

**REPORT ON THE  
APPROPRIATE WEIGHTED  
AVERAGE COST OF  
CAPITAL FOR THE ULLS  
NETWORK  
(PUBLIC VERSION)**

**Prepared for Telstra**

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## INTRODUCTION

- 1 I have been asked by Telstra Corporation Limited (“**Telstra**”) to give my expert opinion in relation to the appropriate Weighted Average Cost of Capital (“**WACC**”) applicable to a Network on which Unconditioned Local Loop Service is provided (“**ULLS-Network**”) for the three financial years 2005/06 through 2007/08. The service is discussed in more detail in section 4 below.
- 2 I am instructed that Telstra considers the information in this statement confidential. I have prepared this statement on the assumption that the information and documents referred to herein will remain confidential and that the information and documents will only be disclosed to a person:
- (a) who has executed a confidentiality undertaking in terms that are satisfactory to Telstra; and
  - (b) who may only use the documents and the information for the following purposes:
    - (i) making submissions to the Australian Competition and Consumer Commission (“**ACCC**”) in respect of the Access Undertakings and the public consultation under s 152AQB(5); or
    - (ii) any application made to the Australian Competition Tribunal under s152E of the Trade Practices Act for review of a decision made by the ACCC in respect of any of the Access Undertakings; or
    - (iii) any other purpose approved by Telstra in writing.

## 2. QUALIFICATIONS AND EXPERIENCE

### 2.1 Qualifications

- 2 I am a Professor of Finance in the Department of Accounting and Finance at the University of Auckland. In that capacity I am involved in issues related to cost of capital on a regular basis. My curriculum vita is annexed as Appendix A to this report.
- 3 I am also active as a financial economics expert and consultant. The bulk of my activities as an expert in financial economics over the past few years have been in the environment of regulation and specifically with respect to cost of capital issues.
- 4 My doctoral dissertation topic at Stanford University (USA) was “An Empirical Investigation of the Debt Equivalence of Leases” which is closely related to capital structure issues and cost of capital.
- 5 In the past ten years at the University of Auckland, Hong Kong Polytechnic University, National University of Singapore and the University of Queensland I have taught courses in Introductory Investments, Introductory Financial Management, Advanced Financial Management, Case Studies in Finance, Financial Statement Analysis, and Seminar in Modern Corporate Finance. All of these

courses include components on the cost of capital. While at the University of Auckland, I have supervised research on topics relevant to cost of capital at the undergraduate, diploma, MBA, masters and doctorate levels.

6 I have published numerous articles in international journals and books, presented research papers at international conferences and presented invited guest research seminars at numerous universities. Nearly half of my research publications are on topics related to cost of capital, including:

- (a) “Estimating Betas Using Comparable Company Analysis: Is it a Reliable Method?”
- (b) “A Test of the Usefulness of Comparable Company Analysis in Australia,”
- (c) “Estimating the Market Risk Premium,”
- (d) “Cost of Capital under Imputation: An Analysis of Comparative Models,”
- (e) “Information Content of Financial Leverage: An Empirical Study: A Comment,”
- (f) “Implications of Dividend Imputation for Equity Pricing in New Zealand,”
- (g) “The Importance of a Market Value Measurement of Debt in Assessing Leverage,”
- (h) “The Debt Equivalence of Leases: An Empirical Investigation,” and
- (i) “The Theoretical Relationship Between Systematic Risk and Financial (Accounting) Variables.”

7 I am currently on the editorial board of an academic journal (*International Review of Finance*) and am an active reviewer for other journals. In these capacities I am involved in evaluating the research work of other scholars on topics including the cost of capital.

## 2.2 Experience

8 I have been involved in the estimation of cost of capital at both a practical and theoretical level through most of my commercial and academic career. In my academic positions I have regularly taught courses on cost of capital at undergraduate and graduate levels. I have lectured to executive audiences in Australia, New Zealand, Hong Kong, Singapore and the United States. I have consulted and provided expert evidence on topics in financial economics, including cost of capital.

9 In my work as a consultant and expert witness over the past five years, I have been involved in cost of capital estimations for a range of different companies including the following:

Australia

Telstra (including in relation to USO, Public Switched Telephone Network (“PSTN”) originating and terminating access, GSM, ULLS, ISDN and Pay TV)

ElectraNet SA

EnergyAustralia

Goldfields Gas Transmission Joint Venture

GasNet Australia

Rail Access Corporation

Queensland Rail

Sunwater

Transend Networks

Westralia Airports Corporation (Perth International Airport)

Argentina

Ente Nacional Regulador de la Electricidad

Italy

Telecom Italia Mobile

New Zealand

ABN-AMRO (NZ)

Air New Zealand

Board of Airline Representatives of NZ

Hawkes Bay Network

PowerCo

TransWaste Canterbury

Unison Networks Limited

Waste Management NZ

Singapore

PowerGas

United States/Thailand

Sithe Mauritius Power Limited

Venezuela

Telcel

- 10 I have also been involved in advising regulators and government agencies on cost of capital issues including the following:
- Ministry of Economic Development (NZ)
  - National Competition Council
  - Office of the Rail Access Regulator
- 11 I was involved in a project in 2000 to advise the National Competition Council (Australia) on aspects of an application from the Northern Territories Government to certify a regime for access to the Northern Territories electricity networks. This involved advising on the proposed approach to WACC (including issues similar to those involved in this context) and the measurement of the network asset base.
- 12 In 2002 I was responsible for the preparation of the cost of capital component of a report to the Ministry of Economic Development in New Zealand on Telecom New Zealand. The objective of the report was to develop an appropriate structure for the estimation of WACC for Telecom New Zealand.
- 13 I have been involved in advising the Office of Rail Access Regulator on appropriate models and parameters to use in setting the WACC for rail access.
- 14 I was involved in the preparation of the report “International Comparison of WACC Decisions,” which was submitted to the Productivity Commission Review of the Gas Access Regime in September 2003.
- 15 I advised GasNet Australia in its appeal to the Australian Competition Tribunal of the ACCC’s Final Approval of 17 January 2003 in connection with revisions to the access arrangement for GasNet’s gas transmission system.
- 16 I have advised PowerCo on cost of capital issues in its submissions to the New Zealand Commerce Commission on the Gas Control Inquiry. This has involved a number of submissions. An issue which has been addressed a number of times in earlier deliberations before the Commission is the asymmetry of the social costs and benefits of an error in setting WACC. This principle had been acknowledged by the Commission. In my submission in response to the Commission’s Draft Decision,<sup>1</sup> I argued that a sensible consideration of the issue required adopting a statistical structure, setting all ranges as estimates of one standard deviation on the underlying parameter. Then the implications for WACC should be determined using Monte Carlo simulation and the regulatory WACC should be set above the “best estimate” of WACC based upon the severity of the asymmetry of social costs. The Commission adopted my recommendations in its Final Decision.<sup>2</sup>

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<sup>1</sup> Response to WACC Issues in Commerce Commission’s Draft Report on the Gas Control Inquiry, dated June 2004.

<sup>2</sup> Commerce Commission’s Gas Control Inquiry Final Report, dated 29 November 2004.

### **3. WEIGHTED AVERAGE COST OF CAPITAL**

17 It is a fundamental principle of finance and of business that investments are made in projects only if there is an expectation that an appropriate reward will be earned to compensate for any risk that the project entails. The higher the risk, the higher the expected return needs to be to entice investors.

18 The principle that risk will require an appropriate expected return applies to both of the major sources of capital to a business; that is debt and equity. The process of determining the appropriate expected return for a business builds upon the estimates of the appropriate return to each source of capital. Then these costs of capital are weighted by their respective contributions to the total capital.

19 The resulting cost of capital for the business is referred to as the Weighted Average Cost of Capital or WACC. This report sets out an appropriate estimate of the WACC for the assets which comprise the ULLS-Network.

20 The context in which I consider the establishment of an appropriate WACC is the undertaking for ULLS-Network provided by Telstra to the ACCC for the financial years 2005/06 through 2007/08.

### **4. OVERVIEW OF THE REPORT**

21 In this report I set out the models, parameters, techniques and evidence that I believe are best suited to the task of estimating an appropriate WACC for ULLS-Network. Before going further, I identify the ULLS-Network business.

22 ULLS-Network costs are the costs associated with an underlying copper customer access network (CAN). The assets consist mainly of cable and trenching costs.

23 The correct time frame for the estimation of the WACC is at the beginning of the relevant period. I am advised that Telstra estimates ULLS Network costs for the three fiscal years 2005/06, 2006/07 and 2007/08. For the fiscal year 2005/06, I estimate WACC as at the beginning of the year, which is as of 1 July 2005. The following two years are in the future, so I will forecast parameter values that are appropriate estimates for the WACC as at the beginning of each of the years, that is, 1 July 2006 and 1 July 2007.

24 In addition to estimating the cost of capital for ULLS-Network, I also address the setting of a WACC for regulatory purposes generally, given the best point estimate of WACC, the scope for estimation error and the asymmetry in social costs of such error. This is an important issue that has been considered by the Commerce Commission in New Zealand but has not been explicitly addressed by Australian regulators.

25 The ACCC has considered using the Monte Carlo technique for estimating the distributional properties of WACC estimates in Appendix C of its draft decision "Assessment of Telstra's ULLS and LSS monthly charge undertakings" dated August 2005. The ACCC also considered WACC estimates based on being one

standard deviation above the mid-point estimate of WACC. This was an important step but did not adequately address the issue of the asymmetry in the social costs.<sup>3</sup>

- 26 The ACCC must estimate the cost of capital in an uncertain environment. Virtually all of its estimates are made with estimation error and, as I will outline later, generally with considerable estimation error. The ACCC therefore needs to give consideration to the intermediate and long-term consequences of either over or under estimating an appropriate cost of capital. It is widely agreed that in a regulatory environment, the net social costs of under estimating the cost of capital are higher than are the net social costs of over estimation. Therefore I consider that the ACCC should set the regulatory WACC above its point estimate of the WACC to reflect the high social cost of setting the WACC too low.

## 5. APPLYING THE WACC MODEL

- 27 Determination of the appropriate WACC will vary depending upon whether the WACC is to be in nominal or real terms<sup>4</sup> and whether it is to be expressed before or after taxes. It is imperative that the form of the WACC is consistent with the measurement of the cash flows to which the WACC will be applied or which are notionally generated.
- 28 Recent regulatory decisions in Australia have adopted what is referred to as a “vanilla” WACC. In this formulation the tax impact of interest expense is included in costs, rather than in the WACC formula. This approach results in a nominal, post-tax vanilla WACC defined as:

$$\text{WACC} = R_e (E/V) + R_d (D/V) \quad (1)$$

where

$R_e$  = cost of equity capital (explained in sections 6 and 9 below),

$R_d$  = cost of debt capital (explained in section 7 below),

$E$  = market value of equity,

$D$  = market value of debt, and

$V$  = market value of the firm (E+D).

- 29 Some versions of the WACC include the tax rate and/or the value of dividend imputation credits. Although neither of these parameters enter into the estimation of the post-tax vanilla WACC, they are reflected in the costings that are a part of the undertaking. Therefore, I will discuss the two parameters in section 8 below.

<sup>3</sup> I addressed this appendix to the ACCC’s draft decision in my “Confidential Report on WACC in Response to ACCC Draft Decision on ULLS and SSS,” dated September 2005.

<sup>4</sup> Amounts or rates of return stated in nominal terms are in current dollar terms. This contrasts with amounts or rates stated in real terms, which means they have been adjusted to exclude the effect of inflation.

## 5.1 ULLS-Network and Telstra

30 My objective is to estimate an appropriate WACC specifically for the assets used by ULLS-Network. When information is only available at the firm level of Telstra, I will use that information but adapt it to suit the circumstances of ULLS-Network. This will inevitably involve estimation and professional judgement.

31 The ULLS-Network business is part of the larger PSTN network. Therefore, in my opinion its WACCs is the same as the WACC for the PSTN network.

## 6. COST OF EQUITY CAPITAL

32 The cost of equity capital is the return that investors expect to earn before they are willing to commit equity funds to a business. The standard model that is used for the estimation of the cost of equity capital is the Capital Asset Pricing Model (“CAPM”):

$$E(R_e) = R_f + [E(R_m) - R_f] * \beta_e \quad (2)$$

where

$E(.)$  = indicates the variable is an expectation,

$R_e$  = cost of equity capital (explained in section 9),

$R_f$  = risk free rate of return (explained in section 6.1),

$R_m$  = market rate of return (explained in section 6.2), and

$\beta_e$  = systematic risk parameter for equity (explained in sections 9.1 and 9.2 and in Appendix F).

### 6.1 Risk Free Rate of Interest

33 The risk free rate of interest is almost universally measured as the rate of return on government bonds, because the debts of the government are regarded as free of default risk. It should be the forward-looking rate that would be known at the beginning of the financial year for which the WACC is being estimated.

34 There have generally been two major issues with respect to its measurement: the appropriate maturity to use and whether to use a market quoted rate on-the-day or an average of rates around the date of setting the WACC. The rate of return on government bonds will be different depending, amongst other things, upon the time that is to elapse until the maturity date of the bond. Therefore, in measuring the risk free rate, it is necessary to specify the maturity of the government bond.

#### 6.1.1 The risk free rate in the cost of equity capital

35 The CAPM is used to estimate the cost of equity capital, and the risk free rate appears in two places in the model. Although it seems obvious that the risk free rate must be the same in both these places, the ACCC had maintained that different



risk free rates could be used within the CAPM. The ACCC's peculiar position has been contested by numerous entities.

36 The error can be illustrated with a simple example. To allow the possibility of the risk free rates being different, I denote the first as  $R_f(1)$  and the second as  $R_f(2)$ . I do not know of any version of the CAPM anywhere in the literature of financial economics that has proposed notation that differentiates these two, but it serves the purpose of considering the possibility.

37 With the modification to allow the possibility of the ACCC's conjecture, the CAPM for a company that has a beta of one is:

$$\begin{aligned} E(R_e) &= R_f(1) + 1 * [E(R_m) - R_f(2)] \\ &= E(R_m) + [R_f(1) - R_f(2)] . \end{aligned}$$

38 Since a company with a beta of one has the same beta as the market, it must be that:

$$E(R_e) = E(R_m) .$$

39 But this can only be the case if:

$$R_f(1) - R_f(2) = 0 ,$$

which of course requires that:

$$R_f(1) = R_f(2) .$$

40 Therefore, the risk free rate applied to estimating the market risk premium must be the same risk free rate as used in determining the base risk free rate.

41 The above analysis, as well as common sense, shows that the measurement of the risk free rate in the CAPM must be consistent.<sup>5</sup> If  $R_f$  is not the same in both instances, the model being used is not the CAPM.

42 In its final decision (17 January 2003) in connection with revisions to the access arrangement for GasNet's gas transmission system, the ACCC used different risk free rates within the CAPM.

43 In an appeal by GasNet Australia (Operations) Pty Ltd, the Australian Competition Tribunal accepted that the CAPM requires internal consistency with respect to measurement of the risk free rate.<sup>6</sup>

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<sup>5</sup> To illustrate the imperative to be consistent on the risk free rate across the CAPM, assume that  $R_m$  is 13%, 10-year  $R_f$  is 6% and 3-year  $R_f$  is 5%. When the historical measure of MRP is calculated using the 10-year  $R_f$  it will be equal to 7%. If subsequently  $R_m$  is estimated as MRP plus the 3-year  $R_f$  the result will be  $7\% + 5\% = 12\%$ , which clearly is understated. The amount of the understatement is 1%, which is the difference between the average 10-year rate of 6% and the average 3-year rate of 5%. If a company is allowed a return on its investments that is based upon a risk free rate that is too low, the return will be lower than its true WACC. In such a case, the company would not make investments because its allowed return is too low and any such investments would destroy value.

<sup>6</sup> Australian Competition Tribunal, Application by GasNet Australia (Operations) Pty Ltd [2003] ACompT 6, paragraph 47.

*The ACCC erred in concluding that it was open to it to apply the CAPM in other than the conventional way to produce an outcome which it believed better achieved the objectives of s 8.1 [of the National Gas Code]. In truth and reality, the use of different values for a risk free rate in the working out of a Rate of Return by the CAPM formula is neither true to the formula nor a conventional use of the CAPM. It is the use of another model based on the CAPM with adjustments made on a pragmatic basis to achieve an outcome which reflects an attempt to modify the model to one which operates by reference to the regulatory period of five years. The CAPM is not a model, which is intended to operate in this way. The timescales are dictated by the relevant underlying facts in each case and for present purposes those include the life of the assets and the term of the investment.*

- 44 Since then, the ACCC has acknowledged that the WACC should be based on a 10-year risk free rate for long-lived assets such as network assets.<sup>7</sup>
- 45 The broader point is that the risk free rate used in the CAPM must be the same rate in both places that it is used (see equation 2). In particular, this requires that the maturity of the risk free rate must be the same in both instances.
- 46 I recommend using 10-year government bonds to estimate the risk free rate when estimating the cost of equity capital for ULLS-Network.

#### **6.1.2 Current or average market rates**

- 47 The second issue often raised with respect to the risk free rate is whether the risk free rate should be set based upon current market on-the-day rates or whether it should be based upon an averaging of rates across some period (e.g., across 20 trading days). The basis for favouring an average is a concern that because of market volatility, the rate on a single day may reflect a transitory error.
- 48 The motivation for averaging is to avoid instances where the rate on a day is not representative of the debt market at that time. This would be a valid argument if there were clear evidence of market thinness that would be consistent with the possibility of noise and bias in market prices. In that case it may be appropriate to use averaging in setting the rate. In my view, the market for government debt is sufficiently liquid for maturities up to ten years that no averaging procedure is appropriate.
- 49 In this report I am estimating WACC for periods that are all in the future. Therefore, averaging is not overtly an issue. However, it is the case that I will be estimating the risk free rate as of a specific date, not the average over some days that surround the beginning of a fiscal year.
- 50 An additional motivation for using the rate on the day for this exercise is to be consistent with the assumptions underpinning the TSLRIC calculations. For purposes of TSLRIC, the relevant asset is notionally assumed to be built overnight between 30 June and 1 July of a year. The values used in calculating the TSLRIC asset base are those on the day.

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<sup>7</sup> Page 67 of the ACCC's Final Decision regarding the Assessment of Telstra's undertakings for PSTN, LCS and ULLS.

51 I am estimating WACC for the three fiscal years beginning with the year 2005/06. For the first year 2005/06, the most appropriate date to measure the WACC and risk free rate is at the open of business on 1 July 2005. I am able to observe that rate. As the beginning of the following two years are in the future, it is necessary to forecast the appropriate rates. I will discuss this further in section 10 when I estimate the WACC.

## 6.2 Market Risk Premium

52 The market risk premium (“MRP”) is the amount that an investor expects to earn from an investment in the market above the return that can be earned on a risk free investment. The MRP in the CAPM is  $[E(R_{mt}) - R_{ft}]$ . This is an expectation of investors and therefore is not directly observable. The difficulties in estimating the forward-looking MRP are well known. The choice of an appropriate rate is inevitably *ad hoc* and is generally chosen from a range of estimates.

### 6.2.1 A historical approach

53 There have been many estimates of the historical MRP in Australia with differing time periods. They are largely based upon the same index and use the 10-year bond rate for the risk free rate, but have some differences in the approaches used for the estimate. Table 1 presents major historical estimates of the MRP in Australia with updating as available.

**Table 1: Historical estimates of MRP**

Source	MRP (%)
Officer (1885-2004) <sup>8</sup>	7.2
Hancock (1883-2004) <sup>9</sup>	7.4
Hathaway (1875-2005) <sup>10</sup>	6.6
NEC (1952-99) <sup>11</sup>	6.6
AGSM (1964-00, including October 1987) <sup>12</sup>	6.2
AGSM (1964-00, excluding October 1987) <sup>13</sup>	7.7
Global Investment Returns Yearbook 2002 (1900-2002) <sup>14</sup>	7.6

54 The mid-point of the range of the historical data above is 7.0%, which is well above the 6.0% figure used by the ACCC in its recent decisions.

<sup>8</sup> S. Gray and R. Officer, “Review of the Market Risk Premium and Commentary on Two Recent Papers,” 19 July 2005.

<sup>9</sup> *ibid.*

<sup>10</sup> *ibid.*

<sup>11</sup> National Electricity Code, schedule 6.1, section 3.2.

<sup>12</sup> Reported in IPART, “NSW Electricity Distribution Pricing 2004/05 to 2008/09 Final Report Other Paper No 23,” June 2004, page 223.

<sup>13</sup> *ibid.*

<sup>14</sup> E. Dimson, P. Marsh and M. Staunton, “Global Investment Returns Yearbook 2002,” London Business School.

55 In my view, the rate adopted by the ACCC is inconsistent with historical data. This is not necessarily a deficiency as the MRP is to be a forward-looking estimate. The ACCC has suggested in some earlier decisions that it believed the MRP had fallen from historic rates. I do not believe that the ACCC has presented a credible defence of such a view.

56 I agree that there have been changes in international securities markets and economies that will tend to decrease a market determined forward-looking MRP relative to prior periods. There has been an explosion in the breadth of investment alternatives available to investors, both domestic and international. As a result, investors are far better positioned to efficiently diversify their portfolios. Economies, at least in the industrialised world, have apparently learned to control inflation.<sup>15</sup> This results in interest rate stability, which is a substantial reduction of risk for businesses. A wide range of new financial securities have been introduced that have advanced portfolio risk management tremendously. Finally, and perhaps most importantly, transactions and monitoring costs have declined markedly.

57 However, the ACCC is asserting that the historical estimates of MRP in Australia are higher than a current forward-looking MRP for Australia. That contention is not obvious as the economic conditions in Australia prior to reforms in the 1980s were of a segmented market that was not open to international investment and funds flows. I do not regard the historical returns in Australia as being indicative of the returns that would have been realised if the markets had been open and unfettered. To sustain its view the ACCC must present credible evidence with respect to the market that existed as the historical returns were generated.<sup>16</sup> It does not do that.

58 Therefore, I conclude that the ACCC rate is also too low as a contemporary forward-looking estimate of the MRP for Australia at the times at issue here.

59 All of the data and analysis cited above is built upon the historical MRP in Australia. In my view this is not a valid basis for estimating the forward-looking MRP. Indeed, I consider that a value of 7% is appropriate, on the basis of the weight of evidence, which I outline below.

### **6.2.2 A benchmark approach**

60 The MRP for Australia at the times at issue here and going forward is set in an international market. Investment funds now move freely into and out of the country, the securities markets and the currency.

61 However, until fairly recently the Australian debt and equity markets were subject to controls and intervention with little direct influence from international markets. The markets were domestic; foreign investment was not able to flow freely into and out of Australia. This is a very fundamental difference with the current situation and is the basis for challenging the relevance of the historical evidence for a forward-looking MRP.

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<sup>15</sup> Just how enduring or strong this is will be revealed in the future. For purposes here it is sufficient that market participants believe that there will be relative interest rate stability in the future.

<sup>16</sup> As I discuss below, the favourable changes in open markets such as the US are not relevant to the ACCC's assertion.

- 62 In the absence of a significant time series of relevant historical information, in my opinion estimating MRP using a benchmarking approach is appropriate.<sup>17</sup> With this approach, a benchmark country is chosen based upon it having the most reliable estimate of MRP available. Then the potential differences between the MRP in that country and the MRP in Australia are considered. The benchmark MRP is adjusted for the estimated difference between the two countries to arrive at an estimate of the MRP for Australia.
- 63 Using this approach, Australia's MRP can be thought of as being equal to an international benchmark MRP plus a premium for the incremental risks associated with the Australian equity market.
- 64 Contrary to the situation in Australia, the US has been an open economy for virtually all of its existence. The quantum of evidence and analysis of the US equities markets (and its MRP) would probably exceed that of all other countries in the world combined. The historical evidence is as good as is available for any country in the world, and the US would be widely regarded as the appropriate benchmark against which to measure risk premiums.
- 65 In assessing the available literature and evidence, it is my opinion that a reasonable estimate of the forward-looking MRP in the US is 5.5%. Starting from this benchmark, the differences that might cause the Australian *ex ante* MRP to be different from the US MRP must be considered: taxation, structure of equity markets and indices, and country risk.
- 66 Details of my assessments are in Appendix B. My conclusions are as follows:
- Taxation – no clear adjustment
  - Market differences – addition to benchmark of 1.1% to 2.75%
  - Country risk – no adjustment although perhaps an increase
- 67 This analysis indicates that an adjustment to the US MRP should be an increase in the range 1.1% to 2.75%. The mid-point of this range is 1.9%. This adjustment should be added to the estimated US MRP of 5.5%.
- 68 In my opinion, a conservative estimate of a long-horizon MRP for Australia is 7.0%.

### 6.2.3 Reasonableness test

- 69 The ACCC has adopted a value of 6% for the MRP in recent decisions. I have supported an MRP of 7.0%. Historical evidence in Australia has averaged over 7%, and the most updated report<sup>18</sup> shows an MRP of 7.9% over the past century based upon long-term bonds.

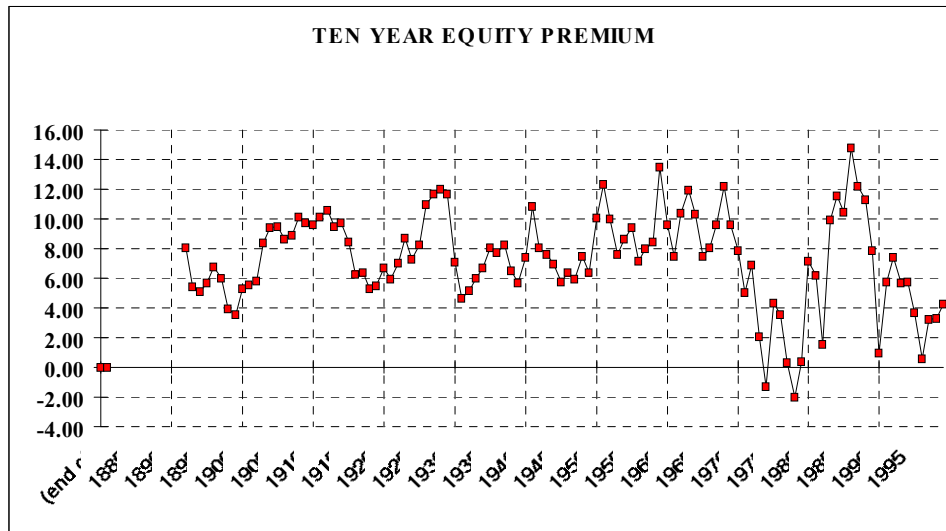
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<sup>17</sup> This approach is explained in more detail in Appendix B. See also R. Bowman, "Estimating the Market Risk Premium," *JASSA*, issue 3, Spring 2001, pp 10-13.

<sup>18</sup> E. Dimson, P. Marsh and M. Staunton, "Global Investment Returns Yearbook 2002," London Business School, p 35.

- 70 I believe there is a simple test of the reasonableness of the ACCC's position ( i.e., the MRP should be 6%).
- 71 The graph below shows the ten-year moving average of MRP in Australia over an extended period.<sup>19</sup>

**Graph 1: Market Risk Premium**



- 72 A simple observation of the graph indicates most sharply that the volatility in the MRP has increased substantially since about 1970. The results during the 1970's are likely affected by the uncertainty surrounding oil. The more recent period is likely affected by the move to deregulation in Australia. Volatility is generally indicative of uncertainty which is a measure of risk. From this graph it is hard to see how an argument could be made that a forward-looking MRP should be lower than the historical average.
- 73 In my opinion, my long-horizon MRP estimate of 7% is much more supportable and reasonable than the ACCC's estimate of 6%.

## 7. COST OF DEBT CAPITAL

- 74 The debt in a firm's capital structure typically consists of a number of different debt instruments including short-term and long-term, secured and unsecured and with or without interim principal payments. It is customary in the regulatory environment of Australia to ignore a firm's actual mix of debt in place for estimating the cost of debt capital.

<sup>19</sup> Slide 6 from a presentation "Trends in Market Risk Premium" by R. R. Officer, Melbourne Business School, 24 June 2002. A similar graph can be found in "Working Paper 4 – Issues in the Estimation of Queensland Rail's Below Rail Coal Network Expected Rate of Return," by the Queensland Competition Authority, December 2000, Figure 4.

75 The cost of debt capital is conventionally estimated as the current cost to the firm of raising and maintaining its debt. This cost is generally determined by three factors: the risk free rate of interest ( $R_f$ ), the debt risk premium (DRP) and the annualised debt issuance cost ( $R_{IC}$ ). From this the cost of debt capital ( $R_d$ ) can be expressed as:

$$R_d = R_f + \text{DRP} + R_{IC} \quad (3)$$

76 The most common regulatory approach to estimating the cost of debt depends upon whether or not the company has publicly traded debt. If there is substantial publicly traded debt and the trading is active so that there can be confidence that it represents a market rate of return, the premium of the company's debt over government debt of the same maturity can be used as the DRP. If suitable publicly traded debt is not available, estimation of DRP is generally based upon three steps. First, the average rating of a company's debt by one of the major rating agencies is observed or estimated. Then the average rate of return on debt issues in that rating is estimated. This will be a range. Finally, the company's debt is placed within this range, and a point estimate is chosen.

77 In the following paragraphs of this section, I will discuss the estimation of the appropriate debt and equity proportions. I will comment briefly on the issue of assumed maturity and then develop a debt risk premium and estimate issuance costs as a rate of return. Finally, I will bring the information together to calculate my estimate of an appropriate cost of debt capital for ULLS-Network.

## 7.1 Debt and Equity Proportions

78 The two primary sources of capital for a business are debt and equity. The return required for each of these sources will be different because the risk is different, equity being riskier than debt. The debt and equity proportions, also referred to as leverage or gearing, are important to a number of measurement issues for WACC in addition to the obvious role they play in equation 1.

79 The market value debt proportion (net debt divided by the sum of net debt plus equity) for Telstra at 30 June 2005, based on Telstra's annual report and ASX share price data, was 16%. The considerations in estimating leverage for Telstra are discussed in Appendix C. I explain why I believe it is generally appropriate to use a company's target proportions as a proxy for its optimal leverage and note that Telstra has advised me that its target debt proportion is in the range [c-i-c]. The actual ratios vary through time, primarily due to fluctuations in the market value of equity, but are currently in the target range. I see no reason to question the validity of the stated target debt ratio range of [c-i-c] for Telstra. I also see no basis for predicting that the target debt ratio will change going forward.

80 Given the estimated leverage for Telstra, it is then necessary to estimate the appropriate leverage for ULLS-Network. The assets of ULLS-Network are largely tangible, long-lived and would provide good security to a lender. It is my opinion that the leverage ratio for those services should be at least as high as that of the rest of Telstra. In my opinion, an appropriate leverage is 20%, and this is appropriate for all three fiscal years. This is a slightly higher level of debt than is the target for the whole of Telstra and is also slightly higher than Telstra's actual leverage.

81 I note that with the models used to estimate WACC, wherein the impact of gearing is endogenised in the calculation of the equity beta, the debt proportion has limited impact on WACC.

## 7.2 Risk Free Rate of Interest

82 The risk free rate of interest was discussed in section 6.1. I concluded that the appropriate maturity for ULLS-Network is ten years. The risk free rate that should be used in equation 3 is the yield on a 10-year government bond as at the beginning of the fiscal year.<sup>20</sup>

83 The ACCC had argued that the maturity should be equal to the regulatory period. Previously it was virtually universally regarded that the debt maturity should be equal to the life of the assets of the company.

84 Furthermore, it is standard practice commercially to match the maturity of debt with the average lives of assets.<sup>21</sup>

*The maturity structure decision is mainly driven by the matching principle and the will to avoid the refinancing risk that may occur if the company should raise debt in "bad times".*

85 In practice the optimal structuring of a company's debt would generally have regular principal payments on the debt such that its balance declines over the life of the asset. This will result in the debt and asset values declining in similar patterns. However, when we use government bonds to measure the risk free rate, those bonds do not have any interim principal payments. This difference between the profile of the balance of the company's debt and of the government bonds necessitates introducing the concept of duration.

86 Duration is a measure developed for bonds that recognises the amortisation of the principal over the life of the debt. So the duration of a bond with regular principal payments would have a lower duration than a bond of the same total life that was all paid at maturity.

87 The duration of a bond with regular and fixed principal payments will generally be approximately half of the life of the bond. Similarly, when we apply the concept to assets, the duration will be roughly half the useful life. As a result, when we choose the maturity of the government bond for measuring the risk free rate, we should choose a government bond that has a maturity of about half the life of the company's assets.

88 I am informed by Telstra that the average life of the revenue generating assets of ULLS-Network is about 35 years. Therefore the appropriate government bond to choose to measure the risk free rate in estimating the cost of debt capital should be approximately 17½ years. It has long been held that the longest government bond that is actively traded, so that the market yield is a reliable measure of true market

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<sup>20</sup> In each case reference to a bond yield at 1 July means an opening bond yield on that day and has been proxied by the closing yield on the previous trading day.

<sup>21</sup> P. Vernimmen, P. Quity, M. Dallochio, Y. Le Fur and A. Salvi, *Corporate Finance: Theory and Practice*, 2005 (John Wiley & Sons, Chichester, England), p 742.



conditions, is the 10-year maturity. Therefore, it is conventional to use the 10-year maturity for all companies with long-lived assets.

- 89 The risk free rate for the fiscal year 2005/06 is measured as of the opening of business on 1 July 2005. As of this date, the 10-year government bonds have a yield of 5.11%.
- 90 The fiscal year 2006/07 and 2007/08 are in the future. Therefore, we cannot observe the risk free rate at the beginning of a these years. We must estimate the rates that will pertain as of the beginning of the two years.
- 91 The beginning of the forecast process is to determine the current rate. As of the close of business on 31 October 2005, the 10-year government bonds have a yield of 5.48%.
- 92 The main source of information on future interest rates is found in the yield curve. As shown in the table below as at the close of business on 31 October 2005, the interest rates on government debt currently show very little difference from 1 year out to 15 years. That is, the yield curve is flat.

1-year	2-year	3-year	4-year	5-year	10-year	15-year
5.38%	5.34%	5.35%	5.39%	5.40%	5.48%	5.51%

- 93 A significant influence in interest rates is expectations of inflation. There is a broad consensus that inflation in Australia is stable at about three percent and unlikely to move appreciably from the current level in the foreseeable future. This is consistent with the observed flat yield curve.
- 94 Another factor in interest rates is liquidity. Liquidity preference is commonly cited as supporting a small increase in interest rates as the time to maturity increases. This is also consistent with the current yield curve.
- 95 In my opinion, the current interest rate conditions support the view that the best estimate of future interest rates for the fiscal years 2006/07 and 2007/08 is the current interest rate. Therefore, I estimate that the 10-year maturity risk free rate is 5.48% for these two fiscal years.

### 7.3 Debt Risk Premium

- 96 Ideally the WACC for ULLS-Network assets should be estimated on the basis of the ULLS-Network business, not the whole of Telstra. However, a direct estimation of the DRP for the ULLS-Network business is not possible because there are not any debt securities directly attributable only to those services. The DRP can only be observed at the Telstra-wide level.
- 97 To estimate the debt risk premium for ULLS-Network, I will first measure the difference between Telstra 10-year debt and Commonwealth 10-year debt. Then I discuss the appropriateness of any adjustments to reflect differences that might be expected between the DRP of Telstra and of the ULLS-Network.

- 98 I have analysed the difference between the yield on Telstra's debt of 10-years and the yield on 10-year government bonds. The DRP for the fiscal year 2005/06 is measured as of the opening of business on 1 July 2005. The spread between the yield on Telstra's debt of 10-years and the yield on 10-year government bonds at the close of business on 30 June 2005 is 1.06%.
- 99 The fiscal year 2006/07 and 2007/08 are in the future. Therefore, we cannot observe the DRP at the beginning of a these years. We must estimate the rates that will pertain as of the beginning of the two years.
- 100 The DRP is the difference between the yield on Telstra's debt of 10-years and the yield on 10-year government bonds, which is 1.15% as at the close of business on 31 October 2005.
- 101 It is likely that ULLS-Network have about the same debt riskiness as the aggregate of the other business activities of Telstra. This would be consistent with a comparable DRP. Also, taken as separated entities, it is likely that both services would have approximately the same default risk as the whole of Telstra. It then follows that the debt risk premium for the two services would be approximately the same as for Telstra as a whole.
- 102 The estimation of the DRP is clearly a matter of judgement. In my opinion, the best estimate of DRP for ULLS-Network for the year 2005/06 is 1.06%. The estimate of DRP for the years 2006/07 and 2007/08 is the observed rate at 31 October 2005, which is 1.15%. For purposes of estimating DRP at the beginning of each of the three fiscal years, I note that the Telstra 10-year DRP has varied from 0.21% to 1.61% over the past ten years. The DRPs for the three fiscal years are similar to the average DRP for Telstra 10-year bonds over the past five years.

#### **7.4 Debt Issuance Costs**

- 103 The cost of debt capital in the WACC is the cost of debt to the entity, in this case the provider of ULLS-Network. The market-based estimates of the debt risk premium provide the cost of debt to the investor. The rate to the issuer (the provider of ULLS-Network) will not be the same as the rate to the investor. The difference between the two is the annualised cost to the firm of issuing the debt. For example, at the date of issuance of a publicly traded bond, it would have a market yield, generally very close to the coupon rate. However, the cost of debt to the firm is based upon the net proceeds of the debt issue, which will be after all the costs incurred in facilitating the debt issue. These costs are called issuance (or flotation) costs and consist of underwriting and management fees and direct costs such as legal and accounting fees.
- 104 The ACCC has recently allowed debt issuance costs of the order of 10.5 to 12.5 basis points to be recovered in electricity and gas decisions. Furthermore, the Australian Competition Tribunal allowed 25 basis points in its determination on the GasNet Access Arrangement, increasing the allowance in the earlier ACCC decision. As the principle has now been accepted, the issue is to estimate an appropriate amount for the costs in this particular context.
- 105 The quantum of issuance costs can be calculated as the difference between the amount paid for the debt by the investor and the net proceeds of the debt issue to

the issuer. The quantum of issuance costs can be converted to an annualised rate of return for direct incorporation into the cost of debt. The process involves computing the rate of return that the investor will realise from the purchase of the debt. This is referred to as the yield to maturity, or simply the yield. Then a similar calculation is made from the perspective of the issuer of the debt. The rate of return is calculated using the net proceeds of the issue to the issuer, which will be less than the amount invested by the purchaser of the debt. Again this is a yield to maturity calculation. The difference between these two rates is the issuance costs expressed as a rate of return.

106 Given the size of the PSTN, of which ULLS-Network is a part, and the assumed leverage, the total debt to use in estimating the debt issuance costs would be about \$8 billion. In raising this quantum of debt, it would be normal and prudent practice to do so in a series of tranches rather than all in one issue. Therefore, the estimated issuance costs as a percent of the debt issue should be based on debt issues of \$1 billion or more. From the available evidence as presented in Appendix D, I believe it is likely that the cost of issuing debt would be about 2% of the proceeds of the debt issue. That percent must then be converted to an annual amount to be recovered over ten years.

107 In my opinion the debt issuance cost for ULLS-Network, stated as a rate of return ( $R_{IC}$ ), would be about 0.2%. I believe this is an appropriate estimate for each of the three fiscal years.

## 7.5 Conclusion on Cost of Debt Capital

108 The cost of debt capital can be estimated using equation 3:

$$R_d = R_f + DRP + R_{IC}$$

109 From the information above, my best estimates of the cost of debt capital for ULLS-Network is as set out below:

for the fiscal year 2005/06:

$$R_d = 5.11\% + 1.06\% + 0.2\% = 6.37\%$$

for the fiscal years 2006/07 and 2007/08:

$$R_d = 5.48\% + 1.15\% + 0.2\% = 6.83\%$$

## 8. TAXATION ISSUES

### 8.1 Tax Rate

110 The tax rate is required for the procedure used to convert between equity betas and asset betas, which will be discussed below. It is also a part of determination of costings in the undertaking process.

111 Two approaches have generally been used to determine the tax rate to use in the calculations:

- the statutory corporate tax rate; or
- the corporation's effective tax rate (which may be the statutory tax rate).

112 The effective tax rate has been measured in a variety of ways, but most commonly it is considered as the tax burden relative to the book income for the firm averaged over a span of years. Thus, a firm that had substantial tax shelters, typically as a result of differences between accounting depreciation and tax depreciation (e.g., from accelerated depreciation), may have had an average effective tax rate that is less than the statutory tax rate. However, the effective rate that is relevant to ULLS-Network is a forward-looking rate for the fiscal years being estimated.

113 Changes in tax law virtually eliminated the potential for creating depreciation timing differences for assets purchased or constructed on or after 21 September 1999.

114 For assets purchased before that date where accelerated depreciation has been used, it would generally be the case that depreciation for book purposes would now be higher than depreciation for tax purposes. This would tend to push the effective tax rate above the statutory tax rate.

115 Aside from issues of the actual book-tax differences, it is the case that TSLRIC is used and all assets are assumed to be put in place at the beginning of the fiscal year being estimated. In that event, no accelerated depreciation would be available and there should be little or no book-tax differences.

116 In my opinion it is reasonable to assume that the effective tax rate would be approximately equal to the statutory tax rate for ULLS-Network. Therefore, the appropriate corporate tax rate to use in the de-levering and re-levering calculations of beta for ULLS-Network is the statutory rate of 30%.

## **8.2 Value of Franking Credits ( $\gamma$ )**

117 Australia has a dividend imputation system of taxation. Dividends that are paid out of after-corporate-tax profits can be accompanied with a 'franking' credit to the extent of the corporate tax paid. The franking credits can then be used as credits against the tax liability of the recipients at their tax rates. So the income of the corporation is ultimately taxed at the tax rate of the investors who receive the dividends. The value of franking credits is typically represented by the parameter  $\gamma$ . Various Australian regulators including the ACCC have used a  $\gamma$  equal to 0.5 in their deliberations on WACC related issues.

118 The value of imputation credits is required for the procedure used to convert between equity betas and asset betas, which will be discussed below. It is also a part of the determination of costings in the undertaking process.

119 I discuss the appropriate value of  $\gamma$  in Appendix E. In my opinion, the weight of evidence is accumulating toward the position that the marginal investor in Australia is an international investor that is not able to realise value from the franking credits.  $\gamma$  would then be zero. However, the research in the area is not yet conclusive. As such, I do not believe there is yet a sufficient basis for

making a change either up or down from the standard that has developed in Australian regulation.

120 Considering all the evidence, I believe a gamma of 0.5 is currently an acceptable position for the value of the imputation credits.

121 Although I believe a gamma of 0.5 is acceptable, gamma does not enter into the estimate of the post-tax vanilla WACC, where all tax issues are addressed in the notional cashflows constructed.

## 9. CALCULATION OF COST OF EQUITY CAPITAL

122 The CAPM is set out in section 6 above. The measurement of the risk free rate and the market risk premium for use in the CAPM were also covered in section 6. In this section, the measurement of systematic risk is discussed. The distinction between equity beta and asset beta is explained and estimates of each are made. Finally, the cost of equity capital is calculated for ULLS-Network.

### 9.1 Systematic Risk and Leverage

123 The systematic risk ( $\beta$  or beta) of a firm is the measure of how the changes in the returns to a company's stock are related to the changes in returns to the market as a whole. It is the only risk factor incorporated in the CAPM.

124 There are three basic approaches to estimating systematic risk:

- direct estimation,
- first principles, and
- comparable companies.

125 Ideally all three should be considered in the estimation and should reinforce each other. However, direct estimation of the beta for ULLS-Network is not possible as a separately listed company that provides only ULLS-Network does not exist. However, ULLS-Network constitutes a substantive part of Telstra and is comparable to the core business of the company.

126 To estimate beta, I consider three sources of information.<sup>22</sup> First I consider the systematic risk of Telstra. Next I consider appropriate beta for the ULLS-Network business from first principles. Then I consider market information on betas of comparable companies listed in Australia. These three sources are discussed in detail in Appendix F. Below is a brief discussion, and then a reasonable estimate of beta is identified.

127 I use share market data for the five years to 31 October 2005 to estimate the equity beta of Telstra, with the S&P ASX-200 as the market index. The results are highly

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<sup>22</sup> It is likely that the risk of the ULLS-Network business that would be rewarded with a return in the securities markets is more than simply systematic risk. The estimate of beta developed here does not attempt to incorporate any risk/return other than conventional systematic risk.

sensitive to the measurement interval (daily, weekly or monthly). I also note the estimates supplied by the AGSM Risk Measurement Service (June 2005). I conclude that the best estimate of the historical equity beta of Telstra for this period is 0.8. I also note that the widely diverse estimates available provide little confidence in the estimate.

- 128 The ULLS-Network business involves significant investments, and once these investments are made they are sunk, with little likelihood of recovery except through operations. Operating risk will be high as fixed costs are a significant proportion of total costs. The elasticity of demand for ULLS-Network services is related to the economy, and empirical research indicates it is about one.<sup>23</sup> [c-i-c]. The regulatory regime is consistent with a moderate systematic risk. My judgement is that the first principles analysis indicates an asset beta for ULLS-Network in the range of 0.4 to 0.9.
- 129 For the comparable companies approach, I use the four US RBOCs as comparable (listed) companies. In addition, I investigate five international companies that are comparable to Telstra. Using share price information for the companies, I estimate their equity betas relative to an appropriate market index. Then I use additional information about the companies to convert the measure of systematic risk of the equity to a measure of the systematic risk of the firm as if it was an all equity firm that had no debt.
- 130 Based on the comparable company analysis, I believe a best estimate of asset beta for ULLS-Network is 0.8.

## 9.2 Conclusions on Asset Beta and Equity Beta

- 131 In my opinion, the information from the three sources of information is consistent and supports an asset beta estimate for ULLS-Network of at least 0.7.
- 132 The asset beta of the businesses could change over time due to developments in the market or adjacent markets such as wireless. The impact of these threats on the asset beta of ULLS-Network is not clear and not amenable to estimation. I believe my estimate of asset beta for ULLS-Network is conservative, and I believe it is appropriate to assume that the asset beta will not change across the three fiscal years.
- 133 From the estimation of an appropriate asset beta for ULLS-Network, I then re-lever the asset beta to obtain the equity beta. I use the Monkhouse equation for this task as it seems to be preferred by the ACCC, and the effect of alternative equations is minor. This process results in an estimate of an equity beta for ULLS-Network that reflects its leverage and tax circumstances.
- 134 My estimate of the asset beta is 0.7 for all three years. However, because of the role of the risk free rate and the cost of debt in the re-levering equation, the equity betas are not all the same.
- 135 In my opinion, an appropriate point estimate of equity beta for ULLS-Network for the fiscal year 2005/06 is 0.80. The appropriate point estimate of equity beta is

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<sup>23</sup> This is discussed in detail in Appendix F.

0.873 for the fiscal years 2006/07 and 2007/08. These results indicate that the equity of ULLS-Network is less risky than the average of all companies on the ASX. In my opinion, that is an appropriate estimation.

### 9.3 Equity Issuance Costs

- 136 As with debt, to raise its equity financing a company will incur substantial costs. In its Final Decision on GasNet,<sup>24</sup> the ACCC decided GasNet's access arrangement should (page 151) "include an allowance for equity raising costs of 0.224 per cent of regulated equity, to be recovered as an annual non-capital cost cash flow."
- 137 I discuss the cost of raising equity in Appendix D. There I show that the available empirical research indicates the cost of raising equity in public markets is substantial. This issuance cost should be converted to an annual allowance that permits ULLS-Network to recover the costs it would be expected to incur in raising equity.
- 138 ACCC used a perpetuity assumption in its GasNet decision to estimate the allowance. I believe the equity of any company has an expected life short of perpetual. The quantification of life expectation is problematic. For long-lived infrastructure assets such as a gas pipeline or the PSTN, I believe it is reasonable to assume that the expected equity life approximates the life of the assets. That indicates a life of 35 years for ULLS-Network.
- 139 The allowance could be recovered as an annual non-capital cost cash flow or treated as an increment to the cost of equity. My preference is to incorporate the allowance into the cost of equity capital.
- 140 Being conservative, I estimate that the annual allowance for equity raising costs for ULLS-Network should be at least 0.15% of equity value. This estimate applies to all three fiscal years.

### 9.4 Conclusion on Cost of Equity Capital

- 141 Using the estimate of equity beta and the other CAPM parameters that are estimated above, I use equation 2 plus the estimated equity issuance cost to estimate an appropriate cost of equity capital for ULLS-Network. The estimates will differ across the three fiscal years because of the different value of the risk free rate and the impact of the cost of debt on the re-levering the asset beta. The estimate for the years 2006/07 and 2007/08 is based on conditions at 31 October 2005.
- 142 My best estimates of the cost of equity capital for ULLS-Network are as set out below.

for the fiscal year 2005/06:

$$R_e = 5.11\% + 0.80 * 7.0\% + 0.15\% = 10.85\%$$

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<sup>24</sup> "Final Decision, GasNet Australia access arrangement revisions for the Principal Transmission System", dated 13 November 2002, pp 143-151.

for the fiscal years 2006/07 and 2007/08:

$$R_e = 5.48\% + 0.873 * 7.0\% + 0.15\% = 11.74\%$$

## **10. CALCULATION OF WACC**

### **10.1 WACCs for Fiscal Years 2005/06, 2006/07 and 2007/08**

143 The nominal, post-tax vanilla WACCs for ULLS-Network for the three years are estimated using equation 1 and the parameter estimates developed in the preceding sections:

for the fiscal year 2005/06:

$$\text{Vanilla WACC} = 10.85\% * 80\% + 6.37\% * 20\% = \mathbf{9.95\%}$$

for the fiscal years 2006/07 and 2007/08:

$$\text{Vanilla WACC} = 11.74\% * 80\% + 6.83\% * 20\% = \mathbf{10.76\%}$$

144 The table below shows the various parameter values that I have estimated and the resultant cost of debt, cost of equity and WACCs.



<b>Report Section</b>	<b>Parameter</b>	<b>Comment</b>	<b>2005/06</b>	<b>2006/07</b>	<b>2007/08</b>
7.2	Risk free rate	Commonwealth 10-year bond and the market rate-on-the-day	5.11%	5.48%	5.48%
6.2	Market risk premium	Benchmark approach adjusted for 10-year risk free rate	7.0%	7.0%	7.0%
7.1	Debt proportion	Target ratio for ULLS-Network	[c-i-c]	[c-i-c]	[c-i-c]
7.3	Debt risk premium	Estimated from Telstra's traded 10-year debt issues	1.06%	1.15%	1.15%
7.4	Debt issuance cost	Cost incurred to issue debt, annualised	0.2%	0.2%	0.2%
7.5	Cost of debt capital	Sum of the risk free rate, debt risk premium and debt issuance cost	6.37%	6.83%	6.83%
8.1	Tax rate	Use statutory rate	30%	30%	30%
8.2	Franking credits	Continue to use status quo value	0.5	0.5	0.5
9.2	Asset beta	Systematic risk for all-equity firm	0.7	0.7	0.7
9.2	Equity beta	Systematic risk for levered equity	0.80	0.873	0.873
9.3	Equity issuance cost	Cost incurred to issue equity, annualised	0.15%	0.15%	0.15%
9.4	Cost of equity capital	Use CAPM plus the equity issuance cost	10.85%	11.74%	11.74%
10.1	<b>WACC</b>	<b>Nominal, post-tax vanilla</b>	<b>9.95%</b>	<b>10.76%</b>	<b>10.76%</b>

## 11. ADDITIONAL CONSIDERATIONS IN SETTING THE WACC

141 The analysis above leads to the “best point estimate” of WACC for ULLS-Network for the three years. The WACC is used by the ACCC as an input to the process of determining an appropriate price for ULLS-Network. However, I do not believe the ACCC should use the best point estimate WACC for that purpose or generally. In my opinion, the ACCC should use a higher WACC.

142 The Productivity Commission reviewed the national access regime and reported its findings including:<sup>25</sup>

*Regulators need to address the likelihood of making errors and explicitly consider the impact of such errors on the regulated business and how this interacts with the form of regulation being implemented.*

- *Over-compensation may sometimes result in inefficiencies in timing of new investment in essential infrastructure (with flow-ons to investment in related markets), and occasionally lead to inefficient investment to by-pass parts of the network. However, it will never preclude socially worthwhile investments from proceeding.*
- *On the other hand, if the truncation of balancing upside profits is expected to be substantial, major investments of considerable benefit to the community could be forgone, again with flow-on effects for investment in related markets.*

*In the Commission’s view, the latter is likely to be a worse outcome.*

143 The ACCC has previously recognised the importance of considering the impact of errors in setting WACC on service providers. In its “Final Decision: East Australian Pipeline Limited Access arrangement for the Moomba to Sydney Pipeline System,” dated 2 October 2003, page 136, it stated,

*... the commission considers that where there is some uncertainty regarding the value of a parameter, and this gives rise to a conflict in objectives in section 8.1 (of the National Third Party Access Code for Natural Gas Pipeline Systems), then it must have regard to the potential for the value adopted to affect the overall performance of the service provider.*

### 11.1 Social Consequences of Over or Under Estimating WACC

144 The “true” WACC is not known; it can only be estimated on the basis of information available. The ACCC must make estimates of all of the components of the WACC in an uncertain environment. Virtually all of its estimates of the WACC components will be made with error, and as I will mention later, generally considerable error. As a result, there are three possible outcomes for the chosen point estimate WACC:

- the chosen point estimate WACC may reflect the “true” cost of capital, which means that the provider of the services will earn a normal economic profit and will have adequate incentives for further investment;

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<sup>25</sup> Productivity Commission 2001, “Review of the National Access Regime,” Report No. 17, AusInfo, Canberra.

- the chosen point estimate WACC may be set above the “true” cost of capital, which means that the provider will earn excess economic profits and it will have clear incentives for further investment including in maintenance and service quality; or
- the chosen point estimate WACC may be set below the “true” cost of capital, which means that the provider will earn below normal economic profits, and it will not have an incentive to invest or to satisfactorily maintain the services it provides.

- 145 The first of the possible outcomes is clearly efficient, whilst the other two are not. However, because the estimation of WACC is so fraught with estimation error, it is very unlikely that the ACCC will actually achieve the efficient outcome. The ACCC is then faced with the possibility of either over or under estimating WACC, each of which has a set of consequences.
- 146 If the net long-term costs to society were the same for over estimating as for under estimating, then it would be appropriate for the ACCC to set WACC at its best point estimate. However, they are not equal. It is widely agreed that in a regulatory environment, the long-term social costs of under estimating the cost of capital are higher than are the long-term social costs of over estimation.
- 147 If the WACC, and hence price for the service, is set too low, there will be short-run benefits to the ultimate consumers of the service, but there will also be disincentives for the provider of the service to invest or to properly continue maintenance or service quality. This will result in a general degradation of services. Services are regulated because there are few or no alternative suppliers and entry barriers to alternative supply are high. Users will not generally have other options to which to turn should service availability decline. As a result, all users (and not only those at the margin between consuming and not consuming the service) will suffer. Put in economic terms, there will be adverse infra-marginal as well as marginal impacts.
- 148 Regulatory decisions in Australia are monitored by a wide range of interested parties, irrespective of industry. Therefore, the impact of under estimating WACC will span all regulated industries, not just the specific instance and company. Regulatory decisions that impinge on the ability of an infrastructure provider to recover its past investments plus a reasonable return provide signals to all potential infrastructure investors as to how new investment will be treated. Ultimately it is the regulatory decisions that reveal the integrity of the regulator’s commitment to promoting efficiency and investment.
- 149 If the WACC is set too high, there will be a cost imposed on the ultimate consumers, but this is unlikely to have a detectable welfare effect on individual consumers. The provider of the services will have sufficient incentives to engage in maintenance of the service and its quality and to invest in innovation and improvements in the service assets. It is possible that there will be some consumer impact on the margin, but efficiency and service provision for the vast bulk of users should not be affected adversely. There will, in other words, be slight marginal impact, but not significant effects infra-marginally.

- 150 Setting the WACC even a little too low can have serious long-term economic consequences, including threatening the viability of the provision of services. On the other hand, the consequences of setting it too high should be much less, especially beyond the short-run. Accordingly, the consequences of estimation error in the WACC are very asymmetric.
- 151 Given the substantial uncertainty in setting WACC, the ACCC should set a WACC that reflects a balancing of the costs of over or under estimating the WACC. This means that WACC should be set above the “best point estimate”.<sup>26</sup>
- 152 This conclusion reflects my opinion there should be a bias in setting WACC toward outcomes that promote socially desirable long-term benefits including ongoing service maintenance and investment. Setting WACC too low creates only a superficial social benefit in the short-run. The long-run social costs of setting WACC too low may be quite significant and may not be evident in the short or even intermediate run.
- 153 There is regulatory precedent for choosing a WACC above the best point estimate to balance the asymmetric consequences of error. The ACCC has taken this position in the past:

*The Commission recognises that given the market evidence currently available this may be viewed as a conservative position which confers some benefit upon EAPL. However, the Commission considers that until more observations become available and the equity beta estimates become more statistically reliable, it is appropriate to adopt this conservative approach. This reflects the Commission’s view that it is better to err on the side which ensures that there are sufficient investment incentives. To take a contrary position would risk deterring investment in the pipeline (section 8.1(d)) and jeopardise other aspects of the service such as the safe and reliable operation of the pipeline (section 8.1(c)).<sup>27</sup>*

- 154 In a recent decision relating to the Hunter Valley coal network, IPART determined a real pre-tax rate of return of 7.3%, from a range of 5.5% to 8%. This was noted as being consistent with its practice of setting the rate of return above the mid-point of the recommended range.<sup>28</sup>
- 155 In its decision on the recent gas control inquiry, the New Zealand Commerce Commission recognised the asymmetry of the consequences of making an error in setting WACC:<sup>29</sup>

*The Commission notes concerns about the asymmetric nature of errors in assessing WACC, i.e., underestimation is the more serious error because it may lead to underinvestment by the regulated companies.*

- 156 The New Zealand Commerce Commission chose the 75<sup>th</sup> percentile in a range of WACC values rather than the mid-point to reflect uncertainty in the parameter

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<sup>26</sup> I will discuss how this task should be approached in the following section.

<sup>27</sup> ACCC, “Final Decision” (6 October 1998, p 60) with respect to access arrangements for GasNet and VENCORP.

<sup>28</sup> IPART (2005), Report on the Determination of Remaining Mine Life and Rate of Return.

<sup>29</sup> New Zealand Commerce Commission, “Gas Control Inquiry Final Report,” dated 29 November 2004, para 9.92.

estimates and to provide some protection against the relatively dire social consequences of under estimating WACC.

- 157 The case for the social costs of under estimating WACC being substantially greater than the social costs of over estimating WACC is, in my opinion, compelling. The issue then becomes how to choose a WACC that balances the asymmetric costs. The starting point is to place the process in a statistical context.

### **11.2 Balancing the Consequences**

- 158 As discussed above, there is a consensus that the social costs of under estimating WACC are substantially greater than the social costs of over estimating WACC. There is some indication in previous regulatory decisions in Australia that regulators have chosen the upper bound of a range to compensate for a variety of asymmetries in the risk exposure of the regulated company. However, this has been very *ad hoc*.

- 159 The ACCC has chosen a beta “towards the top end of the plausible range” in recognition of significant downside risks that outweighed potential upside benefits.<sup>30</sup>

- 160 It is more sensible and defensible to address the asymmetry using statistical methods. In my opinion, this asymmetry should be dealt with using confidence levels. That is, the ACCC should choose a confidence level that reflects the relative long-term costs of under or over estimating WACC.

- 161 If the ACCC chose the mid-point WACC for determining access prices, there would be a 50% chance that it would reach a conclusion that was significantly socially damaging versus a 50% chance that it would reach a conclusion with relatively minor, albeit negative, social consequences. Clearly this should be an unacceptable risk, given that the consequences of an over estimation error are much less onerous than the consequences of an under estimation.

- 162 The difficult issue is to determine the appropriate confidence level that reflects the relative costs to society of over and under estimating WACC. The higher are the long-term social costs of under estimating WACC relative to over estimating WACC, the higher should be the confidence level.

### **11.3 Setting Ranges on CAPM and WACC Parameters**

- 163 To be able to determine a confidence level around the best estimate of WACC, the ACCC must have estimates of the distributional properties of the estimation errors. That is, the ACCC must have range estimates that reflect distributional properties.
- 164 In my opinion the best approach for the ACCC would be to first determine statistically valid ranges for the parameters considered in estimating WACC. In my view the range interval should approximate one standard deviation of the distribution. Although it would generally be necessary to make informed judgements as to the one standard deviation ranges, rather than precise

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<sup>30</sup> ACCC, “Final Decision” (6 October 1998, p 60) with respect to access arrangements for GasNet and VENCorp.

measurements, the objective of the ranges should be clear. The ACCC could then simulate the likely one standard deviation range on WACC based on these parameters.

- 165 The process of estimating WACC is full of estimation and uncertainty at every single step, including the very foundational principles and precepts. At least in principle, every parameter could have a distribution. There are also issues of uncertainty and estimation with respect to the CAPM and WACC models that are inducing estimation error. An additional allowance in WACC could be made for the models themselves.
- 166 Setting ranges to reflect one standard deviation permits statements to be made about the confidence level of WACC. A one standard deviation range will encompass two-thirds of the possible values. So there is roughly a one-third chance (i.e., 34%) that the “true” value, which cannot be observed, is not within the one standard deviation range. When the distribution is symmetric, the chance of being outside the range is equal at each tail of the distribution. There is a 17% chance of the true value being higher than the upper bound and a 17% chance of the true value being lower than the lower bound.<sup>31</sup>
- 167 For example, if the WACC were chosen to be one standard deviation above the best estimate of WACC, it would be correct to say that there was 83% confidence that the chosen WACC was not greater than the true WACC.<sup>32</sup> In other words, there would be 83% confidence that the WACC was not going to lead to the adverse social consequences of economic inefficiency such as under provision of service, maintenance and investment.
- 168 In the context of ULLS-Network, although I do not fully develop and defend ranges for each of the parameters in this report, I discuss all of the parameters, provide some further information on the critical parameters and give my preliminary estimates of appropriate ranges to reflect one standard deviation.

### 11.3.1 Risk free rate

- 169 Although there are issues that could be discussed, to a close approximation the risk free rate for the fiscal year 2005/06 does not have estimation error as we can observe the market rate for government bonds.
- 170 The risk free rate cannot be objectively observed for the other two years being estimated. For the year 2006/07, the yield on the 10-year government bond at the beginning of 1 July 2006 is needed. I have estimated that the rate at the close of business on 31 October 2005 would be an unbiased forecast of that future rate. I have also assumed that the current rate would be an unbiased forecast of the rates for the beginning of 2007/08.

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<sup>31</sup> Statistical tests and confidence levels are generally expressed as “two-tailed”, meaning that they allow for the true value being outside the range in either direction. However, in this application, I believe the concern should focus on the risk of under estimating the WACC, so the statistic should be “one-tailed” and focus on the upper end of the distribution. A confidence should be expressed as to the chance of the true value being below the estimate. I discuss this further in section 11.3.9.

<sup>32</sup> This is conditioned upon the best estimate of WACC, the mean of the distribution. If the parameter values and/or the one standard deviation ranges are biased then this statement could not be made and the assurances could not be relied upon.

- 171 Clearly my estimates for 2006/07 and 2007/08 are uncertain. The question is - what is the one standard deviation on the estimates? For an indication of the range, I used the monthly data on market yields of 10-year government bonds that is available on the website of the Reserve Bank of Australia. Although the data goes back to January 1972, I only used data for the past ten years. This excludes data prior to the restructuring that took place in the 1980s and the periods of double-digit interest rates in the first half of the 1990s. As the management of inflation has become a policy objective, it seems unlikely that such interest rate conditions will occur between now and 1 July 2007.<sup>33</sup>
- 172 I calculated the changes in yields over non-overlapping periods of 8 months and 20 months from this data. These are the time periods between my estimation date and the measurement dates for the risk free rate for the two years.
- 173 The average absolute changes in yield are 0.68% and 1.12% for the forecasting periods to the years 2006/07 and 2007/08 respectively. If the dataset begins in July 1997, to exclude some higher interest rates in the mid-1990s, the average absolute changes are 0.61% and 0.95% respectively.
- 174 Interest rate conditions are reasonably stable currently. The data above must be viewed with caution as they are the average absolute changes over a short time period with few observations. They are not proper estimates of the standard deviation of the estimates. I recommend one standard deviation ranges for the risk free rate for of 0.6% for 2006/07 and 1.0% for 2007/08.<sup>34</sup>

### 11.3.2 Tax rate

- 175 The statutory corporate tax rate is 30% and is normally assumed to remain constant at the current rate. Although there is an element of uncertainty in that assumption, I consider that a range is not necessary.

### 11.3.3 Gamma

- 176 The gamma parameter for the value of franking credits does not enter into the estimation of the vanilla WACC. However gamma is included in the de-levering and re-levering of beta and also is still relevant to the proper measurement of cash flows. Therefore, I will discuss the issue of a range on gamma.
- 177 Gamma is widely estimated to equal 0.5. Although this is arguably a practical compromise for regulators as an estimate, it is almost certainly wrong. The true value of franking credits is almost certainly close to zero or close to one. This makes setting a range problematic, as the estimation error does not have a normal

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<sup>33</sup> This is admittedly *ad hoc*. However, the dataset retains periods of relatively high interest rates. It could be argued that only the period of stable interest rates are relevant for forecasting future interest rates. This would reduce the dataset to a period such as from, say, mid-1997.

<sup>34</sup> There are issues that could be raised such as the averaging procedure, but they are sufficiently minor that I believe that they can be ignored.

distribution.<sup>35</sup> The plausible values do not have a distribution that can be characterised with the statistical measure of a standard deviation.

- 178 Rather than attempt to set a range for gamma, I believe it is more sensible to evaluate gamma by simply setting it equal to either zero or one to establish the bounds of analysis.

#### **11.3.4 Debt proportion**

- 179 There is clearly estimation error in the chosen debt proportion, but with the models used to estimate WACC in which the impact of gearing is endogenised in the calculation of the equity beta, the assumed debt proportion has limited impact on WACC. I believe pragmatism again supports ignoring the estimation error. However, it should be kept in mind that the estimation error will again be marginally understated.

#### **11.3.5 Cost of debt capital and equity issuance cost**

- 180 The cost of debt capital requires the estimation of the debt risk premium and the debt issuance costs specific to ULLS-Network, both of which are measured with potential error. In my view, the ranges around these parameters should not be ignored. Estimating the DRP for Telstra at a point in historical time should have minor estimation error because the bonds are traded less than government bonds. I consider a range on the order of  $\pm 5$  basis points (as one standard deviation) as reasonable. A major uncertainty with the DRP for ULLS-Network relates to adjusting the Telstra DRP to one appropriate for those assets. The estimation error is certainly higher than for Telstra, but not greatly so. A further source of estimation error is that I am forecasting the DRP for particular dates up to 32 months into the future. I believe one standard deviation range in the estimate of DRP for ULLS-Network is approximately  $\pm 0.15\%$ .
- 181 Estimation of the debt issuance costs for ULLS-Network is subject to as much error as the DRP. Based on the analysis presented in section 7.4, I believe a reasonable one standard deviation range is  $\pm 0.15\%$ .
- 182 Equity also has an issuance cost for ULLS-Network, which I discussed in section 9.3. The distribution around the best estimate of equity issuance costs is positively skewed as the value must be greater than zero. Thus, the range upward will be wider than the range downward. I believe a reasonable one standard deviation range would span 0.1% to at least 0.40%. I will state this as a range of  $\pm 0.1\%$  since the focus is on the upside.
- 183 The remaining parameters are the market risk premium and beta. Both of these parameters have substantial estimation error.

#### **11.3.6 Market risk premium**

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<sup>35</sup> This is a bi-modal distribution and is similar to a coin flip for an amount of money. The expected value of flipping a coin is zero as it may turn out to be heads or tails. But there are only two possible outcomes of the gamble on the coin flip. A result of zero (no gain or loss) on a single flip is not possible.



- 184 I discussed the MRP in section 6.2 and Appendix B. It is clear from that discussion that there is considerable uncertainty in reaching an estimate of the MRP for Australia.
- 185 The ACCC is not entirely clear on how it arrives at its estimate for MRP of 6%. I presume that it is a result of considering the historical MRP in Australia and then adjusting this estimate downward substantially to reflect some perceived factors that will influence a forward-looking estimate that did not influence the historical evidence.
- 186 I believe it is fair to say that the estimation error in the ACCC's approach would be every bit as significant as the estimation error in my estimate.
- 187 If analytical (rather than strictly empirical) approaches to the MRP are pursued, in which the estimate is generated by deduction from economic theory in a manner consistent with the assumptions of the CAPM, then a very wide range of estimates can result. Research in the US indicates that the MRP estimates can go as low as 2 per cent and as high as 25 to 30 per cent.<sup>36</sup> I do not believe anyone seriously believes the MRP would be as high as 25% or 30% and very few could support an estimate of 2%. However, this research illustrates the uncertainty surrounding estimates of MRP.
- 188 In practice, the results associated with the empirical methods have high standard errors, so that relatively little confidence can be placed on the "point estimates" (i.e., single best value) they generate. Rather, any reasonable estimate must cover a fairly wide range of possible values. The two most widely cited estimates of MRP for the US are Ibbotson and Associates,<sup>37</sup> which has stated that the standard error of the long-run historical estimates of MRP for the US is about 2.7%,<sup>38</sup> and Dimson, Marsh and Staunton who report that their estimate of MRP has a standard error of 3%.<sup>39</sup>
- 189 In my opinion it is reasonable to assume that the MRP estimate in Australia will have higher estimation error than the MRP estimate for the US. Given the very substantial uncertainty with respect to estimating MRP, a one standard deviation range of at least  $\pm 2.5\%$  is appropriate.<sup>40</sup>

### 11.3.7 Asset and equity betas

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<sup>36</sup> Very low values are generated if one uses the method set out by E. Fama and J. Macbeth ("Risk return and equilibrium: Empirical tests," *Journal of Political Economy* 81, 1973, 607-636). Conversely, the approach originally set out by R. Lucas ("Asset prices in an exchange economy," *Econometrica* 46, 1978, 1429-1445), and subsequently developed by K. French, G. Schwert and R. Stambaugh ("Expected stock returns and volatility," *Journal of Financial Economics* 19, 1987, 3-29) will yield very high or very low values depending on whether reinvestment is allowed (as in the CAPM).

<sup>37</sup> Ibbotson and Associates, "Risk Premia over Time Report: 2004," reports a MRP for the US for the period 1926-2003 of 7.6% for a 5 year horizon.

<sup>38</sup> See Ibbotson's comments in I. Welch, "Research roundtable discussion: The market risk premium," available on Welch's website at <http://welch.econ.brown.edu/academics/>

<sup>39</sup> E. Dimson, P. Marsh and M. Staunton ("Global Evidence on the Equity Risk Premium") also report a MRP over long term bonds of 6.6% for the period 1900 through 2003.

<sup>40</sup> The distribution around the best estimate of MRP is almost certainly positively skewed. That is, the range upward will be wider than the range downward.

- 190 There is a high degree of measurement error in any estimate of beta. For example, data from the June 2005 Risk Measurement Service of the Australian Graduate School of Management's Centre for Research in Finance ("CRIF") contains data for more than 1,600 companies listed on the Australian Stock Exchange, but only 1,272 of those companies have sufficient data to enable betas to be estimated. The average standard error of these equity beta estimates is 0.92. Even when beta is estimated at the level of industry portfolios, where on average there are about 50 companies in each industry, the average standard error is 0.20.
- 191 A further perspective on estimates of beta is the predictive ability of an estimate. This is an important issue because what needs to be estimated is a forward-looking beta. Beta estimation primarily relies upon using historical information on betas to predict the forward-looking beta. A test of the predictive ability should provide additional insight into an appropriate range.
- 192 To address this issue in a current Australian context, I used data from CRIF for June 2003 and June 2004. I took the estimated betas from June 2003 and matched them with CRIF beta estimates for the same company from the June 2004 dataset. I then tested whether the June 2003 betas were good predictors of the betas one year later.
- 193 There are 1,104 companies that have estimated betas in both datasets. For each company there is a change in beta over the year. The average absolute change in beta for this set of companies is 0.51, while the median absolute beta change is 0.36.<sup>41</sup> Using the quartiles<sup>42</sup> of the distribution of absolute beta changes, if the earlier estimated beta was one, the estimated beta one year later was as likely to be outside the range 0.74 to 1.43 as to be within that range.<sup>43</sup>
- 194 The beta estimates in the CRIF dataset are based upon the returns over the previous 48 months. In assessing this predictive ability of the estimated betas, it should be noted that in making the estimates all but twelve of the monthly data points used in the June 2004 estimate were also used in the June 2003 estimate. The two estimates are not independent, yet the prediction error is substantial. This gives one more perspective on an appropriate range for the estimates of beta.
- 195 At every step of the way in estimating betas there are choices being made of alternative data sources, models and parameter estimation. Every data source, model, parameter value and data point has measurement error. In my view, the process of estimating a beta has substantial uncertainty at every step.

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<sup>41</sup> The beta change for an individual estimate of beta is the difference between the beta at June 2003 and the beta at June 2004. The absolute beta change treats each change as a positive amount. The median is the beta change in the middle of the distribution of beta changes.

<sup>42</sup> Quartiles are created by ranking the observations on the absolute beta change and then dividing the distribution into four segments, each with an equal number of observations. The inner quartile range is the two quartiles in the middle and would contain half of the total observations. The range of the inner quartile range from the average of one is not equal in both directions, indicating that the distribution is positively skewed. The distribution extends higher above the average of one than it extends below the average.

<sup>43</sup> This range is developed from the beta change data so that a quarter of the changes would be below the range and a quarter of the changes would be above the range. This shows that the distribution of beta changes is positively skewed.

- 196 I regard a one standard deviation range of  $\pm 0.25$  as reasonable for the asset betas of ULLS-Network. I estimate that the asset beta range expands to a range of  $\pm 0.3$  for the equity beta estimate.

### 11.3.8 The CAPM and WACC models

- 197 The ACCC uses the CAPM and WACC models for the purposes of its decisions. The CAPM assumes that there is only one risk that is rewarded with a return in the market, and that is the systematic risk where returns to the stock are correlated with the returns to the market. All other risks are assumed to be diversifiable and not relevant to the pricing of stocks. A company will have volatility in its returns that are specific to the firm, for example the success or failure of its research and development or its labour relations. These are risks that can be eliminated by an investor by holding a well diversified portfolio of stocks.
- 198 The CAPM is almost universally admired as an elegant economic model, but not necessarily a complete characterisation of security pricing.<sup>44</sup> The process used by the ACCC to estimate WACC ignores risk factors other than systematic risk. Therefore, the ACCCs estimated WACC is downward biased.
- 199 The CAPM and WACC models are widely used internationally, and I concur with their use in this context. In spite of its shortcomings, the CAPM is the best model available for the practical task of estimating the cost of equity capital. The WACC is similarly regarded as the best approach for estimating the appropriate return for a firm. However, there are limitations and problems with these models, even if it is agreed that they are the best models available. I agree with the ACCC that “some non-systematic risks of an asymmetric nature can be recognised in the regulatory framework but not through the CAPM.”<sup>45</sup> Because the models being used have limitations and require assumptions and approximations, it reinforces the point that substantial ranges for the WACC estimates derived from using the models should be estimated.<sup>46</sup>

### 11.3.9 Summary on one standard deviation ranges

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<sup>44</sup> One of the earliest tests that showed that a factor other than beta was rewarded with higher returns was by R. Banz (“The relationship between market value and return of common stocks,” *Journal of Financial Economics* 9, 1981, 3-18). He found that small firms, as measured by market equity, had high returns even after controlling for beta. R. Ball (“Anomalies in relationships between securities’ yields and yield-surrogates,” *Journal of Financial Economics* 6, 1978, 103-126) found abnormal returns related to the earnings-price ratio, E. Fama and K. French (“Dividend yields and expected stock returns,” *Journal of Financial Economics* 22, 1988, 3-25) found that the dividend payout ratio differentiated abnormal returns, L. Bhandari (“Debt/equity ratio and expected common stock returns: Empirical evidence,” *Journal of Finance* 43, 1988, 507-528) found that leverage was a significant explanatory factor, and D. Stattman (“Book values and stock returns,” *The Chicago MBA: A Journal of Selected Papers* 4, 1980, 25-45) found that the book to market ratio added to the explanation of the cross-section of average returns provided by the market. More recently, a stream of research shows that unsystematic (idiosyncratic) risk is important to the pricing of stocks. A. Goyal and P. Santa-Clara (“Idiosyncratic risk matters!,” *Journal of Finance* 48, 2003, 975-1007) is an example.

<sup>45</sup> ACCC, “Decision - Statement of principles for the regulation of electricity transmission revenues – background paper,” dated 8 December 2004, p 94.

<sup>46</sup> The issue being considered here has to do with shortcomings of the models, not with measurement issues that arise when estimating specific parameters of the models. Estimation errors on the parameters were dealt with above.

200 My estimates of appropriate point estimates and one standard deviation ranges for the parameters used to estimate WACC for the three fiscal years 2005/06, 2006/07 and 2007/08 are summarised in the table below.

**WACC Parameters and Ranges for 2005/06, 2006/07 and 2007/08**

Parameter	Distribution	2005/06		2006/07		2007/08	
		Point	Range	Point	Range	Point	Range
Risk free rate	Normal	5.11%		5.48%	0.6%	5.49%	1.0%
Market risk premium	Normal	7.0%	2.5%	7.0%	2.5%	7.0%	2.5%
Debt ratio		10%		10%		10%	
Debt risk premium	Normal	1.06%	0.15%	1.15%	0.15%	1.15%	0.15%
Debt issuance cost	Normal	0.2%	0.15%	0.2%	0.15%	0.2%	0.15%
Cost of debt capital		6.37%		6.83%		6.83%	
Debt beta		0.0		0.0		0.0	
Tax rate		30%		30%		30%	
Franking credits	Bi-modal	0.5	0 and 1	0.5	0 and 1	0.5	0 and 1
Asset beta	Normal	0.7	0.25	0.7	0.25	0.7	0.25
Equity beta	Normal	0.80	0.3	0.80	0.3	0.80	0.3
Equity issuance cost	Normal	0.15%	0.1%	0.15%	0.1%	0.15%	0.1%
Cost of equity capital		10.85%		11.74%		11.74%	
<b>WACC</b>		9.95%	3.1%	10.76%	3.3%	10.76%	3.5%
<b>WACC with uplift of 1sd</b>		13.05%		14.06%		14.26%	

201 Determining the range for my WACC estimates from the ranges for individual parameters has some complexities. Ideally the parameters and the ranges would be modeled using Monte Carlo simulations. I have not conducted those simulations with the above set of parameter values and ranges. However, I have had Monte Carlo analysis conducted under my instruction in investigating the Monte Carlo efforts of the ACCC.<sup>47</sup> My estimates of the ranges on the WACC estimates have been informed by that analysis.

<sup>47</sup> Appendix C of the ACCC's "Assessment of Telstra's ULLS and LSS monthly charge undertakings" dated August 2005.

202 The estimation errors in individual parameters will offset each other to some extent. It will be necessary to model the parameters and their estimation error to fully assess this. In my opinion, reasonable estimates of the one standard deviation upper bounds that would result from a modeling of the parameters and ranges would be approximately:

	<u>2005/06</u>	<u>2006/07</u>	<u>2007/08</u>
Vanilla WACC	13.05%	14.06%	14.26%

203 If these WACCs, based on one standard deviation ranges, are used for ULLS-Network, the ACCC can be 83% confident that it has set WACC at a level that is consistent with economic efficiency.

204 In scientific inquiries, the confidence levels chosen to reflect significance are rarely less than 90% and are often 95%. In my view the importance of the relative social costs of an error in setting WACC is such that a confidence level of this magnitude would be appropriate.

205 Whether 83% confidence, the one standard deviation level, or a higher level of confidence such as 90% or 95%, represents an effective threshold depends on whether it provides an appropriate trade off between the consequences of allowing the firm to earn profit that may be considered excessive and preventing the firm from earning returns at a level estimated in a workably competitive market. This is a judgement that will have to be made by the ACCC.

#### 11.4 Summary

206 Section 152AB of the Trade Practices Act, states that the regulator must have regard to “the legitimate commercial interests of the supplier or suppliers of the services,” and “the incentives for investment in the infrastructure by which the services are supplied.”

207 Virtually every component of the estimation of WACC introduces error. The aggregate effect of the estimation error is substantial.

208 As the ACCC has acknowledged in the context of gas pipelines, when there is uncertainty in determining WACC and its parameters, it is best to err toward providing adequate incentives for service, maintenance and investment. Therefore, the WACC set by the regulator should be chosen above the best estimate of WACC so as to balance the asymmetric social consequences of an error. This approach is the most likely to achieve infra-marginal efficiency.

209 In this section I make a series of recommendations.

- The ACCC should adopt a structured and objectively valid approach to incorporating the asymmetry into its determination of WACC.
- Specifically, I suggest that all parameters have a one standard deviation range estimated, as well as a best estimate.

- The ACCC can then determine the level of confidence that it considers appropriate to achieve a balancing of the social consequences of an error in setting WACC.
- From this, an appropriate WACC can be determined.

210 In my opinion, all regulatory WACCs should be determined with reference to the error involved in estimating the parameters and hence the WACC. Further, the regulatory WACCs should be set above the best estimates of WACC to reflect the asymmetry of the social consequences of errors in setting WACC. This should be done as a matter of principle.

211 In my opinion, appropriate nominal post-tax vanilla WACCs for ULLS-Network in each of the fiscal years 2005/06, 2006/07 and 2007/08 should be at least 13.05%, 14.06% and 14.26% respectively.

**DATED:** December 2005

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Ph.D.           Stanford University, 1978  
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M.S.            San Diego State University, 1969  
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B.A.            Pomona College, 1962  
                   Economics

**Employment Record**

2004-2005      Professor of Finance  
                   University of Queensland (Australia)

2003-2004      Network Associate, Network Economics Consulting Group (NECG)

1987-Present    Professor of Finance  
                   University of Auckland (New Zealand)

1995-96        Visiting Senior Fellow  
                   National University of Singapore

1984-86        President and Chief Executive Officer  
                   Restech Industries, Inc. - A start-up company in the paint/paint sundries  
                   industry (while on leave from the University of Oregon).

1974-87        Associate Professor of Accounting  
                   University of Oregon

1970-71        Treasurer/Chief Financial Officer  
                   Cohu, Inc. - A diversified, high technology company listed on the  
                   American Stock Exchange.

1966-70        Audit Manager  
                   Arthur Young & Company - An international certified public  
                   accounting firm.

1962-65        Line Officer  
                   U.S. Navy - Honourably discharged as Lieutenant.



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- “Estimating Betas Using Comparable Company Analysis: Is it a Reliable Method?” (co-authors S. Bush and L. Graves), *JASSA*, Autumn 2005, pp 10-14 ff.
- “A Test of the Usefulness of Comparable Company Analysis in Australia” (co-author L. Graves), *Accounting Research Journal*, vol 17 (Special Issue), 2004, pp 121-135.
- “Earnings Management and Abnormal Returns: Evidence from the 1970-1972 Price Control Regulations” (co-author F. Navissi), *Accounting and Finance*, vol 43(1), March 2003, 1-19.
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- “Corporatisation and Asset Valuation for a Government Corporation” (co-author J. Buchanan), *Financial Accountability and Management*, vol 6(2), Summer 1990, pp 77-91.
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- “The Importance of a Market Value Measurement of Debt in Assessing Leverage,” *Journal of Accounting Research*, vol 18(1), Spring 1980, pp 242-254.
- “The Theoretical Relationship Between Systematic Risk and Financial (Accounting) Variables,” *Journal of Finance*, vol 34(3), June 1979, pp 617-630.
- “The Role of Utility in the State-Preference Framework,” *Journal of Financial and Quantitative Analysis*, vol 10(2), June 1975, pp 341-352.

### **Research Papers Under Review and Revision**

- “A Test of the Usefulness of Comparable Company Analysis” (co-author S. Bush), submitted to the Journal of Applied Finance.
- “The Performance of Alternative Techniques for Estimating Equity Betas of Australian Firms” (co-authors S. Gray, J. Hall, T. Brailsford, R. Faff, B. Grundy, B. Officer, T. Smith).
- “Earnings Management: Evidence from the Pharmaceutical Industry” (co-authors V. Naiker and F. Navissi).
- “Reverse Leverage Buyouts, Timing and Underpricing” (co-author L. Graves)
- “The Reaction of Major World Equity Markets to the Asian Economic Crisis” (co-author M. Comer).
- “Returns of Acquiring Firms in Horizontal Mergers and Acquisitions” (co-author E. Wong).
- “Agency Problems and Legislative Design for Government Trading Enterprises” (co-authors D. Emanuel, M. Powell and B. Spicer), revising for resubmission to Corporate Governance: An International Review.
- “Long-term Operating Performance of Acquiring Firms after Mergers and Acquisitions” (co-author L. Cai).

### **Books and Chapters**

- "Aligning Management Control Systems with Strategic Direction: The Electricity Corporation of New Zealand Limited" (co-authors B. H. Spicer, D. M. Emanuel and M. Powell), chapter in Strategic Management Accounting: Australasian Cases, edited by K. Moores and P. Booth, Jacaranda Wiley Press, 1994.
- "Managing Radical Organisational Change in New Zealand's Largest State-Owned Enterprise" (co-authors B. H. Spicer, D. M. Emanuel and M. Powell), chapter in Case Studies in the Strategic Management of Organisational Change, edited by M. Patrickson and G. Bamber, Longman Paul, 1993.
- "Financial Management" (co-author L. M. Austin), chapter in CCH Management Manual (46 pages), Commerce Clearing House New Zealand, 1992.
- The Power to Manage (co-authors B. H. Spicer, D. M. Emanuel and A. Hunt), Oxford University Press, 1991.

### **Technical Reports**

- "Crown Research Institutes: Accountability and Performance Measurement" (coauthor D. M. Emanuel), invited submission to Ministerial Science Task Group, 1991.
- "From Government Department to State Owned Enterprise: A Case Study of the Electricity Corporation of New Zealand Limited" (coauthors B. H. Spicer and D. M. Emanuel), commissioned by Industries Branch, New Zealand Treasury, 1990, 212 pages.

### **Other**

- Book review, Capital Markets-Based Research in Accounting: An Introduction, P. Brown, in Pacific Accounting Review, June 1995.
- "The Global NPV Model," Australian Journal of Management, vol 18(2), December 1993, pp 225-226.

Book reviews, Sharemarkets and Portfolio Theory (2nd ed), R. Ball, P. Brown, F. Finn and R. Officer, in Journal of Finance, June 1990, and Accounting and Finance, Nov 1989.  
 "The Undervalued 200: The Market's Ugly Ducklings," Business Week, April 17, 1987, contribution of data and text.

### **Paper Presentations - Conferences**

- “A Test of the Usefulness of Comparable Company Analysis” (co-author S. Bush), AFAANZ Conference, July 2004.
- “A Test of the Usefulness of Comparable Company Analysis in Australia” (co-author L. Graves), Queensland University of Technology Workshop on Asset Price Behaviour, December 2003 (invited paper).
- “Pharmaceutical Industry: Political Exposure and Aggressive Earnings Management” (co-author F. Navissi), presented at American Accounting Association Annual Meeting, August 2002.
- “The Reaction of Major World Equity Markets to the Asian Economic Crisis” (co-author M. Comer), presented at Asia Pacific Finance Association Annual Meeting, July 2000.
- "Tests of Construct Validity of Earnings Management Models: Market and Management Responses to Regulatory Threat" (co-author F. Navissi), Accounting Association of Australia and New Zealand, July 1999
- “Wealth Effects of Regulatory Threats and Firms’ Vulnerability” (co-authors F. Navissi and R Burgess), presented at Asia Pacific Finance Association Annual Meeting, July 1999 and Accounting Association of Australia and New Zealand Annual Conference, July 1999.
- “The Effect of Price Control Regulations on Firms’ Equity Values” (co-authors F. Navissi and D. Emanuel), presented at Accounting Association of Australia and New Zealand Annual Conference, July 1997, Asia Pacific Finance Association Annual Meeting, July 1997 and Financial Management Association Annual Meeting, October 1997.
- "The Robustness of Event Study Methodologies to Varying Market Conditions" (co-authors A. Robin and J. Weintrop), presented at Financial Management Association Annual Meeting, October 1996.
- “Short-Run Overreaction in the New Zealand Stock Market” (co-author D. Iverson), presented at APFA/PACAP Finance Conference, July 1996.
- "A Change in Market Microstructure - The Switch to Screen Trading on the New Zealand Stock Exchange" (co-author M. Blennerhassett), presented at Asia Pacific Finance Association First Annual Conference, September 1994.
- "The Robustness of Event Study Methodologies to Varying Market Conditions" (co-authors A. Robin and J. Weintrop), presented at Third International Conference on Asian-Pacific Financial Markets, September 1993.
- "Implications of Dividend Imputation for Equity Pricing in New Zealand" (co-authors C. Cliffe and F. Navissi), presented at Australasian Finance and Banking Conference, December 1992.
- "From Government Department to State Owned Enterprise: A Case Study of Changes Resulting From Altering the Governance Structure" (co-authors B. Spicer, D. Emanuel and A. Hunt), presented at Accounting Association of Australia and New Zealand Annual Conference, July 1991.
- "Ex-Dividend Day Pricing Under Alternative Tax Regimes: New Zealand Evidence" (co-authors C. Cliffe and F. Navissi), presented at Australasian Finance and Banking Conference, November 1990.

- "It's Hard to be a Believer in the Efficient Market Hypothesis" (co-author J. Buchanan), presented at Accounting Association of Australia and New Zealand Annual Conference, July 1990.
- "Advantages to Trading on Risk-Return Asymmetries," Plenary Address at Accounting Association of Australia and New Zealand Annual Conference, July 1989.
- "Asymmetries in the Risk-Return Relationship" (co-authors A. Robin and J. Weintrop), presented at Australasian Finance and Banking Conference, December 1988.
- "Professional Examinations and Education: Finding a Mutually Beneficial Relationship," presented at American Accounting Association National Convention, August 1986.
- "Some Evidence Concerning the Combining of Forecasts of Earnings Per Share" (co-authors R. King and L. Lookabill), presented at American Accounting Association Western Regional Convention, May 1980.
- "Accounting Research, Education and Practice Revisited" (co-author L. Lookabill), presented at American Accounting Association National Convention, August 1979.

### **Professional Activities**

- Visiting Professor, University of Queensland, 2004-2005
- Visiting Professor, Hong Kong Polytechnic University, 2001
- Visiting Senior Fellow, National University of Singapore, 1995-1996
- Visiting Professor, University of Queensland, 1992
- Visiting Professor, Southern Methodist University, 1991
- Visiting Research Fellow, Australian Graduate School of Management, 1982
- Associate Editor, International Review of Finance, 1998-
- Associate Editor - Finance, Accounting and Finance, 1996-1999
- Editorial Board, Accounting and Finance, 1999-2000
- University of Auckland:
- Chair, Business School, Curriculum Committee Taskforce, 2002
  - Head, Department of Accounting and Finance, 1998-2001
  - Head, Financial Accounting Area, Department of Accounting and Finance, 1999-2001
  - Head, Finance Area, Department of Accounting and Finance, 1987-1998
  - Member, Workload Allocation Committee, School of Business and Economics, 1998
  - Member, Search Committee for Dean of School of Business and Economics, 1998
  - Chair, Department of Accounting and Finance Board, 1991-1995, 1997
  - Member, University Tuition and Resource Fees Study Group, 1997
  - Convenor, Executive Programme Fees Working Group, School of Business and Economics, 1997
  - Course Coordinator, Diploma in Business - Finance, 1989-1995
  - Director, Department of Accounting and Finance Doctorate Programme, 1987-1993
  - Member, University Appointments Committee, 1988
  - Member, Board of Graduate Studies Committee, School of Commerce and Economics 1988-1991
  - Member, Higher Degrees Committee, School of Commerce, 1987-88
- University of Oregon, College of Business Administration:
- Director of the Accounting Ph.D. Program, 1986-87
  - Ph.D. Task Force Committee, 1986-87
  - Chairman, Accounting Department, 1980-83
  - Accounting Department Fund Management Committee, 1979-83, 86-87
  - Ad hoc Committee to Advise the Dean, 1982-83
  - Personnel Committee, 1982-84

Co-organizer and Instructor, CPA Review Course, 1980-87  
 Chair, Accounting Department Recruiting Committee, 1979-80  
 Research and Publications Committee, 1979-80  
 Curriculum Committee, 1976-79  
 Committee for Admissions, Academic Standards and Degree Requirements, 1974-76  
 Faculty Advisor, Beta Alpha Psi, 1974-79  
 Member, Board of Directors, Asia Pacific Finance Association, 1993-1999  
 Member and Chair, Membership Committee, Asia Pacific Finance Association, 1997-1999  
 Member and Chair, Committee to Investigate Establishment of an Association Journal, Asia Pacific Finance Association, 1993-97  
The Accounting Review, Editorial Board, 1981-84  
 American Accounting Association, Professional Examinations Committee, 1985-87  
 Oregon Society of CPAs, Emerald Empire Chapter, Director, 1984-85  
 Oregon Society of CPAs, Forest Products Industry Committee, 1983-84  
 Oregon State Board of Accountancy, Workshop to Review the Content Specifications of the Uniform CPA Examination, Invited Participant, 1980

### **Professional and Society Memberships**

American Finance Association  
 Asia Pacific Finance Association (Founding Member of Board of Directors)  
 Accounting and Finance Association of Australia and New Zealand  
 Financial Management Association  
 Certified Public Accountant (California - inactive)

### **Other Recent Activities**

Trustee, New Zealand Universities' Superannuation Scheme, 1997-2003  
 Elder, Windsor Park Baptist Church, 1998-2002

### **Honours, Grants and Awards**

Prize for Best Article, New Zealand Investment Analyst, 1996  
 R. S. Gynther Lecture, University of Queensland, 1992  
 Plenary Address, Accounting Association of Australia and New Zealand Annual Conference, 1989  
 The John Gregor Award, for Outstanding Accomplishments and Contributions to the Field of Accounting, 1986  
 Coopers & Lybrand Curriculum Development Program, Award Recipient, 1986  
 Distinguished Teacher Award, College of Business Administration, University of Oregon, 1980-81  
 Excellence in Teaching Award, MBA Association, University of Oregon, 1981  
 Lybrand Foundation Dissertation Fellowship, 1973-74  
 American Accounting Association Doctoral Fellowship, 1972-73  
 Haskins & Sells Foundation Fellowship Award, 1972-73  
 Herbert Hoover Foundation in Business Fellowship, 1971-72  
 Beta Gamma Sigma (honorary business society)  
 Beta Alpha Psi (honorary accounting society)