

Telecom New Zealand Limited

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

27 August 2004

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Telecom New Zealand Limited
PO Box 570
Level 9
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WELLINGTON

Attention: Mr A Srzich

Dear Sir

We present our report which provides our estimate of the Weighted Average Cost of Capital ("WACC") to be applied in calculating the Total Service Long Run Incremental Cost ("TSLRIC") in respect of interconnection with Telecom's fixed PSTN ("interconnect services") as of November 2002.

We would be pleased to discuss these matters with you further, if required.

Yours faithfully
PricewaterhouseCoopers



Murray Coppersmith
Partner



John Redmayne
Director

Table of Contents

1.	Introduction	1
	Background.....	1
	Approach	2
	Background Knowledge.....	2
	Disclaimers	3
2.	Risk Free Rate	4
	Discussion	4
	PwC's Estimate.....	5
3.	Debt Premium and Gearing	6
	Discussion	6
	PwC's Estimate.....	6
4.	Investors' Tax Rate	7
	Discussion	7
	PwC's Estimate.....	7
5.	Asset Beta	8
	Discussion	8
	PwC's Estimate.....	9
6.	Tax Adjusted Market Risk Premium	10
	Discussion	10
	PwC's Estimate.....	10
	Commission's Possible Approach to the Risk Free Rate and Implications for the TAMRP	10
7.	Undue Reliance on the CAPM.....	12
	Discussion	12
8.	Summary and Conclusion.....	15
	Summary	15
	Adjustments to the WACC	16
	Conclusion	16
	Appendix A – Asset Beta Issues	17
	Introduction	17
	Commission's Subjective Approach to Date	17
	US RBOC Asset Betas	20
	ACCC PSTN Asset Beta Analysis	20
	US Rate of Return Regulated Electric Utilities.....	23

1. Introduction

Background

1.1. Over the past two and a half years the Commerce Commission (“the Commission”) has released a number of papers and held consultations on its proposed approach to pricing determinations in respect of designated access services. On 2 July 2002 the Commission released a report “*Application of a TSLRIC Pricing Methodology - Discussion Paper*” that sought views on, amongst other things, cost of capital related matters. In response to that report PricewaterhouseCoopers prepared a report addressed to Telecom, dated 16 August 2002, that provided our preliminary view on the WACC related material in the discussion paper. In a report addressed to Telecom, dated 11 April 2003, we then provided an estimate of the WACC for interconnect services as of March 2003.

1.2. On 20 February 2004 the Commission published a report “*Implementation of TSLRIC Pricing Methodology for Access Determinations under the Telecommunications Act 2001, Principles Paper*” (“the TSLRIC Principles Paper”). That report sets out the principles (but without specifying actual estimates of parameter values) that the Commission expects to apply when making a determination on interconnection services in respect of an application for a pricing review determination under section 42 of the Telecommunications Act 2001 (“the Act”). Included in the report is a section on estimating the cost of capital.

1.3. In parallel with developing its TSLRIC pricing principles the Commission has been making estimates of the WACC it allows Telecom to earn in making its telecommunications service obligation (“TSO”) determinations. The Commission has also assessed the WACC that other firms may be allowed to earn in other industries that it regulates or may regulate (e.g. airports, electricity line businesses and gas pipeline businesses). The Commission states that it is willing to reconsider its position on common WACC issues, but that it sees considerable merit in maintaining a consistent approach across the areas that it regulates.

1.4. Our interpretation of the Commission’s position is that it is likely to rely, in particular, on the analysis that it has used in determining Telecom’s TSO WACC when assessing the WACC for Telecom’s interconnect services.

1.5. The Commission has advised Telecom that it has received three applications for pricing review in relation to the Commission’s “*Initial Pricing Determination*”, November 2002, which decision related to the interconnect arrangements between Telecom and other telecommunications service providers. The Commission advises that these applications are to be combined into a single access pricing review determination. As part of that process Telecom requires a WACC estimate to use in its TSLRIC based access costing calculations.

1.6. The purpose of this report is to provide our estimate of the WACC to be applied in calculating the TSLRIC in respect of interconnection with Telecom’s fixed PSTN as of November 2002. We also comment on some of the WACC related material contained in the Principles Paper, the Commission’s Final Determination on the 2001-2002 TSO net cost and the Commission’s Draft Determination on the 2002-2003 TSO net cost since it appears likely that the Commission will seek to rely on some of its previous WACC analysis, particularly in respect of the telecommunications industry, for the present purpose.

Approach

1.7. In preparing this report we have used and relied on discussions with management of Telecom and the following sources of information:

- Reports previously issued by the Commission on WACC estimation, including various report on the TSO and the TSLRIC Principles Paper;
- New Zealand interest rate data from Bloomberg;
- US interest rate statistics from the Federal Reserve Bank of St. Louis “FRED II” website (<http://research.stlouisfed.org/fred2/>);
- Price index statistics from the Bureau of Labour Statistics, US Department of Labour; and
- Share price and market index data from various service providers.

Background Knowledge

1.8. 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 supplementary comments, 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.

1.9. Furthermore, we have assumed readers are familiar with the contents of:

- Our letter to Telecom “Application of a TSLRIC Pricing Methodology – Discussion Paper”, 15 August 2002;
- Our report “Telecom New Zealand Limited, The Cost of Capital to be Applied in Calculating the Cost of the Telecommunication Service Obligation”, 22 August 2002;
- Our report “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;
- Our report “Telecom New Zealand Limited, Comments on the ‘TSO Weighted Average Cost of Capital’ report prepared by the Commerce Commission dated 19 May 2003”, 13 June 2003;
- Our report “Telecom New Zealand Limited, The Weighted Average Cost of Capital to be Applied in Calculating the Cost of the Telecommunication Service Obligation for the Period 1 July 2002 to 30 June 2003”, 9 September 2003;
- Our report “Telecom New Zealand Limited, Comments on the TSO Cost of Capital estimate in the “Draft Determination for TSO Instrument for Local Residential Service for period between 1 July 2002 and 30 June 2003”, Commerce Commission, 30 June 2004”, 13 August 2004;

- The cost of capital related material within the Commerce Commission report “Application of a TSLRIC Pricing Methodology - Discussion Paper”, 2 July 2002;
- Commerce Commission report “TSO Weighted Average Cost of Capital”, 19 May 2003;
- The cost of capital related material within the Commerce Commission report “Draft Determination for TSO Instrument for Local Residential Service for period between 20 December 2001 and 30 June 2002”, 27 June 2003;
- The cost of capital related material within the Commerce Commission report “Determination for TSO Instrument for Local Residential Service for period between 20 December 2001 and 30 June 2002”, 17 December 2003;
- The cost of capital related material within the Commerce Commission report “Telecommunications Act 2001, Implementation of TSLRIC Pricing Methodology for Access Determinations under the Telecommunications Act 2001, Principles Paper”, 20 February 2004; and
- The cost of capital related material within the Commerce Commission report “Draft Determination for TSO Instrument for Local Residential Service for period between 1 July 2002 and 30 June 2003”, 30 June 2004.

1.10. In reaching our conclusions, we have taken into consideration the arguments put forward to the Commission at the various Commission conferences, as well as the content of the Commission’s various reports and draft and final rulings. This report contains our current views on critical WACC issues, many of which have previously advised to the Commission, and remains consistent with our previous position.

Disclaimers

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

1.12. 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 stated above.

1.13. 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.

2. Risk Free Rate

Discussion

2.1. In the TSLRIC Principles Paper the Commission has said that it will use an average risk free rate measured over the six months immediately prior to the commencement of the period to which the access pricing determination will relate.

2.2. We set out below the yields for the various maturities of government stock on issue as at 31 October 2002 (being the last day immediately prior to the month in which the access pricing determination period commences, being November 2002) and the average yield for each of these maturities over the preceding six months:

Maturity	Coupon %	Semi-annual Yield as at 31 October 2002 %	Semi-annual Yield Six Month Average %	Annualised Six Month Average %
15-Apr-03	5.50	5.660	5.666	5.746
15-Apr-04	8.00	5.660	5.823	5.908
15-Feb-05	6.50	5.760	6.100	6.194
15-Feb-06	6.50	5.892	6.160	6.255
15-Nov-06	8.00	5.980	6.262	6.360
15-Jul-09	7.00	6.190	6.416	6.519
15-Nov-11	6.00	6.270	6.465	6.570
15-Apr-13	6.50	6.318	6.524	6.630

2.3. We understand that the life of the assets used to provide interconnect services is in the order of eight to 10 years. We continue to consider that the best approach, and the only approach consistent with forward looking long-run incremental cost, is to use the yield on long maturity, actively traded bonds whose maturity approximates the lives of the relevant assets as the risk free rate input to the WACC. In this case the yield on a notional eight year bond is approximated by the yield between the 15 July 2009 and 15 November 2011 bonds, being 6.55%, while the 15 April 2013 bond provides an indicative 10 year yield of 6.63%. The average of these two yields is 6.59%, say 6.6%.

2.4. We note that the Commission has stated an intention to match the maturity of the risk free rate used in the WACC calculations with the term of the pricing review determination, which is not yet known. In our view the cost of capital used in the TSLRIC based costing of interconnect services should not be founded on a risk free rate set to match an arbitrary or unknown regulatory term. In our view the frequency at which the regulator reassesses the “market price” has no bearing on what the “market price” itself is. The “market price” for the interconnect services, as to be

determined by the Commission, should be based on the economic concept of TSLRIC. In the words of the pioneers of a variation of this concept¹:

““Reasonable profit,” to economists, is a return on investment exactly equal to -- and not exceeding -- the firm’s cost of capital. “Reasonable profit,” or zero economic profit, is the return on investment permitted over the long run in competitive markets, and is the cost of capital built into TSLRIC .”

2.5. If the Expectations Hypothesis of interest rates were strictly true then Lally² argues that use of a series of short term risk free rates (in the WACC) could produce the same ex ante expected regulated income stream as use of a single long term rate. However, there is serious doubt among economists on whether the Expectations Hypothesis does hold true, particularly with respect to longer term interest rates. It is generally agreed that longer term interest rates incorporate a risk premium; possibly for liquidity. In our view such a risk premium is part of the cost of capital of long lived assets and as such is implicitly part of TSLRIC. The frequency with which the price for the service provided by the assets is re-evaluated does not remove the need for such a risk premium to be incorporated into the fair return expected from those long lived assets.

PwC’s Estimate

2.6. Based on the average yields for government bond with maturities of eight to 10 years over the six months immediately prior to November 2002, we estimate an appropriate long term risk free rate, after converting to an annualised yield, as being 6.6%. Consequently we have recommend using a risk free rate input to the WACC to be used in the TSLRIC based interconnect services costing calculations as at November 2002 of 6.6%.

¹ Reply Affidavit of William J. Baumol, Janusz A. Ordovery, & Robert D. Willig – Footnote 6, Appendix B to Reply Comments of AT&T Corporation, In the Matter of Implementation of the Local Competition Provisions in the Telecommunications Act of 1996, CC Docket No. 96-98., 30 May 1996. It is noted that the reference to TSLRIC differs from LRIC due to allocation of common costs (which the Commission has rejected in the context of the TSO), but this difference has no bearing on the choice of risk free rate in the WACC for TSLRIC or LRIC purposes.

² Lally, M., 2002, “*Determining the Risk Free Rate for Regulated Companies*”, prepared for the ACCC and subsequently cited by the Commerce Commission in various of its cost of capital papers and reports.

³ Paragraph 161 of the '02-'03 Draft TSO Determination.

⁴ Paragraph 150 of the '02-'03 Draft TSO Determination.

3. Debt Premium and Gearing

Discussion

3.1. Our analysis to date demonstrates that it is difficult to quantify any material risk difference between Telecom (and for that matter most other integrated telecommunications companies) as a whole and its wireline/PSTN activities. It is therefore reasonable to conclude that any risk differential, if in fact it exists, is unlikely to have any material effect on the WACC for interconnect services via the debt premium input estimate.

3.2. The Commission has previously used a target gearing of 30% in estimating the TSO WACC. This level of gearing happens to be the average level of Telecom's actual gearing over the five years to 30 June 2002. As at 31 October 2002 Telecom's market based gearing was not significantly higher, being approximately 37%. It is therefore debatable as to the extent to which actual gearing of 30% would have lead to any substantial reduction in Telecom's observed debt premium.

3.3. We consider that an assumed gearing level of 30% and use of Telecom's actual debt premium as at late 2002 are reasonable parameter estimates for the TSO WACC.

3.4. Telecom's has previously undertaken detailed analysis of its overall weighted average debt margin (including all facility fees) over ten year New Zealand Government Stock as of August 2002 and again as of early April 2003. The two estimates provided to us by Telecom as of these dates were 202 and 204 basis points respectively.

PwC's Estimate

3.5. For the purpose of our estimate of the WACC for Telecom's interconnect services as at November 2002 we have used an assumed gearing ratio (debt to debt plus equity) of 30% and a rounded (down) debt margin estimate of, say, 2.0%.

4. Investors' Tax Rate

Discussion

4.1. In recent work the Commission has proposed using an investors' tax rate input assumption of 33% (i.e. 0.33) in its simplified specification of the Brennan-Lally CAPM. This approach is based on three simplifying assumptions, all of which are known to be wrong in reality. These assumptions are that:

- a) capital gains are taxed at a rate of zero (although we know that this is not true in the case of most institutional investors);
- b) firms attach maximum imputation credits to their dividends (again known not to be true for all companies; e.g. Carter Holt, Kiwi Income Property, NGC, Powerco and Trustpower do not pay fully imputed dividends); and
- c) shareholders can fully utilise the imputation credits (again not true for all NZ tax residents and certainly not true for all offshore investors).

4.2. Since the above simplifying assumptions are known to be wrong it is not necessary (or for that matter reasonable) to adopt a model that relies on them, particularly where estimates of the investors' tax rate that allow for better treatment of the above factors are readily available.

4.3. In particular we note that:

- a) Lally and Marsden (2003) estimate that the investors' tax rate (as defined comprehensively) had a value of 0.275 in 2001 and 2002;
- b) PricewaterhouseCoopers estimates that the investors' tax rate had a value of 0.28 in November 2002;
- c) in the report commissioned by the Commission on ELBs' WACC, dated 31 January 2003, it is noted that Transpower currently uses an investors' tax rate estimate of 0.20 (and we note was also doing so in 2002);
- d) we are aware that in New Zealand different corporate finance practitioners appear to be using investors' tax rate values of 0.20, 0.28 and 0.33. A simple average of these three estimates is 0.27.

4.4. We therefore suggest that an investors' tax rate estimate in the order of 0.27 accords with current (and also November 2002) best practice in New Zealand. PricewaterhouseCoopers' point estimate of the investors' tax rate in November 2002 is 0.28.

PwC's Estimate

4.5. We consider that a reasonable investors' tax rate estimate for use in the Brennan-Lally CAPM as at November 2002, and one that also closely accords with best practice in New Zealand, is 28% (i.e. 0.28).

5. Asset Beta

Discussion

5.1. The assets Telecom uses to provide interconnect services lie between the access providers' points of presence on Telecom's core network and Telecom's customer local exchanges. The other main assets in Telecom's wireline/PSTN business comprise the remainder of Telecom's core network and the assets that lie between the local exchanges and customers' premises. In our view the assets used to provide interconnect services are a substantial, integral part of Telecom's wireline/PSTN business and (based on our present knowledge and data) it is not practicable to disaggregate, in an objective meaningful way, the asset beta for interconnect services from the asset beta for the wireline/PSTN business as a whole. Hence we assume that all parts of the wireline/PSTN business have materially the same asset beta.

5.2. In three of our recent reports on the WACC appropriate for Telecom's wireline/PSTN business, and hence also for the TSO activities, (refer our reports dated 22 August 2002, 13 June 2003 and 13 August 2004), we provided a comprehensive analysis and commentary on the estimation of wireline/PSTN asset betas, including:

- a) estimation of Telecom's own asset beta for rolling five year periods from July 1996 through until August 2002. Our estimates of Telecom's asset beta over this period (degeared using the average D/E ratio over the five year period the equity beta has been estimated) varied in the range 0.78 to 1.03 with an average of 0.90;
- b) analysis of the asset betas for overseas integrated telecommunications firms:- weighted average 0.70, simple average of 0.83 and median of 0.73;
- c) a "full-information" segmental beta analysis to derive an asset beta for wireline activities of 0.72 to 0.94 (point estimate 0.80). This range is inclusive of the effects of regulation and, in our view the mid- to top end of this range is applicable to the risk attributes of the TSO services;
- d) an estimate of the extent by which US telecommunications firm betas should be adjusted upwards, due to industry market capitalisation differences, before being used as comparators in the New Zealand market. Our estimate, using the Lally and Swidler methodology, is that the US RBOC betas (upon which the Commission seeks to rely) should be multiplied by a factor of 1.8 to 2.0 times before they can be considered valid comparators in the New Zealand market. We estimate that using the US RBOC asset beta data range of 0.36 to 0.41 previously cited by the Commission (paragraph 70 of the Commission's 19 May 2003 TSO WACC Paper) and applying the Lally and Swidler methodology results in an asset US RBOC asset beta range relevant to the New Zealand market of 0.71 to 0.74;
- e) a review of the approach taken by other regulators and, in particular, commentary on why the analysis undertaken by the ACCC on the asset beta for wireline/PSTN activities (upon which the Commission seeks to rely) is seriously flawed; and

- f) an objectively based reconciliation of the asset betas of US rate of return regulated electric utilities (upon which the Commission seeks to rely) with the asset beta for wireline/PSTN activities, demonstrating why the Commission's attempt to anchor off its wireline/PSTN beta estimate off the former is inappropriate.

5.3. We provide a more detailed discussion in Appendix A on the problems that may arise should the Commission seek to rely on any of the last three bases for estimating the asset beta of interconnect services.

PwC's Estimate

5.4. In conclusion it remains our view that the asset beta appropriate for the wireline/PSTN activities of Telecom, including interconnect services, is in the order of 0.80 (mid-point) within the range 0.75 to 0.85.

6. Tax Adjusted Market Risk Premium

Discussion

6.1. In its '01-'02 Final TSO Determination the Commission used a Tax Adjusted Market Risk Premium ("TAMRP") estimate, for the period 20 December 2001 to 30 June 2002, in the range 7.0% to 9.0%, mid-point 8.0%. This is consistent with its 2002 Airfields decision. In its '02-'03 Draft TSO Determination the Commission has moved to using a TAMRP estimate in the range 6.0% to 8.0%, point estimate 8.0%. Part of the reason the Commission gives for using a point estimate from the top end of its assessed range is in range in order to reflect the risk to incentives to invest of a WACC that is too low. As discussed in Section 2 of this report we consider it preferable and more transparent to make this adjustment separately to the final WACC estimate.

6.2. PwC used a TAMRP of 8.0% from January 1998 until June 2002, from which date we have adopted a revised point estimate of 7.5%. We note that this TAMRP estimate is consistent with using our investor tax rate input of 28% (i.e. use of a higher investor tax rate, such as the Commission's 33% estimate, would require an upward adjustment to our TAMRP estimate).

PwC's Estimate

6.3. We consider that a TAMRP estimate of 7.5% is appropriate for use in the PwC simplified specification of the Brennan-Lally CAPM as at November 2002.

Commission's Possible Approach to the Risk Free Rate and Implications for the TAMRP

6.4. If the Commission is to use a short term risk free rate (e.g. a one year rate - as it has done to date with the TSO determinations) in estimating the WACC for interconnect services (which approach we consider to be wrong and unfair to Telecom), then as noted by the Commission⁵ this has implications for the TAMRP used in the CAPM, where the TAMRP has been estimated in relation to longer term government bond rates.

6.5. The Commission states that it has taken this into account in arriving at a TAMRP point estimate of 8%, from within its assessed range of 6% to 8%, for the '02-'03 Draft TSO Determination. Although the adjustment process is not transparent as the Commission also states that its TAMRP point estimate has been adopted from the high end of its range in order to reflect the risk to incentives to invest of a WACC that is too low.⁶

⁵ Paragraph 161 of the '02-'03 Draft TSO Determination.

⁶ Paragraph 150 of the '02-'03 Draft TSO Determination.

6.6. We are in agreement with the prudence of selecting a WACC from the higher, as opposed to lower, end of the range in order to reflect the risk to incentives to invest of a WACC that is too low. However, by making such an adjustment via the TAMRP, in conjunction with a low beta estimate, the Commission is arbitrarily discounting that allowance. There is no logical basis why such an allowance should be scaled by (in effect) the asset beta. In our opinion a more reasonable approach would be to use, say, a best estimate of the TAMRP in conjunction with a margin added to the final WACC to reflect the risk to incentives to invest of a WACC that is too low – as opposed to using a “fudged” TAMRP estimate.

6.7. This still leaves the issue of how much the Commission should adjust its TAMRP estimate (being based largely on measurements of long term risk free rates of return) as a result of using a short term as opposed to long term risk free rate input to the CAPM. In the case of the '02-'03 Draft TSO Determination the Commission proposes an adjustment of 0.6% based on the spread between one year and ten year bond rates averaged over the month to 1 July 2002 (0.85% before adjusting for tax). This would result in a TAMRP range of 6.6% to 8.6%. We concur in principle for the need to adjust the Commission's assessed TAMRP range for the spread between one year and ten year bond yields. However, we do not consider that the adjustment should be based on the observed market spread over the period prior to the beginning of the relevant regulatory period. Instead such an adjustment should be based on the long term historical spread between these bond yields, including under monetary conditions similar to that expected in the future.

6.8. As noted by the Commission it is problematic obtaining a long time series of the necessary data in respect of New Zealand government bonds. However, a long time series of data is readily available from the US Federal Reserve. We have obtained monthly data for the “1-Year Treasury Constant Maturity Rate” and the “10-Year Treasury Constant Maturity Rate” from January 1982 (prior to this inflation in the US was above 10%) through until April 2004. Over this period ten year bonds yielded, on average, 1.39% more than one year bonds, being 1.00% after tax of 28% (PwC T_I estimate) (or 0.93% after tax at 33% using Commission's T_I estimate). Alternatively, if the full data series is used (from April 1953) the average yield spread is 0.81%, being 0.58% after tax of 28% (or 0.54% after tax at 33%). While the latter figures may be relevant to adjusting historically based TAMRP estimates, the former figures will be more relevant to adjusting forward looking TAMRP estimates.

6.9. It is our understanding that the lower end of the Commission's TAMRP range (6.0%) is primarily driven by the forward looking estimation methodologies, while the upper end of its range (8.0%) is primarily driven by historical estimates. Accordingly applying the US derived yield spread adjustments suggests that the Commission's TAMRP range might be adjusted from 6.0% to 8.0% to a range of 7.0% (6.0% + 1.0%) to 8.6% (8.0% + 0.6%) if it were to use a one year risk free rate in its interconnect services WACC calculations. If the Commission is to use a longer term risk free rate (but still with a term less than 10 years) then the magnitude of the adjustment required to its TAMRP range would be somewhat less.

6.10. If a separate, transparent allowance is made for the risks in setting the regulatory WACC too low (as we recommend) then it would be reasonable for the Commission to use the mid-point of a revised TAMRP range as its point estimate (7.8%). We note that if the Commission applies its historical policy of rounding its TAMRP estimate to the nearest two decimal places this would produce a rounded point estimate of 8%.

7. Undue Reliance on the CAPM

Discussion

7.1. The Commission has chosen to use the CAPM as the basis for estimating the cost of equity in, to the best of our knowledge, all of its recent regulatory decisions. In general terms we concur with the Commission's use of the CAPM for this purpose and note that PwC routinely uses the CAPM as its primary tool in assessing the cost of equity capital for firms.

7.2. However, as you will no doubt know, we should all be aware that the CAPM has been under attack for over a decade - on the basis that it fails to perform in the way theory predicts. Two of the most noted critics of the CAPM are Professors Fama and French. In a recent paper⁷ they made these comments on the CAPM:

"The attraction of the CAPM is that it offers powerful and intuitively pleasing predictions about how to measure risk and the relation between expected return and risk. Unfortunately, the empirical record of the model is poor – poor enough to invalidate the way it is used in applications." (p. 1)

"...finance textbooks often recommend using the Sharpe – Lintner CAPM risk-return relation to estimate the cost of equity capital. The prescription is to estimate a stock's market beta and combine it with the risk free interest rate and the average market risk premium to produce an estimate of the cost of equity. The typical market portfolio in these exercises includes just U.S. common stocks. But empirical work, old and new, tells us that the relation between beta and average return is flatter than predicted by the Sharpe – Lintner version of the CAPM. As a result, CAPM estimates of the cost of equity for high-beta stocks are too high (relative to historical average returns) and estimates for low-beta stocks are too low (Friend and Blume, 1970). Similarly, if the high average returns on value stocks (with high book-to-market ratios) imply high expected returns, CAPM cost of equity estimates for such stocks are too low." (pp. 27-28)

7.3. As practitioners we are aware of the shortcomings of the CAPM, but continue to use it as a tool where it is applied to "typical" companies. However, Fama and French document that the CAPM performs particularly badly as a tool for predicting expected returns for companies with low betas or with high book-to-market ratios (i.e. low price-to-net-asset ratios). The Commission's use of a very low asset beta (at least to date in the case of the TSO WACC) together with the application of TSLRIC based costing (that implicitly forces the price-to-net-asset ratio to be 1.0) means that its reliance on the CAPM as the basis for estimating the WACC for the TSO and for interconnect services is highly questionable.

⁷ Fama, Eugene F. and French, Kenneth R., "The Capital Asset Pricing Model: Theory and Evidence" (August 2003). CRSP Working Paper No. 550; Tuck Business School Working Paper No. 03-26. <http://ssrn.com/abstract=440920>

7.4. The following two charts are from the recent Fama-French paper (their Figures 2 and 3) and illustrate the potential magnitude of error from using the CAPM in the situations of a low beta or of a mid to high book-to-market ratio. In its '02-'03 Draft Determination the Commission estimates the TSO equity beta (point estimate) as 0.571 and implicitly sets the book-to-market ratio to 1.0 (and hence also its inverse, the price-to-net-asset ratio, to 1.0). In the Fama-French paper this equates to the lowest beta decile and the sixth book-to-market decile (data points circled on the charts).

Figure 2 -- Average Annualized Monthly Return vs Beta for Value Weight Portfolios Formed on Prior Beta, 1928-2003

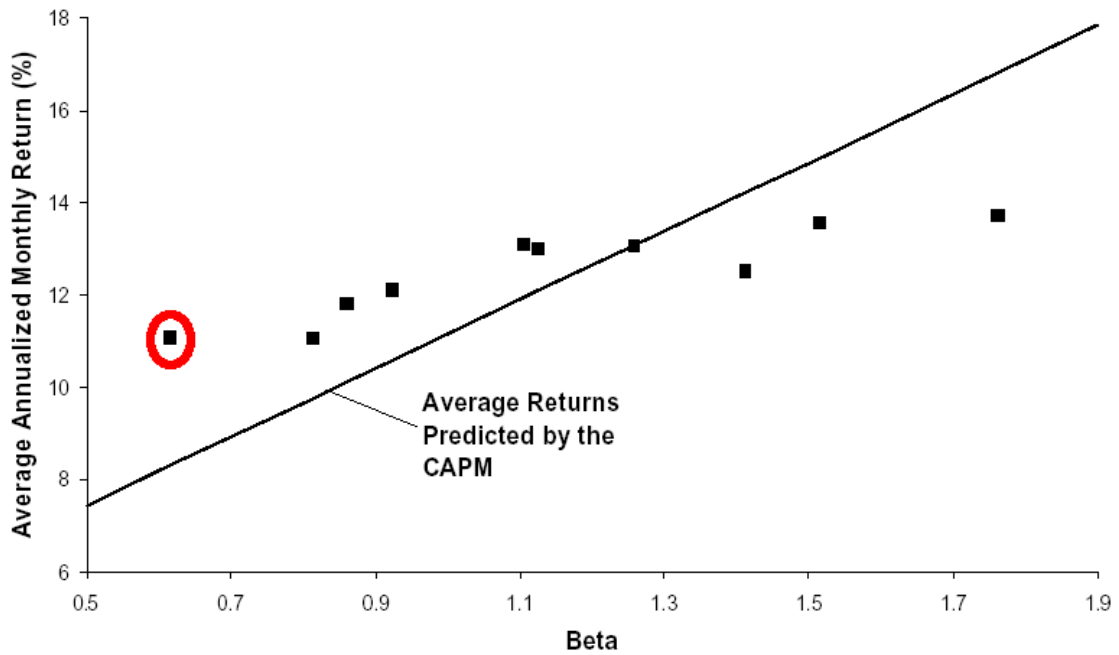
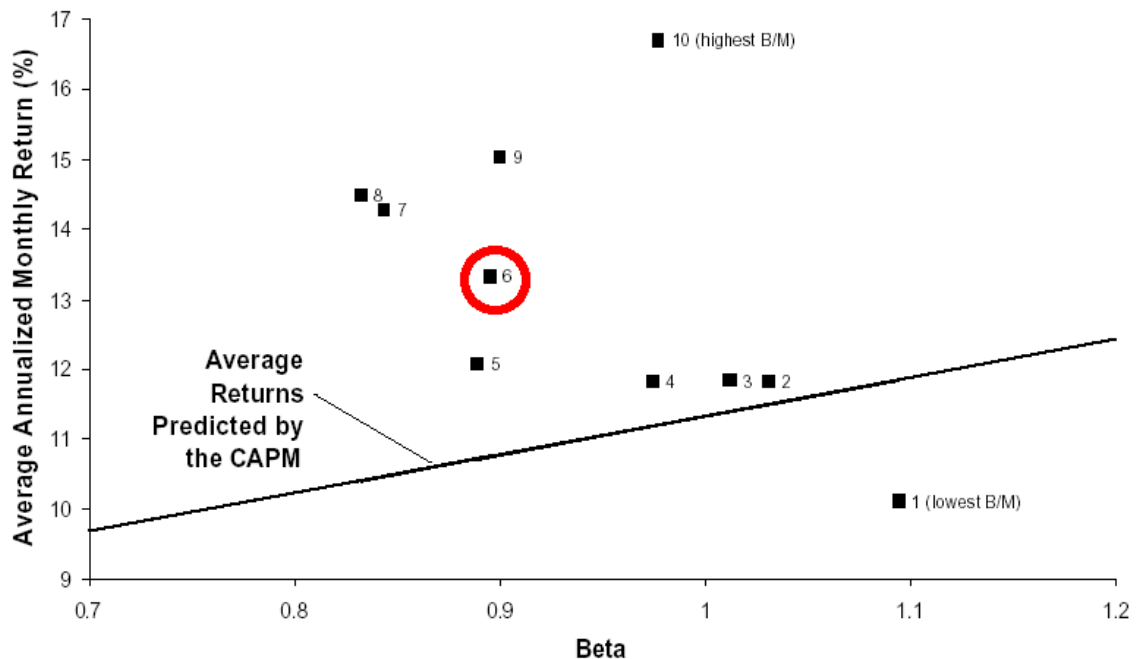


Figure 3 -- Average Annualized Monthly Return vs Beta for Value Weight Portfolios Formed on B/M, 1963-2003



7.5. Fama-French found that the CAPM underestimated the equity returns for their lowest beta decile (equity beta approximately 0.6) by 2.8% per annum (11.1% minus 8.3%). We note that under 30% gearing (as assumed by the Commission in its '02-'03 Draft TSO Determination) this equates to an underestimate of the WACC of 2.0% per annum.

7.6. From reading the second chart Fama-French found that the CAPM underestimated the equity returns for their sixth highest book-to-market decile by approximately 2.8% per annum (approximately 13.3% minus approximately 10.5%). Again we note that under 30% gearing this equates to an underestimate of the WACC of 2.0% per annum.

7.7. Fama and French do not present in their recent paper the situation with respect to portfolios of shares sorted on both beta and book-to-market. To the extent that these two characteristics are not perfectly correlated (and they cannot be since Fama-French retain both variables in their three factor asset pricing model), then the combination of the lowest beta decile and the sixth highest book-to-market decile (i.e. as implicitly assumed by the Commission in TSLRIC based costing) suggests that the underestimation of the WACC as a result of using the CAPM to estimate the TSO WACC and the interconnect services WACC is likely to be in excess of 2.0% per annum.

Adjustments to the WACC

8.3. 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 asymmetric risks. 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.

8.4. As we are not using an extremely low asset beta estimate it is our view that the Fama-French criticism of the CAPM is of less relevance to our WACC estimate, although some “high book-to-market” adjustment might still be warranted. We note that our WACC range and point estimate are still subject to upward adjustment for asymmetric-type risks as noted above. Furthermore, it would be prudent to allow some margin over and above our mid-point WACC estimate in order to mitigate the risk of the interconnect service provider under-investing due to the regulatory WACC being set too low.

Conclusion

8.5. After considering the above, we believe an appropriate WACC to be applied in determining the TSLRIC based cost of Telecom’s interconnect services as at November 2002 lies in the range 10.7% to 11.4%. For the purpose of a point estimate, we recommend the mid-point of our range, being 11.1%. This point estimate reflects an asset beta of 0.80 and is based on the other inputs discussed above, but is before any allowance for:

- Asymmetric risks;
- The documented failings of the CAPM, particularly when applied with/to extreme situations; and
- The risks arising from setting the regulatory WACC too low.

Appendix A – Asset Beta Issues

Introduction

A.1. In its TSLRIC Principles Paper the Commission raises the possibility of using electric utility companies (refer paragraph 209) and US RBOCs (refer paragraph 210) as comparators for estimating the asset beta of Telecom's interconnect services. Many of the issues involved in selecting a valid comparator group, including the need to objectively and transparently make any adjustments that might be required to the comparator group's asset betas, have already been discussed in some detail in our various reports on estimating the TSO WACC.

A.2. We are mindful that the Commission is likely to draw on its TSO WACC analysis in considering the WACC for interconnect services. In our view the Commission's approach to date in assessing the TSO WACC has been subjective and we discuss below the reasons why we hold that view.

A.3. We then review three specific bases that the Commission has considered to date in estimating a wireline/PSTN asset beta, given the Commission's declared objective of conforming (in the absence of any new evidence) to its previous decisions on WACC, pointing out the problems that have arisen in the Commission's use of these bases to date. These three bases are:

- Use of US RBOC asset betas without adjusting for the material difference in telecommunications wireline business market weights as between the US and New Zealand;
- Reliance on the analysis undertaken by the ACCC on the asset beta for wireline/PSTN activities, which analysis we show was seriously flawed; and
- Use of an inappropriate industry comparator group, US rate of return regulated electric utilities, for estimating the asset beta of wireline/PSTN activities.

Commission's Subjective Approach to Date

A.4. In our reports on the TSO WACC, dated 22 August 2002 and 13 June 2003, and our presentation to the Commerce Commission TSO Draft Determination Conference in August 2003 we provided a comprehensive objective analysis of the beta appropriate for a wireline/PSTN WACC, in particular the TSO WACC.

A.5. In its '01-'02 Final Determination and '02-'03 Draft Determination the Commission has used what we consider to be a subjective approach to estimating the TSO asset beta. Its approach has involved subjective discussion of factors that may affect the TSO beta, culminating in a low asset beta estimate, but which estimate is not reconciled with observed beta evidence for listed telecommunications companies.

A.6. Furthermore, in its '02-'03 Draft Determination the Commission has anchored its asset beta estimate on another regulator's asset beta estimate (the ACCC), which more detailed analysis reveals is actually inconsistent with the Commission's own somewhat more rigorous attempt at beta analysis. While in its '01-'02 Final

Determination (which contains analysis that the Commission states⁸ it relies on in its '02-'03 Draft Determination) the Commission selected an unrelated industry, US electricity utilities “subject to rate of return regulation”, as providing a cornerstone for its subjective analysis.

A.7. As we demonstrated with an illustrative example at the Commerce Commission TSO Draft Determination Conference in August 2003, it is possible to construct a seemingly logical subjective analysis of what an industry asset beta “should be” by reference to betas for other industries and a “logical” analysis, but then find that in reality we cannot reliably predict the sign, let alone the magnitude, of how the “unobserved” asset beta for one industry relates to the observed betas for other so called “similar” industries.

A.8. In our view the only rigorous and defensible basis for estimating the asset beta for an “unobserved” industry (e.g. the provision of interconnect services) is to:

- a) select a sample of observed equity betas for the closest comparable industry;
- b) de-lever these to obtain asset beta estimates for that closest comparable industry;
- c) identify the factors that may cause the asset beta of the “unobserved” industry to differ from that of the closest comparable industry;
- d) objectively quantify the extent of those differences; and
- e) combine the data from (b.) and (d.) to arrive at an objective beta estimate for the “unobserved” industry.

A.9. In our opinion the closest comparable industry to the provision of interconnect services, and also of TSO services, is the telecommunications industry, in particular the wireline business segment. The views of other regulators, particularly if those views can be shown to be based on inappropriate data (as we will demonstrate is in fact the case), do not constitute market evidence.

A.10. As part of step (d.) above it is important that any data and models used can also be applied to reconcile the asset betas of the companies in the closest comparable industry. The Commission does not appear to have undertaken this critical step, with the result that its subjective beta estimate is not capable of being reconciled to market evidence on the asset betas for listed telecommunications companies.

A.11. Much of the Commission’s commentary on beta assessment draws on work that first appeared in the Treasury handbook, “Estimating the Cost of Capital for Crown Entities and State-Owned Enterprises”, Appendix 4 – Beta, dated October 1997. However, the Commission omits much of the contextual commentary provided in that handbook. We note the following points:

⁸ Paragraph 145 of the '02-'03 Draft Determination.

- a) A key issue for Crown entities is that their equity is not traded, so their equity betas are not observable. Hence the Treasury handbook (page 53) advises:

"...one has to search out comparator companies, estimate their asset betas, and then in the face of many apparently equally good comparators, engage in some averaging process."

The equity of Telecom is traded so its beta does provide a useful point of reference, although being an estimate for a single company it will be subject to greater statistical error than an estimate for a group of comparable companies;

- b) The handbook then advocates choosing an industry that is believed to be the best comparator to the unlisted Crown entity. It lists and discusses a range of factors (pages 55 to 56, Treasury handbook) that the Commission also lists and discusses in its '01-'02 Final Determination (paragraph 188) and its '02-'03 Draft Determination (paragraph 135). While we concur this is a useful conceptual framework for selecting a comparator industry for an unlisted Crown entity, we consider it to be unnecessary to go through this process when listed companies exist in the same industry as Telecom (i.e. wireline telecommunications firms);

- c) The handbook notes (page 57, Treasury handbook) in respect of the range of factors that might affect beta (other than leverage, for which formulae exist):

"A natural response would be to attempt subjective adjustments. However in view of the sheer complexity of adjustment (betas reflecting sensitivities to several rather than one macro variable) and the inability to properly audit any subjective adjustments which are made (because true betas are unobservable) we strongly recommend against such adjustment. The industry believed to be the best comparator in respect of (1) ... (6) should be selected and that industry's constituent firm's asset betas averaged."

- d) Despite the handbook's warning about the dangers of attempting subjective beta adjustments the Commission states the following in its '02-'03 Draft Determination (paragraph 136):

"Comparators ideally should be similar in the above respects. However, so long as differences can be corrected for, this is not strictly necessary..."

The Commission then goes on to use its beta estimate for US (primarily rate of return regulated) electricity utilities of 0.30 as being a relevant comparator for estimating the TSO asset beta.

A.12. We consider that the Commission's use of US electricity utilities' asset beta as a benchmark for assessing an interconnect or TSO asset beta to be flawed and unreasonable given that a large body of evidence is available on the asset betas for listed telecommunications firms.

US RBOC Asset Betas

A.13. The telecommunications sector in the New Zealand share market has a large market capitalisation weighting (by virtue of Telecom's size). Lally and Swidler (2003)⁹ have shown that in such circumstances beta data from other markets, where the same industry has a lower capitalisation weighting, should be adjusted upwards before being applied as a comparator in the New Zealand market.

A.14. In its report "*TSO Weighted Average Cost of Capital*", dated 19 May 2003, the Commission did not recognise this point when, for example, emphasising the betas of US firms. We applied the Lally and Swidler methodology in our report dated 13 June 2003 to adjust for the different telecommunications industry market capitalisation weightings in the US and New Zealand¹⁰. Our analysis showed that US telecommunications firm betas should be multiplied by a factor of 1.8 to 2.0 times before being valid comparators for the same industry sector in the New Zealand market context. We estimated that using the US RBOC asset beta data range of 0.36 to 0.41 selected by the Commission (paragraph 70 TSO WACC Paper) and applying the Lally and Swidler methodology resulted in an asset US RBOC asset beta range relevant to the New Zealand market of 0.71 to 0.74.

A.15. Subsequently, in its '01-'02 Draft TSO Determination, the Commission resiled from relying on (unadjusted) US RBOC asset betas:

*"The Commission believes that there are sufficient differences between the US regimes and the annual TSO regime to justify placing relatively little weight on the asset betas of the US RBOCs."*¹¹

A.16. Given that the Commission appears to make little differentiation between the asset betas for the TSO and for unregulated wireline/PSTN activities it follows that little weight should be placed on the US RBOC asset betas (absent any adjustment for the material differences in telecommunications industry weights between the US and New Zealand capital markets) in assessing an asset beta for interconnect services in New Zealand.

ACCC PSTN Asset Beta Analysis

A.17. In its '02-'03 Draft TSO Determination the Commission states (paragraph 141):

⁹ Lally, M. and S. Swidler, 2003, "*The Effect of an Asset's Market Weight on its Beta: Implications for International Markets*", *Journal of Multinational Financial Management*, vol. 13, pp. 161-70.

¹⁰ To apply the methodology we have used standard deviation of annual return estimates of 25% for telecommunications firms (being Telecom's historical volatility) and 15% for the market (being the NZSE historical volatility). The telecommunications industry market weightings used are 6% US (BusinessWeek 2001 Global 1000 survey) and 22% New Zealand (PwC estimate over the TSO period 20 December 2001 to 30 June 2002). Using this data we have then analysed a plausible range of US asset and equity beta figures, assuming a 30:70 debt:equity ratio.

¹¹ Paragraph 253 of the '01-'02 Draft TSO Determination.

“The Commission concluded that for the purposes of determining the net cost of the TSO in 2001-02, an asset beta of 0.40 was appropriate. This was on the basis that as a starting point, the likely range of the asset beta for the whole of Telecom’s fixed PSTN business is between 0.50 (the ACCC estimate of the asset beta for Telstra’s fixed PSTN business) and 0.95 (OfTel’s estimate of BT’s asset beta at 0.95). The asset beta for the TSP business (prior to the insurance effect and the annual review of costs) is likely to lie in the lower end of the range, since the provision of access services has less variability and less systematic risk than value added services such as broadband internet access.”

A.18. Thus the Commission assesses an asset beta range of 0.50 to 0.95 for Telecom’s PSTN business, with the lower end of that range anchored on the ACCC’s estimate of the asset beta for Telstra’s PSTN business. The opinion of another regulator does not constitute proper market evidence as to actual asset betas and on that basis alone its use by the Commission as valid “evidence” is questionable. Nevertheless, it is instructive to review the analysis that underlies the ACCC’s asset beta estimate of 0.50. In its final report “A report on the assessment of Telstra’s undertaking for the Domestic PSTN Originating and Terminating Access services”, dated July 2000 the ACCC assessed that the asset beta for Telstra lay in the range 0.40 to 0.80 (point estimate 0.5 chosen by the ACCC) and provided the following table (Table A4.2, with footnotes included) of asset beta estimates:

Source	Levered Beta	Implied asset (unlevered) Beta
Telstra ¹²	0.922	0.83
Telstra’s analysis of US RBOCs ¹³	0.63 - 0.91	0.55 – 0.8
OFTEL ¹⁴	0.8	0.68
IPART ¹⁵	n/a	0.41
PBSA ¹⁶	0.95	0.81
Ibbotson ¹⁷	0.69	0.56

A.19. We have previously advised the Commission that because of material differences in stock market composition US RBOC asset beta estimates need to be re-scaled upwards before being applied in the New Zealand context. In its report “TSO, Weighted Average Cost of Capital”, dated 19 May 2003 the Commission had originally proposed using the US RBOCs as good comparator companies for asset beta purposes. However, by the time of its ’01-’02 Draft Determination, dated 27

¹² Telstra Corporation Limited, *Opportunity Cost of Capital for PSTN Access and Egress: Telstra’s Response to Issues Raised by the ACCC*, 24 July 1998, p. 9.

¹³ Telstra Corporation Limited, *Submission in Support of the Undertaking for Domestic PSTN Originating and Terminating Access – Part A: Economic Submissions*, 6 May 1998, p. 30.

¹⁴ OFTEL, *Pricing of Telecommunications Services from 1997 – Controls and Consultative Document on BT Price Interconnection Charging*.

¹⁵ IPART, *The Rate of Return for Electricity Distribution Networks – Discussion Paper*, November 1998, p. 32.

¹⁶ Prudential Bache Securities (Australia) Ltd, *Telecommunications Sector Review*, February 1998, p. 30.

¹⁷ Ibbotson Associates, *Transportation, Communications, Electric, Gas and Sanitary Services Industry Analysis*, December 1999.

June 2003, the Commission had held discussions with the Federal Communications Commission and stated (paragraph 253):

“The Commission believes that there are sufficient differences between the US regimes and the annual TSO regime to justify placing relatively little weight on the asset betas of the US RBOCs.”

A.20. Given the Commission’s position on not directly relying on US RBOC asset beta evidence it would clearly be inconsistent for it to indirectly rely on it via reliance on its contribution to the ACCC’s opinion. Given the market capitalisation weight of the US RBOCs within the US telecommunications sector the Ibbotson data in the table above should be discarded for the same reason.

A.21. The OfTel beta estimate referred to by the ACCC is the opinion of a regulator and not market evidence as such. Furthermore, the Commission directly uses OfTel’s estimate of BT’s asset beta (0.95) as providing the upper end of the Commission’s own assessment of the asset beta range for a PSTN business. Accordingly it does not make sense to include a second OfTel estimate, via the ACCC’s asset beta estimate.

A.22. The IPART telecommunications asset beta estimate of 0.41 originates from (per page 32 of the IPART November 1998 discussion paper):

“Observed equity betas of the industry groups are based on the Risk Management Service published by the Centre for Research in Finance of AGSM, University of New South Wales (March 1998).”

A.23. We do not have ready access to the March 1998 AGSM equity beta estimates, but we have reviewed the detailed September 1998 AGSM equity beta estimates for the Australian telecommunications industry¹⁸. At that date Telstra was not included in the AGSM “beta book”, we presume on the basis that it had only been listed for ten months - not long enough to provide a meaningful beta observation. The constituents of the AGSM Australian telecommunications sector at that time comprised a handful of small Australian companies and Telecom. As to be expected the Telecom equity beta measured by the AGSM by reference to Australian stock market returns was biased downwards (since Telecom is primarily a New Zealand domestic company) - its equity beta against the Australian market was only 0.55. Furthermore, the AGSM sector average appears to be a market capitalisation weighted average and as at September 1998 Telecom comprised 93% of the sector. Clearly the IPART asset beta has to be rejected as it is primarily based on measuring a New Zealand company versus an Australian market index, which is inconsistent with the Commission’s application of a domestic CAPM (or for that matter the proper application of an international CAPM). Furthermore, the Commission has itself previously objected to PricewaterhouseCoopers including Telecom in its “compco” sample (paragraph A5.34, ’01-’02 Final Determination):

“The data point from Telecom should be excluded, as the purpose is to use data on international telecommunication firms to indicate the beta for Telecom’s PSTN business. The estimates of Telecom’s beta is considered separately.”

¹⁸ The AGSM betas are generally measured over 48 months, so in such cases the March 1998 and September 1998 betas will have 42 out of 48 return observations in common.

A.24. Once the ACCC PSTN asset beta analysis has been subject to this level of scrutiny, including consistently applying the Commission’s own reasoning, the ACCC table is left as follows:

Source	Levered Beta	Implied asset (unlevered) Beta
Telstra	0.922	0.83
PBSA	0.95	0.81

A.25. The average of the two sources remaining in the ACCC’s table is 0.82. We are unable to comment on the data sources that remain, but note that these remaining ACCC PSTN asset beta estimates are in accord with PricewaterhouseCoopers’ own assessment of a wireline/PSTN asset beta, as consistently advised to the Commission, of 0.80.

A.26. Accordingly, the Commission’s PSTN asset beta range (if it is still to be referenced off the data sourced from the ACCC’s analysis that remains appropriate) should be 0.82 to 0.95, rather than 0.50 to 0.95.

US Rate of Return Regulated Electric Utilities

Reconciliation with Market Evidence

A.27. In the process of using US electricity utilities “subject to rate of return regulation” as its starting point for estimating the TSO asset beta in its ‘01-’02 Final Determination, the Commission has not provided any reconciliation of the significant difference between observed wireline telecommunications asset betas (PwC estimate 0.80) and observed US electricity utilities’ asset betas (Commission estimate 0.30). The difference in these two asset beta estimates, at 0.50, is large. It is our assertion that most of this difference relates to risk factors that should properly be priced into the fair rate of return for the provider of interconnect or TSO services. The Commission has not provided any objective analysis of this difference; in particular it has not objectively quantified the factors that drive this difference and then demonstrated, using empirical data and formal models, how and why these would not be relevant to the provision of interconnect or TSO services.

A.28. In our view it is difficult, if not impossible, to satisfactorily reconcile the gap between the above asset beta estimates for wireline telecommunications and US electricity utilities. Notwithstanding this hurdle, we attempt below to reconcile as much of the gap as we can. We also re-present our previous telecommunications industry beta analysis in a reconciliation format, to demonstrate the plausible range in which an objective estimate of a wireline/PSTN asset beta. In particular the TSO asset beta, must lie. As part of that process we first discuss some of the factors affecting beta that are considered by the Commission in its ‘01-’02 Final Determination. This discussion is not intended to be exhaustive, but rather focuses on how relevant industry factors or TSO specific factors might reasonably be quantified for the purpose of an objective asset beta reconciliation.

A.29. In the ‘01-’02 Final Determination the Commission discusses (paragraph 188) the following factors as they relate, in the Commission’s opinion, to estimating the TSO asset beta:

- a) Industry, i.e. the nature of the product or service
- b) Nature of the customer
- c) Pricing structure
- d) Duration of contract prices with suppliers and customers
- e) Presence of price or rate of return regulation
- f) Degree of monopoly
- g) Nature of the firm's real options
- h) Operating leverage
- i) Market weight
- j) Capital structure.

A.30. In its discussion of the above factors the Commission does not provide any evidence or arguments on why (or by how much) the TSO asset beta might differ from that for a wireline telecommunications business, other than for the presence of price or rate of return regulation, factor (e.) above¹⁹. Nor does the Commission provide any objective evidence to support its proposition that the sensitivity of TSO returns is similar to that for US electricity utilities with respect to these factors.

A.31. The Commission also discusses a number of other factors of potential relevance to estimating the TSO beta, being:

- Use of US rate of return regulated electric utilities as a comparator group, based on analysis of the potential TSO “insurance effect” (i.e. systematic risk associated with current year variability in TSO revenue and costs and default risk);
- Shocks to the discount rate (i.e. the market required rate of return); and
- Asset optimisation, stranding and revaluation risk.

A.32. We now discuss each of these latter factors below.

Use of US Rate of Return Regulated Electric Utilities as a Comparator Group

A.33. The Commission uses a model of firm value to measure the effect that the current year “insurance effect” might have on the TSO required rate of return, which is similar to a model proposed by PwC for the same purpose. The Commission reaches a similar conclusion as us, namely that the degree of certainty provided by the TSO regime with respect to current year profits/cash flows can only exert a minor effect on the overall required rate of return²⁰. However, the Commission then relies²¹

¹⁹ The Commission does note that the market value weight (factor (i) above) of the assets used to provide the TSO services will differ from that of Telecom, but does not propose any adjustment. In fact since Telecom's equity beta has been greater than 1.0 the direction of the adjustment would be to increase Telecom's beta before using it as a basis for estimating the TSO beta.

²⁰ Paragraphs 208-209 of the '01-'02 Final Determination.

on a hypothesis proposed by Lally that the systematic risks associated with discount rate (“*d*”) applicable to end of year firm value (i.e. value beyond current year profits/cash flows) is equal across all regulated industries activities. On this basis the Commission goes on to state (paragraph 211) that:

Thus, the systematic risk of the TSP will be primarily determined by the systematic risk (beta) attributable to the discount rate “d” in equation (4). Possible beta estimates for overseas businesses subject to comparable regulation are discussed further below.

A.34. The Commission then relies on an estimate of the asset beta for US electricity firms subject to rate of return regulation (0.30) as providing the basis for estimating the TSO asset beta. However, Lally’s hypothesis is simply that, an untested hypothesis, which is not supported by market evidence, including some of the market evidence presented by the Commission in the ‘01-’02 Final Determination. The evidence we refer to is the beta analysis attributed to Alexander et al in paragraph A5.60. Under Lally’s hypothesis the asset betas for rate of return regulated firms should be the same across all industries (providing the regulatory review period is short), yet the table presented by the Commission shows the following significant variation in rate of return regulated industry asset betas:

Electricity	Gas	Energy	Water	Telecoms
0.35	0.20	0.25	0.29	0.47

A.35. Just as it would clearly be unfounded to use a rate of return regulated gas industry asset beta of 0.20 as the basis for estimating the fair rate of return for a rate of return regulated telecoms company, it is also unfounded to use rate of return regulated electricity asset beta estimates as the basis for estimating the TSO asset beta. While Lally’s model has the variation in regulatory review periods as a potential explanation for variation in rate of return regulated firm asset betas, the Commission has not provided any analysis of the regulatory review periods for the companies in the Alexander et al sample and thus a reconciliation of to what extent, if any, this factor can explain the significant differences observed in the market for regulated industry asset betas. Furthermore, the Commission has not provided any analysis of the specific regulatory regimes and regulatory review periods for the companies it used as the basis for its asset beta estimate for US electricity firms subject to rate of return regulation. Yet the Commission was critical of attempts by Monitor Group to statistically analyse, using a large US company data set, the potential effects of regulatory regimes on asset beta (refer paragraph A5.55-A5.58 of the ‘01-’02 Final Determination).

A.36. In its analysis of the “insurance effect”²² the Commission has omitted to apply the model to unregulated telecommunications firms (or more specifically unregulated wireline businesses) to derive plausible estimates of discount rates “*k*” and “*d*” and to then objectively analyse why and by how much these discount rates might vary for the TSO business. In our report on the TSO WACC dated 13 June 2003 PwC undertook this critical step to demonstrate that the overall TSO asset beta could not be much (nil to 0.05) less than that for an unregulated wireline business. Instead the Commission has relied on an untested hypothesis proposed by Lally (and which is

²¹ Paragraph 210 of the ‘01-’02 Final Determination.

²² Paragraphs 204-211 of the ‘01-’02 Final Determination.

contradicted by market evidence, including evidence presented by the Commission itself) to subjectively reference the discount rate “*d*”, in respect of the TSO, to an asset beta estimate for a completely different industry.

A.37. We note that in the TSLRIC Principles Paper the Commission raises the prospect of using US rate of return regulated electric utilities as a comparator group for estimating a wireline/PSTN asset beta, but without any adjustment for the TSO “insurance effect” (which adjustment by the Commission is not transparent, but which would not appear to be large).

Shocks to the Discount Rate

A.38. The Commission acknowledges that the TSO business will be exposed to potential shocks to market-wide discount rates and that this exposure is implicit in the asset betas of regulated and unregulated firms. We do not address this issue any further in this report.

Asset Optimisation, Stranding and Revaluation Risk

A.39. The Commission states (paragraphs 220 and 226 respectively) the following in the `01-`02 Final Determination in respect of asset optimisation, stranding and revaluation risk:

“The Commission considers that a significant part of the risk of changes in the optimised replacement cost of the TSO’s assets from technology risk and asset stranding may be asset-specific or non-systematic risk, or may be negatively correlated to the market.”

and

“In summary, the Commission is not satisfied that the systematic component of the risks of asset optimisation and the risks of asset stranding warrant any increment to the TSO beta compared to assets valued with reference to historical cost.”

A.40. The Commission states that the risk of asset stranding is reduced through regularly reviewing depreciation parameters (paragraph 334):

“In particular, reviewing the depreciation parameters on an annual basis effectively exposes the TSP to the risk of asset stranding only over the forthcoming year, that is, until the next review date. The risk of asset stranding in later years can be reduced by using new information (as time passes) to correctly identify in advance when this risk has increased and to accelerate the depreciation profile accordingly.”

A.41. In the `01-`02 Final Determination the Commission makes several statements to the effect that by using a tilted annuity and regularly reviewing depreciation rates the risks of asset optimisation, stranding and revaluation are adequately compensated for via the cashflows/depreciation. The Commission would only be correct in this assertion in the following (restricted) circumstances, where:

- Only systematic risk is priced in the market (i.e. the CAPM is “true” – and able to be properly implemented);
- Asset optimisation, stranding and revaluation risk are completely non-systematic risks; and
- Asset optimisation, stranding and revaluation risk are symmetrically distributed around their mean expected values.

A.42. The last point is outside our brief and we understand that you have engaged other experts to advise you on these asymmetric risk related matters. We address the first point, the validity of the CAPM in the section that follows. This leaves the issue of whether or not there is any systematic component to asset optimisation, stranding and revaluation risks. In our opinion there is a significant systematic component to these risks, which is why there are observable differences in asset betas for industries such as telecommunications versus electric utilities.

A.43. By incorporating mean expected rates of asset optimisation, asset stranding and asset revaluations into the tilted annuity calculations used in the TSO costing the Commission is doing no more than what would be expected to occur in the markets for valuing firms and for pricing the services offered by such firms. It is the unexpected “shocks” or variations around these mean expectations that creates risk for investors, risk that has a systematic component.

A.44. It is difficult to obtain relevant data to test the systematic nature of asset optimisation and asset stranding risk. It is also difficult to obtain relevant data on the systematic component of asset revaluation risk that arises as a result of shock changes in the type of technology being used in Modern Equivalent Assets (“MEA”) (e.g. fibre optic versus copper cable). However, US Producer Price Index (“PPI”) data is available to enable us to estimate the systematic risk of “shock” changes to prices within certain categories of telecommunications equipment (e.g. fibre optic cable). We summarise below the methodology we have used to do this:

- Obtain monthly US PPI data for identifiable telecommunications materials and equipment categories (data generally covered the period January 1994 to April 2004);
- Convert the PPI data to a real index, by subtracting US Consumer Price Index inflation for each month (i.e. to “back out” the market’s expectations of general inflationary price changes);
- Compute the overall average real change for each index over the full sample period, then subtract this from the real change for each month (i.e. to “back out” the market’s expectations of real price trends);
- Regress the resulting real unexpected changes in the PPIs (i.e. the unexpected real price shocks) against S&P500 index changes over the period for which data was available – to calculate the betas (or systematic risk component) of the unexpected real price shocks. In calculating these betas we allow for non-synchronous transmission of information between the stock

market and the materials/equipment markets by using the Aggregated Coefficients Method²³ with four lead and four lagged monthly periods.

A.45. The results of our analysis are summarised in the table below:

Item	Group	Series ID	Beta
Fiber optic cable	Metals and metal products	WPU10260333	0.139
Telephone and telegraph wire and cable	Metals and metal products	WPU10260303	0.070
Switching equipment	Machinery and equipment	WPU11760121	0.006
Telephone and telegraph apparatus	Machinery and equipment	WPU11760141	0.173
Average			0.097

A.46. Our analysis demonstrates, using actual data and contrary to the Commission’s subjective opinion, that unexpected changes to the replacement cost of telecommunications assets have a systematic component. For each of the asset categories examined its beta was positive, with an average beta of approximately 0.10. The implication of this is that a telecommunications company regulated to earn rate of return on the replacement cost of its existing assets (but without any risk arising from optimisation, stranding or changes in the MEA) should have an asset beta in the order of 0.10 higher than an equivalent firm regulated to earn rate of return on the historical cost of its existing assets.

A.47. In paragraph 221 of the `01-`02 Final Determination the Commission states:

“For example, a technology price shock that lowers the cost of cellular access may, by allowing better and cheaper communications, provide a positive shock to the economy. The impact on the TSP may, however, be negative as the value of the TSO’s assets falls by an amount greater than may have been expected.”

A.48. However, our objective analysis using actual data demonstrates that in fact the opposite effect occurs:- A technology price shock that reduces the cost of providing telecommunications services appears likely to reduce the capital value of all telecommunications firms and consequently, but to a lesser extent, the capital value of the entire market. The value gains to users of telecommunications services as a result of that technology price shock would not appear to be sufficient to offset this effect. Given Telecom’s weight in the New Zealand share market we would expect that such an effect would be even more pronounced in the New Zealand market.

A.49. It is important to re-iterate that our analysis above was only able to examine the systematic effect of price changes within asset categories. We would expect that shock changes to the type of asset that constitutes the MEA would display the same characteristics and hence that the total beta risk of asset revaluation, that arises from price shocks for the same technology and shock changes to the type of technology (at the MEA level), would be greater than that arising from price shocks for the same technology alone.

²³ Refer, for example, to Sinclair, N.A. ,1981, An Empirical Examination of the Required Number of Leading and Lagged Variables fro ACM Beta Estimation, Australian Journal of Management, 6, 2, pp.119-126. The Aggregated Coefficients Method is routinely used by, for example, Fama and French to estimate company betas.

A.50. Furthermore, and for the same reason, we would expect that asset optimisation risk will also have a systematic component.

A.51. With respect to asset stranding the same dynamics may not apply, but the key issue is whether or not there is a systematic component to asset stranding. The Commission makes the following statement in respect of the systematic risk of shocks to TSO demand (paragraph 225):

“... the TSP tends to supply services to CNVCs in relatively unpopulated and/or remote areas and demand shocks from customers in small regional economies may be relatively uncorrelated to demand shocks nationally.”

A.52. A similar reasoning might thus be proposed as to why asset stranding (e.g. during periods of poor economic performance in small regional economies) might also be presumed to be non-systematic. However, the Commission has not provided any evidence that this is the case. Indeed we note that the economic performance of the New Zealand rural sector is correlated with the overall economic performance of the country. For example, a recent Treasury paper documents the effect that climatic shocks (which cause shocks to agricultural output) can have on national GDP²⁴. Providing there is some positive correlation between asset stranding risk and market returns, then asset stranding risk will have a systematic component that should be reflected in both the interconnect asset beta and the TSO asset beta.

Reconciliation of Beta Estimation Approaches

A.53. As noted at the beginning of this section of our report the Commission, in its `01-`02 Final Determination, did not reconcile its TSO asset beta estimate with the observable betas for listed telecommunications companies nor did it reconcile its US electric utility reference point beta with the observable betas for listed telecommunications companies. We present below a framework for undertaking such reconciliations and, in doing so, highlight the unreasonableness of the Commission’s subjective assessment of the TSO asset beta.

A.54. In moving between asset betas for regulated electricity utilities and regulated telecommunications companies we have available the following estimates of the “industry effect”:

- The data of Alexander et al, as presented by the Commission. This shows the following asset beta differences, as between regulated utilities and telecommunications firms:

Incentive or Regulatory Regime	Electricity	Telecoms	Telecoms less Electricity
High-power (e.g. Price cap)	0.57	0.77	0.20
Intermediate (Discretionary)	0.41	0.70	0.29
Low-powered (e.g. Rate of return regulation)	0.35	0.47	0.12
Average			0.20

²⁴ Robert A Buckle, Kunhong Kim, Heather Kirkham, Nathan McLellan and Jared Sharma, “A structural VAR model of the New Zealand business cycle”, New Zealand Treasury Working Paper 02/26, December 2002.

²⁵ Robert A Buckle, Kunhong Kim, Heather Kirkham, Nathan McLellan and Jared Sharma, “A structural VAR model of the New Zealand business cycle”, New Zealand Treasury Working Paper 02/26, December 2002.

- The extensive analysis presented to the Commission by the Monitor Group at the August 2003 TSO Conference, which showed a difference in equity betas between utilities and telecommunications firms, controlling for regulation and other factors, of 0.68 to 0.69. At an average gearing level of, say, 30% this equates to an asset beta difference in the order of 0.50.

A.55. We have previously estimated that the so called TSO “insurance effect” reduces the TSO asset beta by between nil and 0.05 (our report dated 13 June 2003). While in our analysis above we have shown that a plausible contribution to the TSO asset beta from asset revaluation price risk (excluding optimisation risk, stranding risk and the risk from shock technological changes at the MEA level) is in the order of 0.10. We have not been able to objectively quantify the beta effects of optimisation risk, stranding risk and the risk from shock technological changes at the MEA level. However, the fact that revaluation price risk has a positive beta suggests that these other risk factors also have positive betas.

A.56. Drawing the above together we demonstrate two comprehensive, objective approaches, of which at least one is required in order to arrive at a reasonable TSO (and also interconnect) asset beta estimate. And to provide confidence in the TSO asset beta estimate the two approaches should be reconcilable. “Approach 1” is the approach taken by PwC to date, to use the betas for listed telecommunications firms as the starting point then adjust for identifiable and quantifiable risk characteristics that may differ for the TSO. “Approach 2” is the approach taken by the Commission in its 01-02 Final Determination, whereby its assessment of the asset beta for US rate of return regulated electricity utilities is used as the reference point with adjustment for risk characteristics that may differ for the TSO. While we consider Approach 1 to be more objective and robust than Approach 2, we provide estimates for some of the adjustments required to make a more reasonable attempt to apply Approach 2.

<u>Approach 1</u>	<u>Approach 2</u>			Comment	Paragraph reference
PwC	Commission	PwC	PwC		
Point estimate (PwC's 9 September 2003 Report)	Point estimate ('01-'02 Final Determination)	Low estimate (this report)	High estimate (this report)		
0.80				Start with wireline telecommunications asset beta	A27
0.00				Deduct TSO "insurance effect"	A36
0.80	0.40	0.60 + ?	0.90 + ?	TSO Asset Beta Estimate	
	nil	+ ?	+ ?	Add on systematic risk arising from asset stranding shocks	A52
	nil	+ ?	+ ?	Add on systematic risk arising from shocks via asset optimisation	A50
	nil	+ ?	+ ?	Add on systematic risk arising from shocks to MEA, excluding same asset prices	A49
	0.40	0.60	0.90	Sub-total	
	nil	0.10	0.10	Add on systematic risk arising from shocks to asset prices (same assets)	A55
	0.10	0.20	0.50	Add on industry effect (under regulation)	A54
	0.30	0.30	0.30	Start with US rate of return regulated electricity utilities	A27

A.57. We note that our TSO asset beta estimate is the same as our wireline/PSTN asset beta estimate as the only factor that we consider might cause these to be different, the TSO "insurance effect", has a minimal impact.

A.58. It is evident from examining the two approaches presented above that, by using US electricity utility betas as a reference point for estimating a wireline/PSTN asset beta, additional risk factors have to be quantified and allowed for vis-à-vis using telecommunications firms as the starting point for the beta analysis. Not only has the Commission chosen a poor reference point for its TSO asset beta estimation, but it has also failed to bridge the gap between its reference point (US electricity utilities subject to rate of return regulation) and the observed asset betas for listed telecommunications firms. We would be concerned if the Commission were to try and apply this same approach to estimating the asset beta for interconnect services.

A.59. We provide a framework for undertaking that reconciliation and it can be seen that only modest systematic risk allowances have to be attributed to asset optimisation risk, asset stranding risk and asset MEA risk (other than shocks to prices for the same asset types), together with a modest allowance for the industry specific systematic risks of a regulated telecommunications firm vis-à-vis a regulated electricity utility, in order to get from a US regulated electricity utility asset beta estimate of 0.30 to our wireline/PSTN/TSO asset beta estimate of 0.80. The systematic risk evident in telecommunications asset replacement prices together with the clear differences in industry risk for companies subject to regulation supports the reasonableness of our wireline/PSTN/TSO asset beta estimate even if the Commission's US electricity utility reference point is used.