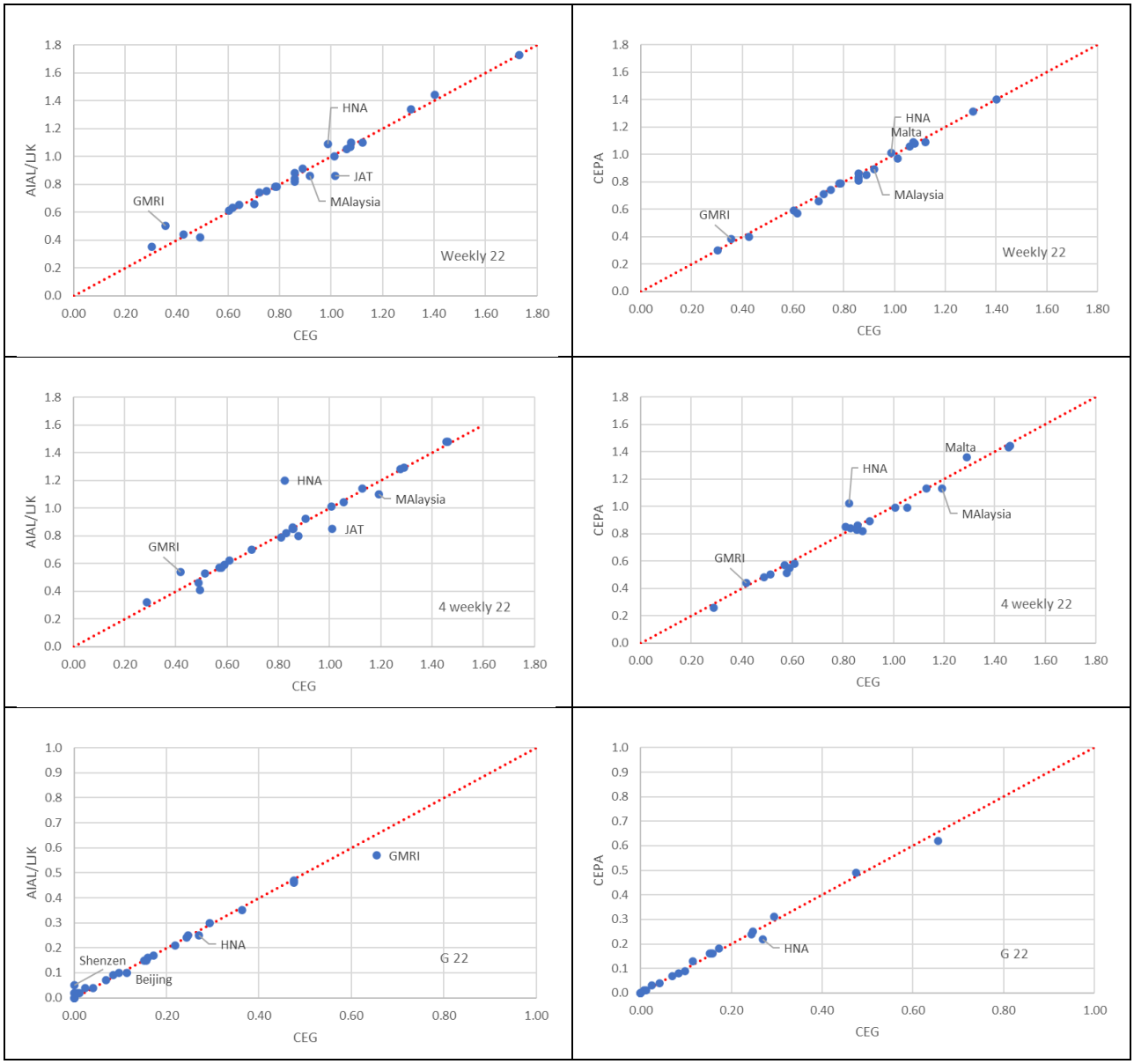
5.2.2 Comparing individual asset beta estimates

121. My individual asset beta estimates are generally very similar to both AIAL(LJK) and CEPAs estimates. However, they are not identical and there are a few examples of large divergences (e.g., more than 0.10). This is usefully summarised in the below charts which show CEG asset betas (or gearing) on the horizontal axis and asset beta estimates from AIAL (LJK) and CEPA on the vertical axis. The red dotted line is at a 45 degree angle and dots that depart from the 45 degree line are observations that are different. Below the line means that CEG has a higher estimate and *vice versa* for above the line.

122. It can be seen from Figure 5-1that:

- CEG and AIAL closely agree on most asset beta estimates but there are four companies where we differ materially in the 2022 estimation period (HNA, JAT Malaysia and GMRI). The GMRI estimates are largely due to gearing and GMRI is not in my preferred sample.
- CEG and CEPA estimates are very similar for Weekly 2022 asset betas but my estimate for HNA is materially lower for Four Weekly 2022 asset betas. This is partly explained by lower estimated CEPA gearing for HNA.

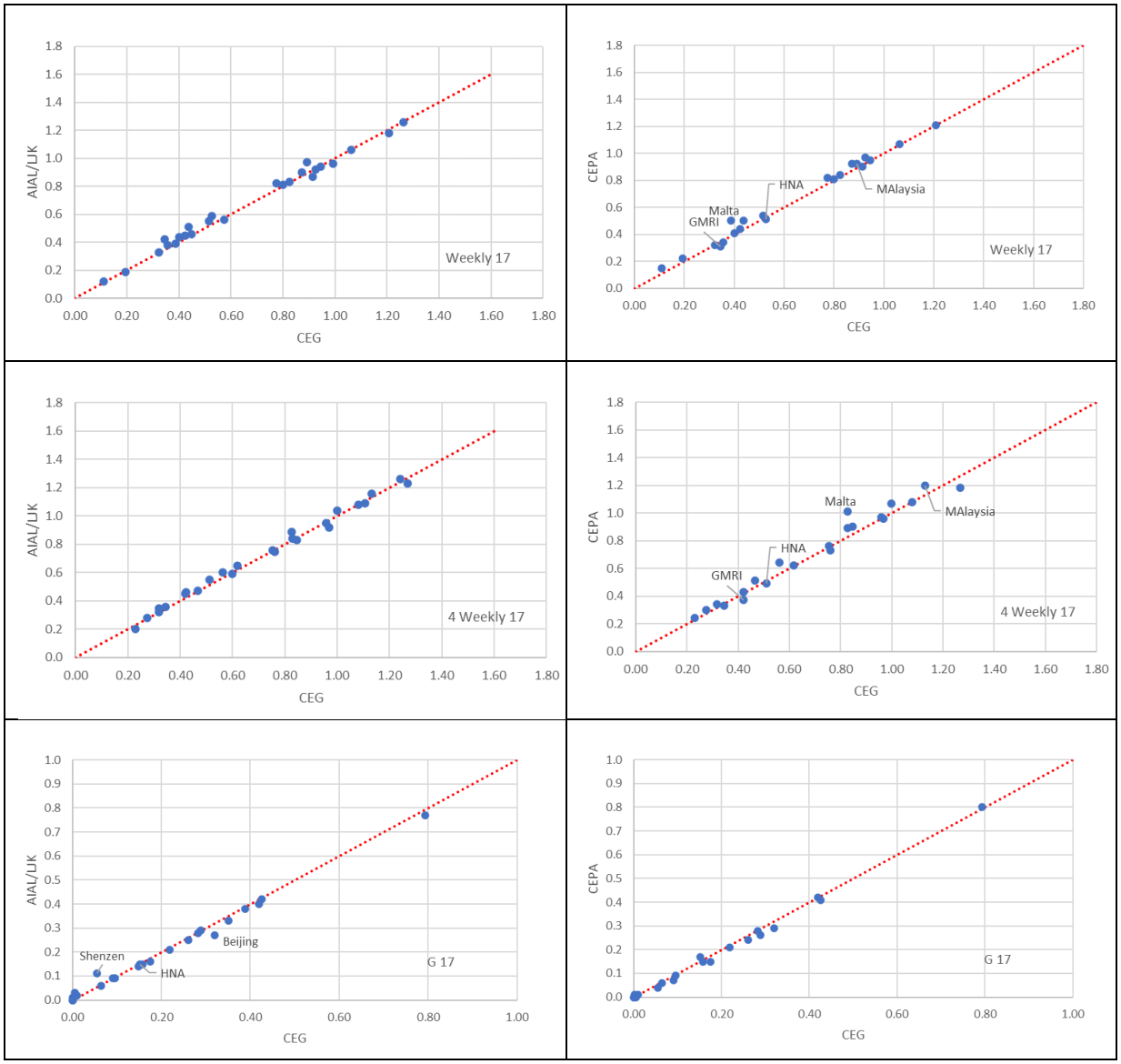
Figure 5-1: 2022 estimation period



123. It can be seen from Figure 5-2 that in the 2017 period :

- CEG and AIAL(LJK) closely agree on most asset beta estimates with no significant differences.
- CEG and CEPA estimates are also very similar with the exception of Malta Airport's Four Weekly 2017 estimate (where CEPA has a higher estimate).

Figure 5-2: 2017 estimation period



124. Without access to the LJK and CEPA data files it is difficult to know what explains the individual differences in company asset betas.[27] However, these differences are

[27] That said, we are informed that LJK informed AIAL that "*HNA's net debt figure for Jun 2021 and Dec 2021 [published by Bloomberg] doesn't look credible. Having been relatively stable for many years, it drops to almost zero, before returning to the previous levels in June 2022. When I looked at their published accounts, there did not appear to be any such material changes in the liabilities or cash balances (although it is always difficult to reconstruct net debt from the statutory accounts). Consequently, I have run two numbers, that make negligible difference to the average results (~0.001 over FY13-22) but do impact on HNA (~0.05 in FY18-22).*" We have investigated this issue and we agree with LJK consulting that it is difficult to reconcile the change in the Bloomberg net debt estimates to any changes in HNA's statutory accounts. Making the adjustments that LJK makes would raise the sample

not material in the sense that the average estimated asset betas are very similar for all consulting firms.

5.2.3 CEG asset beta estimates

Table 5-2: CEG asset beta estimates

		Weekly 2017	Weekly 2022	4 Weekly 2017	4 weekly 2022	G 17	G 22
AIA NZ Equity	Auckland	0.93	1.06	0.85	1.01	22%	16%
SYD AU Equity	Sydney	0.32		0.23		42%	
FLU AV Equity	Vienna	0.19	0.60	0.27	0.59	29%	10%
694 HK Equity	Beijing	0.44	0.86	0.56	0.88	32%	11%
600004 CH Equity	Guangzhou	0.95	1.01	0.96	0.81	0%	1%
357 HK Equity	HNA	0.53	0.99	0.51	0.82	15%	27%
600009 CH Equity	Shanghai	0.83	0.86	0.75	0.58	0%	0%
000089 CH Equity	Shenzhen	0.91	0.70	0.97	0.49	6%	0%
600897 CH Equity	Xiamen	1.06	0.75	1.08	0.57	0%	0%
KBHL DC Equity	Kobenhavns Lufthavne	0.42	0.30	0.47	0.29	16%	16%
ADP FP Equity	Aeroports de Paris	0.40	0.89	0.42	0.86	26%	29%
FRA GR Equity	Frankfurt	0.36	0.62	0.34	0.61	43%	48%
TYA IM Equity	Toscana	0.11	0.43	0.32	0.51	10%	17%
GMRI IN Equity	GMR (India)	0.34	0.36	0.42	0.42	79%	65%
8864 JP Equity	Airport Facilities (Jap.)	0.58	0.49	0.60	0.49	35%	48%
9706 JP Equity	Japan Airport	0.99	1.02	1.11	1.01	15%	22%
MAHB MK Equity	Malaysia Airports	0.89	0.92	1.13	1.19	28%	25%
MIA MV Equity	Malta	0.39	1.07	0.83	1.29	9%	1%
OMAB MM Equity	GAdP Norte (Mexico)	0.77	1.31	1.00	1.46	6%	4%
GAPB MM Equity	GAdP Pacifico (Mexico)	0.87	1.40	0.83	1.46	1%	7%
ASURB MM Equity	GAdP Sureste (Mexico)	0.80	1.08	0.76	1.13	0%	8%
AERO SG Equity	Belgrade	1.26	1.73	1.24	1.28	0%	0%
AENA SM Equity	AENA (Spain)		0.79		0.83		24%
FHZN SW Equity	Zurich	0.51	0.86	0.62	0.86	17%	15%
AOT TB Equity	Airports of Thailand	1.21	1.12	1.27	1.06	0%	0%
TAVHL TI Equity	TAV (Turkey)	0.45	0.64	0.32	0.70	39%	36%
SAVE IM Equity	Venezia						
ADB IM Equity	Bologna (Italy)		0.72		0.91		2%
ACV VN Equity	Vietnam		0.78		0.86		0%
CEG Sample average		**0.68**	**0.90**	**0.73**	**0.88**	**15%**	**13%**

average asset beta very marginally. We have not done so simply to preserve the consistency of our approach across all airports rather than being a rejection of LJK's adjustment.

6 Adjustment for aero vs non-aero

6.1 Conceptual framework

125. The value of airport equity cash-flows ("profits") are correlated with passenger numbers – including aeronautical profits, retail profits, and other sources of profit (e.g., land leasing profits). However, aeronautical profits are often subject to either direct regulation or the threat of regulation. This means that aeronautical prices may be reset periodically so as to target (directly or approximately) a "building block"[28] estimate of costs.

126. Assuming that aeronautical and non-aeronautical cash flows have the same short run sensitivity to shocks to passenger numbers, temporary shocks to passenger numbers (shocks that temporarily depress/elevate passenger numbers – such as are associated with temporary economic recessions) will affect aeronautical cash-flows by the same amount (if not more) than non-aeronautical cash-flows. However, permanent shocks to passenger numbers may affect aeronautical cash-flows differently by virtue of the operation of regulation.

127. By way of further elaboration, compare the sensitivity of cash-flows to changes in passenger numbers at an airport for the following services:

    a. Aeronautical services that are provided on a fixed per unit passenger price where that price (or its path) is set for, say, 5 years.

    b. Non-aeronautical services where, like aeronautical services, revenues are immediately impacted by changes in volumes directly related to passenger throughput. Car parking may be an example of such a service (assuming that this is run by the airport and not leased on a concession); and

    c. Services that have contractually fixed payments (such as land and building leases) and/or where the revenue is not sensitive to changes in passenger numbers (e.g., freight distribution and other commercial property might be examples of this).

128. Now consider the impact of two different types of shocks associated with systematic risk. The first is a temporary shock to passenger numbers that is driven by a temporary departure of economic activity from trend.[29] In this case, the first two categories will have more or less the same cash-flow response and, therefore, the

[28] Regulators of monopoly infrastructure businesses tend to estimate costs based on a cost model that adds various 'building blocks' (operating costs, return on capital and return of capital (depreciation) and tax costs) in order to arrive at an estimate of total costs.

[29] Recall that I explained in section 2.1 that shocks to passenger numbers need to be correlated with shocks to economic activity in order for those shocks to create 'risk' for diversified investors.

same risk. The last category of services will have unchanged cash-flows and, therefore, zero risk exposure to this shock.

129. It follows that, in relation to exposure to **temporary shocks** (e.g., a transient recession or economic growth that drives transient variation in passenger numbers), **aeronautical cash-flows are riskier than the average of airport wide cash-flows**. This is because airport-wide cash-flows are more stable due to the stability of cash-flow from services that have contractually fixed payments and/or are not sensitive to passenger volumes.

130. If all risks emanate from transient shocks then that is the end of my analysis and I can conclude that aeronautical cash-flows have higher risk exposure to passenger numbers than airport-wide cash-flows.

131. However, if there are substantial passenger throughput risks that emanate from permanent shocks to economic activity then the analysis becomes more complex and this conclusion may be reversed. In this context, a permanent shock would be an increase/fall in overall economic activity that was not transient but, rather, expected to persist forever. An example of a permanent shock might be a technological innovation (e.g., the unexpected discovery of low cost energy sources) that creates permanently higher economic activity and permanently higher demand for air travel. An example of a permanent negative shock might be higher energy costs (including for airlines) as a result of war, depletion of natural resources or climate change policy.

132. In the case of permanently lower passenger numbers, an airport's aeronautical cash-flows will be lowered during the existing aeronautical pricing period. However, at the beginning of the next pricing period (which may be up to 5 years away) the airport may be able to raise prices. Thus, the shock may have a larger short to medium term impact on cash-flows but a smaller long-term impact on cash-flows. [30]

133. By contrast, services like car parking may have cash-flows that remain depressed for longer assuming that there is no regulatory mechanism (formal regulation or the threat of formal regulation) to force prices back up to a "building block" cost. This means that the long-term impact of a permanent shock to passenger numbers may be larger (in percentage terms) for, say, car-parking than aeronautical services.

134. This means that, in the context of a permanent shock to passenger numbers, **aeronautical services may be expected to have:**

- **lower risk than some services** (e.g., car parking) where the shock gives rise to both immediately higher cash flows and higher long run cash flows; [31] but

[30] Depending on how bound aeronautical charges are by actual regulation or the threat of regulation.

[31] However, it is worthwhile noting that this assumes that the service (e.g., car parking) has unlimited spare capacity that can accommodate sales at low marginal cost. In reality, permanently higher demand is likely

- **higher risk than some services** where revenues are unrelated to passenger number in both the short and long term (e.g., some land/building leases);[32]
- **uncertain relative risk for other services** where contractual cash-flows mean there is no short term impact but where there may be a long term impact when contracts are renegotiated.[33] [34]

135. The above analysis is summarised in the below table.

to bring-forward the time at which costly capacity expansions (e.g., a new car park) are required (such that the net impact on profits is lower than if capacity was unlimited). Thus, a realistic analysis is likely to be more complicated than the stylised analysis I perform here.

[32] For example, tenants whose next best alternative is leasing land/buildings at another location (which may or may not be near the airport) will be unlikely to be willing to pay more at renewal just because passenger numbers at the airport are higher. For example, tenants in a business park are unlikely to be willing to pay more because passenger numbers at the airport are higher.

[33] For example, permanently higher passenger throughput may lead to a higher rental on a fixed price lease (e.g., for retail space) at some future date when it is renegotiated. Thus, the shock has zero impact on cash-flows for a period and a positive impact from some future date (the opposite of the profile of impact on aeronautical services cash flow). Here, an important issue will be the discount rate used to value future cash-flow improvements. The higher is this discount rate then smaller will be the impact on the present value of cash flows of a permanent shocks that has a delayed impact. In addition, the issue raised in footnote 35 above applies here too – permanently higher passenger numbers will bring forward the need for costly expansions to terminal infrastructure.

[34] The longer the period over which a set of payments is fixed the smaller will be the discounted value of any change to the cash-flows beyond that period. For example, imagine a contract has 10 years of contractual payment after which it can be renegotiated. Now, let a shock occur today that raises the expected cash-flows from year 11 on by 5%. At a 10% discount rate this 5% increase in future revenues only raises the present value of revenues by less than 2%. This is a smaller impact on present value than if revenues were temporarily raised by 5% for 10 years and then returned to their previously expected levels.

Table 6-1: Relative risk of aeronautical vs airport wide cash-flows

Service	Transient shock to GDP and passengers	Permanent shock to GDP and passengers
Aeronautical (cash-flows are immediately impacted by changes in the number of passengers but may be less so in the long term)	Highest risk	Middle risk
Services where cash-flows are impacted immediately and in the long term by the level of passengers	Highest risk	Highest risk
Services where cash-flows are not impacted immediately but are impacted in the long term by the level of passengers	Lowest risk	Middle risk
Services where cash-flows are not impacted (either immediately or in the long term) by the level of passengers	Lowest risk	Lowest risk
Is aeronautical cash flow higher or lower risk than airport average?	**Aero is highest risk**	**Aero is middle risk**

136. This table makes clear that it is not possible to know *a priori* whether aeronautical cash-flows are higher or lower risk than airport wide cash-flows. It is possible that aeronautical risk is lower but it is also possible that it is higher (or the same). A more accurate answer depends on an empirical analysis of both the relative importance of transient (booms and bust) versus permanent (e.g., due to unexpected technological developments good and bad) shocks to economic activity and also on the nature of the contracts at the airport in question.

6.2 NZCC past analysis

137. The NZCC made a downward 0.05 adjustment to asset beta based on a presumption that aeronautical cash-flows are slightly lower risk than airport wide cash flows. In its draft decision, the NZCC originally justified this 0.05 decrement by relying on statistical analysis of the relationship between aeronautical revenues and asset beta. However, in its final decision the NZCC accepted that there was an error in that analysis:[35]

> *We agree with NZ Airports and UniServices that there was an error in Figure 8 of the draft decision, and that when corrected, the revised graph does not support making a downwards adjustment to the sample average.*

35 NZCC, Input methodologies review decisions, Topic paper 4: Cost of capital issues, December 2016, p. 124 at [482].

138. However, the NZCC went on to apply the same adjustment in its final decision. The NZCC's subsequent basis for this adjustment was a presumption that:[36]

> *Unregulated services (such as retail shopping) are generally considered more risky than regulated services (such as provision of airfields), for example there is greater demand uncertainty.*

139. The NZCC provided no empirical analysis to support this conclusion and did not grapple with the conceptual issues that I discuss in section 6.1 above.

6.3 Empirical analysis

140. I have separately, for the New Zealand Airports Association,[37] undertaken an in-depth analysis of the relationship between asset beta risk and the share of non-aeronautical revenues/profits across all listed airports. In that report I conclude:

> *The empirical analysis undertaken in this report strongly suggests that, if anything, non-aeronautical operations are lower risk than aeronautical operations. This is based on evidence that:*
>
> - *Measured asset betas are lower the larger the share of non-aeronautical revenues;*
> - *Aeronautical profits were much more sensitive to COVID19 than non-aeronautical profits;*
> - *Aeronautical revenues were near universally also more sensitive to COVID19 than non-aeronautical profits (across all but 2 out of 26 airports).*

141. Key results from that analysis are that

- There is a statistically significant negative relationship between measured asset betas and the non-aeronautical share of total revenue (noting that this analysis must be performed using revenue rather than profits because the sample would be only 5 firms if profits was used.
- When performing an event study off the effect of COVID19 we find that aeronautical:

[36] NZCC, Input methodologies review decisions, Topic paper 4: Cost of capital issues, December 2016p. 122, Paragraph 478.

[37] CEG, NZCC comments on asset beta estimates for airports, January 2023.

- profit (measured as EBIT or EBITDA) fell by more than non-aeronautical profit for the five airports that report in this way (Japan Airport Terminal,[38] AIAL, Frankfurt, AdP and AENA);
- revenue fell by more than non-aeronautical revenue for 24 out of the 26 airports.

- Moreover, Japan Airport Terminal was one of the two firms where this did not occur and I have already noted that Japan Airport Terminal's revenues are a special case with non-aeronautical revenues overstating the importance of non-aeronautical profits (and that Japan Airport Terminal's aeronautical EBIT fell by more than its non-aeronautical EBIT (as is the case for all other airports that report profits on a segment basis)). This leaves HNA as the only other airport that where aeronautical revenues were less affected by COVID19 than non-aeronautical operations.

142. The following is a subset of the results presented in my report for the New Zealand Airports Association. First, the results of regressing measured asset beta against the non-aeronautical share of revenues.

Table 6-2: Asset beta vs % non-aero revenue

	Coeff	p value	R^2
Full sample			
2018 % non-aero	-0.51	0.09	0.112
2019 % non-aero	-0.50	0.09	0.113
2020 % non-aero	-0.66	0.04	0.169
2021 % non-aero	-0.58	0.05	0.148

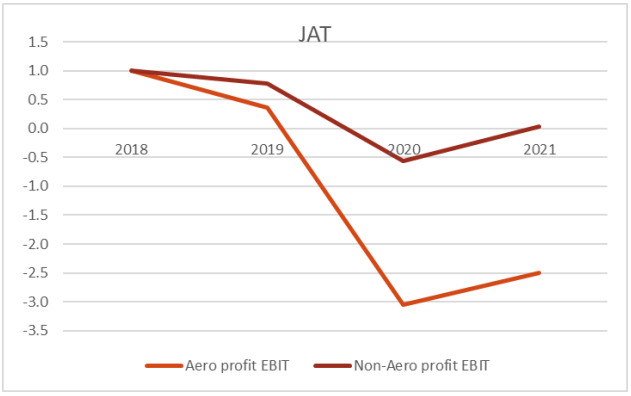
Asset beta is measured for the 5 years to 30 June 2022 using the NZCC method (the average of: a) the average of 5 weekly estimates; and b) the average of 20 four weekly estimates).

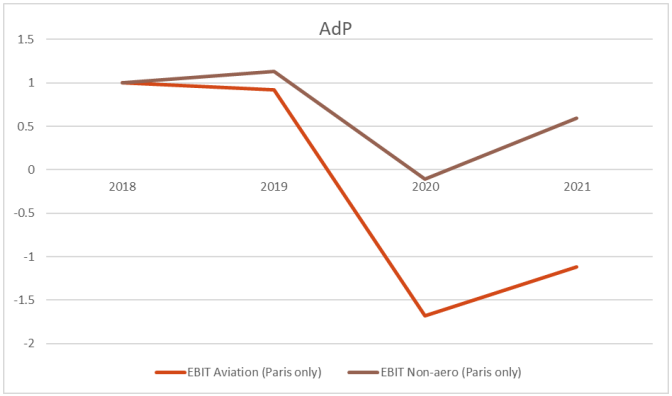
143. Second, I have indexed profits and revenues (not shown in this report) for each segment to 1.0 in 2018. I have then plotted a time series to examine which is more affected by the dramatic reduction in passenger numbers due to COVID19. As noted above, five firms provide EBITDA on the relevant segment basis. Figure 6-1 shows the time series for aeronautical and non-aeronautical profits at these airports.

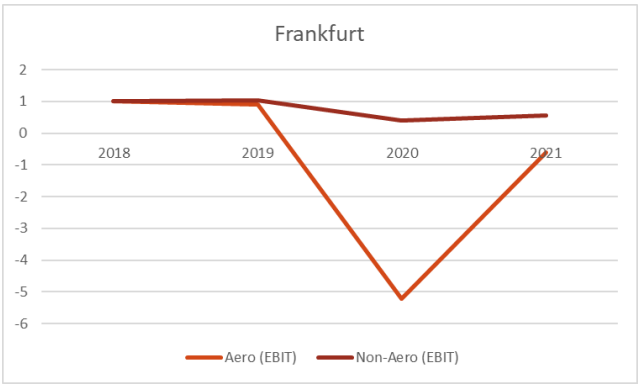
[38] Although for Japan Airport Terminal the result was mixed with aeronautical EBITDA/EBIT falling by less/more than non-aeronautical EBITDA/EBIT.

Figure 6-1: EBIT and EBITDA time series for aero and non-aero (2018=1)

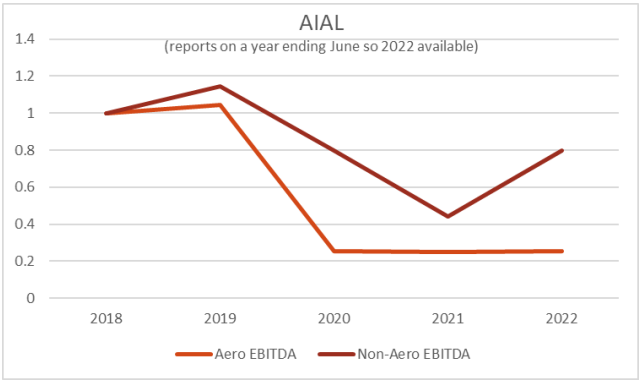
EBIT

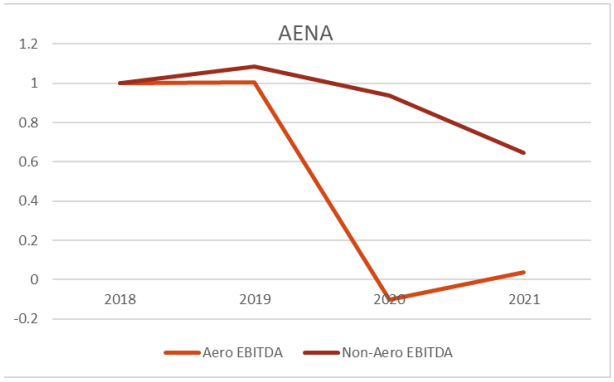


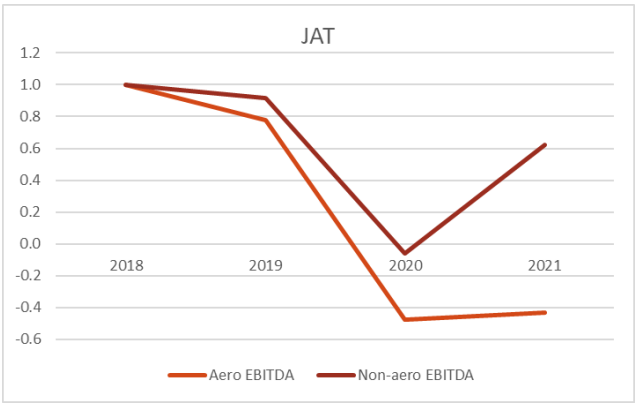


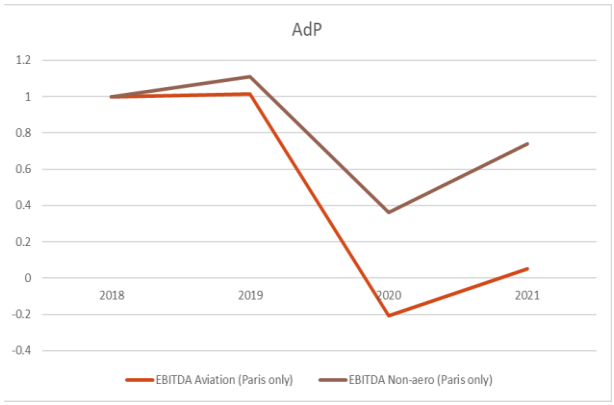


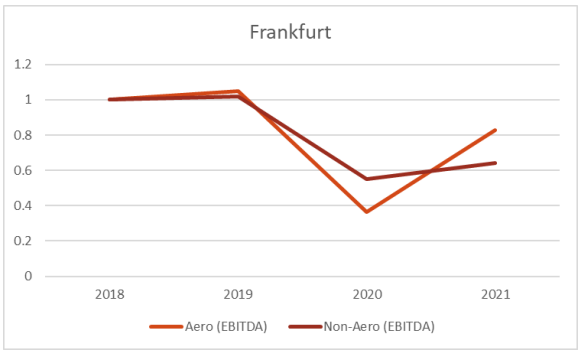
EBITDA







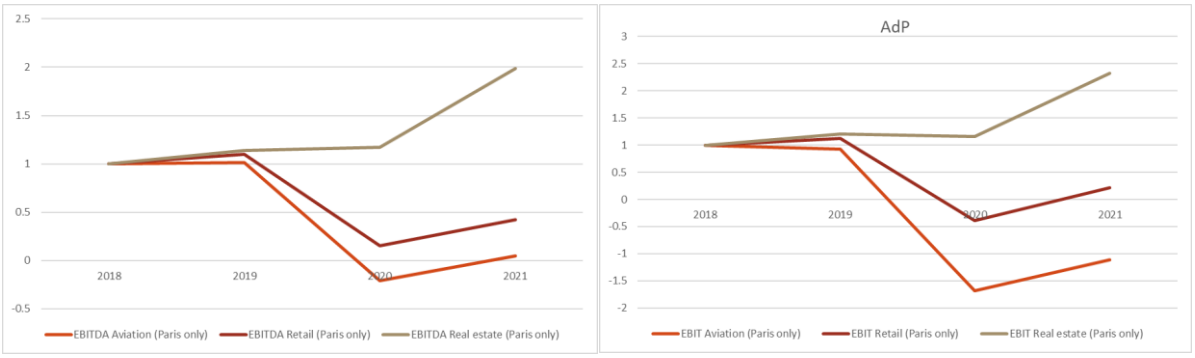




Source: annual reports and CEG analysis.

144. It can be seen that aeronautical profits (whether measured as EBITDA or EBIT) fell by more than non-aeronautical EBITDA following the unexpected passenger shock due to COVID19. AdP reports three segments for its Paris airports: aviation (aeronautical) and retail and real estate (both non-aeronautical). In Figure 6-2 I have combined the retail and real estate segments. However, it is useful to show all three segments separately which I do in Figure 6-2 below.

Figure 6-2: EBITDA and EBIT time series for AdP's three segments (2018=1)



Source: annual reports and CEG analysis. .

145. As might be expected, the real estate segment was the least affected by the COVID19 passenger shock. The retail segment was heavily affected suffering an 85%/140% reduction in EBITDA/EBIT in 2020 versus 2018 but it recovered somewhat in 2021 (to 42%/21% of 2018 EBITDA/EBIT). However, aeronautical profits were even more heavily affected – with a 120%/270% reduction in EBIT/EBITDA relative to 2018 (i.e., a loss in 2020 that was 20%/170% of the profit in 2018).

146. All of these profit time series suggest that aeronautical profits are most susceptible to negative passenger volume shocks of the kind experienced due to COVID19. These results are consistent with the observed empirical relationship that the larger the share of non-aeronautical revenues the lower the asset beta for airports in the asset beta sample.

6.3.1 Summary

147. In summary, I do not consider that there is a valid conceptual or empirical case for presuming that aeronautical asset betas are lower than non-aeronautical asset betas.

148. Conceptually, aeronautical cash-flows are more exposed to temporary economic shocks than non-aeronautical cash-flows and have average risk exposure to permanent economic shocks. If anything, this suggest higher risk for aeronautical activity than non-aeronautical activities.

149. Empirically, the available evidence suggest that if any adjustment were to be made it would be positive. That is, the evidence suggests that, if anything, aeronautical operations are higher risk than non-aeronautical operations at the average airport.

7 Asymmetric risk exposure

150. AIAL is proposing methods for ensuring that it can expect to earn a reasonable return despite the existence of asymmetry of passenger volumes around the most likely (median) estimate. This asymmetry exists because there are events, such as COVID-19, that can lead to extreme reductions in international and/or domestic air-travel (including reducing it to close to zero). However, there are no symmetrical events which can lead to extreme increases in passenger volumes above forecast (at least not in "normal" times when airline and airport utilisation is close to capacity).

151. AIAL has floated three methods for addressing asymmetric risk associated with infrequent extreme negative shocks to passenger numbers.

    i. Retain the use of passenger forecasts based on median expected volumes when setting prices but include an asymmetric risk premium in the target return;

    ii. Adopt a passenger forecast that is below median expected volumes;

    iii. Adopt a risk sharing mechanism with airlines such that when revenues or traffic volumes are substantially different to forecast (e.g., ± 15%) then some or all of the resulting under(over)-recovery of forecast revenues could be recovered from (returned to) airlines.

152. In my view the first two proposals are essentially the same. They involve allowing what is essentially a "self-insurance" premium in regulated revenues. This premium is calculated by estimating the frequency and severity of infrequent extreme events and including a target $ value of compensation in the absence of those events that compensates, in expectation, for the losses that will be incurred when the infrequent extreme events actually materialise. Both proposals should result in the same prices (other things equal). The only difference between these is:

    - The first method achieves higher prices by raising the building block cost base via raising the target return (at median volume forecasts); and
    - The second method results in higher prices lowering the volume forecast which is divided into the building block cost base to arrive at prices.

153. The first two methods continue to leave the airport exposed to the same level of asymmetric risk but seek to compensate the airport for this in an expected sense. These two methods can correctly be thought of as providing compensation for an actuarially fair self-insurance premium.

154. The obvious problem with the first two methods is that they require an accurate estimate of the probability and severity of infrequent extreme events. This is inherently difficult to do because, by their nature, infrequent extreme events are difficult to predict.

155. The third method seeks instead to limit the potential exposure of AIAL to infrequent extreme events. AIAL would still be exposed to asymmetric risk but the proposal is simply that, beyond some level of reduction in demand/revenue, AIAL would be able to recover further losses from customers (e.g., by setting higher prices in future PSEs).

156. If this understanding of the third option is correct then AIAL would only be partially protected from extreme events. For example, if the threshold was a 15% reduction in passenger numbers then AIAL would still be exposed to losses when:

- Passenger demand fell by less than the threshold. For example, if passenger demand fell by 14% then AIAL would bear the full cost of this event;
- Passenger demand fell by more than the threshold. For example, if passenger demand fell by 30% then AIAL would bear at least a half (15%/30%) of impact of this event.

157. It follows that if the third proposal is implemented it still needs to be combined with one of the first two proposals. However, because the third proposal reduces the cost to AIAL of infrequent extreme events the actuarially fair self-insurance premium will be lower than if the third proposal was not implemented. Nonetheless, because the third proposal does not fully protect AIAL from the negative impact of infrequent extreme events, there still needs to be compensation for the expected costs of those negative impacts.

158. The remainder of this section has the following structure:

- Section 7.1 explains that compensation for expected costs of extreme events is separate, and additional to, compensation for the asset beta impact of extreme events;
- Section 7.2 examines whether the adoption of the third proposal would affect the best estimate of asset beta for AIAL.

7.1 Exposure to extreme events requires compensation for expected costs separate, and in addition to, asset beta compensation

159. 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.

160. An example can best illustrate this issue. Let a business "XYZ" operate in Auckland with invested assets of $500m. Assume that a 1-in-50 year major earthquake in

Auckland would cause damage to that company and other companies in a diversified portfolio.

7.1.1 Expected cost of damage to XYZ

161. Let the earthquake when it happens be expected to cause XYZ $100m in damage (e.g., due to direct damage to their property and plant and due to interruption to business). However, given that this has only 2.0% probability of happening the expected cost of this occurring is only $2m pa (=$100m*0.02). This is equivalent to 0.40% (=2/500) of the value of invested assets.

162. An investor in XYZ will require compensation for this expected cost. Specifically, an investor will require that XYZ generate sufficient cash-flows each year to deliver $2m in surplus (0.40% above WACC) in years when an earthquake does not occur that will compensate for the 20.0% below WACC return (=-100/500) when an earthquake does occur.

7.1.2 Impact of risk exposure on XYZ WACC

163. In addition to the expected cost of the earthquake, exposure to this risk raises XYZ's asset beta and WACC. This is because the earthquake, when it happens, will also negatively affect other New Zealand businesses and result in a fall in the value of the market portfolio. Given that this event, when it occurs, has a negative effect on both XYZ and the market portfolio it creates undiversifiable risk (raise the asset beta) for XYZ. Let this increase XYZ's WACC by 0.05%. This implies higher annual compensation in the order of $0.25m.

7.1.3 Investors require compensation for both the expected costs and the undiversifiable risk due to exposure to an event

164. An investor in XYZ will require compensation for both of these costs.

165. In the above example, as is typical, the required annual compensation for the direct expected cost of exposure to the negative event ($2.0m) is larger than the compensation required for the event's impact on asset beta ($0.25m). Put another way, if XYZ was fully insured for an earthquake event such that all risk was borne by the insurer, then their risk premium would include the $2.0m expected annual cost of an earthquake plus a $0.25m margin to cover the fact that the insurer also bears systemic risk (i.e., having cash-flows that are depressed at the same time that a negative shock hits the economy).

166. This is hardly surprising. The direct expected cost of an event is the primary concern of investors. The next, and generally secondary issue for investors, is whether that direct effect is likely to be correlated with movements in other assets in their diversified portfolio. If the answer is "yes" then the investor will also require higher

compensation for the undiversifiable risk. But that issue is secondary to (contingent on) the existence of the direct cost should the event occur.

167. This example illustrates why it would be a mistake to assume that no compensation for the direct expected cost of the event ($2.0m) is required if compensation for the impact of the event on WACC ($0.25m) is provided. The direct expected cost exists, and requires compensation, irrespective of the level of diversifiable risk associated with the risk of the event.

168. An earthquake is an example of a negative "asymmetric" shock. It is "asymmetric" in the sense that there is no opposite, equally unlikely and difficult to forecast, event that would confer an opposite $100m benefit to the investor in XYZ. The expected cost of being exposed to this asymmetric risk is $2m pa. This is above and beyond the $0.25m higher return investors require for the non-diversifiable risk associated with earthquake exposure.

169. Airports' exposure to pandemic risk is another example of this principle. The primary issue for investors is the expected cost of a pandemic – being the lost profits in the event of a pandemic multiplied by the probability of a pandemic occurring. Before investing in an airport, it is reasonable for an investor to require an expectation that annual cash-flows include compensation for this expected cost. That is, in years without a pandemic, an investor could reasonably require a surplus in cash-flows to compensate for the expected deficit in years when there is a pandemic.

7.2 Does AIAL's third proposal affect its best asset beta estimate?

170. If asymmetric risk exposure is solely compensated via a self-insurance premium then this will leave the asset beta exposure to the relevant events unchanged. This was worked through in the above example relating to XYZ and earthquake risk exposure. If an earthquake happens, XYZ suffers the same amount of loss irrespective of how much "self-insurance" compensation it was provided in previous years. XYZ was not insured against earthquakes (in the sense that it received a payout when damaged by an earthquake) but was simply paid in advance the *expected* cost of an earthquake per annum (which is a small fraction of the actual cost if an earthquake occurs).

171. However, AIAL's third option amounts to a form of partial insurance against infrequent extreme events. Under this proposal AIAL will be partially protected against such events (e.g., protected for some of the exposure but only beyond given threshold). This may, prospectively, lower or raise AIAL's asset beta depending on whether the events that cause extreme reductions in passenger volumes have a negative or positive effects on the market portfolio generally.

172. It seems reasonable to assume, consistent with the experience of COVID-19, that events that cause extreme reductions in passenger numbers at AIAL are more likely

to negatively affect than positively affect the value of assets more generally. Therefore, it is more likely that this would reduce AIAL's asset beta than increase it – relative to a scenario where AIAL's third proposal was not implemented.

173. However, given that AIAL's current proposal is to set asset beta based on the average of the NZCC sample, the relevant question is:

- not whether AIAL's asset beta will be lowered; but
- rather, will AIAL's asset beta will be lowered below that of the average firms in the NZCC's sample.

174. AIAL's own estimated asset beta has been consistently above the NZCC sample (averaging around 1.0 versus a sample average ranging from 0.65 to 0.80). This may simply be a statistical fluke but there is good reason to believe that it reflects higher asset beta risk at AIAL than the sample average. These are that AIAL:

- Has a longer price setting period than most airports in the NZCC sample;
- Has (at least historically) had less ability to raise prices in the event that actual volumes varied from forecast volumes; and
- AIAL is not a major hub airport.

175. These are summarised in Table 7-1 below (sources for this table can be found at Appendix C).

Table 7-1: Risk factors for airports

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

Source: Collected from Airport Regulators' decisions and Industry reports, CEG analysis. Full list of sources provide in Appendix C. For some airports I am not able to identify a specific regulatory period (Japan Airport, Belgrade, Airport of Thailand). For Chinese airports, there are 4 regulatory updates during a 10-year period from 2007 to 2017. However, the regulator only changes those prices that it considers no longer reflect costs (i.e. not all prices change in each regulatory reset). While four price resets within 10 years implies an average of 2.5 years pricing period the fact that not all prices change suggests a high threshold is required to elicit a regulatory price change. Given this, for China I also take a conservative estimate of <5 years.

7.2.1 Pricing period

176. AIAL's pricing period is for 5 years which is the equal maximum of the pricing period for the firms in the NZCC sample for whom I could find information. Many firms have the ability to reset prices every year (including TAV, Vienna, Frankfurt, Zurich and Copenhagen).

177. For any given fixed pricing structure, variations in passenger numbers translates into variations in revenues. Variations in revenues, in turn, flow through into variations in profits given that most aeronautical costs are fixed (do not vary with passenger numbers).

178. Aeronautical services typically have a period over which prices are fixed (either by regulation or contract) and are only able to be reset at the end of that period. This

pricing period defines the period over which a permanent positive/negative shock to passenger numbers will result in elevated/depressed aeronautical revenues. At the end of that period the Airport will be able/required to readjust its prices up/down to bring them back into line with per passenger costs (in accordance with the regulatory or contractual regime).

179. It follows that the longer that fixed price period the higher exposure to passenger volume variation and, therefore, higher beta risk.

180. The expert advisor to the Irish regulator, Swiss Economics (2019) also explains that if an airport has a longer period where prices are fixed (longer regulatory period), the airport is more exposed to demand risk because they cannot reset prices to mitigate the demand shocks [emphasis added]:[39]

> ***Short regulatory periods (e.g., annual reviews) reduce the risks of changes in volume compared to longer regulatory periods***. *Changes in passenger numbers typically evolve slowly over time and can be predicted to some extent via flight schedules, which are usually determined well in advance. Regulators can anticipate and re-act to changing traffic volumes when regulatory periods are short, e.g. annual review periods.* ***Regulatory periods of 4 to 5 years, as in the case of Dublin Airport, create incentives to become more efficient over time, but they transfer significant risks to airport operators***.

7.2.2 Adjustments for deviations from forecasts

181. I am instructed that due to the very significant regulatory overhead (both in terms of cost and management time), and because it did not wish to increase the financial burden on airlines that were also suffering unforecast financial losses, AIAL did not elect to reset prices during PSE3 to recover COVID-19 losses. I am also instructed that AIAL elected to freeze prices in year one of PSE4 (FY23) at FY22 levels because of the uncertain COVID-19 recovery trajectory would have made it exceedingly difficult to prepare the building blocks forecasts necessary to reset aeronautical prices, as well as to ease the financial burden on its airlines during the early COVID-19 recovery phase. In effect, this price freeze in year 1 of PSE4 extended the reset period by another year. AIAL has never elected to reset aeronautical prices inside the prescribed 5-year maximum price reset period. I am further instructed that AIAL has no ability or prospect of recovering the lost profits in PSE3 by carrying these forward and recovering them in PSE4 or beyond.

182. By contrast, other airports in the NZCC sample have formal automatic risk sharing arrangements with customers. For example, AdP has a 5 year price setting period

[39] Swiss Economics, Dublin Airport Cost of Capital for 2019 Determination, Final Report, 30 September 2019, pp. 43-44.

like AIAL but, unlike AIAL, AdP has had within period risk sharing mechanisms with airlines. Swiss Economics states that ADP has within period adjustments for

"…factors linked to traffic, investments, operating costs etc."[40]

183. Similarly, Copenhagen Airport has provided AIAL with a presentation describing risk sharing actually negotiated with airlines.[41] The agreement reached appears to have 50/50 risk sharing for all passenger volumes that deviate more than 1.3% from median forecasts and airlines appear to bear 100% of the risk for deviations of more than 2.5%. The same document also sets out risk sharing in relation to capex programs – with 85% sharing (up and down) above a 5% threshold.

184. When COVID19 hit, Copenhagen Airports (like many airports) did not attempt to enforce the risk sharing agreements in place. Almost certainly this was, in part, because doing so would likely be counterproductive in its impact on traffic – an illustration of the difficulty of an airport protecting itself from large asymmetric negative shocks. However, Copenhagen Airport like many European airports, is in negotiations with government and regulators about recovery of lost profits due to COVID19.[42] This is in stark contrast to the position of AIAL which I am instructed has no prospect of recovering lost profits from PSE3 (consistent with the fact that AIAL, unlike Copenhagen and Paris airports, had no formal risk sharing arrangements in place in PSE3)

185. Other firms have both shorter regulatory periods and can pass on more volume risk to customers. For example, Frankfurt and Copenhagen (Kobenhavns Lufthavne) have operator discretion to set the length of the pricing period and the default regulatory model for Copenhagen is a revenue cap[43] – such that all variations in volumes are reflected in variations in prices. Similarly, and Zurich can adjust prices for changes in volumes within the pricing period.[44]

7.2.3 Major hub

186. Large airports, and especially international hub airports, have a diversity of passengers flying to and from a diversity of locations for a diversity of reasons. Diversification in the passenger demand means that aggregate passenger demand can

40 Swiss Economics, Dublin Airport Cost of Capital for 2019 Determination 12 March 2019, p.43.

41 Copenhagen Airport presentation, Recalibration mechanisms | Risk sharing on volume and investments.

42 This issue is being discussed at the EU level. For example, See "Airport charges in times of crisis, 27 January 2022" published by Thessaloniki Forum of Airport Charges Regulators.

43 Ibid, p.43. Swiss Economics states that if there is no agreement between airlines and airport then the regulator sets prices and uses a revenue cap to do so.

44 Swiss Economics, Dublin Airport Cost of Capital for 2019 Determination 12 March 2019, p.43.

be expected to be more stable relative to a small airport with less diversified passenger demand.

187. It is also the case that major hub airports often operate at close to capacity and are typically sited at highly convenient locations for passengers relative to alternative airports the customers could use (e.g., Heathrow versus Gatwick and Stansted). This means that their volumes are less sensitive to economic shocks because the smaller competing airports act as "shock absorbers" for the major hub airports (e.g., in a downturn, reductions in demand at Heathrow are "filled" by switching of demand from Gatwick and Stansted to the more conveniently located Heathrow).

188. AIAL is not a large hub airport with a competing fringe of alternative airports. However, other airports like AdP's Charles de Gaul in Paris, Istanbul (Ataturk) in Turkey and Frankfurt clearly are. It follows that AdP, Fraport and TAV can be expected to have lower asset betas (at least holding other factors constant).

7.2.4 Empirical analysis

189. Based on Table 7-1, it would be expected that AIAL had higher than sample average asset beta and that other airports, especially the bottom 5 in Table 7-1, will have lower than average asset betas. This is borne out by the empirical analysis.

- The bottom 5 airports in Table 7-1, have had an average asset beta of 0.50 over the last 10 years (0.30 below the average for all firms in the sample);
- The average of the top 4 airports Table 7-1 (which includes AIAL) have an average asset beta of 0.96 (0.16 above the sample average); and
- AIAL itself also happens to have an average asset beta of 0.96 over the last 10 years (0.16 above the sample average).

7.2.5 Conclusion

190. To the extent that differences between the regulatory exposure to infrequent extreme events drive differences in estimated asset betas within the NZCC sample it is likely that this has mean that AIAL has historically had a higher-than-average asset beta.

191. AIAL's proposal to share passenger volume risk with airlines beyond a high (15% variance) threshold might serve to reduce AIAL's asset beta towards the sample average. However, AIAL will continue to operate with one of the longest effective regulatory periods and with no or limited risk sharing below this high 15% threshold. AIAL will also continue to operate as a relatively small airport that is not a major hub. It is therefore reasonable to assume that AIAL's asset beta risk will remain at or above the average for the NZCC sample. Therefore, AIAL's proposed use of the sample average asset beta remains reasonable and, arguably, conservative.

8 WACC

192. AIAL's WACC estimate for PSE4 is set out below.

Table 8-1: AIAL WACC

WACC element	Proposed PSE4 input element	Source
Risk free rate	3.60%	NZCC
Investor tax rate	0.28%	
Asset beta	0.80	CEG
Equity beta	0.93	
TAMRP	7.50%	NZCC
Cost of equity	**9.57%**	
Debt margin	1.17%	NZCC
Debt issuance costs	0.20%	NZCC
Cost of debt (pre-tax)	**4.97%**	
Corporate tax rate	0.28%	
Ratios		
Debt to value ratio	0.14%	CEG
Equity to value ratio	0.86%	CEG
Post-tax WACC	**8.73%**	

193. AIAL's WACC estimate based on

- My asset beta estimate (0.80);
- the same average leverage assumption as me (14%);
- the Commission's latest published risk free rate and cost of debt estimates (taken from the Commission's latest WACC determination for AIAL and CIAL (published in August 2022) [45] and the Commission's most recent TAMRP estimate of 7.5%.[46]

194. I consider that the asset beta and leverage assumptions adopted are appropriate for the reasons set out in this report. I also consider that the use of the most recent published Commission values for the other parameters are reasonable when arriving at an estimate of the WACC as at 30 June 2022.

45 Cost of capital determination for Disclosure Year 2023 (2 August 2022);

46 Fibre Input methodologies Determination, 13 October 2020, Gas Distribution Input Methodologies Determination, 25 March 2022 and Gas and Transmission Input methodologies Determination 25 March 2022.

Appendix A There is no workable alternative method that could accurately adjust asset beta for COVID-19 or other economic shocks

195. I first describe the kind of simplistic logic and assumptions that underpin an approach that attempts to adjust asset betas to remove some of the impact of the pandemic.

    a. Let $\beta^{No\ pandemic}$ be the underlying asset beta estimated in an estimation window without a pandemic.

    b. Let the existence of a pandemic in an estimation window raise the asset beta by "α" such that $\beta_{Raw}^{With\ pandemc} = \beta^{No\ pandemic} + \alpha$.

    c. Let "γ" (where 0<"γ" <1) be the frequency/probability of a pandemic like COVID-19 occurring in any given 5 year estimation window.

196. With these assumptions in hand, an investor who does not know in advance whether a pandemic will occur during their investment horizon will demand compensation based on the probability weighted average of the with/without pandemic asset betas - with the weights being γ/(1-γ) respectively. In that case, the probability adjusted asset beta will be given by:

$$\beta_{Adjusted}^{Probability} = \beta^{No\ pandemic} + \alpha \times \gamma$$

197. Note that this "add on" to the asset beta of "α×γ" needs to be applied to all estimates derived from estimation windows that do not include a "COVID-19 like pandemic". For example, if such an adjustment was applied in PSE4, then "α×γ" would need to be added to the asset beta estimate derived from the 5-year estimation window ending June 2017. (This would, naturally, partly offset the "α×(1-γ)" deduction from the 5-year estimation window ending June 2022.) Similarly, all future 5-year estimation windows in all future updates would need the same "α×γ" uplift – unless they happened to have a "COVID-19 like pandemic" in them.

198. In order for an alternative to my proposed method to be accurate (which requires that it gives the same answer as my method on average over time), the alternative method needs to accurately estimate the frequency of pandemic events (i.e., needs an accurate estimate of "γ"). If the alternative method underestimates the true frequency then the method will apply too large/small a deduction/uplift to the COVID-19 affected/unaffected asset betas. That is, the average asset beta over repeated

applications of the alternative method will be too low if "γ" is underestimated and too high if "γ" is overestimated.

199. TDB underlines the difficulty of estimating "γ" accurately when they state:[47]

> *"We note too that while the future scale and nature of pandemics is unknown, the risk of pandemics is not a surprise."*

200. I would add that the future frequency and scale of pandemics not only "unknown" but it is also "unknowable".

201. This is a fundamental reason why I consider pursuing an alternative method is problematic. When an adjustment requires an estimate of an unknowable variable that adjustment should not be pursued unless it is absolutely required in order to correct a known bias.

202. However, in the current case, there is no bias in my proposed methodology because that methodology will, on average and over time, accurately reflect and compensate for the scale and frequency of all shocks. An alternative method adjustment can only achieve the same result if the estimate of the unknowable variables "α" and "γ" are perfectly accurate. If not, as will invariably be the case, the alternative method adjustment will result in a biased estimate of asset beta on average over time.

203. Moreover, any bias associated with a misestimate "γ" is likely to be compounded by a misestimate of the impact of COVID-19 in the current estimation window (a misestimate of "α"). Disentangling the impact of COVID-19 from other factors affecting asset beta in the current estimation window is extremely contentious.

204. However, the key issue is that any attempt to estimate "α" would be an extremely contentious issue. One would need to identify, at a minimum:

    a. When the impact started;

    b. When the impact ended;

    c. How the intensity of the impact varied over the relevant period?

205. By way of illustration, the large and steep decline in equity market valuations in mid-February 2020 (associated with an around 20% fall for the NZSX 50) is probably the easiest to identify direct impact of COVID-19. However, this was short lived, with most of the fall regained by early April and all of it regained by the end of 2020. It is far from clear when one should assume the impact of COVID-19 has ended (or, indeed, if it has at all). Moreover, one should surely assume that the impact of COVID-19 on data points in February and March 2020 was significantly greater than in any subsequent period.

47 TDB Advisory Ltd, Process and Issues and Draft Framework Papers, May 2022 P. 4.

A.1 Applying an adjustment only after the first pandemic is NPV biased

206. A further critical problem is that, even if "α" and "γ" were estimated accurately, starting this series of adjustments only once COVID-19 has happened is not NPV neutral. As explained above, the logic for the adjustment requires that α×γ is added to the asset beta estimated in all periods not affected by a pandemic and that α×(1-γ) be removed from all periods that are affected by a pandemic.

207. If these adjustments are applied systematically to all periods and if the timing of each decrement/increment is random (randomly occurring consistent with the assumed frequency "γ") then this approach is NPV neutral. For example, imagine that "γ" implied that a pandemic was a one-in-fifty year event. If that estimate was accurate then the expected timing of the first pandemic would be roughly after 25 years and would be just as likely to happen in the second 25 year period as the first 25 year period.

208. This means that systematic application of increments and decrements would result in an expectation of 25 years' worth of small increments being applied before the first large decrement was applied. This would result in an expectation of NPV neutral adjustments – with no reason to believe that the large decrement will be applied earlier, on average, than the small decrements.

209. By contrast, the NPV compensation will be seriously biased downwards if one applies a zero pandemic increment to asset betas until a pandemic hits and, only then, begins the process of applying large decrement followed by small increments. Under this approach, a large decrement is applied in the first instance followed by a series of small increments. The average value of these may cancel out (if "α" and "γ" were estimated accurately) but the present value of these will be negative.

210. Such an approach would be the equivalent of a regulator:

- providing zero compensation for insurance against earthquake damage over multiple regulatory periods that did not include an earthquake;
- waiting until the first major earthquake hit and damage was incurred and then making a decision that:
  - earthquakes are a rare occurrence and it is inappropriate to provide compensation for the damage just caused by the earthquake; but
  - in recognition of the fact that another earthquake may occur in the future, the regulator will provide a self-insurance premium to cover the expected cost of future earthquakes.

211. Even if that self-insurance premium (α×γ) is perfectly accurately estimated it will only provide compensation for the expected cost of future earthquakes. It will leave

the regulated business completely uncompensated for the cost of the earthquake that just occurred.

212. In the context of pandemics, the NZCC provided no asset beta uplift in the 2011 and 2016 IM asset betas. Notwithstanding that these risks were well understood to exist the NZCC did not apply an uplift to the estimated asset betas in 2011 and 2016 to reflect this risk. (Noting that this risk was not reflected in the 2011 IM and 2016 IM asset betas because no pandemic of similar scale to COVID-19 occurred in the respective asset beta estimation windows).

213. Having chosen not to adjust asset betas for this risk in the past, it would be unreasonable to only begin a process of adjustment in the first instance when the adjustment would be negative (i.e., in the first period immediately after a pandemic had actually occurred).

214. Indeed, the logic set out in this appendix clearly demonstrates that, if any asset beta adjustments for pandemics were to be contemplated, it would need to:

- Make no adjustment in the 2023 IM to its method for estimating asset beta; but
- Signal that in all future IM's[48] that:
  - an uplift of "$\alpha \times \gamma$" will be applied if there is no pandemic in the estimation window; but
  - a decrement of "$\alpha \times (1-\gamma)$" will be applied if there is a pandemic in the estimation window.

215. Only if this approach was adopted could the present value of the adjustments be expected to be NPV neutral (even if α and γ were estimated accurately). Of course, for the reasons set out above and below I do not recommend attempting any adjustment is appropriate.

A.2 Any reasonable estimate of "γ" is currently elevated above its long term average

216. I am not an expert on the course of pandemics. However, as a lay person it appears reasonable to believe that the near term probability of "pandemic" events is higher than the long-term average. That is, it seems reasonable to assume that consumer and/or public health reactions to changes in the state of the current pandemic are elevated relative to any estimate of the long term average probability of pandemic related events.

[48] Strictly speaking, in all future IM's using an estimation window that begins after March 2023.

217. Put simply, attempting to estimate an asset beta with a "long term average" pandemic risk while the COVID-19 pandemic is ongoing appears to be, on its face, unreasonable.

A.3 The logic does not stop at pandemics

218. The logic for a pandemic adjustment is not peculiar to pandemics. If applied to a pandemic then it invites application to all large infrequent systematic shocks. For example, the following are examples of large systematic shocks of a kind that are also infrequent/unpredictable:

    i. The war in Ukraine, and subsequent sanctions on Russia, is affecting global energy markets and global inflation and interest rates.

    ii. The global financial crisis of 2008-09 and the subsequent Eurozone debt crisis of extending out to at least 2015 represented a large systemic shock;

    iii. The decades long industrialisation of China, and associated reduction in global manufacturing costs and a global excess of savings, has had profound impacts on the structure of the world economy but which cannot be expected to be repeated in the future.[49]

    iv. Etc.

219. In fact, any given 5 year estimation window for asset beta will be made up of a combination of shocks that are unlikely to reflect the "average" set of expected shocks. For example, New Zealand inflation is, at the time of writing, at a 32 year high of 7.2% pa.[50] This is, by definition, a shock that is not expected to be repeated every 5-years. Therefore, the same logical case could be made for attempting to adjust measured asset betas that include this year in order to remove the effect of a 1-in-32 year record high inflation. However, going down such a path would make the IM's unworkable – as is discussed further below.

A.4 Unworkable complexity

220. Much of the previous discussion was centred around a stylised mathematical description of the problem – as set out in paragraph 195 above. This was useful in order to clearly describe some the issues and problems associated with making an alternative method adjustment. Even within that stylised mathematical framework it could be shown that there would be fundamental problems with estimating the

[49] Chinese GDP per capita grew at 10% pa from 1992 to 2012 inclusive and 6% pa for the next 10 years. Data from the World Bank (GDP per capita growth (annual %)).

[50] https://www.stats.govt.nz/news/annual-inflation-at-7-3-percent-32-year-high

relevant parameters ("α" and "γ") and in implementing the adjustment in an NPV neutral way.

221. The simplicity of that framework was useful for illustrating these issues clearly. However, that simplicity also elided over fundamental complexities that would be created by any attempt to actually implement alternative method on an ongoing basis (e.g., at future PSEs).

222. To illustrate these complexities, imagine that a determination on "α" and "γ" was made in the context of PSE4. Consistent with the mathematical logic of the adjustment set out in paragraph 195 above, the analyst would need to:

- Remove α×(1-γ) from the asset beta estimated using 5 years of data ending June 2022 and all future periods affected by a "COVID-19 like pandemic";
- Commit to add α×γ to all future asset beta estimates that are not affected by a "COVID-19 like pandemic" (as well as the estimate for the 5 years ending June 2017).

223. "COVID-19 like pandemic" is easy to say in the above dot points but is, of course, something that is unlikely to be possible to meaningfully implement in the real world.

224. For example, imagine that in any future update there has been a new "pandemic lite" (or, indeed, a "flare up" of COVID-19)[51] but which has a different assessed severity to the original COVID-19 shock. For example, an event somewhere between "swine flu" and the original COVID-19. In that context, logically the Commission would need to:

- create a new category of "pandemic lite" event and assign to it values of $\propto_{lite}$ and γ_{lite}.
- remove the "pandemic lite" impact ($\propto_{lite} \times (1 - \gamma_{lite})$) and commit to add $\propto_{lite} \times \gamma_{lite}$ to all future asset beta estimates not affected by a "pandemic lite"
- add back the previously assessed COVID-19 increment (α×γ) necessary to arrive an asset beta that probability weights a "COVID-19 like pandemic" and "pandemic lite" pandemic.

225. Alternatively, there might be a pandemic that is assessed to have had a larger impact than COVID-19. The same issues would be created.

226. The point that is being made here is that the mathematical description of the adjustments required at paragraph 195 relied on an implicit assumption that the impact of all future pandemics will be carbon copies of COVID-19. This allows us to arrive at the oversimplified policy solution:

[51] For example, a new COVID-19 variant that causes changes in the pattern of passenger flights and more generally affects the New Zealand economy. However, for the sake of this hypothetical, let the impact be something like "half" the impact of the COVID-19 pandemic in 2020.

- Just remove $\alpha \times (1-\gamma)$ when there is a pandemic;
- Add $\alpha \times \gamma$ when there is no pandemic; and
- The adjustments will all wash-out in the long run (provided γ is accurately estimated) so that the correct pandemic risk is compensated in the long run.

227. But the real world will not be that simple. There will be future pandemics but they will, likely, be very different in their impact than the COVID-19 pandemic. When they occur, they will require their own adjustments that are overlayed on the COVID-19 ongoing adjustment.

228. The above is far from a full imagining of the complexity and "pandora's box" that is opened up when attempting to remove or re-weight data in an attempt to reflect the stakeholder's views about the "true probability" certain events happening. It is my view that this sort of analysis will ultimately result in a regulatory quagmire – both now and in future IM updates. With no clear and transparent basis for making any adjustments, stakeholders will be incentivised to engage in what ultimately ends in a "data-mining" exercise – choosing:

a. what events to classify as happening inconsistent with their expected future frequency (noting that events such as the global financial crises have at least as much claim to this as does COVID-19);

b. what period to classify as affected by those events (and which sub periods of that period are most affected etc);

c. how to estimate the magnitude of the impact of the event on the estimated asset betas;

d. what probability to put on that event occurring in the future in order to "add back" the amount necessary to arrive at an appropriately weighted probability of "event X" asset beta.

e. how to keep track of the impact of future "event X" like occurrences in order to also remove the impact of those (so that the "add back" from the previous step does not result in overweighting of "event X" like occurrences).

229. A good way to test whether this is a sensible regulatory path to go down would be to imagine having applied the same approach to the global financial crisis. For example, imagine that, in the context of PSE2 and PSE3, it was determined that the global financial crisis was a large systemic shock that of the kind that is expected to occur relatively infrequently (e.g., once every 25 years) and was, therefore, over-represented in its then estimation period (covering April 2006 to March 2016 inclusive).

230. Had this been done in the past, it would be necessary to now, in 2022/23, to:

a. Assess the extent to which a "financial crisis" type event was included in the current estimation period (June 2012 to June 2022). In doing so, it would have

to grapple with whether the dramatic fall in stock valuations in February 2020, which were especially large for banks, was a "financial crisis". It would also have to consider the extent to which the period 2013 to 2015, which included the eurozone crisis, was a "financial crisis";

b. Remove any impacts of "financial crisis" from the estimated asset beta for June 2017 to June 2022 in order to arrive at a "financial crisis free" asset beta estimate;

c. Add back the financial crisis increment/decrement that was estimated in PSE3 to arrive at an appropriately weighted probability of "financial crisis" asset beta;

d. Grapple with the overlay of new COVID-19 adjustments.

231. The more events that are adjusted for overtime the more complex the asset beta estimate will become. Ultimately, the asset beta estimate will comprise mainly of previously determined estimates of increments/decrements for certain events X, Y and Z added to an asset beta estimate that becomes ever more contentious as stakeholders argue over whether the new estimation period is affected by X, Y and Z like events and, if so, how the impact of those events should be removed.

Appendix B Mathematical expression of beta risk

B.1 Asset returns measured using the CAPM

232. Let r_x be the return on asset "x", and let r_m be the return on a diversified portfolio of assets.

233. If asset "x" is publicly traded on a stock exchange, then β_x is commonly estimated by comparing the historical returns of asset "x" against the historical returns of the diversified portfolio and estimating a best fit line, such that β_x is equal to the slope of the best fit line. This is shown in the following formula:

$$\beta_x = \rho(r_x, r_m) \times \frac{SD(r_x)}{SD(r_m)}$$ [52]

Where: ρ is the correlation between the percentage returns on asset "x" (r_x) and the percentage returns on the diversified market portfolio (r_m). SD(r_x) and SD(r_m) are the standard deviations on the returns on asset "x" and the returns on the diversified market portfolio respectively.

234. The value of β_x in the CAPM increases with the volatility in the returns of asset "x", which is interpreted as the underlying risk of the asset. This assumption implies that investors demand a higher return as compensation in exchange for investing in an asset that is higher risk.

235. As set out in the above formula, β_x decomposes into two sources of risk, namely:

- Volatility of returns for asset "x" *relative* to volatility of average returns on a diversified market portfolio "m".
  - Mathematically this is given by the ratio of the standard deviation (SD) of returns ($\frac{SD(r_x)}{SD(r_m)}$); and
- Correlation (ρ) of returns on an asset with the average return on all assets in the economy (i.e., $\rho(r_a, r_m)$). This is a measure of the extent to which the asset portfolio returns and the market portfolio returns move together.

[52] This formula is also commonly written in terms of covariance between r_x and r_m in that $\beta_x = \frac{COV(r_x, r_m)}{SD(r_m)^2}$. However, $COV(r_x, r_m) = \rho(r_x, r_m) \times SD(r_x) \times SD(r_m)$. Consequently, $\beta_x = \frac{COV(r_x, r_m)}{SD(r_m)^2} = \rho(r_x, r_m) \times \frac{SD(r_x)}{SD(r_m)}$.

- A correlation of 1.0 (-1.0) implies that when the market return is positive the asset's return is always positive (negative);
- A correlation of more than 0.0 but less than 1.0 suggests that the asset return usually moves in the same direction as the market but not universally.

236. Furthermore, the above formula demonstrates that the riskiest assets are those that are both materially more volatile than the diversified portfolio ($\frac{SD(r_x)}{SD(r_m)} >> 1.0$) and also highly correlated with the diversified portfolio ($\rho(r_x)$).

Appendix C Sources for relative risk

Table 8-2: Sources for length of pricing periods

Airport	Source
Aeroports de Paris	https://www.aviationreg.ie/_fileupload/2019/Draft%20Determination/2020-2024%20Draft%20Efficient%20Cost%20of%20Capital%20Study.pdf
Auckland Airport	https://www.aviationreg.ie/_fileupload/2019/Draft%20Determination/2020-2024%20Draft%20Efficient%20Cost%20of%20Capital%20Study.pdf
Kobenhavns Lufthavne	https://www.aviationreg.ie/_fileupload/2019/Draft%20Determination/2020-2024%20Draft%20Efficient%20Cost%20of%20Capital%20Study.pdf,
Fraport (Frankfurt)	https://www.aviationreg.ie/_fileupload/2019/Draft%20Determination/2020-2024%20Draft%20Efficient%20Cost%20of%20Capital%20Study.pdf, Dr Hern's 2018 Heathrow report, p. 27.
TAV (Turkey)	https://www.aviationreg.ie/_fileupload/2019/Draft%20Determination/2020-2024%20Draft%20Efficient%20Cost%20of%20Capital%20Study.pdf
Vienna Airport	https://www.aviationreg.ie/_fileupload/2019/Draft%20Determination/2020-2024%20Draft%20Efficient%20Cost%20of%20Capital%20Study.pdf
Zurich Airport	https://www.aviationreg.ie/_fileupload/2019/Draft%20Determination/2020-2024%20Draft%20Efficient%20Cost%20of%20Capital%20Study.pdf
Sydney Airport	https://www.pc.gov.au/inquiries/completed/airports-2019/report/airports-2019.pdf
Beijing	http://zn.caac.gov.cn/website/dev/ghfzs/WJK/YJXX/JCJKGSFGL/
Guangzhou	http://zn.caac.gov.cn/website/dev/ghfzs/WJK/YJXX/JCJKGSFGL/
Shanghai	http://zn.caac.gov.cn/website/dev/ghfzs/WJK/YJXX/JCJKGSFGL/
Shenzhen	http://zn.caac.gov.cn/website/dev/ghfzs/WJK/YJXX/JCJKGSFGL/
Xiamen	http://zn.caac.gov.cn/website/dev/ghfzs/WJK/YJXX/JCJKGSFGL/
HNA	http://zn.caac.gov.cn/website/dev/ghfzs/WJK/YJXX/JCJKGSFGL/
Airport Facilities (Japan)	https://www.mlit.go.jp/en/koku/content/001311230.pdf
Japan Airport	https://www.mlit.go.jp/en/koku/content/001311230.pdf
GAdP Norte (Mexico)	https://ir.oma.aero/index.php/news-releases/news-release-details/oma-announces-approval-master-development-plan-investments-and
GAdP Pacifico (Mexico)	https://www.globenewswire.com/news-release/2019/12/12/1960218/0/en/Grupo-Aeroportuario-Del-Pacifico-announces-Approval-of-Master-Development-Programs-and-Passenger-Tariffs-for-Its-Airports-for-2020-2024-Period.html
GAdP Sureste (Mexico)	https://www.bloomberg.com/press-releases/2018-06-27/asur-announces-2019-2023-investment-plan
GMR (India)	https://www.newdelhiairport.in/pdf/AIC-Aera-Order.pdf
Malaysia	https://www.malaysiaairports.com.my/media-centre/news/mahb-clarifies-airport-passenger-service-charge-and-condition-use
Toscana	https://www.enac.gov.it/sites/default/files/allegati/2020-Lug/ENAC_ING_2019.pdf
Venezia	https://www.enac.gov.it/sites/default/files/allegati/2020-Lug/ENAC_ING_2019.pdf

Appendix D Curriculum Vitae

COMPETITION ECONOMISTS GROUP

Economics of competition, regulation and damages

Curriculum Vitae

Dr Tom Hird / Director

Contact Details

[redacted]

Key Practice Areas

Tom Hird is a founding Director of CEG's Australian operations. CEG has been recognised by Global Competition Review (GCR) as one of the top 21 worldwide economics consultancies with focus on competition law. Tom has a Ph.D. in Economics from Monash University. Tom has also been named by GCR in its list of top individual competition economists globally. Tom's area of practice has a focus on financial economics both in regulatory settings and commercial strategy and commercial disputes.

Tom has given expert witness testimony to the Federal Court of Australia, the Australian Competition Tribunal, the Supreme Court of Victoria, and the Supreme Court of Western Australia in addition to numerous regulatory proceedings in Australia and New Zealand.

Selected recent assignments are set out below.

Selected recent projects

Ongoing retained by the Australian Energy Networks Association (ENA) since 2015 to be the industry expert collating and analysing cost of debt data incurred by all privately owned energy network businesses regulated by the Australian Energy Regulator.

2022 Retained by nbn to provide an expert report on the cost of capital.

2022 Retained by ATCO to provide an expert report on the costs of debt raising.

2022 Retained by APGA to provide an expert report on estimating the cost of equity for regulated businesses.

2022 Retained by nbn to provide advice on pricing structures.

2021 Retained by Jemena to advise on benchmarking of operating costs.

2021 Retained by various parties to provide advice in relation to the compensation for stranding risk for gas transport businesses.

2021 Retained by Aurizon to provide advice in relation to the appropriateness of moving from an on-the-day cost of debt allowance to a trailing average cost of debt allowance without transition.

2021 Retained by G+T to provide advice on how to assess economically efficient investment in the Port of Melbourne.

2021 Retained by DLA Piper to provide expert testimony on the cost of capital for Perth Airport in the context of legal proceedings by Perth Airport against QANTAS Airways and others.

www.ceg-ap.com

COMPETITION
ECONOMISTS
GROUP

Dr Tom Hird / Director

2021	Retained by Vector to advise on the potential utility of funding itself with inflation indexed debt instruments and/or engaging in the inflation derivative markets to achieve similar exposure.
2020	Retained by Seven West Media and Nine Entertainment to advise on the value of news content used by Google and Facebook in the context of the News Media and Digital Platforms Mandatory Bargaining Code.
2020	Advice in relation to competition concerns raised by the ACCC about TVSN's proposed requirements for exclusivity with its suppliers. Retained by Gilbert + Tobin.
2020	Retained by the ENA to provide an expert report to the AER on the treatment of inflation when estimating a real WACC under the National Electricity Rules and National Gas Rules.
2020	Retained by the Australian Pipelines and Gas Association to assist with drafting a submission to the AER on estimation of the rate of return for regulated pipeline businesses.
2020	Retained by WaterNSW to provide an export report estimating the WACC for its water infrastructure business.
2020	Retained by Vector in New Zealand to provide an export report on estimating the WACC for its electricity and gas businesses.
2020	Advice to the Australian Gas Pipeline Association in relation to application of Rule 546(1) of the National Gas Rules in relation to valuation of gas pipelines.
2019	Advice in relation to Dalrymple Bay Coal Terminal's submission to the QCA's Declaration Review process. Retained by DLA Piper.
2019	Advice in relation to the competitive effects of a merger between building materials companies. Retained by Clayton Utz (Australia) and Chapman Tripp (New Zealand).
2019	Competition analysis of the Australian mortgage sector in the context of proposed regulation of mortgage broking commissions.
2019	Advice on the proposed merger between Malt suppliers Cargill and BBM. Retained by Gilbert and Tobin.
2019	Advice in relation to the impact of price transparency on competition.
2019	Advice in relation to a dispute between Esso and the Australian Tax Office in relation to the use of WACC in royalty calculations for stabilised crude oil and liquid petroleum gas. Retained by Allens-Linklater.
2019	Advice to a number of Australian and New Zealand businesses on the optimal design of the regulatory system for the treatment of inflation forecast errors (under the National Gas Rules and the National Electricity Rules in Australia and the New Zealand Input Methodologies).
2019	Advice to Vector on the implications of historically low nominal and real risk free rates on the design of the New Zealand regulatory "Input Methodologies" for electricity and gas distribution businesses.

COMPETITION
ECONOMISTS
GROUP

Dr Tom Hird / Director

2019	Advice on the quantification of 'timing benefits' in the AER's PTRM model. Retained by Jemena and SAPN separately.
2018	Expert report for Sydney Water in the context of the IPART review of its financeability test.
2018	Advice to Aurizon on the cost of capital and estimation of expected inflation.