# Review of the Commerce Commission's Draft Views on the Cost of Capital of Wellington International Airport Limited's Airfield Activities

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# 1 Introduction and Summary

This report reviews the Commerce Commission's draft views on the cost of capital of Wellington International Airport Limited's (WIAL's) airfield activities.

We take as given the Commission's choice of model for estimating the weighted average cost of capital (WACC) as well as the tax parameters that enter into the model. In the report, we focus on the Commission's estimates of the other parameters: the risk-free rate, the post-tax market risk premium, WIAL's asset beta, and WIAL's leverage and debt premium.

In several cases, we argue that the Commission's approach is not the best. In some of those cases, it might be argued that the Commission's approach was satisfactory given its purpose. WIAL's recent returns are well below its cost of capital, so approximations and short-cuts may not materially affect the conclusion that price control is unwarranted in the case of WIAL. We address the issues here, nevertheless, on the grounds that the Commission's choices may have some precedential value in contexts where small differences in the estimates matter more.

# 2 Summary

Our report argues first that the Commission's approach to the estimation of parameters and therefore WACC would be improved if it recognised the degree of uncertainty surrounding the estimates of parameters and, as a result, WACC.

In terms of parameter estimates, we conclude as follows:

- The appropriate term of the risk-free rate is longer than the pricing period. We conclude that 10 years is a reasonable choice.

- The Commission does not have good evidence for moving away from 9% as an estimate of post-tax market risk premium

- The Commission's estimate of airport betas does not take sufficient account of the differences, such as the income elasticity of demand, between airports and other utilities. Further the Commission's estimate of WIAL's asset beta is based on a misunderstanding of the nature of price adjustments under WIAL's Deed. WIAL's previous estimate of its current asset beta as lying between 0.45 and 0.60 is reasonable. The Commission's estimate of 0.30 to 0.35 is implausibly low. WIAL's asset beta may differ in future as the arrangements governing price adjustments change.

- WIAL's leverage and debt premium should be estimated taking into account facts about WIAL, and not solely on the basis of Auckland International Airport Limited's

(AIAL's) characteristics. WIAL's leverage is probably around 45 to 50%. WIAL's own estimate of its debt premium (1.5%) is more reliable than the Commission's estimate of 1%.

# 3 The Commission's Draft Views on WIAL's Airfield Cost of Capital

We set out below the Commission's views on the cost of capital for WIAL's airfield activities and the role of estimates of the cost of capital in its study. Where appropriate we comment on the views expressed by the Commission's expert on the cost of capital, Dr Martin Lally, in his report.

## 3.1 Role of the Commission's Estimates of the Cost of Capital

The Commission uses its estimates of WIAL's airfield cost of capital as an input into its calculation of the total costs WIAL incurs in providing airfield services. The estimates of total costs enter into the Commission's estimates of the extent of any excess returns. These estimates in turn feed into the Commission's estimate of the extent of allocative efficiency present in the current regulatory environment and the Commission's judgement whether price control is warranted.

The estimates the Commission makes in deciding whether to impose price control may also influence any subsequent decision it makes about the appropriate levels of controlled prices. And they may influence others who must form a view of WIAL's cost of capital.

## 3.2 The Commission's Model

The Commission estimates the cost of capital as a weighted average of the costs of debt and equity. Its estimate is of a "nominal post-tax" WACC. It estimates the cost of equity using the standard post-tax form of the capital-asset pricing model (CAPM).

By using the expression "post-tax", the Commission means its estimates of a company's WACC are estimates of the returns that investors would expect to receive from investments in the company after the company had paid tax on its profits. Nevertheless, these returns as estimated by the post-tax CAPM reflect the underlying structure of personal taxes.

The mathematical details of the post-tax model are set out in Annex A1. Since we discuss the post-tax market risk premium that enters into this model extensively, however, it is appropriate to note here the equation underlying this parameter. It is:

$$PTMRP = R_m - R_f\left(1 - t_{int}\right) \qquad (1)$$

where $PTMRP$ stands for the post-tax market risk premium, $R_m$ is the expected return on the market portfolio, $R_f$ is the risk-free rate, and $t_{int}$ is the tax rate on interest income.

In the rest of this report, we take as given the Commission's model and the tax assumptions that enter into it. [1] We focus on the Commission's estimates of the parameters.

## 3.3 The Commission's Parameter Estimates

To estimate WACC using the standard post-tax model, it is necessary to estimate five parameters: the risk-free rate, the post-tax market risk premium, the company's asset beta, the proportions of debt and equity in the company's capital structure, and the company's debt premium.

### *3.3.1 The Risk-Free Rate*

As is conventional, the Commission estimates the risk-free rate as the observed yield on New Zealand Government stock. The issues the Commission considers are the appropriate maturity of the risk-free bond and the period over which the yield on that bond should be measured. The Commission's draft view is that the maturity should correspond to the period over which prices are set and that the rate should be the average observed yield over the six-month period before prices come into effect. For WIAL it therefore considers the average yield on government stock of a five-year maturity over the six months before 1 July 1997, which it finds to be 7.47%.[2]

### *3.3.2 Post-Tax Market Risk Premium*

The Commission notes that the most common estimates of the post-tax market risk premium appropriate for the model it uses are 8% and 9%. It concludes that "[t]he various approaches to estimating market risk premium all suggest a figure of 8% rather than 9% (paragraphs 70 and 8.38)."

### *3.3.3 Asset Beta*

The Commission's draft view is that the "regulatory environment" is the dominant factor in determining the airports' asset betas and it chooses electricity companies from the United Kingdom and United States as comparators. It reports evidence of average asset betas for these companies of 0.56 and 0.36, respectively.

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1 The standard post-tax model has been the common form of the CAPM in use in New Zealand since the introduction of dividend imputation. The model is easily derived from the assumptions specific to the model. The Lally (1992) CAPM reduces to the post-tax CAPM if the tax assumptions underlying the model are simplified to those of the post-tax CAPM.

2 Lally also reports estimates of WIAL's WACC assuming a risk-free rate of 6.92%, the rate he uses for AIAL and CIAL.

The Commission's draft view is that the asset betas of AIAL and CIAL are likely to fall within the range of 0.36 to 0.56 and, more precisely, within a range of 0.4 to 0.5. It notes that the asset betas of these two airports may in fact be higher than those of electricity companies, but makes no adjustment given the difficulties of deciding exactly how large an adjustment would be warranted.

The Commission notes that WIAL's Deed with airlines allows for price adjustments if actual landing volumes or operating costs differ from forecasts or if inflation exceeds certain levels and concludes that

> The provisions of its current deed suggests that WIAL's risk is closer to that of US rate of return regulated entities than UK price-capped entities. This implies [*sic*] a beta in a range of 0.3 to 0.35 (paragraph 79).

### *3.3.4 Leverage and the Debt Premium*

The Commission's draft view is that the best estimate of appropriate leverage, defined as the ratio of debt to debt plus equity, is based on the current book value of debt, as a reasonable proxy for the market value of debt, and the current market value of equity.[3] The Commission estimates this ratio as being 0.25 for AIAL, and chooses to uses this estimate for CIAL and WIAL as well.[4]

The Commission's preliminary view is that a debt premium of 1% is appropriate for all three airports (paragraph 67).

## 4 The Commission's Approach to Parameter Estimates

Several difficulties arise in attempting to make precise estimates of companies' costs of capital. Uncertainty about the appropriate model is one source of uncertainty. The source we focus on, however, is the estimation of the parameters of the chosen model. All of the parameters are estimated with uncertainty, some with a large degree of uncertainty. Decisions about the appropriate values of all parameter estimates inevitably require judgement. And the combined effect of the uncertainties in the estimation of the individual parameters is a high degree of uncertainty surrounding the consequent estimate of WACC.

Further, a company's WACC is not constant but changes with the level of interest rates, even if the company's business does not change. In addition, estimates of company-specific parameters such as the asset beta depend on the nature of the company's business, including the nature of the services it offers, its customers, its contracts with suppliers and customers, its policies for changing prices, the type of regulation to which

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3 Paragraphs 82 and 83. Note that while the Commission refers to current levels in its Executive Summary, Lally estimates AIAL's leverage during mid-2000.

4 See Lally, page 364: he estimates the market value of the equity as being $1 billion and the book value of the debt as being $300 million. That gives an estimate of 23%, which we assume he "rounds" to 25%, so as not to exaggerate the precision of the estimate.

it is subject, and the structure of its costs. On the one hand, this complicates estimates of a particular company's WACC by reference to those of other apparently similar companies. On the other, it means that, even if interest rates do not change, a company's WACC will tend to change over time as its business and business environment change.

The Commission's approach to estimating parameters in the face of uncertainty appears unsatisfactory in a number of respects:

First, although the Commission recognises the uncertainty of many of its parameter estimates, it presents—with the exception of asset betas—point estimates, and its interval estimates for betas are, especially in the case of WIAL, narrow given the actual uncertainty. The resulting interval estimates of WACC, based on "low" and "high" beta estimates, are thus very narrow, relative to the uncertainty surrounding them. To take an example, the Commission estimates that the post-tax market risk premium is 8%. As Lally notes, however, even relatively good estimates of the post-tax market risk premium can have 95% confidence intervals as large as 10 percentage-points wide. Thus if the best point estimate was 8%, one could be 95% confident only that the true value lay between 3% and 13%. In this situation, it appears desirable to state a range and to recognise that even typical ranges, such 8 to 9%, may be misleadingly precise.

Second, in at least one case, the Commission "resolves" uncertainty not by choosing an average value or range but by opting for what it believes is the more likely of two possible values. In particular, in considering the post-tax market risk premium, the Commission recognises in some parts of its report that there is considerable uncertainty about whether 8% or 9% is the more appropriate estimate. While the evidence presented by the Commission and Lally seems fairly evenly balanced as to whether 8% or 9% has more support, the Commission opts not for a range or the average value of 8.5%, but for 8%. As we mentioned earlier, the Commission's report defends the choice by stating, "The various approaches to estimating market risk premium all suggest a figure of 8% rather than 9%." The evidence in the Commission's report shows, however, that this is not true. The strongest claim that could be made is that there are more pieces of evidence pointing to 8% than there are pieces pointing to 9%. (Later, we consider whether even this weaker claim is justified.)

Third, on some occasions, the Commission expresses a view that an observed value is likely to be lower or higher than the actual value, but makes no adjustment for the difference, on the grounds that it is difficult to know how large an adjustment to make. For example, the Commission notes that airport betas are likely to be higher than electricity betas, but makes no adjustment to observed electricity betas to account for the difference. The recognition that it is difficult to know the appropriate magnitude of the adjustment appears to us correct. But judgements cannot be avoided and the decision to set the adjustment at zero is not necessarily the best one. And of course the Commission does itself make judgements at each step in its estimation of WIAL's WACC: for example, it judges that price adjustment mechanisms are the dominant determinant of asset betas; that WIAL's price adjustment mechanisms are like those of US electricity utilities; that US electricity utilities have asset betas of about 0.36; so—making an adjustment—WIAL's asset beta is between 0.30 and 0.35.

The appropriate approach in our view is to:

- Recognise in the estimate of WACC the extent of the uncertainty underlying it, for example by presenting relatively wide ranges.

- If point estimates have to be derived, take averages.

- Make adjustments on the basis of judgements, recognising that the judgements are subject to error.

We turn now to the parameter estimates themselves.

# 5 Risk-Free Rate

## 5.1 Term

### *5.1.1 Lally's Argument*

The Commission states that its preliminary view is that the risk-free rate should be measured as the yield on a risk-free bond with maturity equal to the frequency with which prices are revised. The Commission does not give reasons for its view, but Lally (page 361) recommends the use of such a maturity, arguing as follows:

> The appropriate bonds are those corresponding to the review period (period 1) rather than the duration of the airports['] assets (period 2), and the reason is thus. If yields for the two periods differ, this is due to either an expected change in yields after the end of period 1 (expectations hypothesis) or a reward for bearing risk after the end of period 1. Since landing charges are set for the first period, and are intended to reflect expected costs and risks over that period, they should not be affected by expectations of interest rates or risks after that period.

### *5.1.2 Effect of Fully Cost-Covering Revisions of Prices*

In a pure case, we would accept the Lally argument. However, the environment for WIAL's price setting does not match the assumptions of the pure case.

A cost-based (or "building-block") approach to setting airport charges sets the price so that the expected present value of the airport's revenues over the pricing period is equal to the expected present value of its costs over the same period. To take into account the costs of the company's invested capital, the definition of costs must include the initial value of the firm's assets and the definition of revenues must include the value of its assets at the end of the period. (The end-of-period asset value is analogous to a terminal value in a discounted-cashflow valuation.) Thus, if prices are set for five years, the cost-covering price is the one that equates the expected present value of the net cashflows in each of the five years plus the asset value in five years with the initial value of the assets.[5]

[5] Algebraically, the price is set so that

In the pure case, the value of the assets at the end of the period is measured at cost (e.g. ODRC) according to the same method of valuation used to arrive at the opening value of assets. If the airport could be assured that its value at the end of the period would equal the book value, the only interest rates that would enter into the calculation would indeed be those for the years in the pricing period.[6] In this case, cashflows after the period are reset so that the expected present value of future revenues equals the accounting value of what are now the opening-period assets. Accordingly, it would be appropriate to use a risk-free rate with a maturity equal to the length of the pricing period.

### 5.1.3 *The Case of WIAL*

The assumptions of the pure case would hold if the airport could elect to receive its end-of-period book value in cash at the end of the period (just as a holder of a bond of that maturity receives the principal of the loan at loan's maturity). They would also hold if the airport were sufficiently confident in the efficacy of the price-resetting process that it was indifferent between receiving cash at the end of the period and retaining the airfield assets. Or, taking a different perspective, the assumptions would hold if a rational investor conducting a discounted-cashflow valuation of the airfield assets would ignore possible outcomes after the pricing period and consider only the forecast of cashflows during the pricing period and the accounting value of the assets at the end of the period.[7]

These assumptions appear too strong in the case of WIAL. In practice, the price-setting process does not necessarily equate revenues and costs in this way. When WIAL last set its prices, for example, we understand that the expected present value of revenues fell short of the expected present value of costs. Nor can WIAL be assured, it would appear, that it will be able to increase prices sufficiently in the forthcoming round of consultations to equate revenues and costs.

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$$E\left(\sum_{t=1}^{T}\frac{R_t - C_t}{(1+WACC_t)^t} + \frac{V_T}{(1+WACC_T)^T}\right) = V_0$$

where $R_t$ is revenue in year *t*, $C_t$ is amount of cash costs in year *t*, $WACC_t$ is the cost of capital appropriate for discounting cashflows that occur in year *t*, $V_T$ is value of assets at the end of the pricing period (e.g. in five years), and $V_0$ is the value of assets at the beginning of the pricing period.

6 Note that in the equation in the footnote above the only *WACC*s that matter are those in years 1 to *T*, inclusive. In contrast to the case of discounted-cashflow valuations, $V_T$ does not depend on future cashflows and future interest rates.

7 In these cases, the investment in long-term airfield assets is equivalent to a series of independent investments each with a life equal to the pricing period.

In this case, interest rates and risks beyond the end of the pricing period *are* relevant to its actual value at the end of the period and need to be taken into account in setting prices for the first period.[8]

When this is the case, the appropriate maturity is longer by some amount than the pricing period. To the extent that price resets can be expected to bring the present value of future cashflows closer to the book value of assets, the appropriate maturity will be shorter than that for a firm that does not undertake cost-based price revisions. While the maturity that is precisely appropriate is unclear, the use of a rate of 10-years at the beginning of WIAL's current Deed does not seem unreasonable. The appropriate maturity in the future will depend on the reasonableness of the expectation that WIAL's end-of-pricing-period value of airfield assets is the same as its book value.

### 5.2 Adjustment for Semi-Annual Compounding

The Commission's estimate of the risk-free rate appropriate for estimating WIAL's past cost of capital is the average five-year government-stock rate over the six months ending 1 July 1997, which is estimated as 7.47%. The figure of 7.47% is equal to the average of the monthly rates recorded by the Reserve Bank for the six months preceding 1 July 1997. The rates published by the Reserve Bank are, however, semi-annually compounded and should be adjusted to give annually compounded rates. The equivalent annually compounded rate is 7.62%.[9]

## 6 Post-Tax Market-Risk Premium

The Commission's view stated in the draft report is that the estimate of the PTMRP should be 8%. In contrast, all three airport companies, consistent with the long-standing practice in New Zealand in application of the post-tax CAPM, stated in their submissions the view that the appropriate estimate is 9%. The basis for the Commission's conclusion is not clearly articulated but presumably it reflects Lally's review and conclusion that the PTMRP is 8%. On closer examination, the evidence could equally support an estimate of 9% (see Annex A3). Here we consider whether the available evidence provides a strong

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8 In the equation in the footnote above, $V_T$ is not necessarily equal to the accounting value at time $T$ but depends on the value at time $T$ of cashflows to be received after $T$, which in turn depend on future interest rates. In this case, $V_T$ resembles the terminal value in a discounted-cashflow valuation, which depends on future cashflows and the discount rates applicable to them.

9 The data are taken from http://www.rbnz.govt.nz/statistics/exandint/b2/hb2.xls (average monthly wholesale interest rates). The conversion to an annually compounded rate uses the following relationship:

$$R_f^{annual} = \left(1 + \frac{R_f^{semi-annual}}{2}\right)^2 - 1$$

We convert the monthly rates and then take their average.

case for departing from current practice when using the post-tax form of the CAPM. We conclude that the evidence in fact supports continuing use of the estimate of 9%.

The estimate of 9% for the PTMRP has been in use from the time of the switch from the Sharpe-Lintner CAPM to the post-tax form of the CAPM, which occurred following the introduction of dividend imputation. The Sharpe-Lintner CAPM states that

$$R_e = R_f + b_e MRP$$

where

$$MRP = R_m - R_f$$

Now, the PTMRP is

$$MRP = R_m - R_f(1 - t_{int})$$

and it thus follows that

$$PTMRP = MRP + R_f t_{int}$$

Thus initial adoption of the estimate of 9% for the *PTMRP* was roughly consistent with the then currently used estimates of 6 to 7% for the market risk premium (*MRP*) for the Sharpe-Lintner CAPM. This estimate for the *MRP* appears to have been based on the work of Ibbotson & Associates in the US and the Australian study by Officer (1989). Use of the estimate 9% for the *PTMRP* was consolidated by anecdotal evidence of unpublished studies conducted by sharebroking firms, which apparently provided support for the estimate.

The *PTMRP* is the margin of return that investors expect to achieve from holding the market portfolio of risky assets. As the *PTMRP* is an expected amount it is not possible to directly measure it from any observable market variable. Instead it must be estimated. To date there have been not been any studies published which have attempted to estimate the *PTMRP*. Estimation of the *PTMRP* must therefore rely on the results of attempts to estimate *MRP* (or the risk premium applicable to some other form of the CAPM). The approaches that have been used to estimate the *MRP* can be broadly categorised as (i) simple extrapolation of the historical margin earned from investment in some suitable proxy for the market portfolio over the return on a proxy for a risk-free investment, (ii) estimation by use of economic models which include the expected rate of return on the market portfolio as one of the variables, and (iii) extrapolation from opinion surveys of the premium.

There are only two publicly available sources of information on New Zealand data for estimation of the *PTMRP* and both relate to approach (i)[10] viz, extrapolation from the

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10 In addition, Lally (2001) refers to an unpublished study by Credit Suisse First Boston (1998) and quotes from the study the estimate of the market risk premium obtained by use of the

realised premium. The first source comprises the studies by Chay et al (1993) and (1995). These studies are academic studies that fully disclose the methods used and have gone through the normal refereeing process. The second source is PWC (2000) undertaken by PWC as part of its work on cost of capital for New Zealand companies and published on the PWC website.

The Chay et al studies report inter alia on realised returns on equity, returns on long-term Government bonds, and the *MRP*. The earlier study covers the period 1931/92 and the later study provides an update of the data to 1994. The studies follow the work of Ibbotson and Sinquefield (1976, 1989) on similar data for the US. The studies report an arithmetic mean *MRP* (calculated by arithmetic differencing), for the period 1931/94, of 6.49%. If this were adopted as the basis for an estimate of the *MRP*, an estimate for *PTMRP* can be approximated by adjusting the estimate of the *MRP* for the additional tax term. Assuming a value of 6.92% for the risk free rate (for the sake of facilitating comparison with the work of the Commission (and Lally) for AIAL and CIAL), the resulting estimate for the PTMRP would be 8.77%.

PWC (2000) provides an estimate of the market risk premium ("*LMRP*") for the CAPM due to Lally (1992). The *LMRP* relates to the *PTMRP* as follows

$$LMRP = PTMRP - D_m T_m - R_f (t_{int} - T_I)$$

where

$D_m$ is the cash yield of the market as a whole, and

$T_m$ and $T_I$ are complex weighted averages of individual investor tax rates.

The PWC report provides a summary of a study covering the period 1926/99 and updates earlier work by the firm which went back only to 1956. The report states that "…use of the last 30 to 60 years of data supports an MRP estimate of around 9%…" but "… addition of data from the 1920s and 1930s pulls the average down to around 8%." and PWC adopt 8% as the revised estimate. The study has not been through the refereeing processes that the Chay et al studies passed through before publication and the report does not describe in any detail the procedures used in the study or the data accessed. The estimate is actually based[11] on an arithmetic mean MRP with arithmetic differencing of $R_m$ and $R_f$ and the conversion of the MRP to the LMRP is based on estimates of $D_m T_m$ and $T_I$ equal to 0.0013 and 0.28 respectively. Thus if the estimated LMRP of 8% was used as the basis for an estimate of the PTMRP, the resulting estimate would be 8.22%.

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Merton approach. However, the quoted result relates to the LMRP, the market risk premium for the Lally (1992) CAPM. The study also quotes an estimate for the MRP of 6.1%, which converts to a PTMRP of 8.38%. It should be noted that the data used covered only the period 1967-1997 and the methodology is not fully disclosed.

11 Advised by Mr J Redmayne of PricewaterhouseCoopers, 14 August, 2001.

For a given standard deviation of returns, the standard error of the estimated *MRP* is inversely proportional to $\sqrt{n}$ where *n* is the number of years in the study. Thus, the fact that the PWC study covers a slightly longer period might lead to preference for that study over the Chay et al study as a basis for estimation of the *PTMRP*. However, as noted above, the PWC study has not been fully published. This factor leads to a preference for the Chay et al studies as the basis for an estimate of the PTMRP.

The New Zealand financial environment was heavily regulated from the 1930s through to the mid 1980s and this must cast doubt on the validity of data from this period as a basis for estimates of the MRP in the future. Furthermore, the data covering the early years must suffer from a number of deficiencies, in particular, survivor bias. Given these shortcomings, it would seem preferable to rely on data from other (comparable) countries as the basis for estimation of the PTMRP. A

recent study by Dimson et al (2000) provides the ideal basis. The study covers 12 major western countries for the period 1900/2000. See Table 1. It thus covers a longer period than do the New Zealand studies, and it covers a broader range of experience. Furthermore, the data have been corrected for deficiencies such as survivor bias. The median of the arithmetic mean MRPs for the 12 countries is reported to be 7.1%. The MRPs are calculated by geometric differencing. Thus if the median MRP of 7.1% was used as the basis of an estimate of the PTMRP for New Zealand then, adjusting to arithmetic differencing and allowing for the tax adjustment, the resulting estimate of the PTMRP is 9.87%.

**Table 1: Evidence from Dimson et al (2000)**

| Country | MRP (arithmetic mean) |
|---|---|
| Australia | 0.076 |
| Canada | 0.061 |
| Denmark (from 1915) | 0.036 |
| France | 0.070 |
| Germany (excludes 1992/23) | 0.101 |
| Italy | 0.085 |
| Japan (from 1914) | 0.109 |
| Netherlands | 0.068 |
| Sweden | 0.080 |
| Switzerland (from 1911) | 0.043 |
| USA | 0.072 |
| UK | 0.058 |
| | |
| Mean (all) | 0.072 |
| Median (all) | 0.071 |
| Mean (Australia, UK, US) | 0.069 |
| Median (Australia, UK, US) | 0.072 |

Note: the means and medians are based on the estimates for each country as presented in the table above.

Studies employing approach (ii), the modelling approach, either (a) follow Merton (1980) in estimation of the MRP from market volatility, or (b) involve the use of some form of valuation model and place reliance on forecasts of performance made by analysts or based on observed market regularities (see, for example, Fama and French (2001), Claus and Thomas (2001), and Harris and Marston (1999), and the references therein). The type (b) studies are a more recent development. The estimates obtained for the MRP are usually lower than those based on realised returns. However, the models are open to question and there is uncertainty on the forecasting.[12]

The third approach is to survey opinions on the MRP. A recent US study on the views of academic financial economists (Welch (2000)), reports a consensus forecast of a MRP (arithmetic and over bonds) of about 6%. A survey of leading US corporates and financial advisers (Bruner et al (1998)) indicates considerable variation in practice but typically the MRP used is around 6%.

Of the three approaches to estimation of MRP, extrapolation from realised returns remains the common approach but there are an increasing number of financial economists who question this evidence as being representative of the expected MRP. In part this questioning arises from the literature based on Mehra and Prescott (1985) which finds inconsistency between the relatively low level of household investment in the stock market and an MRP as high as the historically based estimates. In part it also reflects attempts to explain the high level of the stock markets in recent years. The results of the studies under the second approach are tending to provide support for the questioning. However, this questioning is not new and, in our view, the recent study by Dimson et al has significantly strengthened the historical evidence for the use of an estimate of 9% for the *PTMRP*. Thus, while we recognise that considerable uncertainty must surround the estimate of the *PTMRP*, we see no reason for a downward revision of the estimate from 9%.

# 7 Asset Beta

In this section, we consider the range in which WIAL's current asset beta is likely to fall and, in doing so, set out the main factors that will influence its future level.

We start by briefly reviewing the factors that affect companies' asset betas. Next we consider what WIAL is like in respect of each of these factors and how it compares with plausible comparators (airports and other utilities, including electricity, gas, ports, and water). On the basis of this, we select comparators and review evidence about their betas.

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[12] Lally (2001) considers the type (b) approach and on the basis of two quick calculations derives estimates for the PTMRP of 8.9% and 7.1%. The high degree of uncertainty on parameter choice leaves little confidence in either of these estimates. However, if the estimates have any significance, then their size in comparison to similar results for the US lends support for a PTMRP in New Zealand of at least 9%.

## 7.1 Factors that Affect Asset Betas in General

A company's asset beta is influenced by the following factors:[13]

- The extent to which *demand* for the company's services varies with the strength of the economy (the income elasticity of the demand for the company's services). The more demand varies with economic activity, the higher the asset beta.

- The extent to which the company's *costs* vary with demand (operating leverage). The greater the proportion of costs that are fixed, the greater the variation in the company's profits with changes in demand, and thus the higher the asset beta.

- The extent to which the *prices* the company charges translate changes in demand and costs into changes in revenue. This depends on the structure of prices (such as the balance between fixed and variable charges) and the way in which prices are adjusted over time in response to changes in demand and costs. The contractual or regulatory framework governing the company's pricing is thus crucial. The greater the importance of variable charges, and the less prices adjust to compensate for changes in costs and demand, the higher the asset beta.

## 7.2 Relevant Characteristic of WIAL and Possible Comparators in Respect of these Factors

### *7.2.1 Demand*

The income elasticity of demand for air travel is likely to be relatively high compared with income elasticities for electricity, gas, and water utilities.[14] Other things equal, we would expect airports as a group to have higher betas than these utilities. How they compare with ports is unclear.

The income elasticity of demand can also be expected to vary among airports, according to the types of passengers that use the airports. Variation could be expected according to the proportions of business and leisure travellers, resident and visiting travellers, and domestic and international travellers. *A priori*, however, the magnitude and even direction of the effects are generally unclear.[15]

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[13] Other factors are often mentioned in the literature. Of those mentioned by Lally, we incorporate industry and the nature of the customer under the heading of demand, and duration of contract prices, presence of price or rate-of-return regulation, and degree of monopoly under the heading of prices.

[14] Discussing the effect of income elasticity on betas, Lally notes, "energy suppliers have particularly low betas while travel and recreation are particularly high."

[15] Recently, WIAL's exposure to the number of major airlines serving Wellington has been brought into relief by the demise of Qantas New Zealand and the talk of Virgin starting service. At first sight, these risks might seem to be idiosyncratic rather than systematic. Yet they may have a systematic element. Suppose increases in demand reflecting an upturn in the economy cause a third airline to enter the market, and the entry makes the airline market more competitive. Prices

In Australia, several attempts have been made to distinguish between airports on these grounds using empirical analysis, and the ACCC has reported that it has relied on empirically based estimates of the income elasticities of demand facing each airport in estimating their asset betas. We have not undertaken such analysis in the case of WIAL, and we work on the basis that WIAL is a typical airport in this respect.

We conclude that the best comparators for WIAL will be other airports. Other things equal, comparisons based on other electricity, gas, and water utilities are likely to underestimate WIAL's beta.

#### *7.2.2 Costs*

WIAL has high operating leverage. In this respect, WIAL is similar to other airports and utilities. Because WIAL operates as a landlord airport, leasing space to others to provide services, rather than providing them itself, its operating leverage may actually be higher than that of many airports. Lacking clear data on the subject, however, we assume that WIAL's operating leverage is broadly similar to the comparators under consideration (airports, electricity, gas, ports, telecoms, and water).

#### *7.2.3 Prices*

Price Structure

Considering first the structure of prices, we note that WIAL's charges are all variable: for airfield services, the charges are based on tonnes of landed MCTOW (maximum certified take-off weight).[16] If no planes land, WIAL receives no revenue. WIAL's pricing structure is typical of airports around the world.

The charges levied by other utilities sometimes include fixed charges. Electricity companies, for example, may charge a fixed daily charge as well as a usage charge. Fixed connection and capacity charges may be relatively important for business customers.

In terms of price structure, then, airport companies appear the best comparator for WIAL. Other things equal, comparisons based on electricity, gas, and water utilities are likely to underestimate WIAL's beta.

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would then fall, causing a further increase in passenger numbers, thereby exaggerating the positive shock. Conversely, if a downturn in the economy forced one of two airlines to exit, the remaining airline's increased market power would lead it to raise prices, exacerbating the negative shock. WIAL's small number of airline customers may thus increase its exposure to systematic risk.

16 WIAL also earns revenue from the airport departure charge and from a charge on landed seats. We focus on MCTOW-based landing charges because they are linked to airfield services.

Price Adjustment Mechanisms

Turning now to price adjustment mechanisms, we note that WIAL's charges are governed by its Deed. When the Deed comes to an end, they can be reset. During its term, the Deed provides for adjustments of landing charges if traffic volumes in the previous year diverge by more than certain agreed amounts from forecast volumes.[17]

These provisions reduce WIAL's exposure to demand risk, which is likely to have a large element of systematic risk, and can thus be expected to reduce its asset beta relative to a contract providing for no price adjustments. Two important issues therefore arise. To what *extent* do the contractual price adjustment mechanisms reduce WIAL's exposure to risk? And how do the price adjustment mechanisms present in WIAL's contract compare with those in *other utilities'* contractual or regulatory arrangements?

Careful consideration of the Deed and WIAL's circumstances suggests that its price adjustment mechanisms do not reduce WIAL's exposure to demand risk as much as implied by the Commission. Note first that the Commission estimates that WIAL's airfield activities are currently earning significantly less than their cost of capital: this in itself suggests that WIAL's business is not low risk. Second, examination of the terms of the Deed shows WIAL remains exposed to significant demand risk. There are three reasons:

- First, the adjustments do not compensate WIAL for changes during the year. If demand is low in the first year, there is no retrospective adjustment of the price for that year (no "wash up"); only next year's price may be changed.

- Second, no change is made if demand stays within a band around a forecast;

- Third, when adjustments are made, they are not generally large enough to bring the next year's revenue back to the forecast level.

In passing, it is also worth noting that the adjustments are asymmetric around the level of demand that was forecast at the time of the signing of the Deed. On average, prices rise by less when demand is below forecast than they fall when it is above forecast (see Figure 1).

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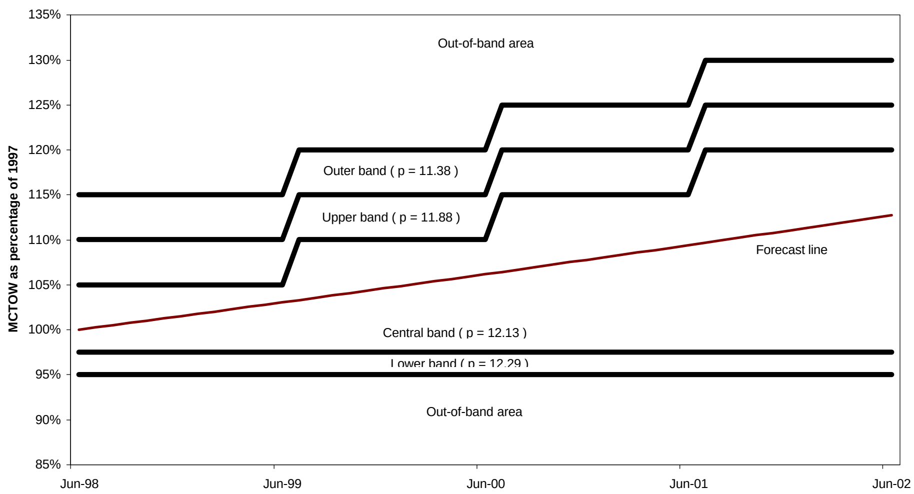
[17] The Deed also provides for the adjustment of charges if inflation exceeds 2% or falls below 0%. The provision is similar to the CPI–X adjustment mechanism, except that it does not provide for adjustments when inflation is between 0 and 2%. Further, if inflation is 2.1%, the increase in prices is 0.1% (= 2.1 – 2.0) not 2.1%. As a result, WIAL is exposed to more inflation risk than companies under CPI–X regulation. The Deed also provides for adjustments in the terminal charge if operating costs exceed or fall below forecast by 7.5%. We do not consider this adjustment here, because it does not apply to landing charges for airfield services.

**Figure 1: Price–Volume Bands under the Deed**




We can illustrate the extent to which the Deed shelters WIAL from variations in demand with an example comparing what was forecast to happen at the commencement of the Deed with a scenario in which volumes are lower than expected in the first year (1998) but from then on grow at the expected rate.

In the year before the Deed commenced, Band-I MCTOW was 966,391 tonnes. During the term of the Deed, it was expected to grow by 3% per year. If it did, the landing charge for Band-I MCTOW would remain at $12.13 per tonne throughout the five-year period.[18] Columns 2 to 4 of Table 2 show volumes, prices, and revenue if MCTOW grows as forecast.

Columns 5 to 7 show what would happen if the volume of MCTOW in 1998 fell to the mid-point of the band below the central band (96.25% of the level forecast for that year) and then grew from that point at 3% per year. Notice first that WIAL's revenue in 1998 falls in proportion to the fall in demand; there is no compensation. In 1999, the price increases but WIAL's revenue is still below the level that was forecast at the beginning of the Deed. Further, MCTOW has now grown enough to get back into the central band, so the price returns to $12.13 in the third year, even though volumes are significantly less than originally expected.

At the beginning of the Deed, WIAL could have expected to earn about $64 million over the next five years; with the one-off reduction of 3.75% in the level of MCTOW in the first year followed by resumed growth at the forecast rate, WIAL earns only $60 million.

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18 We assume no adjustments for inflation.

**Table 2: Price Adjustments in WIAL's Deed**

| Year (ending June) | Expected volume (000 tonnes MCTOW) | Expected price ($ per tonne) | Expected revenue ($ million) | Low-MCTOW scenario (000 tonnes) | Corres-ponding price ($ per tonne) | Resulting revenue ($ million) |
|---|---|---|---|---|---|---|
| 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| 1998 | 995 | 12.13 | 12.1 | 930 | 12.13 | 11.3 |
| 1999 | 1025 | 12.13 | 12.4 | 958 | 12.29 | 11.8 |
| 2000 | 1056 | 12.13 | 12.8 | 987 | 12.13 | 12.0 |
| 2001 | 1088 | 12.13 | 13.2 | 1016 | 12.13 | 12.2 |
| 2002 | 1120 | 12.13 | 13.6 | 1047 | 12.13 | 12.7 |
| | | | 64.1 | | | 60.0 |

Thus the reduction in exposure to demand risk afforded by the contract is modest.

Table 3 sets out the types of price adjustment mechanisms present in likely comparators:

**Table 3: Price Adjustment Mechanisms of Comparators**

| Comparator company or companies | Nature of price adjustment mechanism |
|---|---|
| Australian airports | The price-control regime appears close to a pure 5-year CPI–X price cap and thus relatively high risk. Security costs have, however, a pass-through element. |
| BAA | In the current pricing period (1 April 1997 to 31 March 2002), BAA is subject to a nearly pure price cap, similar to those facing Australian airports. Maximum limits, adjusted by CPI-3, are set for its "revenue yield" defined as revenue divided by passengers. It is not a pure price cap, because there is some pass-through of security-related costs and charges are adjusted to compensate BAA for the abolition of duty-free shopping within the European Union. Further clouding the picture, BAA has chosen not to increase prices as much as it could. |
| Copenhagen airport | We understand that Copenhagen airport has been subject to a regulatory regime in which it is able to request (one-off) price increases when it believes they are necessary. Its regulatory regime may be similar, in that case, to US rate-of-return (cost-of-service) regulation and may subject Copenhagen to relatively low risk. Alexander et al (1999) describe its incentives and risk as "medium-powered" in a discussion of asset betas and regulation. |
| Vienna airport | Vienna airport's charges are adjusted, according to a formula, for changes in traffic volumes and for inflation. In particular, if traffic growth is between 7% and 11%, there is no adjustment in prices. But, if traffic growth is lower, prices rise by up to the rate of inflation; and, at zero growth, the adjustment is CPI-0. If traffic growth is greater than 11%, prices reduce in nominal terms. |
| UK electricity and other utilities | UK utilities are subject to hybrid price-and-revenue caps or price caps with some cost pass-through (i.e. not to pure price caps). Those facing relatively pure price caps are likely to be more exposed to changes in demand than WIAL; those facing hybrid revenue / price caps such as the regional electricity companies may be in a similar position. |
| US utilities (excluding telecoms) | US electricity, gas, and water utilities are typically subject to rate-of-return (cost-of-service) regulation, which provides for adjustment of prices in response to changes in costs of demands. Because of regulatory lags and reforms designed to improve incentives, actual regulation is not pure rate of return. On average, however, the price adjustment mechanisms for US electricity, water, and gas utilities appear to provide more protection than WIAL's deed from changes in costs and demand. |

In terms of price adjustment mechanisms, it would appear that BAA and the Australian airports may face more systematic risk than WIAL, while Copenhagen may face somewhat less. Regional electricity companies in the UK appear like reasonable comparators. US utilities appear to face less risk.

Conclusion on Prices

The best comparators in terms of price structure would appear to be airports. In terms of price adjustment, the best comparators would appear to be firms subject to regulatory arrangements providing for less adjustment than rate-of-return regulation, but more than pure price caps.

### 7.2.4 *Choice of Comparator Companies*

If we start with a range of possible comparators including airports, ports, and electricity, gas, and water utilities, we can narrow down the list by reviewing the factors considered above. All the utilities would appear to have high fixed costs like WIAL; but there are probable differences in terms of the income elasticity of demand, price structure, and price adjustment mechanisms. The following table summarises the conclusions we draw from the discussion above.

**Table 4: Comparability of Possible Comparators: Degree of Systematic Risk**

| Potential comparator or group of comparators | Similarity of income elasticity | Similarity of price structure | Similarity of price adjustment mechanism |
|---|---|---|---|
| Other airports | Similar | Similar | BAA and Australian airports higher; others similar or lower |
| UK utilities | Lower | Lower | Similar in case of electricity; possibly higher for water and gas |
| US Utilities | Lower | Lower | Lower |
| Ports | ? | ? | ? |

We conclude that the most relevant comparators are other airports and UK electricity utilities. US utilities do not appear to be good comparators as in each of the three relevant respects their asset betas seem to underestimate WIAL's. The similarity of ports is unclear.

## 7.3 Asset Betas for Comparator Companies

In this Section, we present evidence about the asset betas of the comparators selected above. Our review is necessarily limited; we focus on estimates that have already been published, and, ideally, presented by the Commission or other regulatory agencies.

Table 5 presents evidence from listed airports, as reported by the Commerce Commission (paragraph 8.50) and the ACCC in its Adelaide report.

**Table 5: Listed Airport Betas Reported by Commerce Commission and ACCC**

| Airport company | Commerce Commission | ACCC (Adelaide) | Average |
|---|---|---|---|
| AIAL | | 0.66 | 0.66 |
| BAA | 0.88 | 0.56 | 0.72 |
| Copenhagen | 0.32 | 0.47 | 0.40 |
| Vienna | 0.77 | 0.68 | 0.73 |
| | | | |
| Median | 0.77 | 0.61 | 0.69 |
| Mean | 0.66 | 0.59 | 0.63 |

Alexander et al (1999) estimate the asset betas of five airport companies (BAA, Copenhagen, Infratil Australia, Rome, and Vienna):

**Table 6: Evidence from Alexander et al (1999)**

| "Regulatory Regime [price adjustment mechanism]" | Average asset beta |
|---|---|
| "High-powered" (Australia and UK) | 0.69 |
| "Medium-powered" (Copenhagen, Rome, Vienna) | 0.56 |
| "Low-powered" (no airports in this category) | |
| | |
| Mean | 0.61 |

The decisions and provisional views of airport regulators provide another set of comparators:

**Table 7: Airport Regulators' Recent Decisions (or Views)**

| Company | Regulator | | Asset beta[19] |
|---|---|---|---|
| BAA | UK CAA | Position Paper June 2001 | 0.60–0.77 |
| | | Midpoint | 0.685 |
| | | | |
| Adelaide | ACCC | October 1999 | 0.61 |
| Brisbane | ACCC | April 2000 | 0.70 |
| Canberra | ACCC | June 2000 (draft) | 0.65 |
| Darwin | ACCC | September 2000 | 0.73 |
| Launceston | ACCC | June 2001 | 0.80 |
| Melbourne | ACCC | August 2000 | 0.70 |
| Perth | ACCC | April 2000 | 0.70 |
| Sydney | ACCC | May 2001 | 0.60 |
| | | | |
| Mean | ACCC | | 0.69 |
| Median | ACCC | | 0.70 |

Note that the mean and median of the ACCC estimates are not greatly different from the mid-point of the UK CAA's proposed range.

As noted earlier, the Australian airports and BAA may face greater demand risk than WIAL given their relatively pure price caps, while being similar on average in terms of income elasticity of demand and price structure. Other airports such as Copenhagen may face less risk than WIAL.

PricewaterhouseCoopers provides the following estimates of the asset betas of New Zealand ports:[20]

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19 Annex A3 discusses whether these asset betas need to be adjusted and concludes that they do not.

20 Published on the company's website at http://www.pwcglobal.com/nz/eng/ins-sol/publications/index.html. In addition, the Office of the Regulator-General in Victoria, Australia estimated the asset betas of Melbourne Port Corporation and the Victorian Channels Authority as, respectively, 0.6 and 0.5 (*Victorian Ports Price Review, Final Decision*, 13 June 2000). The Office cites estimates of the asset betas of three New Zealand ports that are similar to those in the Table (0.44 for Port of Tauranga, 0.61 for Northland Port Corporation, and 0.83 for Ports of Auckland). Alexander et al (1999) report an average beta of 0.42 for five New Zealand ports, rather lower than the estimates above and an asset beta of 0.40 for one Philippine port. In its submission in response to the Commission's Critical Issues Paper, CIAL presents estimates of the asset betas of four UK ports that range from 0.69 to 0.77 and have a median of 0.715.

**Table 8: Evidence from New Zealand Ports**

| Port | Asset Beta |
|---|---|
| Lyttelton Port Co Ltd | 0.92 |
| Northland Port Corporation (NZ) Ltd | 0.85 |
| Ports of Auckland Ltd | 0.73 |
| Port of Tauranga Ltd | 0.37 |
| | |
| Average | 0.72 |
| Median | 0.79 |

Alexander et al's (1996) evidence on UK electricity utilities, discussed by the Commission, is as follows:

**Table 9: Evidence from UK Electricity Utilities[21]**

| | All electricity | Electricity distributors |
|---|---|---|
| Asset beta | 0.60 | 0.58 |

As noted earlier, the UK electricity distributors may face lower income elasticities of demand, price structures that generate somewhat less risk, and similar price adjustment mechanisms. (Note that Lally reduces the all-electricity estimate of 0.60 down to 0.56, adjusting for estimates of differences in aggregate leverage between the United Kingdom and, originally, Australia, which he states provides a reasonable estimate of the appropriate adjustment for New Zealand. We have not attempted to make any such adjustment.)

As Lally notes, the size of the samples is also important. For airports, we have estimates based on in total 6 listed airports and the decisions of 2 regulators. For ports, we have estimates based on 9 listed New Zealand and UK ports and the decisions of 1 Australian regulator. For electricity, we have estimates based on 12 UK regional electricity distributors.

21 Alexander et al (1996) also report estimates for other UK utilities. They report asset betas of 0.84 for British Gas, 0.87 for British Telecom, and 1.13 for Vodafone, and they report an average asset beta of 0.67 for a sample of 10 water companies. We exclude them from the table because they are subject to price caps rather than the hybrid price/revenue caps of the electricity distribution companies (the price caps for water companies do, however, include significant cost pass throughs). Alexander et al present an average for all electricity firms, but this includes estimates for generators and vertically integrated firms, whose profits are less influenced by regulatory price adjustments. We therefore also present the average for the sample of 12 "Regional electricity companies" which are likely to be better comparators.

## 7.4 Conclusions on Current Asset Beta

Table 10 summarises the information on the asset betas of the comparators presented above:

**Table 10: Summary of Estimates of Asset Betas of Comparators**

| Comparator | Average Asset Beta | Expected level of comparator relative to WIAL |
|---|---|---|
| Listed airports[22] | 0.63 | Similar |
| Airport regulator decisions for Australia and UK | 0.69 | Higher |
| New Zealand ports | 0.72 | Unclear |
| UK electricity distributors | 0.58 | Lower |

Our review has required many judgements about which it is impossible to be strongly confident and makes use of beta estimates that are surrounded by large margins of error. Thus we do not have evidence that allows us to confidently conclude that the appropriate asset beta lies in the range in the Table above.[23] However, given the evidence set out above, we do conclude that WIAL's estimate of its asset beta as lying in the range of 0.45 to 0.60 (Disclosure Statement) is reasonable. If anything, the upper end seems conservative.

The Commission's draft view that WIAL is likely to have an asset beta of between 0.30 and 0.35 is based largely, we believe, on a misunderstanding of the extent to which WIAL's Deed shelters it from systematic demand risk. The estimate is implausibly low.

## 7.5 Remarks on Future Asset Beta

In the preceding sections, we have considered the Commission's estimate of WIAL's beta under the current Deed. WIAL's beta may change after its forthcoming round of consultations. If WIAL fixed its price for five years with no adjustments except for inflation, for example, we would expect its asset beta to increase. In this case, the Australian and UK price-capped airports would appear the closest comparators. On the other hand, if WIAL committed itself to a price adjustment formula according to which prices changed so that WIAL's profits were largely independent of traffic volumes and changes in its costs, we would expect WIAL's asset beta to fall.

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22 According to the Commerce Commission and the ACCC. We don't include the estimates from Alexander et al (1999) but note that the mean is similar.

23 Among those we have not mentioned are the possible difference between airfield and all-airport betas and the conversions of foreign to domestic betas.

# 8 Leverage and the Debt Premium

Other things equal, a company's leverage and its debt premium should be related, and we therefore treat the two parameters together.

## 8.1 Leverage

The Commission's view that the best estimate of leverage is the ratio of the book value of debt to the book value of debt plus the market value of equity is in general reasonable (assuming there is no reason to think the market value of the debt differs materially from its book value).

In the case of WIAL, however, the relevant question is whether the best estimate of leverage is based on such a ratio for another company or whether a better estimate can be derived from WIAL-specific information. In our view, it can.

As the Commission notes, no direct evidence is available on the market value of WIAL's equity. But in the case of WIAL's *airfield activities* book values are unlikely to underestimate market value, since they are based on current costs and airfield activities are, according to all estimates, currently earning less than their cost of capital. After the forthcoming consultations, we expect WIAL's charges will rise so that returns are closer to the cost of capital. Overall, the book value of airfield activities may in this case be a reasonable proxy for their market value. (To the extent the book values overestimate market values, the estimated ratio will be too low.)

WIAL's disclosure statements for the year ending March 2000 show total aeronautical assets of approximately $209 million and non-current liabilities (excluding the subordinated shareholder loan, which we treat as equity) of $99 million. Using book values as proxies for market values, then, WIAL's leverage as of 31 March 2000 would have been around 47%—say, 45–50%. The precise ratio is of course a matter of doubt, given the uncertainty of the market value of equity, but the estimate based on WIAL's aeronautical data would appear at least as good as the estimate based on AIAL's whole business.

To be consistent with the rest of its estimate, the Commission should, however, measure WIAL's leverage during the period before the Deed was signed. In June 1997, the book value of WIAL's debt for the whole company was about $47 million and the book value of its assets was $164 million. Estimated in this approximate way, its leverage would be 29%—as it happens not much different from the Commission's estimate.

## 8.2 Debt Premium

The Commission estimates WIAL's debt premium as being 1%. WIAL, on the other hand, has estimated it as being 1.5%.

The Commission's estimate appears to be based on the assumption that WIAL's leverage and other relevant features are the same as AIAL's.

We understand from WIAL that its estimate is arrived at by taking the sum of (i) the spread that WIAL would pay over short-term New Zealand Government rates and (ii) the 10-year swap spread—as indicated by banks. WIAL states that the former spread is about 0.6 percentage points. The swap spread varies over time; in the last year, we understand it has varied between about 0.6 and 1 percentage points. If the former spread were constant, the sum would therefore have varied between 1.2 and 1.6 percentage points.

We note that the spread calculated by WIAL is not dissimilar to the spread observed at the time of writing between 10-year US Treasury bonds and non-callable US corporate bonds with a similar maturity and the same, A– rating from Standard & Poor's as WIAL. (A recent sample of six such bonds had an average spread over 10-year Treasury bonds of about 1.4 percentage points[24]).

We note also that WIAL's credit rating and other measures of creditworthiness are lower than those of AIAL and CIAL, suggesting its debt premium would be higher than theirs (Table 11).

**Table 11: Credit Ratings and Credit-Worthiness of the AIAL, CIAL, and WIAL**

| Airport | AIAL | CIAL | WIAL |
|---|---|---|---|
| Pre-tax earnings net interest cover (times) | 5.1 | 4.8 | 1.4 |
| FFO net interest cover (times) | 5.4 | 5.6 | 1.9 |
| FFO / average total debt | 28.5 | 32.5 | 7.4 |
| Credit Rating | A+ | A | A– |

Source: Standard & Poor's

In the absence of any evidence to suggest that WIAL's capital structure is inefficient, WIAL's estimate of its debt premium (1.5%) appears more reliable than the Commission's, based as the latter is on data relating to AIAL. We note, finally, that the debt premium will change, both if economy-wide credit spreads change and if WIAL's financial position changes.

# 9 References

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# Annexes

## A.1 Commission's Model for Calculating the Cost of Capital

The Commission's basic formula for the cost of capital ($WACC$) is the standard formula, in which the cost of capital is a weighted average of its cost of debt ($R_d$) after corporate taxes ($t_c$) and its cost of equity ($R_e$):

$$WACC = W_d R_d (1 - t_c) + W_e R_e \qquad (1)$$

where $W_d$ is the weight of debt in the capital structure and $W_e$ is the weight of equity in the capital structure.

The Commission estimates the cost of debt as the sum of the risk-free rate ($R_f$) and a debt premium ($DP$):

$$R_d = R_f + DP \qquad (2)$$

The Commission's model for the cost of equity is a standard post-tax model:

$$R_e = R_f (1 - t_{\text{int}}) + b_e [R_m - R_f (1 - t_{\text{int}})]$$

o,

$$R_e = R_f (1 - t_{\text{int}}) + b_e PTMRP \qquad (3)$$

where

$t_{\text{int}}$ is tax on interest, $b_e$ is the company's equity beta, $R_m$ is the expected return on the market portfolio, and $PTMRP$ is the post-tax market risk premium.

The Commission derives the company's equity beta from an estimate of the company's asset beta $b_a$ using the following formula:[25]

$$b_e = b_a (1 + \frac{W_d}{W_e}) \qquad (4)$$

[25] The Commission also sets out a formula that also includes the debt beta and notes that equation (4) can be derived from that formula by assuming the debt beta to be zero (paragraphs 8.46 and 8.47). Lally presents equation 4.

## A.2 Using Foreign Beta Estimates: What Conversions are Appropriate?

*Introduction*

In its decisions on Australian airports, the ACCC has used a range of asset betas from 0.60 in the case of Sydney and 0.61 in the case of Adelaide to 0.73 in the case of Darwin. Drawing on AIAL's submission (Attachment 5), Lally adjusts the ACCC's Sydney and Adelaide estimates of asset betas for differences in the formulas for converting between asset and equity betas. The range of 0.6–0.61 thus becomes 0.51–0.55. In this Annex, we analyse this conversion.

*Formulas for Converting between Asset and Equity Betas*

There are many formulas in use for converting between asset and equity betas. The most common formula in New Zealand is relatively simple:

$$b_e = b_a\left(1+\frac{D}{E}\right) \tag{1}$$

or, equivalently, but for converting an equity beta to an asset beta:

$$b_a = \frac{b_e}{1+\dfrac{D}{E}} \tag{2}$$

where $b_e$ is the equity beta, $b_a$ is the asset beta, and $D/E$ is the debt–equity ratio.

This formula was used by all three airports and has been used by the Commission and by Lally in his advice to the Commission.

While several formulas are used in Australia, the one that appears to have been used by the ACCC in the Adelaide decision is called the Appleyard–Strong formula:

$$b_e = b_a + (b_a - b_d)\left[1-\frac{K_d T_c}{1+K_d}\right]\frac{D}{E} \tag{3}$$

where $b_d$ is the debt beta, $K_d$ is the cost of debt, and $T_c$ is the corporate-tax rate. Use of the Appleyard–Strong formula is not consistent with the assumptions made by the ACCC and others about personal tax in Australia and, perhaps as a result, the ACCC used a slightly different formula in its Sydney decision. This formula, known as the Monkhouse form of the Appleyard–Strong formula, is

$$b_e = b_a + (b_a - b_d)\left[1-\frac{K_d T_c (1-g)}{1+K_d}\right]\frac{D}{E} \tag{4}$$

where *g* is a parameter measuring the extent to which imputation credits are valued.[26]

### *Conversion of Australian Asset Betas*

In its Adelaide and Sydney decisions, the ACCC starts with assumptions about the asset betas and the other parameters set out in Table A3.1 below and derives equity betas. In the case of Adelaide, the assumed asset beta of 0.61 translates into an equity beta of 1.61[27] using the Appleyard–Strong formula (3) and the other assumptions. In the case of Sydney, the asset beta of 0.60 translates to an equity beta of 1.37, using the Monkhouse formula (4) and other assumptions.

Lally's argument appears to be as follows: if you take as given the *equity* betas in the Adelaide and Sydney decisions and want to find equivalent asset betas for use in New Zealand, you should convert the equity betas using the standard New Zealand formula (2). Using this formula, and the debt–equity ratio assumed by the ACCC, the Adelaide equity beta of 1.61 translates into an asset beta of 0.51. Likewise, the Sydney equity beta translates into an asset beta of 0.55.[28]

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26 The AIAL submission does not recognise that the ACCC uses different formulas in the two decisions.

27 The ACCC actually calculates an equity beta of 1.60; our calculation of an equity beta of 1.61 possibly results from the ACCC's having used parameter estimates with more decimal places than they reported.

28 A reading of Lally's paper might suggest that the asset betas of 0.60 and 0.61 are converted *respectively* to 0.51 and 0.55. Actually, the 0.60 becomes 0.55 and the 0.61 becomes 0.51.

**Table A3.1: Conversions of Asset to Equity to Asset Betas**

| | Abbreviation | ACCC Adelaide | ACCC Sydney |
|---|---|---|---|
| ACCC Parameters | | | |
| Debt-to-Value | D | 0.68 | 0.60 |
| Equity-to-Value | E | 0.32 | 0.40 |
| Debt Beta | $B_d$ | 0.13 | 0.08 |
| Cost of Debt | $K_d$ | 0.073 | 0.0598 |
| Corporate-Tax Rate | $T_c$ | 0.30 | 0.30 |
| Gamma | $\gamma$ | n.a. | 0.50 |
| Asset beta | $\beta_a$ | 0.61 | 0.60 |
| Derived Equity Betas | | | |
| Appleyard-Strong | | 1.61 | |
| Monkhouse | | | 1.37 |
| Asset Betas Derived from Equity Betas (NZ formula) | | 0.51 | 0.55 |

*Is the Conversion Appropriate?*

Lally's conversion would be appropriate if the equity betas in the Adelaide and Sydney decisions were the basic parameters in the decisions—that is, the numbers that should be taken as given. But since these decisions derive equity betas from asset betas, the asset betas are really the basic parameters. In this case, no conversion is required to get asset betas for use in New Zealand.

## A.3 Lally's Evidence on PTMRP

| Study | Result as reported by Lally | Comments on applicability | (Derived) result relevant for PTMRP for Commission Model | Comments | Weight |
|---|---|---|---|---|---|
| New Zealand | | | | | |
| Chay et al (1993 and 1995) | Mentioned but no number reported | Needs to be adjusted to PTMPR | 0.087 | Covers long period (1931 to 1994), and published. | Medium / High |
| PWC (2000) | 0.08 | Needs to be adjusted to PTMRP | 0.082 | Covers longer period (1926 to 1999), but not published. | Medium / Low |
| CSFB (1998) | 0.075 | Needs to be adjusted to PTMRP | 0.084 | The study is based on only 30 years, the | Low |

| | | | | | |
|---|---|---|---|---|---|
| | | | | period 1967to 19970, methodology not fully disclosed; and not published. | |
| Lally forward looking | 0.071 and 0.089 | | 0.071 and 0.089 | | Low |
| Foreign | | | | | |
| Lally, p. 368? | 0.088 to 0.11 | | 0.088 to .11 | Source not stated | Low |
| Ibbotson and Sinquefield (1976, 1989) | | | 0.0877 | Covers long period. Well-known study. Relates only to the US. | Medium |
| Dimson et al (2000): United Kingdom and Australia | 0.081 to 0.099 | | 0.0987 | Covers 12 countries for 85 to 99 years each; addresses problems of survivorship bias better than other studies. | Very high |
| Forward looking | “significantly lower numbers” | | significantly lower numbers | | Low |
| Welch (2000) | .082 | | .083 | | Low |