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Asset beta update for the 2023 IMs

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COMPETITION ECONOMISTS GROUP

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1 Introduction

1. I, Tom Hird of 14 Glen Eira Rd, Ripponlea, Victoria, have been engaged by Russell McVeagh, on behalf of the New Zealand Airports Association, to provide an independent expert opinion on the asset beta for airports estimated in the context of, and having regard to, the New Zealand Commerce Commission's (NZCC) approach to estimating asset beta for the New Zealand airports input methodology (IM).

2. I hold the following qualifications:

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

3. From 1990 to 2000 (both prior to, during and after the completion of my PhD in economics) I was employed by the 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 Report structure

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

   - **Section 2** is divided into the following subsections:
     - Section 2.1 explain what drives asset beta risk
     - Section 2.2 explains the difference between the expected cost of an event (sometimes referred to as "asymmetric risk") and the asset beta risk associated with that event. I explain that both sources of risk require separate compensation.
     - Section 2.3 provides an updated estimate of the asset beta for an updated version of NZCC's 2016 IM sample including sensitivities for the exclusion

of certain firms and for the estimation period. In doing so I identify several new airport comparators and suggests the removal of Airport Facilities in Japan on the basis that it has no exposure to passenger demand. The updated sample average asset beta is estimated to be 0.83.

  - Section 2.4 explains why I agree with the NZCC methodology of focusing on the average of a large sample of comparators;
  - Section 2.5 considers and rejects TDB's suggestion to focus on smaller airports. However, had I accepted TDB's suggestion my estimate would be higher than 0.83.

- **Section 3** explains why the NZCC's established methodology already appropriately incorporates the effect of the COVID-19 pandemic on the estimated asset betas such that adjustments to the estimation technique are unnecessary (and I recommend against any attempt to do so).
- **Section 4** examines whether there is any conceptual basis to conclude that aeronautical operations are lower risk than non-aeronautical operations at airports. I conclude that there is no such conceptual basis and, if anything, aeronautical operations are likely higher risk than non-aeronautical operations.
- **Appendix A** provides a mathematical description of asset and demand beta definitions.
- **Appendix B** is my CV.

2 Updated estimates of asset beta

8. The asset beta measures the fundamental risk of the underlying business operations. The asset beta is the measure of risk of investing in a line of business ("asset") if that line of business is 100% equity funded (i.e., zero debt funding). The asset beta is also closely related to the "equity beta", which measures the risk of investing in an asset that is partially financed by debt.[1]

2.1 Asset beta measures sensitivity to economy wide shocks

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. 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).

11. 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).

12. 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

[1] Equity beta is larger than asset beta for assets that are partially financed by debt (leverage > 0). This is because equity holders are subordinate to debt holders, which raises the relative risk of investing in an asset that is partially financed by debt as compared to an asset that is financed only by equity.

than expected for completely unrelated reasons – with little net effect on the overall performance of the diversified portfolio.[2]

13. 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.

14. 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.

15. 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).

16. 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:[3]

> ***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*

[2] 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 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.

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

> *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 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.)

2.2 Compensation for expected cost is separate to compensation for asset beta impacts

17. 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

18. 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.

2.2.1 Expected cost of damage to XYZ

19. 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.

20. 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 $2

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.

2.2.2 Impact of risk exposure on XYZ WACC

21. 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.

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

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

23. 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).

24. 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.

25. 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.

26. 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.

27. 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.

28. One way in which this could be achieved is to set prices each year based on actuarially expected passenger volumes. In the presence of a very large negative impact from a small probability event (e.g., a pandemic) the actuarially expected level is lower than the "most likely" level.[4] This would create relatively small surpluses in the majority of years (without pandemics) to offset large losses in the small number of years affected by a pandemic.

29. Having established that this direct exposure exists, the secondary question for investors is to what extent will the advent of a pandemic add to the correlation between the value of the airport's cash-flows and those of a diversified portfolio (i.e., to what extent will a pandemic affect asset beta). I use the term "secondary" to convey that this question only gets asked contingent on a pandemic having a direct effect (i.e., the term "secondary" is not meant to convey that this impact is unimportant to investors).

30. It follows that the updating of the asset beta under the IM review is therefore a separate matter to, and does not impact on, any consideration airports might give to compensation for ex ante expected costs in pricing consultations.

2.3 NZCC sample and updated asset beta estimates

31. I regard the NZCC's approach, especially its approach of having regard to a wide range of comparator airports, as highly robust. It is also the case that the NZCC method is highly transparent including by the publishing of the spreadsheet used for their calculations of asset beta. I am unaware of any other regulator with as robust and transparent methodology. The NZCC's approach was the outcome of contested proceedings with well-resourced airlines and airports making submissions to an independent regulator and was the subject of review before the High Court of New Zealand[5] and was largely unchanged following the 2016 IM Review.

4 That is, the mean of the distribution of outcomes is lower than the median (or mode) of the distribution.

5 Wellington Airport & others v Commerce Commission [2013] NZHC 3289.

32. The NZCC's approach to estimating a benchmark asset beta for the airports involves the following steps:

    a. Identify a list of publicly traded airport businesses;

    b. Estimate their equity betas and debt leverage levels using data available from the Bloomberg data service over the most recent 10 year period – where that period is divided into two separate 5 year periods. The NZCC estimates equity betas using weekly and four-weekly estimation windows;

    c. Using the debt leverage for each business, "de-lever" each individual business's estimated equity beta into a corresponding asset beta (the "asset beta" is the estimated equity beta that would exist if a firm had zero debt), assuming that the business's debt had, itself, a debt beta of zero; and

    d. Calculate the average asset beta across the full sample.

33. The NZCC makes an adjustment to that average asset beta based on a presumption that non-aeronautical activities (e.g., parking, retail outlets and land rentals) have higher risk than aeronautical activities. This is the only aspect of the NZCC methodology that I consider is problematic.

34. The NZCC asset beta estimate for the 2016 IM update, for both airports and energy businesses, was consistent with the asset beta estimated for the 5 years ending:

    - 31 March 2011; and
    - 31 March 2016.

35. The NZCC did also report asset beta estimate for the five years ending March 2001 and March 2006. However, the NZCC determined that it would give "less weight" to the more distant estimates and, ultimately, based its final estimates only on the periods ending 2011 and 2016.

36. Assuming the NZCC will keep to the same end date (31 March) in its 2023 IM update I have updated the asset beta estimates to cover:

    - The five years ending March 2018; and
    - All of the data from 1 April 2018 to the present day;
        - This means that the NZCC will have around 9 months of additional data unavailable to me at the time of writing.

37. I follow the NZCC in taking the sample average of the asset beta estimate in each 5 year window and then taking the average of the two sample averages. In its most recent 2016 application of this methodology the NZCC identified the following airport comparators and average asset betas.

38. The results are reported in Table 2-1 below.

Table 2-1: Asset betas for companies in NZCC comparator sample

Ticker	Name	NZCCBeta2006-2016^	2013-18	2018-23	Average
AIA NZ Equity	Auckland	0.710	0.925	1.061	0.993
SYD AU Equity	Sydney	0.360	0.330	#N/A	0.330
FLU AV Equity	Vienna	0.408	0.252	0.613	0.433
694 HK Equity	Beijing	0.748	0.541	0.884	0.713
600004 CH Equity	Guangzhou	0.823	0.967	0.885	0.926
357 HK Equity	HNA	0.938	0.474	1.025	0.750
600009 CH Equity	Shanghai	0.813	0.788	0.711	0.750
000089 CH Equity	Shenzhen	0.873	0.990	0.600	0.795
600897 CH Equity	Xiamen	0.863	1.097	0.626	0.861
KBHL DC Equity	Kobenhavns Lufthavne	0.325	0.460	0.303	0.382
ADP FP Equity	Aeroports de Paris	0.545	0.422	0.879	0.651
FRA GR Equity	Frankfurt	0.573	0.356	0.604	0.480
TYA IM Equity	Toscana	0.258	0.240	0.479	0.359
SAVE IM Equity	Venezia	0.413	#N/A	#N/A	#N/A
GMRI IN Equity	GMR (India)	0.693	0.409	0.355	0.382
8864 JP Equity	Airport Facilities (Jap.)	0.535	0.583	0.483	0.533
9706 JP Equity	Japan Airport	0.795	1.158	1.009	1.083
MAHB MK Equity	Malaysia Airports	0.858	1.058	1.069	1.063
MIA MV Equity	Malta	0.543	0.663	1.212	0.937
OMAB MM Equity	GAdP Norte (Mexico)	0.710	0.897	1.414	1.156
GAPB MM Equity	GAdP Pacifico (Mexico)	0.675	0.849	1.456	1.152
ASURB MM Equity	GAdP Sureste (Mexico)	0.665	0.850	1.099	0.974
AERO SG Equity	Belgrade	1.155*	1.365	1.584	1.474
FHZN SW Equity	Zurich	0.578	0.641	0.866	0.754
AOT TB Equity	Airports of Thailand	0.908	1.246	1.071	1.158
TAVHL TI Equity	TAV (Turkey)	0.340	0.443	0.649	0.546
ACV VN Equity	Vietnam	#N/A	#N/A	0.766	0.766
ADB IM Equity	Bologna (Italy)	#N/A	#N/A	0.835	0.835
AENA SM Equity	AENA (Spain)	#N/A	#N/A	0.815	0.815
CAAP US Equity	Corp America Airports Sa	#N/A	#N/A	0.667	0.667
Average		**0.65**	**0.72**	**0.86**	**0.79**
Average ex Airport Facilities and GMR		**0.66**	**0.74**	**0.89**	**0.82**
Average ex Airport Facilities, GMR, Vietnam, Bologna AENA and CAAP		**0.66**	**0.74**	**0.91**	**0.83**

*Source: New Zealand Commerce Commission, Bloomberg, CEG analysis. ^The NZCC estimates weekly and 4-weekly asset betas for 2006-2011 and 2011-2016. This results in four different asset beta estimates for each airport. The NZCC practice is to take an average of these four separate asset betas I follow this method in this table. * Belgrade receive 50% weight in the Commission's average because it only has stock data available from 7 February 2011.*

39. I have added four airport companies (ACV, ADB AENA and CAAP) highlighted in red. These four airport companies were listed since 2015 and therefore were not included in the previous IM decision. I followed the process outlined in the previous IM decision to identify the four airport companies. I have further analysed the composition of their business operation and confirm that the majority of their revenues correspond to airport operations.

40. I have highlighted two airport companies (GMR and Airport Facilities) in brown. This is because closer inspection of these companies suggests that, at least historically, their risk exposure was not primarily to variations in airport passenger traffic.

41. Airport Facilities, as its name suggests, provides 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.[6] 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.

42. I also highlight GMR given that, while it has always had airport operations subject to the risk of fluctuations in passenger numbers, prior to its split/demerger on 11 Jan 2022, it had extensive non-airports related activities. The split separated the non-airports business into a newly listed entity GMR Power and Urban Infrastructure Limited. As reported, one of the key reasons for the split was to attract "sector-specific global investors".[7]

43. In short, the listed GMR company is currently solely an airport operator but was, over much of the period, a diversified infrastructure conglomerate. This means that while it may be reasonable to exclude GMR prior to January 2022 it should be included in asset beta samples beyond that date.

44. I have also examined Japan Airport Terminals. Japan Airport Terminals does not own the runway operations at the airports it operates at (they are owned by government). However, it does receive direct per passenger payments from the airlines that use those terminals (with the amount explicitly nominate on airline

[6] 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

[7] 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)

ticketing). Its terminal retail operations have the same or similar per passenger demand exposure to aeronautical operations at the same site.[8]

45. The Supreme Court of Western Australia also confirmed the exclusion of Airport Facilities but the inclusion of Japan Airport Terminals in the case between Perth Airport and Qantas delivered early this year.[9] 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-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."*

46. I consider that the asset beta of 0.83 (found in the bottom right hand cell of Table 2-1) reflects an accurate estimate of the asset beta derived by updating the NZCC's 2016 IM methodology. Specifically, I consider that the addition of four new airport companies (listed in the bottom four rows of airports) and the removal of two companies (Airport Facilities and GMR) is a reasonable basis on which to form the relevant sample. That said, I note the historical exclusion of GMR is a judgement call and that GMR should not be excluded from future IM updates (assuming its current corporate structure remains constant).

2.4 Focus on the average of a large sample

47. The NZCC sample average asset beta varies with the estimation period but only modestly relative to the individual asset beta estimates. For example, HNA varies between 0.5 and 1.0 depending on the period in question.

48. This underlines the noisiness in individual asset beta estimates and the danger of relying on a comparison to only a small number. The estimated asset beta for any individual airport tells me little about the true beta for that airport. Investors' perceptions of HNA's beta likely did not double over the last five years. The variability

8 In their recent financial report, Japan Airport Terminal Co., Ltd indicated that their business performance is heavy correlated to passenger volume. Financial Results for the Year Ended March 31, 2022 [J-GAAP], p.2, https://www.tokyo-airport-bldg.co.jp/files/en/ir/000012099.pdf

9 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

of their individually estimated asset betas almost certainly largely reflects noise in the estimation process. It is important to keep this fact in mind when interpreting the data. This is why I consider that it is important to take an average over as large a sample of comparators as possible.

49. To further illustrate why this is important, note that there will be geographic diversity in the shocks that are hitting the airport sample. In some geographies there may be shocks occurring to which airports are relatively less affected while in other geographies the opposite will be true. With a sample that covers greater geographic diversity these effects will tend to balance out.

50. By construction, the average estimated equity beta for all firms in the market is roughly equal to 1.0. That is, equity beta is a measure of "relative risk". In any given period, the measured equity beta for one industry depends not just on its own absolute risk but on the risk of other industries during the measurement period.

51. If a large shock hits the economy that disproportionately affects some industries, then those industries will have a higher measured equity beta in that period. Moreover, because equity beta is a measure of relative risk, this means, by construction, that all other industries will have their measured equity beta lowered.

52. By contrast, focussing on one 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.

2.5TDB suggested focus on "small" and "single airport" comparators

53. TDB makes the following statement in its report.[10]

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

54. TDB does not identify which airports it considers fit these categories. As explained in the previous section, I consider that the NZCC is correct to rely on the largest

[10] TDB Advisory Ltd, Process and Issues and Draft Framework Papers, May 2022 p. 7.

possible sample of comparators of airport companies – provided that these companies are, in fact, airport companies subject to passenger demand risk.

55. The evolution of the NZCC's methodology has been based on a preference for a broad sample of comparable companies rather than engaging in, inevitably, subjective analysis to try and identify a small sample of the most comparable companies. The NZCC has logically argued that the average estimated beta of a smaller sample, even if it was on some dimensions more comparable, may be less reliable due to noise in the individual asset beta estimates.

56. For example, Auckland Airport is clearly the most comparable airport to Auckland Airport. However, the NZCC has in the past rejected relying solely, or even mainly, on estimated asset betas for Auckland Airport because the resulting estimate would be noisy.

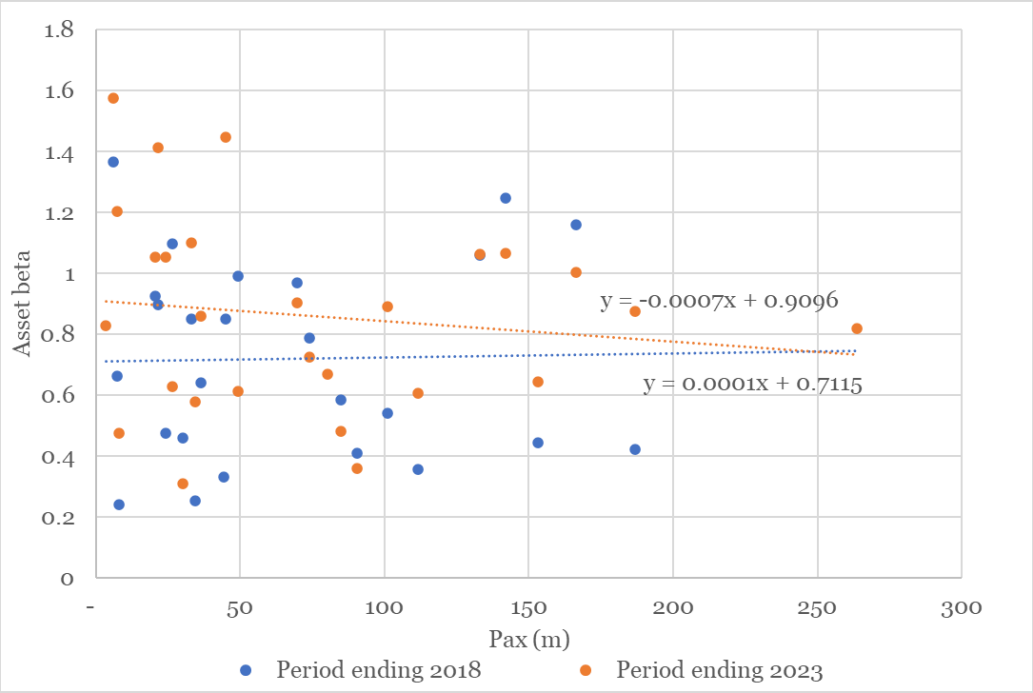
57. In any event, I have investigated the relationship between asset beta and:

- the size of an airport company (proxied by total passenger throughput in 2018 (the last/first year of the March 2018/2023 estimation window); and
- the proportion of total passenger traffic through the largest airport operated by the airport company.

58. I find that neither relationship is statistically significant. Moreover, I find that what relationship exists suggests that asset beta would be higher than average for smaller airport companies and for airport companies with most of their traffic at a single airport (noting that these two sets are largely the same). This means that adopting TDB's suggestion would, if anything, raise the estimated asset beta relative to the NZCC methodology.

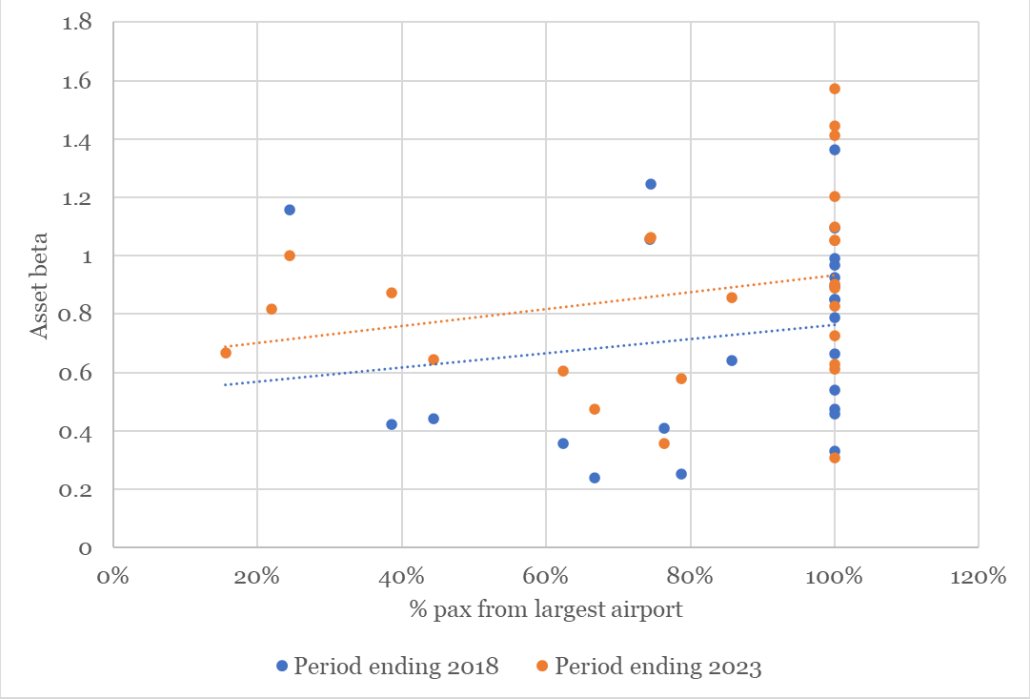
59. In particular, Figure 1 shows that as the total number of passengers for an airport company increase the estimated asset beta for that company remains either unchanged or falls slightly (although this relationship is not statistically significant). Figure 2 shows that companies that have a greater proportion of their total passenger traffic at their main airport have, if anything, a higher asset beta than companies where passengers are spread more evenly across multiple airports (noting that the large number of observations at "100%" are associated with a company that owns a single airport).

Figure 1: Airport company size and asset beta



Source: Bloomberg and CEG analysis

Figure 2: Passenger % at main airport and asset beta



Source: Bloomberg and CEG analysis

2.6 Key conclusions

60. The key conclusions from the analysis in this section are:

- Asymmetric risk exposures, including to pandemics, will have expected costs and systemic costs. Investors need compensation for both.
- The NZCC's methodology as applied in past IM reviews is robust. An asset beta estimate of 0.83 is a reasonable estimate of the sample average asset beta applying the NZCC's methodology (although this will change as new data between now and March 2023 becomes available);
- TDB's proposal that the NZCC changes its methodology is not robust. Moreover, applying TDB's proposed method would, if anything, raise the estimated asset beta.

3 Impact of COVID-19 pandemic

61. It can be seen from the data presented in the previous section that the average asset beta for airports tends to be higher in the most recent period that includes the effects of the COVID-19 pandemic than in the earlier period that does not.

62. This is unsurprising, at least in terms of the negative impacts of COVID-19 on airports and the economy more generally. Airports, being reliant on air travel, were materially affected by travel restrictions (both government and customer driven) on air travel 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).

63. Accepting that the COVID-19 pandemic had an effect on measured airport betas, the question remains as to whether the NZCC's established IM methodology will appropriately incorporate that impact. The NZCC methodology to date 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.

64. Each time the IMs are updated the older data in the estimation window is dropped and replaced with newer data. The effect of this method is that the asset beta estimate in any given IM update reflects the balance of systematic shocks that occurred in the previous 10 years but these shocks only influence the estimated asset beta temporarily (while they remain in the 10 year estimation window).

3.1.1 Critical analysis of the method

3.1.1.1 NZCC method automatically calibrates to observed magnitudes and frequencies

65. The major advantage of the NZCC approach is that, in the long run:

- all systematic shocks that actually occur are captured in the IM asset beta estimates;
- 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.

66. 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 NZCC method will generate asset betas 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 IM estimation window in 50 years will include such an event. But if the true frequency is one-in-twenty or one-in-100 the rolling update will ensure that the event is captured in one IM estimation window every 20 or 100 years – as appropriate.

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

68. In the context of pandemics, the NZCC provided no asset beta uplift in the 2011 and 2016 IM asset betas. As the TBD report makes clear, the risk of pandemics to the airport sector was conceptually well understood at the time of the 2011 and 2016 IMs. [11]

> *We note too that while the future scale and nature of pandemics is unknown, the risk of pandemics is not a surprise. Pandemics have long been cited among the natural disasters and other catastrophic events that potential investors are alerted to in bond or equity offerings by airport owners and operators. For example, in the prospectus accompanying its share offer in 2010, Auckland Airport noted that "Future pandemics… may reduce passenger volumes at very short notice and, depending on the severity of the outbreak, may depress passenger volumes for an indefinite period which could adversely affect Auckland Airport."*

69. Notwithstanding that these risks were conceptually well understood 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).

70. Having chosen not to adjust asset betas for this risk in previous IMs it would be unreasonable for the NZCC to only consider whether a change in methodology is required for the first IM when the change in methodology would be to seek to achieve a lower asset beta (i.e., in the first IM when a pandemic had actually occurred). If an argument for considering a change is that the pandemic is over-represented in the estimation window relative to its long-run average expected impact then it also follows that every estimation window (past and future) that does not include a

[11] TDB Advisory Ltd, Process and Issues and Draft Framework Papers, May 2022 P. 4.

pandemic will result in an asset beta that underestimates the expected impact of a pandemic on airport asset betas.

71. If a new methodology meant that asset betas estimated in windows with pandemics are adjusted down then asset betas estimated in windows without pandemics would need to be adjusted upwards. Moreover, the average effect over-time should be zero (i.e., these effects should cancel out). Only adjusting asset beta downward when there is a pandemic would lead to a clear bias in a new methodology. Similarly, even if future estimation windows without pandemics had their asset betas adjusted upwards, this would still result in an NPV bias given the failure to adjust past asset betas upward for expected pandemic risk.[12]

In this regard, I agree with TDB's conclusion, if not their reasoning, when they state:[13]

> *"…we think that the Commission should resist Covid-related arguments for adjustments in the equity or asset betas."*

72. 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.

73. In this context, I note that TDB expresses the "hope" that such risks are "largely" behind us but, quite reasonably, does not attempt to claim that this is in fact true with 100% certainty.[14]

> *We suggest that the 2010 context was quite different from current circumstances, where (**we hope**) Covid-induced uncertainties on the real economy and financial markets are **largely** behind us and markets are more focused on other developments. (Emphasis added.)*

74. 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.

75. 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

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12 That is, staring a series of adjustments only when the first adjustment is negative will lead to a NPV negative result even if the adjustments average out to zero in the long run without discounting.

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

14 TDB, op. cit., p.5

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.[15]

iv. Etc.

76. 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.[16] 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.

77. It is my view that this would ultimately result in a regulatory quagmire – both now and in future IM updates. 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).

78. The more events that an estimation methodology seeks to adjust for overtime the more complex the asset beta estimate will become. Ultimately, the Commission's 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.

3.2 IM WACC is an industry-wide benchmark

79. Under the New Zealand regulatory framework, NZCC WACC estimate for airports is not binding but provides guidance to airports. It reflects an industry-wide benchmark but airports ultimately decide on risk allocation mechanisms following consultation, and also have the ability to set their own WACC – which implies setting their own asset beta.

80. In this context, it is even more questionable as to whether the NZCC should consider departing from its established approach to estimating asset beta.

3.3 Conclusion

81. In my view, there is a strong case for the NZCC to continue to apply its existing methodology (i.e., it will appropriately incorporate the impact of COVID-19) given:

- The NZCC's current methodology provides the correct estimate of asset beta risk on average over time. This is because the rolling estimation windows ensures that every event that occurs (e.g., a pandemic, a global financial crisis, historically high inflation, a war in Ukraine etc.) will be weighted in the long run average IM asset beta according to the frequency with which that type of event actually occurs.
- Any attempted change in methodology to seek to incorporate specific risk events would almost certainly result in too high or too low average asset beta over time. This is because it is impossible to accurately estimate the parameters necessary for incorporating the impact of such events.
  - Noting that any change in methodology to seek to reduce the estimated impact of the pandemic in the 2018 to 2023 window (to reflect an estimated long run average frequency of pandemics) would, based on its own internal logic, need to be paired with an increase in estimated asset betas in all other (past and future) estimation periods unaffected by pandemics.

- If done correctly, this should have zero effect on the long run average asset beta. However, because we simply do not know either the true frequency of these events or the impact on measured asset beta when they occur, then attempting such an adjustment will inevitably lead to over or underestimation of the asset beta in the long run.

- There would be a massive increase in the complexity of the IM process (both now and in future IMs) associated with attempting to ensure internal consistency across time; and
- The complexity would introduce scope for cherry-picking analysis and provide incentives for stakeholders to try and game the process by promoting approaches that were not internally consistent through time.

4 Adjusting asset betas for differences in risk between aero and non-aero operations

4.1 Conceptual framework

82. The value of most airport equity cash-flows ("profits") are likely 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"[17] estimate of costs.

83. This means that temporary shocks to passenger numbers (shocks that temporarily depress/elevate passenger numbers – such as are associated with temporary economic recessions) are likely to affect aeronautical cash-flows by the same amount (if not more) than non-aeronautical cash-flows. However, permanent shocks to passenger growth may affect aeronautical cash-flows by less than non-aeronautical cash-flows because there is no regulatory control (or threat of control) over the latter.

84. By way of further elaboration on this point, 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).

85. I 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

[17] 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.

temporary departure of economic activity from trend.[18] In this case, the first two categories will have more or less the same cash-flow response and, therefore, the same risk. The last category of services will have unchanged cash-flows and, therefore, zero risk exposure to this shock.

86. 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.

87. 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.

88. 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.

89. 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.[19]

90. 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.

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

[18] 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.

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

- **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; [20] but
- **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);[21]
- **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.[22] [23]

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

[20] 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 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.

[21] 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.

[22] 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.

[23] 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 4-1: 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**

93. 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.

4.2 NZCC past analysis

94. 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:[24]

> *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.*

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

95. 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:[25]

> *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.*

96. The NZCC provided no empirical analysis to support this conclusion and did not grapple with the conceptual issues that I discuss in section 4.1 above.

4.3 Summary

97. In summary, I do not consider that there is a valid case for presuming that aeronautical asset betas are lower than non-aeronautical asset betas. This is because aeronautical cash-flows are more exposed to temporary economic shocks than non-aeronautical cash-flows and has average risk exposure to permanent economic shocks. If anything, this suggest higher risk for aeronautical activity than non-aeronautical activities.

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

Appendix A Mathematical expression of beta risk

A.1 Asset returns measured using the CAPM

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

99. 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:

$$\beta_x = \rho(r_x, r_m) \times \frac{SD(r_x)}{SD(r_m)}$$ [26]

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.

100. 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.

101. 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.

[26] 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.

102. 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 ($\rho(r_x)$).

COMPETITION ECONOMISTS GROUP

Appendix B Curriculum Vitae

Curriculum Vitae

Dr Tom Hird / Director

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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.

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.

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.