THE COST OF CAPITAL FOR THE AIRFIELD ACTIVITIES OF NEW ZEALAND'S INTERNATIONAL AIRPORTS

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CONTENTS

EXECUTIVE SUMMARY

In accordance with The Airport Authorities Amendment Act, 1966, the international airports of Auckland, Wellington and Christchurch are required to consult with their customers in the setting of airfield landing charges, with a frequency of at least every five years. A significant factor in setting these landing charges is their cost of capital. Estimates have been offered by all three airports and challenged by the airlines in a number of respects, namely the riskfree rate, the cost of debt premium, the market risk premium, and the asset beta. This paper surveys the views expressed on these four issues and then offers conclusions on them.

First, I favour a riskfree rate of .0692 for AIAL and CIAL, representing an average of yields on three year government stock over the six month period preceding the point at which AIAL's new prices came into effect. In general, I favour an average on government bonds over the period in which consultation occurred, ending with the point at which the new prices come into effect, and with a maturity on the bonds matching the point at which the new prices will be reviewed. With respect to WIAL's current prices, this would retrospectively imply a riskfree rate of .0747, being the five year government stock rate averaged over the first six months of 1997. Second, I favour a debt risk premium of .01 over the riskfree rate, along with the leverage ratio exhibited by AIAL in 2000, which is around .25. Third, I favour a market risk premium of .08. Finally, I favour an asset beta for AIAL and CIAL of .45 (with a band of .40 to .50), and one for WIAL of .30 to .35. The difference in asset betas reflects provisions in WIAL's Deed permitting it to vary prices within the five-year review period in response to demand and cost shocks. These parameter values imply a WACC range for CIAL and AIAL from .080 to .088, and one for WIAL from .072 to .076 if the same riskfree rate of .0692 was used.

1. Introduction

In accordance with The Airport Authorities Amendment Act, 1966, the international airports of Auckland, Wellington and Christchurch are required to consult with their customers in the setting of airfield landing charges, with a frequency of at least every five years. A significant factor in setting these landing charges is their cost of capital. Estimates have been offered by all three airports and challenged by the airlines in a number of respects, namely the riskfree rate, the cost of debt premium, the market risk premium, and the asset beta. This paper surveys the views expressed on these four issues and then offers conclusions. We commence with a brief description of the model that is generally accepted by all parties as appropriate, and then consider each of the four parameters in dispute. Having done this, WACC estimates are then offered for each airport.

2. The Model

The cost of capital is generally agreed by the parties to be a weighted average of the costs of debt and equity, i.e.

$$WACC = k_e(1-L) + k_d(1-T_c)L$$

where k_e is the cost of equity capital, k_d the current interest rate on debt capital, T_c the corporate tax rate and L the leverage ratio. It is also generally agreed that k_d should be estimated as the sum of the current riskfree rate (R_f) and a premium (p) to reflect marketability and exposure to the possibility of default, i.e.,

$$k_d = R_f + p$$

In respect of the cost of equity, it is generally agreed that it should be determined by a simplified version of the Brennan-Lally version of the Capital Asset Pricing Model (Lally, 1992), i.e.,

$$k_e = R_f(1-T_I) + fb_e \qquad (1)$$

where T_I is the average tax rate on interest income, f the market risk premium, and b_e the beta of equity capital. The equity beta is sensitive to the leverage ratio L, and it is generally agreed that the relationship is

$$b_e = b_a\left[1+\frac{L}{1-L}\right] \qquad (2)$$

where b_a is the asset beta, i.e., the equity beta in the absence of debt.

It is generally agreed that the parameters T_I and T_c are both .33. Finally it is generally agreed that, with the cost of equity determined in this fashion, the leverage ratio L exerts little effect upon the *WACC* calculation. This leaves four parameters, to which *WACC* is sensitive and there is divergence of opinion: the riskfree rate R_f, the debt premium p, the market risk premium f, and the asset beta b_a.

3. The Riskfree Rate

In respect of this parameter, the airports have suggested figures ranging from .067 to .073, whilst the airlines favour .065. The choice affects not only the cost of equity but also serves as a benchmark for setting the cost of debt. Consequently, a variation of .006 in the riskfree rate will generate almost the same variation in the WACC. There is agreement amongst the parties that the yields on government bonds offer a good proxy for the riskfree rate. Debate revolves around two questions: what is the appropriate maturity date for the government bonds and the point at which the rate is set.

In respect of the first question, the alternatives suggested are a maturity corresponding to the end of the review period and a maturity corresponding to the duration of the airports' assets. The former leads to the use of three or five year government bonds, and the latter to the use of ten year ones. There is little difference between the rates on such bonds at the time the rate was chosen. Consequently a decision here has no immediate implications. However, on future occasions, yields may differ, and the issue will then need to be faced. 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. The CIAL submission (2001) notes the second of these factors.

In respect of the second issue, the obvious point at which to select the rate is the point at which the new prices come into effect, because the prices are supposed to reflect costs (of which this is one). However the precise day has no fundamental significance, and was to some extent controlled by the airports. Furthermore the prices were set prior to them coming into effect, based on costs at that time. Finally there is variation in riskfree rates from day to day. All of this suggests that the rate should not be chosen on the day on which the new prices came into effect. Instead it should be averaged over the preceding consultation period. This prevents inequitable results arising from freakish rates on one day, prevents the airports choosing the time at which new prices come into effect in an attempt to benefit from unusually high riskfree rates at that time, and reflects the riskfree rate underlying the new prices at the time the latter were set. In respect of AIAL, the bulk of the consultation was over the period from February till August 2000, and the new prices took affect on 1.9.2000. Consistent with this, AIAL (2001) have averaged the weekly yields over the period March till September 2000, for government stock maturing around the end of the three year period for which prices are set. This figure is .0692. In respect of CIAL, consultation effectively commenced in February 2000 and prices came into effect on 1.1.2001. Thus the consultation period was very similar. Consistency suggests use of the same riskfree rate for both airports. Accordingly I recommend the same figure for CIAL. In respect of WIAL, their current prices came into effect on 1.7.1997. Consistent with the practice recommended for the other two airports, I retrospectively recommend use of the average government stock yield over the 6 months preceding 1.7.1997, using five year government bonds (this five year span corresponds to the duration of the new prices). This figure is .0747 (Reserve Bank website).

In summary I recommend a riskfree rate of .0692 for AIAL and CIAL. In respect of WIAL, and future price setting by the other two airports, I recommend use of the average government stock yield over the 6 months preceding the point at which the new prices take effect, using bonds whose maturity coincides with the period for which the new prices apply. Retrospectively, this is .0747 for WIAL.

4. The Debt Premium

As indicated in section 2, this is a premium added to the riskfree rate to generate the current cost of debt for an airport. The airports have suggested figures ranging from .50% to 1.5%, whilst the airlines have suggested .80% for AIAL and WIAL, and .50% for CIAL. The range of figures is then 1%. With a leverage ratio of 25% (see below), and a company tax rate of .33, this would imply a variation in the WACC of only .20%. This is not substantial.

Various sources of evidence are offered on this figure, including regulatory judgements, empirical studies relating yields to debt ratings, and market yields on AIAL bonds relative to government stock of the same maturity. [

] Air New Zealand (2000a) argues for a premium of .80% based on an unspecified study of American companies' credit ratings. The high figure of 1.5% comes from the WIAL submission (2001), and is not accompanied by any supporting evidence. The low figure of .50% comes from the BARNZ submission (2001), and is similarly unaccompanied by any supporting evidence. The AIAL submission (2001) argues for 1%, based on ACCC decisions for Australian airports. Bowman (2000) notes that the empirically determined figures reflect all airport operations, and the appropriate number for aeronautical activities will be less.

The best evidence offered here is that from Marsden (2000a), in respect of AIAL, and it differs only trivially from that argued for by the airlines for AIAL. I agree with Bowman's point that it will overestimate the appropriate figure for aeronautical activities, but the required adjustment is not apparent and I do not think it would be substantial. In support of this are margins for similarly low default risk businesses, such as .90% for Transpower and 1% for Housing New Zealand (data from the Debt

Management Office of The Treasury). Consequently I favour a figure of 1% for AIAL. This rate reflects the actual leverage level of AIAL, and therefore must be coupled with it. There are numerous references to a leverage ratio of .40 for AIAL, but this does not reflect market leverage and this is the appropriate concept. In mid 2000, AIAL's equity had a market value of about $1b (data from NBR). In addition the 2000 Financial Statements of AIAL record debt of around $300m (Commerce Commission, 2001, p. 47), and will be a good proxy for its market value. This implies a leverage of about .25, and the figure for the preceding year is similar. Thus a leverage ratio of .25 rather than .40 should be ascribed to AIAL. Its debt margin of 1% can be attributed to the other airports so long as the leverage ratios assumed for them matches this figure of .25. Lacking data on the debt margins of these other airports comparable in quality to that available for AIAL, I favour doing this.

One final point is thus. The debt margin of 1% should be coupled with the riskfree rate suggested in the previous section, to generate the airport's cost of debt. That riskfree rate is associated with the review period for the landing charges rather than the duration of the company's debt or its assets. Consequently the estimated cost of debt is that for the review period rather than the duration of the firm's actual debt or the duration of its assets. The argument for doing so corresponds to that in the previous section - landing charges should reflect expected costs and risks over the review period.

5. The Market Risk Premium

Given the tax environment generally agreed upon, the definition of the market risk premium in the present version of the CAPM is

$$MRP_{BL} = k_m - R_f\,(1-.33) \qquad (3)$$

where k_m is the expected rate of return on the market portfolio. All three airports agree on a value for this market risk premium of .09 whilst the airlines favour a value of .08. The difference of .01 translates into a WACC difference of about the same.

There are a number of ways of estimating this parameter. The most widely used is to observe the ex-post annual counterparts to each term comprising the market risk premium, and then arithmetically average over a large number of years. The methodology was first applied by Ibbotson and Sinquefield (1976) to the market risk premium in the standard version of the Capital Asset Pricing Model (CAPM: Sharpe, 1964; Lintner, 1965; Mossin, 1966). PricewaterhouseCoopers (hereafter PwC, 2000) have applied it to the CAPM version in question here, and generated an estimate of .08 using data from 1925. Interestingly both the airports and airlines refer to the PwC work, with the .09 figure arising from their earlier estimates, which involved a shorter time period. The choice of time span involves a trade-off between more data (which improves the statistical precision of the estimate, assuming the true value has not changed over time) and potentially less relevant data (in so far as the true value has changed over time). I favour the longer time span, and hence the .08 estimate.

Period aside, there are also issues arising from whether geometric or arithmetic averaging should be employed, and Cooper's (1996) analysis supports arithmetic averaging. Furthermore there are also questions arising from the choice of term for the riskfree rate used in these calculations, which were discussed earlier and favour the 5 year rate used by PwC. Whichever period, definition of the riskfree rate and form of averaging is used, there are a number of more fundamental concerns with the methodology. The most significant may be the statistical uncertainty surrounding the estimate. Chay et. al (1993, Table 5) give a standard deviation for the annual figures used in estimating the New Zealand market risk premium for the standard CAPM of .22, for the years 1931-92. The corresponding figure for the PwC data should be very similar. This implies a 95% confidence interval on the .08 estimate of about

$$.08 \pm 2\frac{.22}{\sqrt{75}} = .08 \pm .05$$

This is a very large interval. Other concerns with the methodology include the use of listed equity as a proxy for the market portfolio (Roll, 1977; Roll and Ross, 1994; Lally, 1995), potential biases arising from survivorship (Brown et. al., 1995; Jorion and Goetzmann, 1999; Dimson et. al, 2000), potential biases arising from unexpected

inflation in the post WWII period (Siegel, 1999), and changes over time in the true value, arising from changes in such factors as market volatility.

The second method for estimating the market risk premium arises from the fact that market volatility clearly changes over time, and this will give rise to changes in the market risk premium. The methodology was first applied by Merton (1980) to the market risk premium in the standard version of the CAPM, and involved postulating that the market risk premium was proportional to either market variance or standard deviation. In respect of New Zealand data and the version of the CAPM considered here, Credit Suisse First Boston (1998) have generated an estimate of .075. This work has been referred to by the airlines in support of their view. However the methodology used here differs in some ways from that of Merton, is not fully disclosed and has not yet appeared in the financial economics academic literature. [

] Other concerns with the methodology include statistical uncertainty, and whether the market risk premium is proportional to variance or some other measure of market risk. Notwithstanding this, the estimate is remarkably consistent with the PwC estimate of .08.

A third approach to estimating the market risk premium eschews historical returns data in favour of the current market dividend yield and estimates of growth in market dividends. With current market dividends denoted DIV_m, expected growth rates for years 1,2….denoted g_1, g_2…and the discount rate being k_m, the value of the market portfolio is the present value of the future dividends, i.e.,

$$P_m = \frac{DIV_m(1+g_1)}{1+k_m} + \frac{DIV_m(1+g_1)(1+g_2)}{[1+k_m]^2} + ...$$

Thus

$$1 = \frac{D_m(1+g_1)}{1+k_m} + \frac{D_m(1+g_1)(1+g_2)}{[1+k_m]^2} + ... \quad (4)$$

where D_m is the market dividend yield. Substituting in the current market dividend yield and the set of estimated growth rates, this equation is then solved for k_m. Substitution of this into equation (3), along with the current riskfree rate, then yields an estimate for the market risk premium. Surprisingly, neither the airlines nor airports have referred to this approach. Variants of this "forward-looking" approach arise according to whether short-term forecasts of earnings per share are extrapolated indefinitely or whether they are assumed to converge on a long-run expected growth rate. Cornell (1999, Ch. 4) argues that the long-run expected growth rate in dividends must equal the long-run growth rate in the economy, and short-term (five year) forecasts in earnings per share typically exceed this. The latter must then converge to the former over some period, and Cornell suggests 20 years.

At the relevant time (mid 2000), estimates of EPS growth in the NZSE40 companies were 20%, 18% and 12% for the next 3 years, converging to a long-run rate of 8% (data from Ord Minnett, 2000). If convergence to the 8% rate occurred in 5 years then equation (4) along with a market dividend yield of 4% (data from Ord Minnett) yields k_m = .135. Substitution into equation (3), along with our riskfree rate of .0692 yields an estimate of the market risk premium of .089. If we accept Cornell's argument about the long-run growth rate, then a (nominal) value for such of around 4% (comprising 2% real and 2% inflation) seems appropriate. If convergence to this takes 15 years then the estimate of k_m in equation (4) falls to .117 and that of the market risk premium in equation (3) falls to .071.

Like the earlier approaches, this forward-looking approach has a number of drawbacks. These include uncertainty about dividend growth rates and the period of convergence towards the long-run rate, the assumption that the observed market price of the market portfolio is rationally set, and that the model used by the market in setting k_m corresponds to that invoked here in equation (1). Bearing these concerns in mind, the above results of its application favours an estimate of the market risk premium of .08 rather than .09.

A final approach to estimation involves consideration of market risk premium estimates for foreign markets. Estimates are not available for the market risk premium in equation (3). Thus, they must be corrected for differences in definition.

These foreign estimates are in general of the market risk premium in the standard CAPM, denoted MRP_S. [ ] the relationship is

$$MRP_{BL} = MRP_S + R_f\,(.33) \qquad (5)$$

[

]

]

[1].

Substitution into equation (5), along with our selected riskfree rate of .0692, then yields estimates for MRP_{BL} of .088 to .11, and this supports use of .09 rather than .08. However these results are determined over different periods and, as pointed out by Dimson et. al (2000), there are also substantial differences in methodology. Dimson et. al. apply consistent methodology to twelve major markets for the period 1900-2000. The results (using long-term bonds) for the three foreign Anglo-Saxon markets then range from .058 for the UK to .076 for Australia[2]. Inserting these figures into equation (5), along with a riskfree rate of .0692, then yields an estimate for our market risk premium ranging from .081 to .099, which less clearly favours .09 over .08. In addition, these foreign estimates are based on Ibbotson (1997) methodology and the experience from foreign markets (most particularly that of the US) is that alternative methodologies (i.e., of the Merton and forward-looking kind) produce significantly lower numbers (see Lally, 2000, pp. 19-20, for a survey of this evidence).

The AIAL submission (2001) also mentions survey evidence from Welch (2000), yielding a figure of .06-.07. However the range mentioned arises according to whether the risk premium is measured relative to a long-term or a very short-term riskfree rate. The riskfree rate used in the PwC report is long-term. Consequently, the relevant Welch figure is .06, and this is translated by equation (5) into a market risk premium of .082. These points aside, all foreign estimates are subject to the problem of inter-country differences relevant to market risk premiums, such as market volatilities and personal taxes.

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[1] The New Zealand figure here of .065 is clearly inferior as an estimate of MRP_{BL}, even after correcting by (4), to the direct estimate presented by PwC. Thus only the foreign estimates should be considered.
[2] Dimson et. al (2000) do not report results for New Zealand.

In summary, we have considered a range of methodologies for estimating the market risk premium in equation (3). Collectively they point to an estimate of .08 rather than .09. Accordingly I favour the latter figure.

6. Asset Beta

6.1 Introduction

The final parameter in dispute is the asset beta. The airports favour values from .40 to .65 whilst the airlines favour lower values from .30 to .35. The difference, of up to .35, translates into a WACC difference of almost .03. Accordingly it is the most significant parameter under dispute.

Both parties support their positions by reference to estimated asset betas of "comparable" companies along with the judgements of others. The comparable companies suggested are AIAL (the only listed New Zealand airport), three foreign listed airports, port companies in various countries, and utilities in various countries. Judgements that are referred to include Australian regulatory decisions for airports, gas and electricity, Airways Corporation, Transpower, and Commerce Commission Ruling 266 on the gas distribution business of NGC. We start by examining these comparators. A fundamental step in the selection of comparable companies is some knowledge of what underlies betas, and we start with a review of these determinants.

6.2 Determinants of Betas

Rosenberg and Guy (1976a) suggest that betas arise from the sensitivity of an asset's price to macro-economic shocks ("factors") affecting the returns of most assets in an economy. Chen, Roll and Ross (1986) suggest that these factors are unexpected changes in real GNP, inflation, market risk aversion and the long term real interest rate. Dybvig and Ross (1985) show that the beta of an asset is a linear function of its coefficients against the factors. Differences in betas would then arise from differences in these factor coefficients. Amongst equities, sensitivities to the last three of the factors mentioned – inflation, market risk aversion and the long-term real interest rate – should be similar. However, sensitivities to the first factor (real GNP) may differ. Thus differences in equity betas across assets should arise from

differences in the sensitivity of their returns to real GNP shocks. We then ask what governs the sensitivity of equity returns to real GNP shocks. The following are suggested:

(1) Industry, i.e. the nature of the product or service. Firms producing products with low income elasticity of demand (necessities) should have lower sensitivity to real GNP shocks than firms producing products with high income elasticity of demand (luxuries), because demand for their product will be less sensitive to real GNP shocks. Rosenberg and Guy (1976b, Table 2) document statistically significant differences in industry betas after allowing for various firm specific characteristics, and these differences accord with intuition about the income elasticities of demand. For example energy suppliers have particularly low betas whilst travel and recreation are particularly high.

(2) Nature of the customer. Firms producing a product whose demand arises exclusively from the public sector should have lower sensitivity to real GNP shocks than for firms producing a similar product demanded exclusively by the private sector, because demand should then be less sensitive to real GNP shocks. This is a variant of (1). This has no implications for airlines or any suggested comparators.

(3) Duration of contract prices with suppliers and customers. The effect of this on beta will depend upon the type of shock and the firm's reaction to it in the absence of a temporarily fixed price. For example, an output price fixed for a period prevents a firm from exploiting a positive demand shock, through raising its output price, and this reduces the firm's beta. By contrast, if a negative demand shock arises from an adverse cost shock to an economy, the same restriction on output price also prevents a firm from raising its output price in response to the adverse cost shock, and this magnifies its beta.

(4) Presence of price or rate of return regulation. Firms subject to rate of return regulation should have lower sensitivity to real GNP shocks, because the regulatory process is geared towards achieving a "fair" rate of return. Rosenberg and Guy (1976b, Table 2) find that such industries have amongst the lowest betas

after allowing for various firm specific variables. Price regulation will have a similar effect, providing prices are frequently reset. However, as the reset interval increases, such a firm tends to resemble one with an output price voluntarily fixed for a long period. As indicated in (3), this can increase its beta. Consistent with this, Alexander et al. (1996) show that utilities subject to UK style regulation (in which prices are set for five years) have significantly larger average asset betas than for utilities subject to US regulation (which is close to cost plus). Lally (2001) attributes part of the difference in asset betas to market leverage differences, but this still leaves a substantial residue, apparently attributable to the difference in regulatory regimes.

(5) Degree of monopoly, i.e. price elasticity of demand. So long as firms act to maximise their cash flows, theory offers ambiguous results – Subrahmanyam and Thomadakis (1980) conclude that monopoly power reduces beta whilst Conine (1983) concludes that the direction of impact depends upon various other parameters. By contrast, if monopolists do not optimise their cash flow, in the sense of reacting to demand shocks by varying the cushion provided by suboptimal pricing and cost control more than do non-monopolists, then their returns should exhibit less sensitivity to demand, and hence to real GNP shocks. The empirical results in this area are equally mixed – Sullivan (1978, 1982) concludes that increased market concentration is associated with lower asset betas whilst Curley et al (1982) finds no relationship.

(6) Nature of the firm's real options. The existence of options permitting expansions of the firm (adopting a new product, expanding existing operations etc) should increase the firm's sensitivity to real GNP shocks, as the values of these growth options should be more sensitive to real GNP shocks than equity value exclusive of them, and these two value components should be positively correlated. Chung and Chareonwong (1991) model the relationship between beta and growth options, and find empirical support for a positive relationship. By contrast, the existence of options permitting contractions of the firm should reduce the firm's sensitivity to real GNP shocks, because the option value should be negatively correlated with equity value exclusive of it. Black and Scholes (1973) show that the sensitivity of an option value to an underlying variable (and hence that of a

firm possessing one) will vary with the term to maturity of the option and with how close it is to “the money”.

(7) Operating leverage. If firms have linear production functions and demand for their output is the only random variable, then firms with greater operating leverage (higher fixed to total operating costs) should have greater sensitivity to real GNP shocks because their cash flows will be more sensitive to own demand, and hence to real GNP shocks. A number of papers including Rubinstein (1973), Lev (1974) and Mandelker and Rhee (1986) have modeled this. However the assumptions noted above, which underlie this work, are very restrictive. Booth (1991), by contrast, examines a perfectly competitive firm facing price uncertainty, and reaches the opposite conclusion about the sign of the relationship between operating leverage and beta. In respect of empirical work, Lev (1974) shows that operating leverage is positively correlated with equity beta, for each of three industries. Mandelker and Rhee (1974) refine the procedure and reach the same conclusion in respect of a set of firms spanning numerous industries. However Lev’s conclusions are specific to the three industries examined. Furthermore Mandelker and Rhee’s conclusions are at best valid for the majority of firms included in the data set, i.e. some industries may exhibit the opposite pattern but are outweighed in the data set. These concerns about lack of generality of the results are prompted and supported by the theoretical literature just surveyed. Nevertheless, the situation facing airports would seem to correspond to that modeled by Rubinstein et. al., and this implies that the high operating leverage of airports should magnify their betas.

(8) Market weight. Increasing an industry’s weight in the market proxy against which its beta is defined will draw its beta towards 1, although not necessarily in a monotonic fashion (Lally and Swidler, 1997). Even for a market weight as low as 5%, the effect can be substantial. Airports and possible comparators have limited weights in market indexes. Consequently this point is not relevant.

(9) Capital structure. Firms with greater financial leverage will have greater sensitivity of equity returns to real GNP shocks because cash flows to equityholders will be more sensitive to own demand, and hence to real GNP,

shocks. Hamada (1972) and Conine (1980) have modelled this, and Hamada (1972), Mandelker and Rhee (1984) and Bhandari (1988) provide empirical support. Ehrhardt and Shrieves (1995) extend this to convertible debt and warrants. Lally (2001) shows that firm leverage matters only in relation to market leverage. Thus, ceteris paribus, firms in different markets that have different market leverages will have different betas.

Prima facie, comparators will need to be similar in the above respects. However, so long as differences can be corrected for, this will not be necessary (and will therefore expand the set of comparators, with resulting improvement in the statistical reliability of the beta estimate). Comparators need not be individual firms ("pure plays"). They can be subunits of a firm. Estimates of the "pure-play" betas can be extracted from the overall company betas by the process suggested by Ehrhardt and Bhagwat (1991). In addition, standard practice is to correct for financial leverage, and the appropriate formula is that shown in equation (2). Correction should also be made for differences in market leverage, if beta estimates are drawn from different economies (see Lally, 2001). Correction for other factors affecting beta is problematic, due to lack of theoretical formulas or to significant controversy about the appropriate formula.

6.3 Arguments Presented

We now assess the arguments and data presented by the various parties concerning the aeronautical activities of New Zealand airports. Clearly, the estimated asset beta of AIAL is a useful source of information. Air New Zealand (2000b, p. 63) cites an estimated equity beta of .63, and translates this into an asset beta of .51. They add that it has been trending down since listing. They also add that capital repayments are expected, so that conversion to an asset beta should use "..a more normal gearing ratio.." Doing so yields an asset beta of about .40. The claim concerning trending down should be disregarded – any trend will most probably be a reflection of statistical estimation error rather than the underlying true value. In respect of a normal gearing level, the appropriate gearing ratio to use is the actual average over the period in which the equity beta was estimated (see Lally, 1998a). If this is unusually high so too will the equity beta, and the de-gearing must therefore reflect the actual rather than the normal gearing level. Thus, the figure of .51 should be treated as the

estimated asset beta for the whole business, which includes non-aeronautical activities (retailing, etc). Air New Zealand goes on to suggest that these latter activities warrant a higher asset beta, leading to them deducting .05 from the .40 to yield an estimated asset beta for aeronautical activities of .35. The weights used in this exercise are not disclosed but are implicitly .50 each. [

] and the CIAL submission (2001) cites a figure of .72. [

] The fact that the three separate estimates differ as much as they do is simply an illustration of this fact. Furthermore such statistical uncertainty is aggravated by the short period for which AIAL has been listed (betas are typically estimated from five years of data).

Marsden (2000b) [ ], and the CIAL submission (2001) cites estimates for the same three companies, with an average of .53[3]. However, in so far as these foreign airports have substantial non-aeronautical activities, their asset betas may be poor proxies for that of aeronautical activities. In respect of one of these three foreign airports (BAA), Crighton Seed (1999, p. 11) notes that only 30% of its revenues are derived from aeronautical services. This information, along with the weighting on aeronautical services for AIAL noted above and asset beta estimates for the two companies (BAA and AIAL) of .67 and .72 respectively (CIAL, 2001, Table 2), can be used to deduce the "pure-play" betas, following Ehrhardt and Bhagwat (1991). Let the asset betas on aeronautical and other activities be denoted b and b_c. Since company betas are weighted averages of those for their component activities, then

$$.67 = .30b + .70b_c$$

$$.72 = .88b + .12b_c$$

Solving simultaneously yields b = .73 and b_c = .64. If revenue weights on aeronautical and other activities were supplied for the other two airports, they could

be added to this exercise, thereby improving the accuracy of the number. However, even if that were possible, only four companies constitutes a very small (and therefore statistically unreliable) set. There are also concerns about whether the equity betas from which these asset betas are derived are "raw" numbers or have been adjusted towards 1 (Lally, 1998b, shows that such adjustments are unwarranted and would have the effect here of overestimating the appropriate asset beta).

In addition to these problems there is no correction of the foreign asset betas for market leverage differences. Lally (2001) shows that such differences can exert a substantial effect upon asset betas, and CIAL (2000, p. 68) acknowledges the need for such adjustments. Finally, no information is supplied about the regulatory regime under which these three foreign airports operate, and point (3) in the previous section indicates the significance of this issue. In respect of this last point, both Air New Zealand (2000b) and BARNZ (2001) claim that overseas airports that are subject to regulation are not good comparators because AIAL can reset prices at any time subject to consultation. However the precise nature of the regulatory regime under which these foreign airports operate is not disclosed. What does seem clear is that AIAL and CIAL cannot reset landing charges at will. Resetting is bound by consultation requirements and these do not seem to be trivial. Furthermore I understand that the New Zealand airports have not historically exercised this power within the five-year reset points, at least in respect of demand or cost shocks[4]. In addition, their charges are fixed in nominal terms so that they face inflation risk over the period between price reviews. By contrast, the foreign regulated airports may resemble Australian or UK regulated firms, in that the inflation uncertainty is borne by customers. WIAL is in a rather different situation, with a Deed (WIAL, 1999) that allows it to vary charges in accordance with realized levels of inflation and demand. Its risk will therefore be less than AIAL or CIAL. However it is not apparent that the risk for the latter two is less than the foreign airports offered as comparators.

The CIAL submission (2001) suggests that port companies are comparable to airports on the grounds of being in the same (transport) industry, enjoying regional

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[3] [

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monopolies and a mix of contestable and non-contestable activities. They then present asset betas for eight such companies (four New Zealand and four British) with an average asset beta of .72[5]. Based on this they ascribe an asset beta of .70 to airports. In addition they conjecture an asset beta for contestable activities of .80. These two figures along with the fact that 55% of CIALs revenue was derived from non-contestable sources is then claimed to imply an asset beta for aeronautical activities of .60.

As noted before the asset betas for the foreign companies referred to here require correction for market leverage, and this has not been done. In addition, CIAL's process for converting the airport asset beta of .70 to an aeronautical activities beta of .60 is flawed, in that it treats the latter as derived from the former. The reality is the complete reverse. An airport's beta is a weighted average of the betas for aeronautical and contestable activities, with the weights (and hence the overall beta) varying over airports. Thus one would need to take the asset betas of port companies and deduce the asset beta of core port activities from them, following the Ehrhardt and Bhagwat (1991) process described earlier. The latter beta could then be applied to the aeronautical activities of airports, without any need to consider the contestable activities of airports. It is not apparent that port companies have substantial non-core activities. Consequently it is then merely a question of whether their core activities are good comparators for the aeronautical activities of airports.

As noted, CIAL claim that ports and airports are in the same (transport) industry. However, ports are concerned with transporting goods whilst aeronautical activities largely involve transporting people. In respect of non-business traffic, this is essentially a luxury good rather than a transport activity. Following point (1) in the previous section, this should imply a higher asset beta than for pure transport activities. In respect of business traffic, this is an intermediary good, but with rather more discretion over incurrence of the expense than for the transportation of goods. Thus it too may have a higher asset beta than port companies. CIAL also claim that

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[4] AIAL did temporarily raise prices to finance a major construction project.

[5] Crighton Seed (1999) also report figures on these British companies, and they are generally larger than the CIAL ones. Since the former are obtained from LBS, who adjust betas towards 1 using the Vasicek (1973) method, this is unsurprising. It also illustrates the need to check whether such adjustments are embodied in the beta estimates accessed.

both airports and ports have strong regional monopoly powers. However the monopoly power of airports would seem to be greater, because the charges are paid by an intermediary (the airlines) and the charge is a very small proportion of the total cost of air travel. Thus, if the charges rise, it will be essentially undetectable by the passengers who ultimately determine where aircraft land. By contrast, if ports raise their charges, the party paying the bill also makes the decision as to which port is used. This suggests that airports have greater monopoly power, i.e., lower price elasticity of demand. In addition, airports are also regulated. However, as point (4) in the previous section indicates, it is not clear whether this lowers their asset betas relative to an otherwise identical but unregulated firm.

The last type of comparator suggested is gas and electricity companies, [

] However, as noted earlier, estimates from foreign markets require correction for market leverage differences, and this has not been done. There is also the question of comparability in the regulatory regimes. As indicated in point (4) of the previous section, there is considerable variation and the effect can be substantial. Finally, the products seem different, in the income elasticity of demand sense, i.e., utilities versus services whose consumption involves a significant discretionary element, in respect of both business and personal travel. Nevertheless, as we shall see, I consider these firms to be useful comparators, but on the grounds of regulatory regime rather than monopoly power (the latter is largely nullified by the former).

To summarise this evidence from allegedly comparable companies, we firstly have various estimates of the asset beta for AIAL of .50 to .72, and these are not greatly complicated by AIAL's non-aeronautical activities. However a sample size of one is too small to offer reliable results. Secondly, we have asset beta estimates for three foreign airports, with averages of .53 to .57. These are complicated by lack of correction for market leverage differences, possibly different regulatory regimes, potentially significant non-aeronautical activities with different betas, and a sample size of only three. Thirdly, we have asset beta estimates for four New Zealand and four British ports. The latter are not corrected for market leverage differences. Furthermore these do not seem to be in the same industry as airports and there are differences in respect of monopoly powers and regulatory regime. Finally, we have

asset betas for a set of gas and electricity companies. However market leverage corrections are lacking for the foreign data, and there are potentially significant differences in regulatory regimes.

In addition to this evidence from comparators, there are numerous references to others' judgements. The CIAL submission (2001) cites the ACCC decisions over asset betas for five Australian airports, ranging from .60 to .70. However the AIAL submission (2001) notes that the degearing process for both Sydney and Adelaide does not correspond to equation (2). Invoking equation (2), the figures of .60 and .61 become .51 and .55. Lovick (2000) asserts that the regulatory regimes in the two countries are quite different, in that the New Zealand review period is shorter (three versus five years), the New Zealand airports do not need regulatory approval to raise charges, and they can also recoup the effects of adverse shocks since the last review. Clearly the current review period for AIAL and CIAL is three rather than five years, and this should lower risk. It is also true that New Zealand airports are subject to a periodic consultation process rather than a price imposed by a regulator. This may lower risk, in so far as it enables recouping of the effects of adverse shocks since the last review (which is Lovick's third point). On this matter, the prices put forward by the airports are at least notionally based on current rather than past costs. However, in the absence of prices decreed by a regulator, there is presumably some latitude in this process for covertly recouping the effects of past adverse shocks. Nevertheless there should be significant restraints on this. In addition, the Australian prices are set in real terms, so that their customers rather than the airports face inflation risk. By contrast, the New Zealand prices are set in nominal terms and therefore the airports face inflation risk. However this does not seem to be a substantial source of risk in the current environment. In summary it would seem that AIAL and CIAL face less risk on account of their regulatory regime than their Australian counterparts.

Notwithstanding all of this, the significance of any comparison with the Australian situation will depend upon the weight given to the ACCC decisions. For example, the ACCC's Adelaide decision (ACCC, 1999, pp. 25-26) is based on the asset betas of only four foreign airports (the same four noted earlier here). In addition most of the weight seems to assigned to one of the four airports (AIAL), in contravention of the principle that beta estimates for individual companies have such high standard errors

as to be very unreliable. Furthermore there are no corrections for market leverage differences in respect of these foreign betas, no discussion of differences in regulatory regimes, and one of the four firms has a reported asset beta in excess of its equity beta. None of this suggests that strong weight should be given to the ACCC decisions over and above the underlying data used, which have already been referred to. The same applies to other judgements, involving asset betas for Airways Corporation (.30), Transpower (.30), and Commerce Commission Ruling 266 on the gas distribution business of NGC (.275).

In summary, the comparators offered are subject to significant limitations and the judgements offered do not mitigate this. We now proceed to offer an estimate.

6.4 Estimating the Asset Beta

In seeking to estimate the asset beta for any industry, two benchmarks are worth noting. The first are US firms engaged in electricity generation and/or distribution, which are subject to rate of return regulation designed to almost guarantee their rate of return[6]. Unsurprisingly this industry appears to have the lowest asset beta that can be reliably estimated (due to the large number of firms). Recent estimates typically lie in the .25 -.30 range. Alexander et. al (1996) give a figure of .30, and Lally (2001) converts this into an Australian equivalent of .36 by correcting for market leverage differences. Since Australian and New Zealand market leverages are similar (Ernst and Young, 2000, estimate both at .19) then the .30 also converts to a New Zealand figure of .36. This represents a lower bound on the asset beta of any New Zealand industry. A second useful benchmark is the asset beta of an average New Zealand firm. Since the average equity beta is 1, and market leverage is .19, equation (2) implies an average New Zealand asset beta of .81.

We now consider the eight factors underlying betas that were listed earlier in section 6.2[7]. We start with AIAL and CIAL, and then later consider WIAL because its

[6] Substantial rate of return shocks are possible for them, such as disallowing price allowances for cost overruns on plant construction. However these type of shocks are unsystematic risks. Systematic risks appear to be largely capable of being reimbursed.

[7] The last of them (financial leverage) is dealt with through a focus on asset betas and correcting for market leverage differences in respect of foreign beta estimates. This leaves eight factors to consider.

regulatory environment is significantly different. Of the eight factors, the de-facto regulation faced by the airports is crucial. In this respect, comparators are available in the form of electricity companies subject to US and UK style regulation. Clearly the airports face more systematic risk than under the US rate of return regulation, i.e., demand shocks between successive price resets can be substantial and will induce revenue shocks until the price is subsequently reset (after three years). On the other hand, the price resetting every three years has strong similarities to that of the UK regime. However there are four differences from the UK regime, as follows. First, UK prices are set for five rather than three years, and this implies lower risk for the airports. Second, the fact that the airport prices are arrived at by consultation rather than being decreed by a regulator gives the airports some power to covertly recoup the effects of past adverse shocks. This lowers risk relative to the UK regime. Third, the UK regime fixes prices for a period whereas the airports have the power to vary prices within the three-year period. However, as noted earlier, the airports have not exercised that power in the past, and this is the best indicator for the future. In so far as it warranted any weight, this point implies lower risk for the airports. Finally, the UK regime passes inflation risk to the customer rather than the firm whilst the New Zealand regime passes it to the airports. This raises risk relative to the UK regime. On balance I think the first three points are more significant than the last, and therefore the airports face less risk than firms subject to the UK regulatory regime.

Thus, in regulatory terms, the airports lie between the US and UK models. Absent any formula to quantify this, I treat them as lying mid-way. Alexander et. al. compare the US and UK regimes and cite average asset betas of .30 and .60 respectively, for electricity distributors/generators. The difference is then .30. However this difference is contaminated by differences in market leverages. Lally (2001) converts these figures into Australian equivalents of .36 and .56. Since Australian and New Zealand market leverages are similar (Ernst and Young, 2000), the same figures can be ascribed to New Zealand. Thus the effect of moving from US to UK style regulation would seem to be to raise the asset beta by about .20. Having argued that AIAL and CIAL lie mid-way between these two bounds (before consideration of factors other than regulation), this implies an asset beta of .46 for them. I round this to .45.

This figure of .45 is subject to modification to reflect differences between aeronautical activities and electricity distribution other than regulation. Any such differences will be reflected in the remaining seven factors listed in section 6.2. In respect of the nature of the product, the airports appear to supply a product (business and personal travel) whose demand faces more exposure to real GNP shocks in that market. This points to a higher asset beta for aeronautical activities. Mitigating factors are that landing charges are based on seats rather than passengers landed, and much of the demand arises from foreign tourists whose demand is sensitive to home country rather than New Zealand GNP shocks. In respect of customer type, neither have substantial sales to government. Consequently they are comparable in this respect. In respect of contract duration, this point is subsumed within the regulatory regime. In respect of monopoly powers (i.e., price elasticity of demand), the two industries are similar; for the airports, this is only because the airport landing charges represent such a small component of the total cost of air travel. However this point is overshadowed by the regulatory regime, which largely obstructs exercise of monopoly power. In respect of real options, both industries appear to have only modest exposure. In respect of operating leverage, both industries have high levels of this. Finally, in respect of market weight effects, both industries have generally small market weights, and are therefore comparable in this respect.

In summary, AIAL and CIAL have regulatory regimes that place them between US and UK electricity companies. Absent any other points of difference this would suggest an asset beta of .45. Taking account of other factors affecting beta, the only significant point is that demand shocks between successive price resets may be greater for aeronautical activities, pointing to a higher beta. I am unable to quantify this effect. However it is limited to a maximum of three years. In addition it is mitigated by the fact that landing charges are based on seats rather than passengers landed, and also by the presence of foreign tourist traffic lowering the sensitivity of demand to New Zealand's real GNP shocks. In view of all this I believe any increase in beta would be modest. I am also disinclined to attempt subjective adjustments. In view of my belief that the effect would be modest, I retain the estimate of .45. There is some uncertainty about this figure, due to uncertainties about both the comparator betas and the position of AIAL/CIAL relative to the boundary figures. My bounds on the estimate are .40 to .50.

A final point here is as follows. I understand that AIAL's traffic contains a higher proportion of foreign tourists than CIAL's. This traffic is less sensitive to New Zealand real GNP shocks than domestic traffic. Accordingly the asset beta for AIAL should be lower than that for CIAL. Having recommended no adjustment to the asset beta of the airports on account of them being more exposed to real GNP shocks than electricity companies, because it is considered too difficult to estimate and modest, the same applies to this distinction between AIAL and CIAL.

We can now finally turn to WIAL. Relative to AIAL and CIAL, its Deed and the consequent ability to adjust prices within the five-yearly reset period (in response to specified demand and cost shocks) implies an environment approximating that of US rate of return regulated utilities rather than UK price regulated utilities. Accordingly I recommend the estimated New Zealand equivalent asset beta of the US firms, of .36. I now round this to .35. Again there is some uncertainty about this figure, due to uncertainty about the asset beta for these US rate of return regulated utilities. Recent estimates that I am aware of have ranged from .25 to .30, with New Zealand equivalents of .31 to .36. Thus my (rounded) bounds on the asset beta for WIAL are .30 to .35[8].

7. WACC

We are now in a position to estimate the WACC for the three airports. For AIAL and CIAL, the parameters are a riskfree rate of .0692, a debt premium of .01, a market risk premium of .08, an asset beta of .45 and leverage of .25. Following the equations of section 2, this yields a WACC of .084. I have suggested bounds on the asset beta of .40 to .50, and this leads to WACC values ranging from .080 to .088.

In respect of WIAL, the only variation from this is in the asset beta. With bounds of .30 to .35, the implied WACC values are .072 to .076 if the same riskfree rate of .0692 was used.

[8] Having effectively employed a mid-point value of .33 here, consistency demands I use the .33 figure rather than the .36 figure in my beta estimates for AIAL and CIAL. If I do so, the figures used in the

8. Conclusion

Differences of opinion between the parties to this consultation are limited to four parameter values. My views on them are as follows. First I favour a riskfree rate of .0692 for AIAL and CIAL, representing an average of yields on three year government stock over the six month period preceding the point at which AIAL's new prices came into effect. In general, I favour an average on government bond yields over the period in which consultation occurred, ending with the point at which the new prices came into effect, and with a maturity on the bonds matching the point at which the new prices will be reviewed. With respect to WIAL's current prices, this would retrospectively imply a riskfree rate of .0747, being the five year riskfree rate averaged over the first six months of 1997. Second, I favour a debt risk premium of .01 over the riskfree rate, along with AIAL's leverage of .25. Third, I favour a market risk premium of .08. Finally, I favour an asset beta for AIAL and CIAL of .45 (with a band of .40 to .50), and one for WIAL of .30 to .35. The difference in asset betas reflects provisions in WIAL's Deed permitting it to vary prices within the five-year review period in response to demand and cost shocks. These parameter values imply a WACC range for CIAL and AIAL from .080 to .088, and one for WIAL from .072 to .076 if the same riskfree rate of .0692 was used.

AIAL/ CIAL analysis, of .36 and .56, become .33 and .56, with an average of .445. This is still approximated by the .45 figure used.

REFERENCES

AIAL, 2001, *Submission to the Commerce Commission (April 2001).*

Air New Zealand, 2000a, *Further Interim Consultation Response: Auckland International Airport Limited (June 2000).*

_____ 2000b, *Draft Interim Consultation Response: Auckland International Airport Limited (February 2000).*

Alexander, I., Mayer, C. and Weeds, H. 1996, 'Regulatory Structure and Risk: An International Comparison', prepared for *The World Bank.*

Australian Competition and Consumer Commission, 1999, *Application to Pass Through the Price Cap the Costs of a Multi-User Integrated Terminal at Adelaide Airport.*

BARNZ, 2001, *Submission to the Commerce Commission (April 2001).*

Bhandari, L. 1988, 'Debt/Equity Ratio and Expected Common Stock Returns: Empirical Evidence', *Journal of Finance*, vol.43, pp.507-28.

Black, F. and Scholes, M. 1973, 'The Pricing of Options and Corporate Liabilities', *Journal of Political Economy*, vol.81, pp.637-54.

Booth, L. 1991, 'The Influence of Production Technology on Risk and the Cost of Capital', *Journal of Financial and Quantitative Analysis*, vol. 26, pp. 109-27.

Bowman, R. 2001, report prepared for *Network Economics Consulting Group*.

Brown, S., Goetzmann, W. and Ross, S. 1995, 'Survival', *Journal of Finance*, vol.50, pp.853-73.

Chay, J., Marsden, A. and Stubbs, R. 1993, 'Historical Rates of Return to Equities, Bonds, and the Equity Risk Premium: New Zealand Evidence', *Pacific Accounting Review*, vol.5, pp.27-46.

_____ 1995, 'Investment Returns in the New Zealand Market: 1931-1994', *New Zealand Investment Analyst*, vol.16, pp.19-27.

Chen, N., Roll, R. and Ross, S. 1986, 'Economic Forces and the Stock Market', *Journal of Business*, vol.59, pp.383-403.

Crighton Seed & Associates Limited, 1999, *Weighted Average Cost of Capital for Christchurch International Airport Limited.*

Chung, K. and Chareonwong, C. 1991, 'Investment Options, Assets in Place and the Risk of Stocks', *Financial Management*, vol.20(3), pp.21-33.

CIAL, 2000, *Airport Charges*.

_____ 2001, *Submission to the Commerce Commission (April 2001).*

Commerce Commission, 2001, *Price Control Study of Airfield Activities: Critical Issues Paper (March 2001)*.

Conine, T. 1980, 'Corporate Debt and Corporate Taxes: An Extension', *Journal of Finance*, vol.35, pp.1033-36.

_____ 1983, 'On the Theoretical Relationship Between Systematic Risk and Price Elasticity of Demand', *Journal of Business Finance and Accounting*, Summer, pp.173-82.

Cooper, I. 1996, 'Arithmetic Versus Geometric Mean Estimators: Setting Discount Rates for Capital Budgeting', *European Financial Management*, vol.2, pp.157-67.

Cornell, B. 1999, *The Equity Risk Premium*, John Wiley & Sons, New York.

Credit Suisse First Boston. 1998, *Equity Valuation Methodology*.

Curley, A., Hexter, J. and Chio, D. 1982, 'The Cost of Capital and Market Power of Firms: A Comment', *Review of Economics and Statistics*, vol.64, pp.519-23.

Dimson, E. and Marsh, P. 1982, 'Calculating the Cost of Capital', *Long Range Planning*, vol.15, pp.112-120.

Dimson, E., Marsh, P. and Staunton, M. 2000, 'Twelve Centuries of Capital Market Returns', working paper.

Dybvig, P. and Ross, S. 1985, 'Yes, the APT is Testable', *Journal of Finance*, vol.40, pp.1173-88.

Ehrhardt, M. and Bhagwat, Y. 1991, 'A Full-Information Approach for Estimating Divisional Betas', *Financial Management*, vol.20, Summer, pp.60-69.

_____ and Shrieves, R. 1995, 'The Impact of Warrants and Convertible Securities on the Systematic Risk of Common Equity', *The Financial Review*, vol.30, pp.843-856.

Ernst and Young. 2000, *Country Leverage and its Relevance to the Valuation of New Zealand Companies*.

Hamada, R. 1972, 'The Effect of the Firm's Capital Structure on the Systematic Risk of Common Stocks', *The Journal of Finance*, vol.27, pp.435-52.

Ibbotson, R. and Sinquefield, R. 1976, 'Stocks, Bonds, Bills, and Inflation: Year-by-Year Historical Returns (1926-1974)', *Journal of Business*, pp. 11-47.

Ibbotson Associates, 1997, *Stocks, Bonds, Bills, and Inflation: 1996 Yearbook*, Ibbotson Associates, Chicago.

Jorion, P. and Goetzmann, W. 1999, 'Global Stock Markets in the 20th Century', *The Journal of Finance*, vol. 54, pp. 953-980.

Lally, M. 1992, 'The CAPM Under Dividend Imputation', *Pacific Accounting Review*, vol.4, pp. 31-44.

_____ 1995, 'The Accuracy of CAPM Proxies for Estimating a Firm's Cost of Equity', *Accounting and Finance*, vol.35, pp. 63-72.

_____ 1998a, 'Correcting Betas for Changes in Firm and Market Leverage', *Pacific Accounting Review*, vol.10, pp. 98-115.

_____ 1998b, 'An Examination of Blume and Vasicek Betas', *The Financial Review*, vol. 33, pp. 183-198.

_____ 2000, 'The Real Cost of Capital in New Zealand: Is it too High', report prepared for *The New Zealand Business Roundtable*.

_____ 2001, 'Betas and Market Leverage', *Accounting Research Journal*, forthcoming.

_____ and Swidler, S. 1997, 'The Effect of an Asset's Market Weight on its Beta', working paper, Victoria University of Wellington.

Lev, B. 1974, 'On the Association Between Operating Leverage and Risk', *Journal of Financial and Quantitative Analysis*, vol.9, pp.627-41.

Lintner, J. 1965, 'The Valuation of Risky Assets and the Selection of Investments in Stock Portfolios and Capital Budgets', *Review of Economics and Statistics*, vol.47, pp.13-37.

Lovick, S. 2000, *Commentary on the WACC Assumptions Adopted by CIAL*.

Mandelker, G. and Rhee, S. 1984, 'The Impact of the Degrees of Operating and Financial Leverage on the Systematic Risk of Common Stock', *Journal of Financial and Quantitative Analysis*, vol.19, pp.45-57.

Marsden, A. 1999, *Auckland International Airport Limited: Cost of Capital – Identified Airport Activities (September 1999)*.

_____ 2000a, *Comments on Air New Zealand Further Interim Response to AIAL Pricing (July 2000)*.

_____ 2000b, *Draft Response to Air New ZealandDraft Interim Response to AIAL Airport Pricing Proposal (March 2000).*

Merton, R. 1980, 'On Estimating the Expected Return on the Market', *Journal of Financial Economics*, vol.8, pp.323-61.

Mossin, J. 1966, 'Equilibrium in a Capital Asset Market', *Econometrica*, vol.24, pp.768-83.

Officer, R. 1989, 'Rates of Return to Equities, Bond Yields and Inflation Rates: An Historical Perspective', in Ball, R., Finn, F., Brown, P. and Officer, R. editors, *Share Markets and Portfolio Theory*, 2nd edition, University of Queensland Press.

PricewaterhouseCoopers. 2000, *The New Zealand Equity Market Risk Premium*.

Roll, R. 1977, 'A Critique of the Asset Pricing Theory's Tests; Part I: On Past and Potential Testability of the Theory', *Journal of Financial Economics*, vol. 4, pp. 129-76.

_____ and Ross, S. 1994, 'On the Cross-Sectional Relation Between Expected Returns and Betas', *Journal of Finance*, vol.49, pp.101-21.

Rosenberg, B. and Guy, J. 1976a, 'Prediction of Beta from Investment Fundamentals', *Financial Analysts Journal*, May-June, pp.60-70.

_____ 1976b, 'Prediction of Beta from Investment Fundamentals', *Financial Analysts Journal*, July-Aug, pp.62-70.

Rubinstein, M. 1973, 'A Mean-Variance Synthesis of Corporate Financial Theory', *Journal of Finance*, vol.28, pp.167-81.

Sharpe, W. 1964, 'Capital Asset Prices: A Theory of Market Equilibrium Under Conditions of Risk', *Journal of Finance*, vol.19, pp.425-42.

Siegel, J. 1999, 'The Shrinking Equity Premium', *Journal of Portfolio Management*, Fall, pp. 10-17.

Subrahmanyam, M. and Thomadakis, S. 1980, 'Systematic Risk and the Theory of the Firm', *Quarterly Journal of Economics*, vol.94, pp.437-51.

Sullivan, T. 1978, 'The Cost of Capital and the Market Power of Firms', *Review of Economics and Statistics*, vol.60, pp.209-17.

_____ 1982, 'The Cost of Capital and The Market Power of Firms: Reply and Correction', *Review of Economics and Statistics*, vol.64, pp.523-25.

Vasicek, O. 1973, 'A Note on Using Cross-Sectional Information in Bayesian Estimation of Security Betas', *Journal of Finance*, vol.26, pp.1233-39.

Welch, I. 2000, 'Views of Financial Economists on the Equity Premium and on Professional Controversies', working paper, University of California, Los Angeles.

WIAL, 1997, *Deed Relating to Airport Charges and Services from 1 July 1997 until 30 June 2002*.

_____, 2001, *Submission to the Commerce Commission (April 2001)*.

Wood, J. 1997, 'A Simple Model for Pricing Imputation Tax Credits under Australia's Dividend Imputation Tax System', *Pacific-Basin Finance Journal*, vol.5, pp.465-80.