

Telecom New Zealand Limited

The Cost of Capital to be Applied in Calculating the Total
Service Long Run Incremental Cost of Interconnect
Services

11 April 2003

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11 April 2003

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Attention: Mr A Szrich

Dear Sir,

TELECOM NEW ZEALAND LIMITED -
The Cost of Capital to be Applied in Calculating the Total Service Long Run
Incremental Cost of Interconnect Services

I Introduction

Background

1. We provide our opinion on the Weighted Average Cost of Capital (“WACC”) applicable to estimating Telecom New Zealand Limited’s (“Telecom”) Total Service Long Run Incremental Cost (“TSLRIC”) in respect of interconnection with Telecom’s fixed PSTN (“interconnect services”).

Approach

2. In assessing the WACC for interconnect services we have:
 - (a) described and compared current approaches to calculating WACC;
 - (b) calculated the WACC using PricewaterhouseCoopers’ (“PwC”) specification of the Capital Asset Pricing Model (“CAPM”);
 - (c) taken into account the New Zealand Commerce Commission’s (“the Commission”) previous reports and papers issued in relation to the determination of WACC;
 - (d) concluded on a WACC range appropriate for the interconnect services.

Sources of Information

3. In preparing this report we have used and relied on discussions with management of Telecom and the following sources of information:
 - (a) A report issued by the Commission entitled “Application of TSLRIC Pricing Methodology – Discussion Paper” (the “TSLRIC Discussion Paper”).
 - (b) The Commission’s Final Report “Part IV Inquiry into Airfield Activities at Auckland, Wellington and Christchurch Airports” (the “Airfield Decision”).
 - (c) The Commission’s report “Regulation of Electricity Lines Businesses, Targeted Control Regime, Implementation Details, Draft Decisions” and a supporting paper prepared by Associate Professor Martin Lally, “The Weighted Average Cost of Capital for Electricity Lines Businesses”, both documents dated 31 January 2003 (the “Draft ELB Decisions”).
 - (d) Bloomberg.
 - (e) Audited Annual Financial Statements of Telecom.
 - (f) Quarterly Financial Statements of Telecom.
 - (g) Discussions with Charles Rivers & Associates.
 - (h) Annual reports of comparable companies.
 - (i) Office of Telecommunications (“OFTEL”) Reports.
 - (j) Telecom Treasury reports.

Background Knowledge

4. WACC theory is a specialist technical subject. It is not the purpose of this report to provide a detailed discussion on the theory underpinning WACC and its components. In presenting our findings, we have assumed that readers of this report have a basic understanding of the theory underpinning WACC and how WACC and its components are derived.

Disclaimers

5. Our report has been prepared to assist Telecom in its submission to the Commission in relation to the WACC applicable to interconnect services.

6. We accept no responsibility to any other party other than Telecom to whom our report is addressed, and, except that the report can be submitted for consideration by the Commission, unless specifically stated to the contrary by us in writing it should not be copied to any third party without our prior, written permission. We accept no responsibility for any reliance that may be placed on our report should it be used for any purpose other than that stated above.
7. We reserve the right, but will be under no obligation, to revise or amend our report and the opinions contained therein if any additional information, which was in existence on the date of this report but was not brought to our attention in preparing our report, subsequently comes to light.

General Comments

8. The Commission is advocating a conventional and generally applied definition of WACC and a simplified Brennan-Lally specification for CAPM. This is consistent with the WACC specification and broadly consistent with the CAPM specification currently used by PwC and, in general terms, we support its application in these circumstances.
9. There are some areas where PwC's input parameters differ from those that might be used by the Commission. In this paper, we point out the main differences and provide support for the PwC position, with the key areas of potential difference likely to be the:
 - (a) term of the risk free rate (refer paragraphs 40 - 47);
 - (b) investor tax rate (refer paragraphs 56 - 61);
 - (c) asset beta (refer paragraphs 62 - 100); and
 - (d) tax adjusted market risk premium (refer paragraphs 101 - 109).
10. The main area where debate is likely to arise is in the determination of the asset beta. While the estimation of this parameter is to some extent judgmental, the objectivity of the process can be increased by using a large pool of data and rigorous analysis, which is what we have sought to do.
11. Our current WACC estimate for interconnect services differs from our 22 August 2002 report on the TSO WACC due to a market-wide change in the level of interest rates since the date of that report and to use of a more up-to-date beta estimate. As to be expected these inputs to the WACC can vary over time.

12. PwC has significant experience in determining WACC and estimating asset betas, and we have done this for hundreds of New Zealand businesses. Globally and in New Zealand PwC is the largest provider of business and share valuations. Central to this service is the requirement to calculate a WACC in relation to the entity being valued.
13. To support the determination of WACC, we have a technical advisory group (both globally and in New Zealand) which ensures that we are at the forefront internationally and domestically in the theory and practice behind WACC and are fully aware of all recent developments and trends.

Conclusion on WACC for Interconnect Services

14. Our analysis, which follows, supports a WACC estimate for the TSLRIC of interconnect services at the current time in the range of 10.4% to 11.1%, with a mid-point estimate of 10.8%.

II Model Specification

WACC Specification

15. WACC reflects the return required by both debt and equity investors, weighted by their respective contributions of capital. The conventional and generally applied definition of WACC is given as¹:

$$WACC = R_d (1 - T_c) \frac{D}{V} + R_e \frac{E}{V}$$

where:

- R_d = cost of debt, before taxes
- T_c = corporate tax rate
- D = market value of debt
- V = market value of the firm, $D + E$
- R_e = cost of equity
- E = market value of equity

16. Most of the inputs to the WACC calculation are observable in the capital markets. However, the cost of equity is not readily observable and requires estimation based on available information.

Cost of Debt

17. The cost of debt should be determined using the weighted average market yields for an appropriately geared business' outstanding debt plus issue costs. On some occasions, particularly where market yields for the business' debt cannot be observed, it may be appropriate to use a "short cut" method based on a benchmark market yield, such as a government stock rate (R_f), plus a borrowing margin (m) as follows:

$$R_d = R_f + m$$

Cost of Equity

18. Determining the cost of equity is an exercise in pricing risk. This requires an estimation of risk and its incorporation into a pricing model.

¹ This definition is consistent with the definition applied by the Commission in the Airfield Decision and the Draft ELB Decisions.

19. The cost of equity is the most widely debated and contentious component of WACC. This is largely due to the difficulties in using theoretical models to explain actual market behaviour.
20. The most commonly used model for estimating the cost of equity is the CAPM). Variations of the “classical” CAPM have been derived that allow for the effects of investor taxes, in particular, in the New Zealand context, for the effects of dividend imputation. The CAPM specification that most comprehensively allows for investor tax effects is the Brennan-Lally CAPM.
21. We note that the Commission sees value in maintaining a consistent approach to the specification of the CAPM across its decisions. Having regard to this objective, our discussion of the CAPM specification has regard to both the Commission’s TSLRIC Discussion Paper and its recent decisions on Airfields and ELBs (draft decisions).

Brennan-Lally CAPM Specification

22. The full definition (see for example Lally, 1992) of the Brennan-Lally CAPM is as follows:

$$R_e = D_j T_j + R_f (1 - T_l) + \beta_e [R_m - D_m T_m - R_f (1 - T_l)]$$

where:

- D_j is the cash dividend yield of (risky) firm j
- T_j is the weighted average over investors of $\frac{(t_{di}^j - t_{gi})}{(1 - t_{gi})}$ where t_{di}^j is investor i 's marginal tax rate on dividends from firm j and t_{gi} is investor i 's marginal tax rate on capital gains. The value of t_{di}^j takes account of the value to investors of the imputation credits distributed with firm j 's dividends
- R_f is the risk free rate of interest
- T_l is the weighted average over investors of $\frac{(t_i - t_{gi})}{(1 - t_{gi})}$ where t_i is investor i 's marginal tax rate on interest income
- β_e is the equity beta
- R_m is the expected return on the market
- D_m is the cash dividend yield on the market portfolio
- T_m is the weighted average over all assets (i.e. the market) of T_j

and hence the term $[R_m - D_m T_m - R_f(1 - T_l)]$ is the tax adjusted market risk premium (“TAMRP”).

Commerce Commission’s CAPM Specification

23. In the Airfields Decisions and Draft ELB Decisions the Commission has used a ‘simplified’ Brennan-Lally specification, being:

$$R_e = R_f(1 - t_i) + \beta_e TAMRP^*$$

24. For the sake of clarity the terms and definitions used are the same as in the preceding sub-section. Note that the definition of *TAMRP** differs slightly from *TAMRP* under the full Brennan-Lally CAPM due to ‘simplifying’ tax assumptions.
25. This CAPM specification is based upon a simplifying set of assumptions, essentially that:
- (a) dividends are effectively tax free to investors because they are assumed to be fully imputed and investors are able to fully utilise the attached imputation credits;
 - (b) the average investor in ‘the market’ faces a 33% marginal tax rate on interest income;
 - (c) capital gains are not taxed; and
 - (d) the tax rate, t_{int} (as defined in Appendix I of the Commission’s TSLRIC Discussion Paper, or defined as T_l in the Draft ELB Decisions) is thus 33%.
26. PwC does not believe that the above assumptions are reasonable. In particular:
- (a) the average individual share market investor is typically a wealthy individual, who is likely to be on the top marginal tax rate of 39%, this has the effect of raising the average investor’s marginal tax rate on interest above 33%;
 - (b) while New Zealand does not currently have a formal capital gains tax regime, we know that some investors are effectively taxed on realised capital gains (i.e. institutions actively managing New Zealand equity funds).
27. PwC also uses a simplified version of the Brennan-Lally CAPM, but based on a subtly different set of assumptions, as discussed below.

PricewaterhouseCoopers New Zealand CAPM Specification

28. If it can be assumed that dividends give rise to no further taxes at the investor level (relative to capital gains), then the Brennan-Lally model can be simplified by dropping the $D_j T_j$ term. Our analysis of the New Zealand market shows that where dividends carry full imputation credits there is, on average, no further taxes at the investor level (relative to capital gains) upon payment of a dividend. (i.e. the tax impost arising in the investors' hands upon receipt of a cash dividend, vis-à-vis receiving a capital gain, is offset by the imputation credits attaching to that dividend)². This is therefore the standard assumption made by PricewaterhouseCoopers in its cost of capital work in New Zealand, which leads to the following 'simplified' specification of the Brennan-Lally CAPM:

$$R_e = R_f(1 - T_l) + \beta_e [R_m - D_m T_m - R_f(1 - T_l)]$$

29. Note that this specification of the CAPM is subtly different from the simplified Brennan-Lally model proposed in the Commission's TSLRIC Discussion Paper and by Dr Lally in the Draft ELB Decisions. In Dr Lally's paper supporting the Draft ELB Decisions the T_l term, as applied against the risk free rate in the CAPM, is equivalent to the term t_i , as defined above, under the Brennan-Lally CAPM Specification. It can be seen that $t_i = T_l$ only if $t_{gi} = 0$, i.e. if investors are not subject to tax on capital gains. For the reasons discussed below we do not consider this to be a valid or reasonable assumption.
30. The CAPM model being used is a domestic model. While it is debatable whether the domestic market should be defined as comprising all investors in the domestic market or only those investors in the domestic market who are also New Zealand residents for tax purposes, one class of investor that falls into either definition and that is subject to tax on share market capital gains is New Zealand domestic institutions (e.g. superannuation funds and unit trusts). Recognition of the presence of this class of investor leads to the conclusion that $t_i \neq T_l$. This is the position of PricewaterhouseCoopers and is a conclusion also reached in Lally and Marsden (2002).
31. We discuss estimation of the T_l parameter in Section III that follows.

² Note that this assumption is based on PwC's analysis of the mix of investors in the market and their tax status, which results in the assumed value of imputation credits (U , as defined in Appendix I of the Commission's TSLRIC Discussion Paper) being less than their face value. However, PwC's estimated value of T_l is such that the estimated value of T_j is close to zero. While the resulting conclusion that fully imputed dividends are effectively "tax free" is the same as that reached in the Commission's TSLRIC Discussion Paper's simplified Brennan-Lally CAPM there are subtle, but potentially significant, differences in the estimated values of T_l and $TAMP$.

Officer CAPM Specification

32. We note that the Officer specification of the CAPM is commonly used in the Australian market. It can be shown that the Officer model is in fact a special case of the Brennan-Lally model, where T_I is assumed to be zero (which may be a more realistic assumption in the Australian market, because of the presence of a formal capital gains tax regime). To date the Commission has not used this specification of the CAPM in any of its decisions, so we limit our comments on it to two points (and do not provide a full definition and discussion of that model).
33. The Officer model makes only a partial allowance for the effects of personal taxes. A key attribute of the Officer model is that a firm's cost of capital can be reduced by increasing the distribution of its imputation credits. This is because the Officer model places value on distributed imputation credits. However, unlike the Brennan-Lally model, the Officer model does not recognise the tax impost that arises at the investor level upon payment of the attached cash dividend. In our view these two effects offset each other in the New Zealand market, yet the Officer model implies that dividend policy can have a material impact on the WACC.
34. The supposed difficulty in estimating T_I is a reason sometimes put forward by advocates of the Officer model for use of that model over the Brennan-Lally model. However, this argument does not withstand close scrutiny. The reason is that application of the Officer model requires estimation of a "gamma" parameter, γ , to reflect the "value" of imputation credits. And whatever process is used to estimate this parameter (there are least two in common use³), the same underlying data and assumptions can be used to provide an estimate of T_I for use in the Brennan-Lally model.

³ Gamma (γ) estimates are typically derived by examining the "drop-off" behaviour of share prices at dividend payment dates, specifically for dividends carrying imputation credits. The same underlying data set can also be used to examine the drop-off behaviour of dividends that do not carry imputation credits – to provide a direct estimate of T_I . Alternatively γ may be estimated by analysing the mix of investors in the market and their assumed tax status. Under this second approach the data/assumptions are also available to make an estimate of T_I .

III Input Parameters

35. Set out below is a summary of inputs to the PwC NZ CAPM specification used to calculate the WACC to be applied in calculating the cost of interconnect services:

$$WACC = R_d(1 - T_c) \frac{D}{V} + R_e \frac{E}{V}$$

		Paragraphs
R_d cost of debt, before taxes	8.2%	38 – 39
T_c corporate tax rate	33%	48 – 49
D market value of debt	30%	53 - 55
V market value of the firm, $D + E$	100%	
R_e	12.5% - 13.6%	
E market value of equity	70%	53 - 55

$$R_e = R_f(1 - T_I) + \beta_e TAMRP$$

R_f risk free rate	6.2%	40 - 47
T_I investors' effective tax rate	28%	56 - 61
β_e equity beta	1.07 – 1.21	62 - 100

$$\beta_e = \beta_a \left(1 + \frac{D}{E} \right)$$

β_a asset beta	0.75 – 0.85	62 – 100
$TAMRP$ tax adjusted market risk premium	7.5%	101 – 109

36. Using a single WACC to be applied to future cash flows necessitates having to determine the Company's long-term target leverage ratio, and then assuming that it remains constant. Accordingly, we have assessed the WACC on the basis that leverage will be at a level typical for a business in this industry. We note that, under a dividend imputation tax regime, WACC is not particularly sensitive in any event to different debt/equity assumptions, within reasonable commercial bounds.
37. On the basis of the above inputs, we calculate the post tax nominal WACC for the interconnect services to fall in a range of 10.4% to 11.1%, with a mid-point estimate of 10.8%.

Pre Tax Cost of Debt (R_d)

38. We have based R_d on the risk free rate (R_f) plus a borrowing margin (m) calculated as follows:

$$R_d = R_f + m$$

$$\begin{aligned} &= 6.2\% + 2.0\% \\ &= 8.2\% \end{aligned}$$

39. Our estimates for R_f and m are set out below.

Risk Free Rate (R_f)

40. Government stock rates are generally accepted as an appropriate source of the risk free rate to be incorporated into the cost of capital. The key issue is the term or maturity of the government stock to be used.
41. The TSLRIC Discussion Paper considered three approaches:
- (a) Lifetime of the assets used to provide the regulated service.
 - (b) Duration of the Commission's determination.
 - (c) Bond rate used to estimate the market risk premium.
42. PwC favours the first approach, the lifetime of the asset used to provide the service. We consider that the maturity of the risk free asset selected should reflect the duration of the cash flows to be earned from the assets required to provide the interconnect services on the grounds that the estimation of forward looking costs required under the regulatory regime is of costs over the long run. Estimation of these costs is based on the life cycle of the assets, rather than the arbitrary length of the regulatory period. The regulatory regime is forward looking, it is not based on a rate of return regime that protects the value of initial investment. Furthermore, the regime provides Telecom's competitors with a right, but no obligation, to use its interconnect services. From the perspective of Telecom's providers of debt and equity funding an investment in long term assets of the type required to provide the services would be expected to provide a return commensurate with long term interest rates – the investment decision would not be based on short term interest rates, or the outlook for these rates.

43. The fact that the users of interconnect services priced on the basis of TSLRIC may contract to use the assets for periods much shorter than the life of the assets (and at their option) is not, in our view, a relevant factor in determining the appropriate maturity of the risk free asset. Indeed the short term "optionality" that users and prospective users of the designated services enjoy imposes additional, asymmetric costs on the service provider, but which are beyond the scope of our WACC estimate.
44. We are aware that in the Airfield Decision and the Draft ELB Decisions the Commission favoured the use of a maturity period equivalent to the regulatory period. However, the nature of the interconnect services regulatory regime is forward looking and the requirement to periodically estimate the TSLRIC of interconnect services should be based on long run costs at the time. In our view this means that the approach used in the Airfields Decision and the Draft ELB Decisions is not applicable to estimating the WACC for interconnect services. Furthermore, we note that evidence given by other experts who addressed this point in their submissions on the Draft ELB Decisions was in favour of using a risk free rate matching the life of the assets used to provide the service, with a ten year bond viewed as a reasonable proxy (see, for example, the evidence of Professors Bowman, NECG, and Professor van Zijl, LECG).
45. We set out below the yields for the various maturities of government stock on issue as at 31 March 2003 and the average yield for each of these maturities over the preceding six months:

Maturity	Coupon %	Semi-annual Yield ⁴ as at 31 March 2002 %	Semi-annual Yield 6 Month Average %
15-Apr-04	8.00	5.391	5.584
15-Feb-05	6.50	5.369	5.631
15-Feb-06	6.50	5.452	5.719
15-Nov-06	8.00	5.473	5.763
15-Jul-09	7.00	5.781	6.003
15-Nov-11	6.00	5.923	6.084
15-Nov-13	6.50	5.971	6.121

⁴ It is noted that New Zealand government bond yields are by convention quoted on a semi-annual yield basis and that the yields in this table therefore need to be converted to annual yields for WACC estimation purposes, using the following formula:

$$\text{Annual Yield} = \left(1 + \frac{\text{Semi-annual yield}}{2} \right)^2 - 1$$

46. We understand that the life of the assets used to provide the interconnect services is typically in excess of the longest maturity bond in the above table (which has a maturity of approximately 10½ years). Given the difficulties in trying to extrapolate⁵ risk free yields beyond the maturity of the longest maturity of actively traded government bonds, we consider that the best approach is to use the yield on the longest maturity, actively traded bond – in this case the 15 November 2013 bond.
47. We note that the Commission adopted a methodology of calculation based on averaging bond rates for the previous six months in the Airfields Decision. Based on the average yield for the 2013 government bond over the last six months to 31 March 2003, we estimate an appropriate long term risk free rate, after converting to an annualized yield, as being 6.214%, say, 6.2%. Consequently we have selected a risk free rate input to our WACC calculations of 6.2%, although we consider that averaging over other time periods would also be acceptable.

Corporate Tax Rate (T_c)

48. PwC recommends use of the statutory 33% corporate tax rate in the WACC calculation.
49. In addition, notional cash tax payable should be allowed for when estimating the TSLRIC of interconnect services (e.g. in any tilted annuity-type calculations). It is noted that the notional tax depreciation shield may not necessarily match, over time, the asset depreciation implicit in any tilted annuity.

Debt Margin (m)

50. For the purpose of our August 2002 estimate of the TSO WACC, Telecom analysed its overall weighted average debt margin (including all facility fees) over ten year New Zealand Government Stock. At that time this provided a debt margin estimate of 203 basis points over ten year New Zealand Government Stock.
51. Telecom has updated its debt margin analysis and advises that at the beginning of April 2003 its weighted average debt margin, including amortised underwriting fees / costs and swap margins, was 204 basis points over ten year New Zealand Government Stock. For the purpose of our WACC estimate we have used a debt margin estimate of, say, 200 basis points or 2.0%.
52. We note that increasing or decreasing the debt margin by 25 basis points will result in a change in the WACC of only ± 5 basis points.

⁵ Our approach is conservative since extrapolation of the current upward sloping yield curve would likely lead to a higher risk free rate estimate.

Market Value of Debt (D) and Equity (E)

53. We note that under an imputation tax system (as modeled using the simplified Brennan-Lally CAPM), the WACC is not particularly sensitive to the gearing assumption that is used. Under these circumstances, and assuming Telecom's gearing can be considered to be at roughly an efficient level (and also equivalent to the gearing in the provision of interconnect services), then the gearing ratio should be calculated at Telecom's market value of debt, divided by Telecom's market value.
54. However, in assessing financial leverage or gearing (i.e. D/V and E/V in the WACC formula) we have also made reference to the observed leverage of other telecommunication companies. We summarise at Appendix A the leverage of publicly traded integrated telecommunications companies based on their latest reported financial year and also based on a five year average⁶. We note that the simple average and median of the current D:E ratio are respectively 35%:65% and 34%:66% and the simple average and median of the five year average D:E ratio are both 26%:74%. This compares to Telecom's current D:E ratio of 37%:63% and five year average D:E ratio of 28%:72%.
55. After considering the above, we have assessed a reasonable D:E ratio to be 30:70. As noted the WACC is not materially sensitive to small changes in the D:E ratio.

Investors' Effective Tax Rate (T_I)

56. T_I is the weighted average tax rate of investors, taking into account different investor groups in the New Zealand equity market⁷ and their respective marginal tax rates on dividends and interest income vis-à-vis capital gains.
57. T_I is calculated using the formula set out above, under the sub-heading Brennan-Lally CAPM Specification. Based on PwC research our weighted average T_I estimate, over the market, is currently 28%.
58. The Commission's Airfields Decision and Draft ELB Decisions use an estimate for T_I , being Dr Lally's assumption of the marginal personal income tax rate on interest (i.e. t_i as defined above, under the sub-heading Brennan-Lally CAPM Specification) for the an assumed 'median' taxpayer, being a rate of 33%. However, because some investors are subject to capital gains tax in New Zealand, T_I is not equal to a personal income tax rate on interest income. This fact should be recognised in estimating T_I .

⁶ Where less than five years' data was available the average gearing covers the period for which data was obtained.

⁷ Refer to Appendix B for a discussion of the appropriate definition of 'the market' for the purpose of estimating CAPM parameters.

59. In particular it is noted that:
- (a) Lally and Marsden (2002) estimate that T_I (as defined comprehensively) has a value of 0.28 in 2000.
 - (b) PricewaterhouseCoopers also estimates that T_I has a current value of 0.28.
 - (c) Dr Lally notes in the Draft ELB Decisions that Transpower currently uses a T_I estimate of 0.20.
 - (d) We are aware that in New Zealand different practitioners appear to be using T_I values of 0.20, 0.28 and 0.33. A simple average of these three estimates is 0.27.
60. We therefore suggest that a T_I value of 0.28 accords with current best practice in New Zealand.
61. While the difference in T_I estimates (0.28 versus 0.33) could be dismissed as ‘trivial’ or derived on the basis of ‘simplifying’ assumptions, this type of ‘rounding down’ is unwarranted.

Equity Beta (β_e)

Approach to Beta Assessment

62. The beta input required for the CAPM is an equity beta. Equity betas reflect the "riskiness" of shareholder returns that arises as a result of fixed debt servicing commitments (i.e. the effects of financial leverage or gearing) and the underlying riskiness of the firm's assets. The latter is measured as an asset beta (β_a). Only equity betas are "observed" in the market place, through statistical analysis of share price behaviour for companies whose shares are actively traded. The conventional calculation of an equity beta is simply a linear regression of company returns against market returns, with the slope of the regression line determining the equity beta.
63. Since financial leverage varies between companies, the preferred, and indeed conventional, approach to estimating the equity beta for the firm being valued is as follows:
- (a) Obtain equity beta estimates for a sample of listed companies that are considered comparable to the company being evaluated ("compcos");
 - (b) Obtain financial leverage details for the compcos;
 - (c) "De-lever" the compco equity betas to arrive at asset beta estimates for the compcos (the formula for doing this is discussed below). This step removes the influence on beta arising from variations in compco financial leverage;

- (d) Having regard to the compco asset betas, make an assessment of the asset beta appropriate for the company being evaluated; and
 - (e) “Re-lever” the assessed asset beta for the level of gearing being assumed for the company being evaluated, to arrive at an assessed equity beta for that company (the formula used is generally the reverse of that applied in the “de-levering” process).
64. For the purpose of assessing an equity beta for the WACC for interconnect services the above process can be applied to:
- (a) analysis of Telecom’s own asset beta;
 - (b) analysis of other listed telecommunications companies’ betas (which are all overseas); and
 - (c) analysis of the betas of any New Zealand listed companies that might be considered to have broadly comparable risk characteristics as the provision of interconnect services.
65. In practice, particularly given the lack of depth in New Zealand capital markets, it is often worthwhile considering data from all three sources. In this estimation of the WACC for interconnect services, we have undertaken (a) and (b) above, as well as considering betas allowed in other regulatory regimes. We have not identified any other industry with similar risk characteristics in the New Zealand market. We do not consider including any betas from (c) above would enable a better estimation of the WACC for interconnect services.
66. We also consider the need, and ability, to adjust the asset betas of Telecom and overseas integrated telecommunications companies for elements of these businesses that are not related to the provision of interconnect services.

Beta Measurement Issues

67. Betas do not remain constant over time, for example, business risk may change. Further, the observed beta is only a sample of the "true" underlying beta. For these reasons any historical measure of beta must always be treated with caution in assessing the expected cost of capital in the future.

68. The choice of measurement interval and the period covered will affect the measurement of historical beta. Too short a measurement interval can cause beta estimation error as a result of thin and non-synchronous trading. Too long a measurement interval then requires a long overall measurement period, which may introduce beta estimation error if the firm's business risk profile has changed over the measurement period (which is more likely the longer the measurement period is). On the other hand using a short measurement period may increase the influence of any idiosyncratic factors that might have affected a firm's share price. It is common practice to use a monthly measurement interval, with 60 observations (i.e. a five year measurement period). This is PwC's preferred beta measurement interval and period.
69. The CAPM model being applied is a domestic model, hence we note that all betas being analysed should be measured as against a domestic share price index for the country in which each compco is domiciled.

Degearing Betas

70. Equity betas used in the CAPM for a specific company or project are normally derived from an assessed asset beta (β_a), having regard to the gearing of the particular company or project. Asset betas reflect the contribution to portfolio risk of the investment, independent of financing, i.e. the riskiness of the business itself. Equity betas incorporate the effects of financial risk as well as operating risk. Since only equity betas are directly observable in the market this data is first collected, then the effects of company specific gearing are removed to arrive at the appropriate asset beta sample for the company or project being analysed using the following formula:

$$\beta_e = \beta_a \left(1 + \frac{D}{E} \right)$$

71. The above formula does not include any tax shield term, this can be justified on the basis of one of two assumptions:
- (a) There is no relative tax benefit arising from the use of debt financing in the firm's capital structure (as is the case under an imputation system, but even under a "classical" tax system the effective tax shield on debt may be much lower than implied by the statutory corporate tax rate⁸); or
 - (b) The firm's future debt servicing schedule is uncertain⁹ (i.e. although we may assume a certain future leverage ratio, since the evolution of future firm value

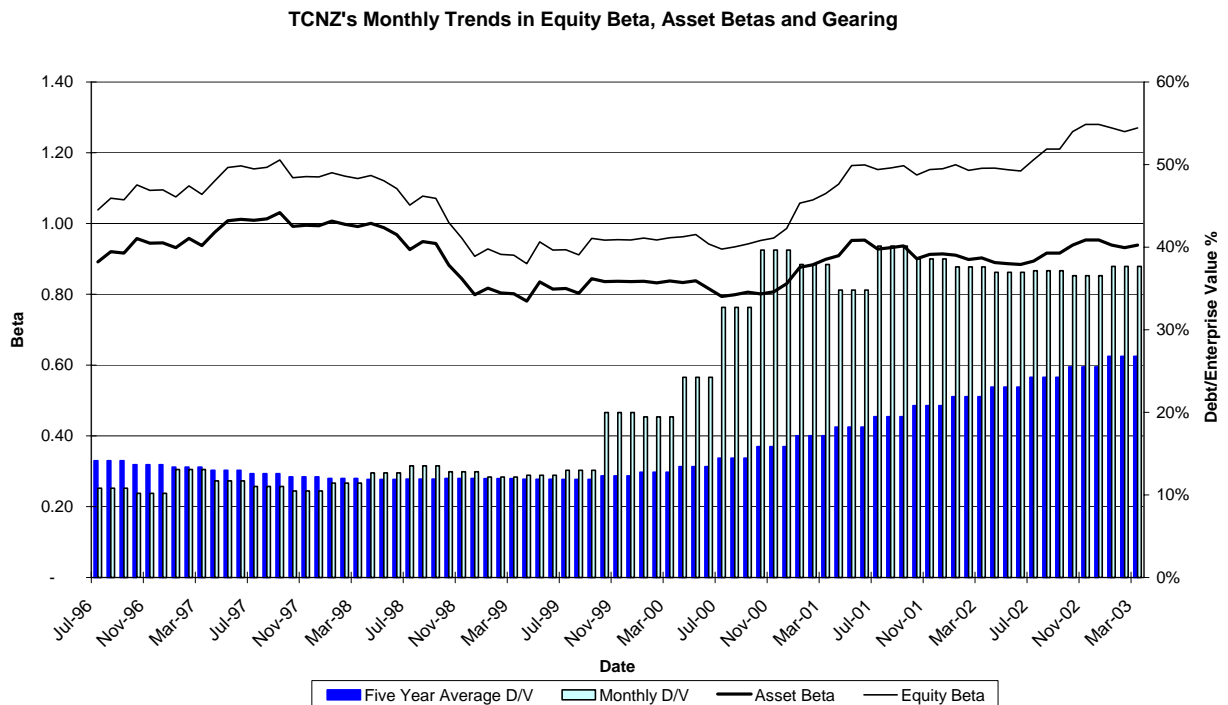
⁸ Refer Graham (2000), who estimates that after allowing for features of the corporate tax environment and personal tax effects the effective tax shield on debt in the US is only about 1/3rd of the statutory corporate tax rate.

⁹ See, for example, Harris and Pringle (1985).

is unknown it follows that the future dollar amounts of debt servicing are unknown).

Telecom New Zealand's Beta

- 72. As a starting point we have calculated for each month a rolling average equity beta for Telecom using a sliding window of five years' monthly returns, from when it first listed in July 1991. We have also calculated for each month a rolling average asset beta by degearing the calculated equity beta using Telecom's average gearing over the same sliding five year period.
- 73. The results of our analysis are illustrated in the graph below:



- 74. We note that between July 1996 and March 2003 Telecom's five year monthly based equity beta has varied between 0.89 and 1.28 with an average of 1.08.
- 75. The average D:E ratio for Telecom for the most recent five year period is approximately 28:72 although the current D:E ratio is approximately 37:63.
- 76. Telecom's asset beta, degeared using the average D/E ratio over the five year period the equity beta has been estimated, has varied in the range 0.78 to 1.03 with an average of 0.90. This is readily confirmed by viewing the chart above; Telecom's 'five year' asset beta has generally fluctuated within the gridlines 0.80 and 1.00 over the entire period since listing.

77. In our experience, observed equity betas are subject to significant variation depending, for example, on the day of the week or month that they are calculated. PwC's most recent Cost of Capital report quotes an equity beta for Telecom of 1.13 as at 31 December 2002. This represents an average of the five year monthly equity betas calculated on different days of the month for Telecom using data collected in December 2002. Whilst the average is 1.13, the equity betas measured on different days of the month range from 0.94 to 1.28 (coincidentally a similar range for Telecom's rolling five year monthly based equity beta as referred to above).
78. As at 28 February 2003 the Bloomberg five year, monthly based equity beta estimate for Telecom was 1.26. The difference between this estimate and the PwC 31 December 2002 estimate appears to be due to the following:
- (a) Use of a slightly different five year period;
 - (b) Use of a slightly different market index (Bloomberg uses the NZSE 40, PwC uses the NZSE Capital); and
 - (c) Bloomberg's use of a single day of the month versus PwC's averaging procedure.
79. To be conservative we have used the lower equity beta of 1.13 in all of the calculations in this report.
80. Using a current Telecom five year, monthly based equity beta estimate of 1.13 and our analysis of Telecom's average gearing over the last five years we have derived an asset beta for Telecom of 0.82; by degearing the equity beta using the average gearing of 28:72 for the last five years. Given Telecom's size relative to the NZSE40, it is noted that Telecom's equity beta may be biased.

Beta's of Comparable Integrated Telecommunications Service Providers

81. In addition to direct observation of Telecom's beta, we have also calculated the asset betas, using five year average gearing, for a range of integrated telecommunication service providers. These companies were selected on the basis of:
- (a) Their provision of interconnect services, as part of integrated service provision;
 - (b) Medium to large market capitalisation (generally at least as large as Telecom's); and
 - (c) Data availability via Bloomberg.
82. We summarise the results of our analysis below and more details of the companies included in our sample are set out at Appendix A:

Integrated Telecommunication Companies	Simple Average	Median
Equity beta, monthly returns last five years	1.12	1.10
Five year average D:E	26%:74%	26%:74%
Asset beta based on five year average gearing	0.81	0.79

83. The comparable companies equity betas vary significantly within the range 0.39 to 1.79. There is also a significant difference between the current gearing levels of these companies and the average gearing over the five year period in which the equity betas have been calculated. It is our view that, due to the volatility of share prices and therefore of market value, the five year average gearing is the more appropriate level of gearing to apply to degearing the equity betas. Applying the companies' five year average gearing to degearing the calculated equity betas results in an asset beta range of 0.35 to 1.34. The simple average (i.e. mean) and median assets betas are 0.81 and 0.79 respectively.
84. Technically, it can be argued that asset betas derived for companies in other markets might need to be adjusted for differing leverage between markets. However, in order to make an accurate adjustment, we consider that the market leverage needs to be considered over the period that the beta has been estimated, in this instance five years. For the purposes of this exercise we have not undertaken this work because we do not consider that it would have a material impact on our assessment of an appropriate asset beta for the interconnect services WACC.
85. Asset betas for other companies from other markets are likely to reflect the effect on systematic risk of the regulatory regimes in those markets. We do not consider it practicable to make any explicit adjustments for this. However, we note that if any adjustment is required it would most likely be to increase the betas for any companies that are regulated on a rate of return basis (rather than on a forward looking basis).

Adjustments to Telecom and Compcos Betas

86. The asset betas of Telecom and overseas compcos are affected by the risk associated with non-interconnect service lines of business, such as internet, directory, international and wireless. Since the provision of interconnect services excludes these other services the asset betas of Telecom and overseas compcos should, in theory, be "deconsolidated" to reflect an accurate beta for only interconnect services¹⁰.

¹⁰ The same issue arise in the case of estimating the TSO asset beta, but the same difficulties also arise in trying to estimate the magnitude of any adjustment that might be required (if any).

87. There is no current acceptable method for deconsolidating a beta. Theoretical techniques include adjustments based on the relative earnings, turnover, contributions and relative accounting book values. However, these methods are difficult to apply in practice and are not well proven empirically.
88. Furthermore, the telecommunications industry is subject to rapid technological and market change. This makes it highly likely that the asset betas for non-traditional lines of business, in particular, will vary with time, making it problematic to try and disaggregate line of business asset betas for integrated telecommunications companies. For example, the wireless business has gone from being a high risk entrepreneurial activity to now being a more stable line of business, which may already or in the near future have a lower systematic risk (i.e. lower asset beta) than the traditional wireline businesses. The latter is under threat from new technologies and, with high operating leverage exacerbated by any decline in volumes, may in fact face increased systematic risk in the future.
89. Moreover, for the purpose of our initial WACC estimation for interconnect services, we have assumed that the impact of the income streams from these businesses on Telecom’s interconnect services beta would not be material as its internet, directory, international and wireless businesses represented less than one quarter of Telecom’s EBIT¹¹ contribution for the year ended 30 June 2002.

Betas Applied by Regulators

90. Research on the range of asset betas applied by regulators in Australia, the United States, and United Kingdom, to USO and interconnection cost calculations is summarised in the table below:

Asset Betas	Low	Average	High
Australia ¹ (1999)	0.55	0.64	0.80
United States (1997 – 2000)	0.64	0.70	
United Kingdom (2001)		0.83	

Note (1): Excludes one estimate derived using unusually high D/E ratio

91. In Australia, the Australian Competition and Consumer Commission (“ACCC”) determines an appropriate WACC for Telstra’s Public Switched Telephone Network (“PTSN”) charges or interconnection costs. In a 1999 study the ACCC concluded that the asset beta for Telstra’s PTSN lay in the range 0.55 to 0.73. Their conclusion was based on consideration of the betas applied by regulators in the UK and Canada and the US RBOCs.

¹¹ Earnings Before Interest and Tax (measured before Corporate, Eliminations and Abnormal Items).

92. In 2000, the ACCC concluded an asset beta of 0.50 for the PTSN. It appears that the ACCC 2000 estimate has been heavily influenced by an asset beta estimate of 0.41 published by the Independent Pricing and Regulatory Tribunal of New South Wales (“IPART”). The IPART estimate uses a gearing assumption of 41%:59% based on an equity beta of 0.7. Degearing this equity beta using instead Telstra’s five year average D:E ratio of 9%:91% produces an asset beta of 0.64 which is similar to the mid point of the range derived in the 1999 study.
93. In the United States, State regulators have adopted asset betas of between 0.64 and 0.70 in UNE and USF decisions between 1997 and 2000.
94. In the United Kingdom, the telecommunications regulator, the Office of Telecommunications (“OFTEL”) uses betas for British Telecom plc (“BT”) derived by the London Business School Risk Measurement Service (“LBS”). In its report, “Proposals for Network Charge and Retail Price Controls from 2001”, dated February 2001, OFTEL applied an equity beta of 0.95 or an asset beta of 0.83 to calculate an appropriate WACC for BT’s regulated activities. We note that whilst in the past OFTEL had reduce BT’s equity beta by 0.10 to calculate the WACC for BT’s regulated activities, it has now decided that there is no justification for this deduction.
95. We note that the beta assumptions made by regulators are not market evidence per se, but merely represent some views on the interpretation of market evidence.

Betas for Other Regulated Utilities

96. Our view is that using listed utilities (primarily electricity line businesses) in New Zealand as benchmarks for the appropriate equity betas should be considered as having only minor applicability to the WACC for interconnect services. We see significant differences in the utilities business to interconnect services as being:
 - (a) Interconnect services are likely to have a greater exposure to the New Zealand economy than the utilities as the use of electricity is less discretionary than for telecommunications services.
 - (b) The telecommunication network is more susceptible to competition than utilities as evidenced by the growth of parallel telecommunication networks versus no parallel electricity networks. Utilities operate in a more monopolistic environment than Telecom.
 - (c) Voice and data transmission have greater growth prospects than electricity transmission.
 - (d) Telecommunications assets are subject to much greater expected rates of technological change (and hence obsolescence) than assets employed in sectors such as electricity and gas distribution.

97. Given these differences, we would be surprised if the asset beta for interconnect services was not significantly greater than that of a utility.
98. Furthermore, we are aware of beta estimation problems with the small number of utilities that are listed in New Zealand, making use of any such data questionable.

Conclusion on Beta

99. In summary:
- (a) Telecom, since listing, has had an average β_e of 1.08 and β_a of 0.90.
 - (b) Based on data for the last five years Telecom has a β_e of 1.13 and β_a of 0.82.
 - (c) Comparable overseas telecommunications companies have five year β_a of:
 - (i) Simple average of 0.81;
 - (ii) Median of 0.79.
 - (d) Regulators in Australia, US and UK have adopted β_a of between 0.55 and 0.83 (the most relevant one, in our opinion, being in the UK which is the most recent and where, no “arbitrary” downward adjustment by the regulator was deemed to be appropriate)¹².
100. On the basis of all the above, we have selected β_a range of 0.75 to 0.85 with a point estimate of 0.80.

Market Risk Premium $[R_m - D_m T_m - R_f(1 - T_f)]$

101. PwC has undertaken extensive research into New Zealand share market returns and estimated a Brennan-Lally TAMRP using data since 1925. In March 2000, we published a document which provided our then revised TAMRP of 8% (which represented a decline from 9% previously estimated by PwC). PwC used an 8% TAMRP estimate in its cost of capital analysis from that time until mid-2002, when we further updated our analysis and revised our TAMRP estimate to 7.5%.
102. PwC considers that a range of methodologies and data from a range of markets can usefully be analysed in assessing a TAMRP appropriate for the New Zealand market. However, in the absence of any compelling evidence to the contrary, we place most weight on the historical TAMRP realised in the New Zealand market for as long a time period as data is available.

¹² As noted the beta assumptions made by regulators are not market evidence per se, but merely represent some views on the interpretation of market evidence.

103. It is noted that the Commission's simplified Brennan-Lally CAPM differs slightly from the specification used by PwC in New Zealand. This means that PwC's historical TAMRP estimate would need to be adjusted upwards, by approximately 0.5%, before it could be used in the Commission's simplified Brennan-Lally CAPM specification¹³. Such an adjustment is required to re-state tax adjusted historical New Zealand market returns in a manner consistent with the Commission's 'simplified' Brennan-Lally CAPM specification.
104. The TSLRIC Discussion Paper (paragraphs 275-276) suggests a methodology for converting a standard MRP to a simplified Brennan-Lally TAMRP. It is noted that if the Brennan-Lally model is to be used an implicit assumption is that investors are concerned with after tax returns. The proposed approach ignores the historical impact of changes in investor tax parameters on post tax market returns¹⁴. Further, there is no reason to think that investor tax rates/parameters historically faced by investors in other markets (from which standard CAPM MRPs might be sourced) are the same as those currently faced by investors in the NZ market. Accordingly, the proposed basis for converting a standard MRP to a TAMRP should be treated with some caution.
105. In its recent Airfields Decision, the Commission, relying on analysis by Dr Lally, selected a point estimate for the TAMRP of 8.0% (i.e. 0.080). Parties with an interest in the decision submitted TAMRP estimates in the range 8.0% to 9.0%, while Dr Lally concluded a plausible band for the TAMRP was 7.0% to 9.0%¹⁵, with a point estimate of 8.0%. In the more recent Draft ELB Decisions Dr Lally, in advising the Commission on WACC matters, had revised his TAMRP estimate to a range of 6.0% to 8.0%, with a point estimate of 7.0%.
106. While, expectations of the future TAMRP may have declined between the time of the Airfield hearings and the ELB analysis, the change in Dr Lally's view on the expected TAMRP in New Zealand (from a range of 7.0% to 9.0% to a range of 6.0% to 8.0%) is not, to the best of our knowledge, supported by the general view of other experts and practitioners. In particular, (and apart from Dr Lally's current preference for a 7.0% point estimate) we are not aware of any experts advocating Brennan-Lally TAMRP estimates in the range 6.0% to 7.0%.

¹³ It is also noted that the PwC historical TAMRP estimate is based on excess returns over short term government bonds (generally one year, subject to data availability). Using longer term bonds instead of one year bonds results in a slightly different estimate of the historical realised market risk premium in New Zealand. However, we advise the Commission that the difference is insignificant and use of, for example, five year bonds does not result in any change to our rounded market risk premium estimate of 7.5%.

¹⁴ Lally (1997) p. 47 notes a problem with the approach proposed here is that tax changes over time impart less intertemporal stability to MRP than TAMRP and therefore more bias to a direct estimate of MRP than TAMRP.

¹⁵ The Cost of Capital for the Airfield Activities of New Zealand's International Airports, Martin Lally, November 2001, page 481.

107. As part of the ELB hearings we critiqued Dr Lally's TAMRP analysis and we attach our analysis as Appendix B. We note that Dr Lally's current advice to the Commission on the TAMRP appears to be anchored to a simple average of six different MRP estimation methods and data sources. Two of these six estimates use research results from Lally and Marsden (2002). As discussed in Appendix B, it is our view that the Lally and Marsden (2002) TAMRP estimates are biased downward because of flawed assumptions about the historical tax rates facing individual investors in the New Zealand share market.
108. We note that evidence given by other experts in their submissions on the Draft ELB Decisions was in favour of using tax adjusted market risk premium point estimates in the range 8.0% to 10.5% (Professor Bowman, NECG, advocated 7.5% to 10.5%, point estimate 9.0%; Professor Emanuel advocated 7.5% to 8.5%, point estimate 8.0%; and Professor van Zijl, LECG, advocated 8.0% to 9.0% , point estimate 9.0%).
109. It is PwC's opinion that the tax adjusted market risk premium should be set at point estimate of 7.5% for use in the PwC New Zealand specification of the 'simplified' Brennan-Lally CAPM. In light of the position of other experts in the field our position is in fact seen to be conservative.

IV Summary and Conclusion

110. We have calculated the WACC to be applied in assessing the TSLRIC of interconnect services using the PwC New Zealand specification of the ‘simplified’ Brennan-Lally CAPM. We have also calculated the WACC using CAPM specification adopted by the Commission in the Airfield Decision and the Draft ELB Decisions.

PricewaterhouseCoopers New Zealand CAPM Model

111. The PwC Model indicates a post tax nominal WACC for interconnect services lies in the range 10.4% to 11.1%, with a point estimate of 10.8%.

Commerce Commission CAPM Model

112. The principal differences in our calculation of WACC and the calculation of WACC in the Airfield Decision and Draft ELB Decisions is that PwC uses a PTRMP of 7.5% and T_I of 28% whilst the Commission uses a TAMRP of 8.0% (Airfields), and more recently has contemplated using 7.0% (ELBs), and a T_I of 33%.

113. Accepting all other inputs, the Commission’s calculation of the WACC adjusted for these two parameters would be in a range of 10.6% to 11.4% with a point estimate of 11.0% (8.0% TAMRP) or in a range of 9.8% to 10.5% with a point estimate of 10.2% (7.0% TAMRP).

Cash Flows

114. In deriving cash flows, appropriate allowance must be made for the tax and inflation assumptions implicit in the CAPM specification applied.

115. The Brennan-Lally and PwC specifications assume that all dividends are either fully imputed or subject to dividend withholding payments.

Adjustments to the WACC

116. The WACC we have estimated in this report is applicable to determining a required rate of return on assets employed to provide interconnect services, before allowing for the asymmetric risks created by the nature of the regulatory environment. Such risks may be significant and we note that an upward adjustment will need to be made to our WACC estimate for these. The detailed reasoning for and estimation of such an adjustment is beyond the scope of our engagement. We understand that you have engaged Charles River Associates to advise you on these matters.

Conclusion

117. After considering the above, we believe an appropriate WACC to be applied in determining the TSLRIC of interconnect services lies in the range 10.4% to 11.1%. For the purpose of a point estimate, we recommend the mid-point of our range, being 10.8%. This point estimate reflects an asset beta of 0.80 and is based on the inputs set out at paragraph 35 above. This WACC range and point estimate are subject to upward adjustment for asymmetric-type risks as noted in the preceding paragraph.

118. We will be happy to discuss this with you.

Yours faithfully
PricewaterhouseCoopers



MICHAEL SCHUBERT
Partner



JOHN REDMAYNE
Director

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Appendix A

Gearing and Beta Data – Integrated Telecommunications Service Providers

Company	Country	Current D/V	5 Year D/V	Equity beta	Asset beta
Telstra Corp Ltd	AUS	0.17	0.12	0.39	0.35
Tele Norte Leste Part	BRA	0.48	0.27	1.13	0.83
Embratel Participacoes	BRA	0.74	0.46	1.40	0.75
Cia Telecomunicacion Chile	CHL	0.40	0.38	1.23	0.77
Deutsche Telekom Ag	DEU	0.63	0.42	1.01	0.58
TDC A/S	DNK	0.43	0.29	1.54	1.10
Telefonica S.A.	ESP	0.36	0.28	1.38	0.99
France Telecom Sa	FRA	0.70	0.46	1.79	0.97
BT Group Plc	GBR	0.43	0.29	1.71	1.21
Cable & Wireless Plc	GBR	0.26	0.20	1.67	1.34
Hellenic Telecommun Organiza	GRC	0.34	0.20	0.61	0.49
Telecom Italia Spa	ITA	0.26	0.20	1.04	0.84
Nippon Telegraph & Telephone	JPN	0.22	0.14	1.16	1.00
Telefonos De Mexico Sa	MEX	0.20	0.17	0.97	0.80
Portugal Telecom Sgps Sa	PRT	0.34	0.27	1.38	1.00
Verizon Communications Inc	USA	0.29	0.25	0.92	0.69
SBC Communications Inc	USA	0.17	0.14	0.79	0.68
Bellsouth Corp	USA	0.24	0.18	0.80	0.66
AT&T	USA	0.42	0.45	1.10	0.60
Centurytel Inc	USA	0.46	0.37	0.92	0.58
Commonwealth Telephone Entrp	USA	0.12	0.16	0.62	0.52
IDT CORP	USA	0.05	0.10	1.10	0.99
Simple average		0.35	0.26	1.12	0.81
Median		0.34	0.26	1.10	0.79

Source: Bloomberg

Appendix B

Review of Dr Lally's Market Risk Premium Estimate in the Draft ELB Decisions

Introduction

1. In his paper for the Commission, “The Weighted Average Cost of Capital for Electricity Lines Businesses”, dated 31 January 2003, Dr Lally considers six bases for estimating the tax adjusted market risk premium:
 1. NZ historical or ex post market risk premium
 2. Overseas historical or ex post market risk premium
 3. Merton-type estimate (using historical NZ data)
 4. Forward looking (using NZ data)
 5. Welch survey (using US data)
 6. Siegel method (using historical NZ data)
2. Dr Lally then calculates a simple average of his six estimates, which appears to provide the anchor for his point estimate of 0.070 (i.e. 7.0%) for the TAMRP. We discuss each of the estimates made by Dr Lally below.

1. NZ Historical

3. The Lally and Marsden (2002) estimate of the New Zealand ex-post Brennan-Lally MRP of 0.071 (i.e. 7.1%) is broadly comparable to the PricewaterhouseCoopers estimate of the New Zealand ex-post Brennan-Lally MRP of 0.075. Dr Lally prefers the former on the grounds that it “...has the advantage of greater transparency in its taxation assumptions and estimates; accordingly it is preferred.” However, the Lally and Marsden (2000) analysis invokes several simplifying assumptions to overcome potential data limitations. This potentially reduces the reliability of the resulting MRP estimate. On the other hand, the PricewaterhouseCoopers analysis has benefited from in-house access to more detailed historical knowledge and data on the New Zealand market, in particular the taxation system. For example:

- (a) Lally and Marsden use a single average assumed ratio of 0.40 for imputation credits to cash dividends over the period 1988 to 2000, based on an estimate provided by a broker in respect of 1999. On the other hand PricewaterhouseCoopers has sampled the level of imputation credits attached to the dividends of the top 40 companies over this period and used, in each year, a more precise imputation credit ratio estimate, that varies between 0.04 and 0.49.
 - (b) Lally and Marsden use a single average assumed proportion of 0.20 for the ratio of institutional to institutional plus individual share market investors over the period 1931 to 1987, primarily based on a 1987 share market ownership survey. On the other hand PricewaterhouseCoopers has obtained share market ownership data for the 1970s and 1960s, which has provided us with what we consider to be more accurate assumptions over that period (and extrapolating earlier) for this parameter.
4. In addition to the above type of estimation differences, the two studies also differ slightly in the time period covered. Notwithstanding this, the magnitude of any resulting difference in MRP estimates due to these sources would not appear to be all that large.
5. The major difference in the two studies appears (at least from PricewaterhouseCoopers' analysis) to arise from Lally and Marsden's assumption that the price setting individual investor in the New Zealand share market is taxed at the marginal personal tax rate applicable to median investment income (including non-share market investment income) or median taxable income, whereas PricewaterhouseCoopers assumes that (within New Zealand individuals) the marginal tax rate of the price setting individual investor is the top personal tax rate. Lally and Marsden describe their approach (page 36) as follows:

“This marginal tax rate for individuals clearly varies over years, and we recognize this. It also varies over individual investors, even those of type A. In the interests of computational simplicity we elect not to model this, and treat type A individuals as a homogeneous group, with a marginal tax rate equal to that of the individual whose income corresponds to the median income. Thus, if the median income in year t is \$12,000, and the marginal tax rate at that level is .30, then we act as if all type A individuals experience a marginal tax rate of .30.”
6. Lally and Marsden use data on investment income (which comprises dividend and interest income, and in several years other ‘unearned income’) to compute median investment income, for which they then obtain the marginal personal tax rate corresponding to that income level. They acknowledge complications in applying this approach. In fact for 1984 to 2000 they end up using the marginal tax rate on the median of taxable income, rather than the median of investment income.

7. The Capital Asset Pricing Model (“CAPM”), in its various (e.g. tax adjusted) forms, is generally derived or expressed as a model for pricing all risky assets. This is the case, for example, in Brennan (1970) and in Lally (1992). The market portfolio of risky assets, in theory, comprises not just shares, but also bonds, real estate and even human capital. However, in order to implement the CAPM as a practical tool it is necessary to define “the market” in more narrow terms, in particular in terms of assets that are traded and hence whose market value is observable.
8. The usual definition of “the market” when applying the CAPM is the domestic share market. To be consistent this definition of “the market” must then be used for estimating the market risk premium, for estimating betas and, in the case of the Brennan-Lally CAPM, for estimating the investor tax rate (T_I) for the investors in that market. This latter parameter is required both to apply the Brennan-Lally CAPM at the present time and to measure the historical realised market risk premium under the Brennan-Lally CAPM. We are concerned here with the last purpose.
9. PricewaterhouseCoopers is strongly of the view that the best estimate of the investor tax rate (T_I) for individual investors is the top marginal tax rate, as opposed to Lally and Marsden’s (2002) use of the median tax rate applicable to all types of investment income (including all interest) or simply the median tax rate applicable to all income. Our objective is to focus on the estimation of tax adjusted share market returns vis-à-vis the tax adjusted returns obtainable from government bonds. PricewaterhouseCoopers interprets this by defining “investors” as those that invest in the share market (i.e. equities). An alternative, and potentially broader, definition would define “investors” in terms of equities (the market of risky assets) and government bonds (the risk free asset). In fact Lally and Marsden (2002, page 9) describe the issue thus (underlining added):

“In estimating this market risk premium, the concept of an “investor” is fundamental. Investors are the group who determine asset prices as a consequence of their portfolio decisions. These decisions allocate investable wealth across capital assets. For purposes of measurement, these assets are assumed to involve equities and government bonds.”

10. Lally and Marsden (2002) thus define the investor group in terms of equities and government stock. Note that this definition is not in terms of all interest bearing securities, including risky debt – such assets simply do not appear in the specification of the Brennan-Lally CAPM as it is applied in practice. On the other hand for the purpose of estimating the historical realised market risk premium PricewaterhouseCoopers has viewed the investor group solely in terms of equities. For the Lally and Marsden (2002) investor tax rate assumptions to be defensible their definition of the investor group would therefore have to be considerably broader than PricewaterhouseCoopers’ and in fact coincide with the investor group that derives any interest income (and from 1984 any taxable income of any type); i.e. using the Lally and Marsden (2002) concept of investor, individual holders of equities would need to be shown to be a subset of those individuals holding government stock. It turns out that this proposition can be readily disproved, as shown in the next paragraph.
11. The New Zealand Stock Exchange (2000) survey of direct share ownership by adults aged 18 years plus showed that in May 2000 approximately 30% of adults held shares listed on the New Zealand Stock Exchange. Extrapolating the survey findings to the total population aged 18 and over in the year 2000 suggests that some 800,000 individuals held shares (with, as discussed below, the median level of share market wealth heavily skewed toward or in the top decile of share market investors). As at 28 February 2003 the Reserve Bank advises that 5,432 individuals held New Zealand government stock (i.e. approximately 0.2% of the adult population¹⁶). We have not researched the data going back in time, but from the data we have it would appear most likely that individual holders of New Zealand government stock (the “risk free asset”) have historically comprised only a small, wealthy subset of those individuals that hold shares (i.e. only about 1 in every 150 individual share investors appears to also hold government stock). This accords with commonsense, government stock is largely a “wholesale” investment security, traded in larger denominations (typically of at least \$10,000) and is therefore only likely to be held by those individuals with significant levels of wealth, who are likely to also hold large share portfolios and are also most likely to be on the highest marginal tax rate.
12. It is PricewaterhouseCoopers view that the assumptions used in Lally and Marsden’s analysis lead to a downward bias in their estimation of the historical values of T_t and hence a downward bias in their estimate of the historical TAMRP. This bias arises from three sources, which are subsequently discussed:
 - (a) For the period 1931 to 1983 the Lally and Marsden analysis does not differentiate between the marginal tax rate on median dividend income and the marginal tax rate on median ‘investment’ income (which includes dividends and interest, and in some years other ‘unearned’ income).

¹⁶ Even if individual holders of all types of government security (e.g. retail Kiwi bonds) are counted, then the proportion of the adult population holding government securities is still less than 1%.

- (b) For the period 1984 to 2000 the Lally and Marsden analysis does not differentiate between the marginal tax rate on median dividend income and the marginal tax rate on median taxable income (i.e. they use the latter, which comprises income from all sources and, in particular, the income of low earners who are unlikely to have any share market investments).
 - (c) The identity of the price setting individual investor in “the market”. It is PricewaterhouseCoopers view that the price setting individual investor in “the market” is more likely to be on the top personal tax rate, as opposed to an investor with the estimated median dividend income.
13. To address the issues noted above we have surveyed the literature on the relationship between marginal tax rates, income levels, wealth levels and household portfolio composition. The general conclusion from the literature is that there are high levels of correlation between marginal tax rates, income levels, wealth levels and holdings of equities (i.e. shares). Furthermore, marginal tax rates, income levels and wealth levels are generally higher in respect of individuals receiving equity income than for those receiving interest income or income from all sources. While the more detailed studies are in respect of overseas markets, there is no reason to believe that findings are not also applicable to the New Zealand setting. Specifically, because (and in common with overseas jurisdictions) the New Zealand taxation system has provided a relative tax advantage to individual investors in equities, compared with interest bearing instruments, and has had a progressive personal income tax scale.
14. Jolivet (1966) estimates the average marginal tax rate on dividends received by US individuals over the period 1955 to 1962 as being in the range 39% to 42%. Over the same period Joines (1981) estimates that the effective marginal tax rate on labour income is in the range 20% to 24%. These marginal tax rates for US labour income (and those for later years) are in line with Ang et al (1985) estimate of the marginal tax rates for US bonds over the period 1973 to 1983, being 25%. In other words the marginal tax rate for US equity investors was significantly greater than that for interest income or labour income (with the Joines data providing a point of reference for comparing the marginal tax rate estimates for dividends and interest from non-overlapping periods).
15. Hubbard (1985) analyses the impact of marginal tax rates on the composition of US household portfolios. Consistent with an earlier study on this topic he finds that higher marginal tax rates (which arise under a progressive personal income tax scale) increase the demand for equities. Assuming overall growth in incomes and savings across all income levels this suggests that in the equities market the price setting individual investors are likely to be on the higher or highest personal tax rates.

16. Bækgaard (1998) analyses the composition of Australian household wealth for 1986 and 1993. For 1986 the median dollar of wealth held in interest bearing assets coincides with the 92nd percentile of households holding interest bearing assets, while the median dollar of dividend yielding assets coincides with the 100th percentile of households holding this asset class. I.e. the top 1%, ranked by wealth invested in equities, of Australian households that hold dividend yielding assets held over half of these assets. For 1993 the medians fall in the 96th and 100th percentiles respectively. In other words share ownership in Australia is much more skewed towards the very wealthy than is holdings of interest bearing assets, which itself is still skewed towards the wealthy. Given the general association between higher wealth and higher income and hence higher marginal tax rates, we interpret this as evidence that in Australia dividend income (before allowing for imputation credits) is taxed at higher marginal rates than interest income, which in turn is taxed at higher marginal rates than income from all sources.
17. King and Leape (1998) estimate average marginal tax rates for households in the US, using 1978 data, for different asset classes. Average marginal tax rates on taxable interest income are estimated as 35.0% (checking accounts), 35.1% (liquid savings), 32.3% (less liquid savings) and 45.9% (taxable bonds). By comparison the average marginal tax rate on corporate equity is estimated as 49.9%. A weighted average marginal tax rate for all classes of interest income is not provided, but clearly the average marginal tax rate for US households investing in equities is higher than for those households investing in any type of taxable interest bearing asset.
18. Poterba and Samwick (2002) analyse US household taxation and portfolio composition data over the period 1983 to 1998. The data used in this study showed that the majority (99%) of households owning equities also held taxable interest bearing accounts, but only a minority (23%) of household with interest bearing accounts also held equities. The authors find a positive and statistically significantly relationship between households' marginal tax rate and their holdings in equities and tax-deferred/tax-exempt instruments, greater (as expected by the authors) than for taxable bonds. The authors conclude (page 36):

“A household’s marginal tax rate on ordinary income displays a substantial correlation both with the set of financial assets that the household owns and with the share of the household’s portfolio that is allocated to various financial assets. Although the results vary from one cross-sectional survey year to another, they are broadly consistent with simple theoretical models of portfolio selection in the presence of taxes. Households with higher marginal income tax rates are more likely to own tax-advantaged assets such as publicly traded stock and tax-exempt bonds than are comparable households with lower marginal tax rates.”

19. The New Zealand Stock Exchange (2000) surveyed direct share ownership by adults aged 18 years plus in May 2000. At that time only 30% of adults held shares listed on the New Zealand Stock Exchange. Consistent with overseas research the incidence of share ownership increased with income levels. In addition the distribution of the total value of shares held by individuals was skewed towards a small proportion of shareholders holding larger levels of average investment. The median dollar of direct New Zealand share market investment wealth occurred around, or greater than, the 90th percentile of those adults holding direct share market investments. In other words the median dollar of direct New Zealand share market investment wealth (and hence median level of dividend income) is likely to have occurred somewhere around the 97th percentile of the total population ranked on wealth or income. Based on strong associations between wealth, income and marginal tax rates (as confirmed by the US research) we would expect that the most likely marginal tax rate facing the 97th (or greater) percentile investor would be the top personal tax rate.
20. Furthermore, it appears reasonable to assume that New Zealand individuals with the median taxable income are unlikely to have held any direct share market investments whatsoever. The marginal tax rate of such individuals is therefore unlikely to be relevant in trying to estimate the marginal tax rate of the price setting individuals in the New Zealand share market.
21. In conclusion it is the view of PricewaterhouseCoopers that Lally and Marsden's use of the marginal tax rates for median investment income, and from 1984 onwards median taxable income, are downward biased estimates of the marginal tax rates that applied to median dividend income. Furthermore, there is strong evidence (e.g. Hubbard, 1985; Poterba and Samwick, 2002) to suggest that demand for equities from individuals is likely to be associated with high marginal tax rates (this may, in particular, be the case upon transition into the highest personal tax rate), in which case use of the top marginal tax rate would better reflect the tax rate facing the price setting individual investor than would use of the marginal tax rate applying to median dividend income (although it is most likely that the marginal tax rate that has historically applied to median dividend income of New Zealand individual has in any event been the top personal tax rate).
22. From PricewaterhouseCoopers' review of Lally and Marsden's analysis, it appears that if top personal tax rates were to be used as individuals' marginal tax rate in their analysis (i.e. with their remaining data set and assumptions) this would yield an ex-post MRP estimate in the order of 0.085 rather than 0.071.

2. Overseas Historical

23. Dr Lally's overseas historical ex post MRP estimate (adjusted for New Zealand use in the Brennan-Lally CAPM) is derived from a study by Dimson et al (2000) of realised returns in 12 markets over the period 1900-2000. Of all the MRP estimates considered by Dr Lally this one draws upon the deepest and broadest data set. If weightings were to be given to each of Dr Lally's MRP estimates, then arguably this MRP estimate should be accorded the highest weighting.

3. Merton-type Estimate

24. It is noted that Dr Lally's Merton-type MRP estimate of 0.075 is taken from a 1998 analysis by Credit Suisse First Boston ("CSFB"). The CSFB Merton-type MRP estimate is conditional upon then current market parameters (including recent volatility). A current Merton-type MRP estimate is not available, but CSFB note that between 1980 and 1998 its Merton-type MRP estimate ranges between 0.065 and 0.098. This overall range may provide, as a band, a better long term estimate than an out of date conditional point estimate.

4. Forward Looking

25. Dr Lally's forward looking MRP estimate is based on the New Zealand market average dividend yield, short term earnings growth forecasts (from one broker) and long term economic growth forecasts in 2001. This estimate is therefore conditional on market conditions at that time and thus may be of less relevance at the present time.

5. Welch Survey

26. Dr Lally adjusts the Welch (2001) US MRP survey estimate for the CAPM model being used and to express the MRP over a ten year government yield, to arrive at a tax adjusted MRP estimate of 0.062.
27. The Welch (2001) US MRP survey was undertaken at a time (August 2001) when the US share market was at high levels – leading some experts to believe that the future expected market returns and hence the expected MRP would have to be much lower. The large fall in the US share market since August 2001 may now have caused these academics to revise their expected future MRP estimates upwards.
28. Consideration should also be given to adjusting upwards any MRP estimates sourced from large, liquid overseas markets before these can be applied in the New Zealand market.

6. *Siegel Method*

29. Lally and Marsden (2002) apply the “Siegel” methodology to their set of New Zealand data and assumptions to arrive at a TAMRP estimate in the order of 0.051 to 0.059. Accordingly their Siegel-based TAMRP estimate is also biased downward as a result of their downward biased investor tax assumptions. If top personal as opposed to median tax rates were used for the individual investor class in their analysis we estimate that a Siegel-based TAMRP estimate in the order of 0.075 would be obtained from their data set.
30. The “Siegel” MRP estimation methodology discussed by Lally and Marsden is based on the argument that the very low historical real returns on bonds were due to pronounced unanticipated inflation. But as Lally and Marsden (2002) note:

“However, as pointed out by Dimson et al (2002), past equity returns may also have been higher if the economic and other factors that gave rise to very low real bond returns had not arisen. Thus Siegel’s (1992) arguments must be treated with some caution.”

31. The Siegel method amounts to saying that historical interest rates were “wrong”. The difficulty with this type of argument is what else might we say, with the benefit of hindsight, is “wrong” with the historical returns data? Should we try to adjust historical share market returns for specific events that we might consider unlikely to ever occur again?
32. Because of these concerns we do not favour placing much, if any, reliance on using the Siegel MRP estimation methodology, even after correcting for the downward bias in the Lally and Marsden (2002) estimate. However, for the sake of completeness we retain a revised Siegel-based TAMRP estimate in a re-calculation of Dr Lally’s simple average of the six approaches he considered.

Summary

33. The six types of tax adjusted MRP estimate considered by Dr Lally, his values and adjusted values (as discussed above) are summarised in the table below. To be conservative we still leave in the table the Lally and Marsden (2002) downward biased figures (mid-point) as the lower end of the range for the “NZ historical” and “Siegel method” TAMRP estimates.

	Per Dr Lally / Draft ELB Decision	Adjusted
1. NZ historical	0.071	0.071 – 0.085
2. Overseas historical	0.094	0.094
3. Merton-type estimate	.075	.065 – 0.098
4. Forward looking	0.058 – 0.079	0.058 – 0.079
5. Welch survey	0.062	0.062
6. Siegel method	0.051 – 0.059	0.055 – 0.075
Simple average	0.071	0.075

34. While academic-based research into the MRP is insightful, we consider that its is also relevant to consider the tax adjusted MRP estimates currently being used by valuation experts and other practitioners in New Zealand. Not because this group is possessed of superior forecasting skills, but because these experts value assets and businesses for buyers and sellers involved in real transactions. If their MRP estimate produces discounted cash flow valuations and advice consistently out of line with market transactional evidence and/or valuations based on other yardsticks (e.g. earnings multiples) then they will be at risk. In this regard we note that PricewaterhouseCoopers currently uses a tax adjusted MRP estimate of 0.075, recently revised downwards from an estimate of 0.080. Two of the other major accounting/advisory firms were known to recently be using a tax adjusted MRP estimate of 0.080.
35. In its recent Airfields decision the Commission, relying on analysis by Dr Lally, selected a point estimate for the MRP of 0.080. Parties with an interest in the decision submitted MRP estimates in the range 0.080 to 0.090, while Dr Lally concluded a plausible band for the MRP was 0.070 to 0.090¹⁷, with a point estimate of 0.080. While, expectations of the future MRP may have declined between the time of the Airfield hearings and the present time, the change in Dr Lally’s view on the expected MRP in New Zealand (from a range of 0.070 to 0.090 to a range of 0.060 to 0.080) is not, to the best of our knowledge, supported by the general view of other experts and practitioners. In particular, (and apart from Dr Lally’ current preference for a 0.070 point estimate) we are not aware of any experts advocating Brennan-Lally MRP estimates in the range 0.060 to 0.070.
36. In conclusion we consider, based on our own research and an analysis of the evidence outlined above, that the tax adjusted market risk premium should be set at point estimate of 0.075, from within the range 0.065 to 0.085.

¹⁷ The Cost of Capital for the Airfield Activities of New Zealand’s International Airports, Martin Lally, November 2001, page 481.