REPORT ON THE APPROPRIATE WEIGHTED AVERAGE COST OF CAPITAL FOR THE SERVICES PROVIDED OVER THE CAN

Prepared for Telstra

Robert G Bowman

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INTRODUCTION

1 I have been asked by Telstra Corporation Limited ("**Telstra**") to give my expert opinion on a single Weighted Average Cost of Capital ("**WACC**") for all the services provided over Telstra's Customer Access Network ("**CAN**"). I have been asked that the WACC be a nominal, vanilla WACC. For simplicity, I will often refer to this as the CAN WACC.

2 Two alternative costing models are considered: the Current Cost Accounting **("CCA**") model and the Total Service Long Run Incremental Cost ("**TSLRIC**") model. These alternatives are discussed in section 4 below. The letters of instruction to me from Telstra are included as Appendix B. The estimates are for use in determining the relevant costs at 1 July 2005, 1 July 2006 and 1 July 2007. The CAN and the services that are provided over the CAN are also discussed in more detail in section 4 below.

3 The context in which I consider the establishment of an appropriate WACC is the access disputes in relation to the Line Sharing Service ("**LSS**") supplied by Telstra.

4 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 not disclosed to any person without Telstra's consent.

2. QUALIFICATIONS AND EXPERIENCE

2.1 Qualifications

2 I am the Bank of New Zealand 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 twelve 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) "Using Comparable Companies to Estimate the Betas of Private Companies"

(b) "Estimating Betas Using Comparable Company Analysis: Is it a Reliable Method?,"

(c) "A Test of the Usefulness of Comparable Company Analysis in Australia,"

(d) "Estimating the Market Risk Premium,"

(e) "Cost of Capital under Imputation: An Analysis of Comparative Models,"

(f) "Information Content of Financial Leverage: An Empirical Study: A Comment,"

(g) "Implications of Dividend Imputation for Equity Pricing in New Zealand,"

(h) "The Importance of a Market Value Measurement of Debt in Assessing Leverage,"

(i) "The Debt Equivalence of Leases: An Empirical Investigation," and

(j) "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*), am a consulting editor on another (*Afro-Asian Journal of Finance and Accounting*) 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 ten 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, 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 acted on behalf of 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 was 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,[1] 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.[2]

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 a single estimate of the WACC that is appropriate for the all the services provided over the CAN.

4. OVERVIEW OF THE REPORT

20 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 all the services provided over the CAN, including the LSS. Before going further, I identify the CAN and the services that are provided over the CAN.

21 Telstra's CAN is the series of wires, cables and equipment which connects customers' telephone termination points and the local exchange building or node. The connection can be by copper wire or by other means such as radio. The CAN is used by the public switched telephone network ("**PSTN**") and by Telstra's broadband network.

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1 Response to WACC Issues in Commerce Commission's Draft Report on the Gas Control Inquiry, dated June 2004.

2 Commerce Commission's Gas Control Inquiry Final Report, dated 29 November 2004.

22 The main services that use the CAN in provision of their services are:

- Local calls;
- Long distance calls (both national and international);
- Fixed to mobile calls;
- Basic access (from customers' premises to the PSTN);
- LSS;
- Asymmetric digital subscriber line ("**ADSL**");
- Unconditioned local loop service ("**ULLS**");
- Wholesale line rental service ("**WLR**");
- Local carriage service ("**LCS**");
- PSTN originating and terminating access service ("**PSTN OTA**"); and
- Wholesale ADSL.

23 This report covers the two alternative costing models: CCA and TSLRIC.

24 In my opinion, the WACC for will be the same for the CCA and TSLRIC models. The models are alternative approaches to current cost valuation. The asset bases and costs that are appropriate for each model will differ, but the WACC will not. In this report, I will make note of distinctions between the two models, but the WACC that I estimate will be the same for both costing models.

25 The correct time frame for the estimation of the WACC is at the beginning of a relevant period. This report estimates WACC as at the beginning of three years: at 1 July 2005, 1 July 2006 and 1 July 2007.

26 In addition to estimating the cost of capital for the services provided over the CAN, 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 the ACCC.

27 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.[3]

28 The ACCC must make estimates of 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

29 Determination of the appropriate WACC will vary depending upon whether the WACC is to be in nominal or real terms[4] 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. The development of WACC that follows assumes that the cash flows are measured using one of the current cost models and that the costs include all costs related to the CAN network.

30 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:

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

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).

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[3] 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.

[4] 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.

31 Some versions of the WACC include the tax rate and/or the value of dividend imputation credits. Although neither of these parameters enters directly into the estimation of the post-tax vanilla WACC, they are reflected in the costings that are a part of estimating the costs of supplying the services that use the CAN. Therefore, I will discuss the two parameters in section 8 below.

32 When information is only available at the firm level of Telstra, I will use that information but adapt it to suit the circumstances of the CAN. This will inevitably involve estimation and professional judgement.

6. COST OF EQUITY CAPITAL

33 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**"):

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

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
- β_e = systematic risk parameter for equity (explained in sections 9.1 and 9.2).

6.1 Risk Free Rate of Interest

34 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.

35 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.

6.1.1 Current or average market rates

36 An 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 ten 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.

37 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.

38 The risk free rate should be measured as of the opening of business on the relevant date. As this rate is not generally available, it is standard to use the government bond yield at the close of business on the immediately preceding business day.

6.1.2 Maturity

39 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.

40 It is widely regarded that the debt maturity should be equal to the life of the assets of the company. Furthermore, it is standard practice commercially to match the maturity of debt with the average lives of assets.[5]

> *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".*

41 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, government 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.

42 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.

43 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

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5 P. Vernimmen, P. Quity, M. Dallocchio, Y. Le Fur and A. Salvi, *Corporate Finance: Theory and Practice*, 2005 (John Wiley & Sons, Chichester, England), p 742.

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.

44 The average life of the organisational assets of the CAN is about 35 years. Thus, the appropriate government bond to choose to measure the risk free rate in estimating the cost of debt capital should be approximately 17.5 years. However, t 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 conditions, is the 10-year maturity. Therefore, it is conventional to use the 10-year maturity for all companies with long-lived assets. I will use the 10-year maturity for estimating the risk free rate.

6.1.3 Conclusion

45 I estimate the risk free rate as the rate on the day of the 10-year government bond. Using this approach, the risk free rates for 1 July 2005 and 1 July 2006 are 5.11% and 5.79% respectively.[6]

46 As I July 2007 is in the future, that risk free rate cannot be observed. The rate must be forecasted.

47 The beginning of the forecast process is to determine the most current rate. As of the close of business on 20 April 2007, the 10-year government bonds have a yield of 5.96%.

48 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 20 April 2007, the interest rates on government debt are declining from 1 year out to 15 years. That is, the yield curve is moderately down-sloping.

1-year	2-year	3-year	4-year	5-year	10-year	15-year
6.32%	6.28%	6.21%	6.17%	6.15%	5.96%	5.94%

49 A significant influence in interest rates is expectations of inflation. There seems to be a broad consensus that inflation in Australia is stable at about three percent but is likely to trend down moderately from the current level in the intermediate future. This is consistent with the observed yield curve.

50 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 not consistent with the current yield curve and may mask some expectation of falling inflation.

51 The task is to forecast the 10-year government bond rate to 1 July 2007, a period of two months and 10 days. I note that there is no appreciable

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6 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.

difference between the 10-year and 15-year rates, indicating a flat yield curve at that long in the future. In my opinion, there is likely to be little change in the interest rate over this short period. This supports the view that the best estimate of future interest rates for 1 July 2007 is the current interest rate. Therefore, I estimate that the 10-year maturity risk free rate on 1 July 2007 will be 5.96%.

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)[7]	7.2
Hancock (1883-2004)[8]	7.4
Hathaway (1875-2005)[9]	6.6
NEC (1952-99)[10]	6.6
AGSM (1964-00, including October 1987)[11]	6.2
AGSM (1964-00, excluding October 1987)[12]	7.7
Global Investment Returns Yearbook 2006 (1900-2005)[13]	7.4

7 S. Gray and R. Officer, "Review of the Market Risk Premium and Commentary on Two Recent Papers,"19 July 2005.

8 ibid.

9 ibid.

10 National Electricity Code, schedule 6.1, section 3.2.

11 Reported in IPART, "NSW Electricity Distribution Pricing 2004/05 to 2008/09 Final Report Other Paper No 23," June 2004, page 223.

12 ibid.

13 E. Dimson, P. Marsh and M. Staunton, "Global Investment Returns Yearbook 2006," London Business School.

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.

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 diversity their portfolios. Economies, at least in the industrialised world, have apparently learned to control inflation.[14] 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 the most important, 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 should present credible evidence with respect to the market that existed as the historical returns were generated.[15]

58 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

59 The market risk premium ("**MRP**") for Australia in 2005 and going forward is set in an international market. Investment funds now move freely into and out of the country and the currency. However, the Australian debt and equity markets, until fairly recently, 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.

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14 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.

15 As I discuss below, the favourable changes in open markets such as the US are not relevant to the ACCC's assertion.

60 In a recent study, Ragunathan found that the Australian stock market was segmented from the world capital markets during the period 1974 to 1983. Over the period 1984 to 1992, Australia was integrated with the world markets. She says,[16] "*Consistent with expectations, our test indicates that the capital market, segmented prior to deregulation, was integrated in the post-deregulation period.*" It seems likely that integration would have increased subsequent to the end of this study in 1992. This is a very fundamental difference and is the basis for challenging the relevance of the historical evidence.[17]

61 In the absence of relevant historical information, in my opinion estimating MRP using a benchmarking approach is appropriate.[18] With this approach, a benchmark country is chosen based upon its 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 in Australia.

62 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.

63 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.

64 The most common reference for MRP in the US is from Ibbotson Associates, and the most common period is from 1926. For the 78 years, 1926 through 2003, the risk premium for large stocks over the long-term (20-year) government bonds was 7.2%.[19] An alternative source is Dimson, Marsh and Staunton, which covers from 1900 through 2005. They report a premium over bonds of 6.5%.[20] The estimates have a standard error of 2%.

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16 V. Ragunathan, "The Effect of Financial Deregulation on Integration: An Australian Perspective," *Journal of Economics and Business*, November 1999, pp 505-514.

17 Although Australian markets have been open to international investment for nearly two decades, that is too short to provide a reliable *ex ante* estimate of MRP. For example, B. Cornell, J. Hirshleifer and E. James ("Estimating the Cost of Equity Capital," *Contemporary Finance Digest*, 1997, p 16) state, "The unfortunate fact is that stock prices are so variable that the risk premium cannot be estimated precisely even with 20 years of data."

18 See R. Bowman ("Estimating the Market Risk Premium," *JASSA*, issue 3, Spring 2001, pp 10-13) for a thorough coverage of this approach to estimating the MRP.

19 Ibbotson Associates, "Risk Premia over Time Report: 2004."

20 E. Dimson, P. Marsh and M. Staunton, "Global Investment Returns Yearbook 2006," London Business School, p 42.

65 In a broad based online poll of financial economists, Welch found that the average estimate of MRP was 7-8% depending on the horizon assumed for the risk free rate, with 7.1% relative to 10-year government bonds.[21] Welch has reported an update of his survey[22] that indicates respondents on average had become more pessimistic and reduced their estimates by an average of 1.6%. A caution needs to be made about these polls. First, they were from on open online poll and the respondents are likely to be educated with respect to the MRP, but there were none of the normal controls on participation. Second, the polls were taken during a period of considerable turmoil in the US markets. The first result was toward the end of the "bubble" when many people felt markets were over-valued. The second poll was taken around the time the bubble was being corrected, which would most likely have had a transitory impact on perceptions of the MRP.

66 There have been numerous empirical estimations of the MRP in the US. A common result of a stream of research on the volatility of the US markets is that the historical returns seem high relative to that volatility. However, this is a contentious area of research. Much of the early research in this area challenged the reasonableness of the historical MRP as a forward-looking estimate. Predictions of a forward-looking MRP ranged from about the historical level down to as low as 2%. Recent research has been more successful in reconciling historical returns with rational behaviour of investors and the markets.

67 The use of historical information to estimate a forward-looking MRP is logical, but subject to measurement error and distortions. The approach requires an assumption that the conditions underlying the historical returns are expected to be present in the future. Clearly this is a strong assumption and is unlikely to be appropriate when comparing the US equity markets in the twentieth century with those markets going forward. A comprehensive review of the literature in this area is beyond the scope of this report. However, there are four changes that I believe are particularly important in assessing the MRP.

68 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. This change includes the growth in mutual funds and pension plans. Economies, at least in the industrialised world, have apparently learned to control inflation.[23] 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

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21 I. Welch, "Views of Financial Economists on the Equity Premium and on Professional Controversies," *Journal of Business*, 2000, pp 501-537.

22 I. Welch, "The Equity Premium Consensus Forecast Revisited," Cowles Foundation Discussion Paper No. 1325, September 2001.

23 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.

management tremendously. Finally, and perhaps the most important, transactions and monitoring costs have declined markedly. I include the improved liquidity of the markets as a reduction in transactions costs.

69 Reflecting these changes in an estimate of a long-horizon MRP is necessarily subjective and uncertain. Interesting perspectives on a forward-looking long-horizon MRP come from the authors of the two best known sources of historical estimates, as cited above. Ibbotson[24] has estimated a MRP of 6.2%. Dimson, Marsh and Staunton[25] have proposed an estimate of 5% as a plausible forward-looking MRP.

70 UBS Investment Bank recently released a report[26] on estimating WACC.

> *We provide pragmatic solutions including: a global market risk premium of about 5%, based on historical data, market expectations, and a review of the literature.*
>
> *….*
>
> *Yet under the forces of globalism and capital market convergence, many experts now suggest that increasingly the US market may serve as the best proxy for a future global market risk premium. The U.S. has the largest economy and the most liquid capital markets. Consequently, the 5% risk premium seems appropriate for other markets, after adjusting for differences in tax rates, etc.*

71 Notice that UBS is suggesting an approach to estimating the MRP for markets in other countries using the same approach as I employ here.

72 The corporate finance textbook by Brealey and Myers is perhaps the most known and respected of all. They state the belief that the MRP based on long-horizon bonds is in the range 4.5% to 7%.[27]

73 In assessing the available literature and evidence, my estimate of the forward-looking, long-horizon US MRP is 5.5%.[28]

74 To estimate the appropriate MRP in Australia, I now consider differences in taxation, in equity markets and indices, and country risk that might cause Australia's *ex ante* MRP to be different from the US MRP.

Taxation

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24 R. Ibbotson, "Predictions of the Past and Forecasts for the Future," and "The Supply of Stock Market Returns" (with P. Chen), both available on the Ibbotson Associates website at http://www.ibbotson.com

25 Ibid, p 43.

26 UBS Investment Bank, "The WACC User's Guide," March 2005.

27 R. Brealey and S. Myers, *Principles of Corporate Finance* (7th ed), 2003 (McGraw-Hill/Irwin: Boston), p 160. They state their belief as 6% to 8.5% measured against US Treasury bills. The difference between bills and long-term bonds in the US has historically been about 1.5%.

28 I note that the reasonable range around this estimate is large. Ibbotson has reported that the standard error on the historical estimates of MRP is 2.7%. 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/

75 There are many differences in the structure of the personal income tax systems between Australia and the US, notably taxation of capital gains, Australia's dividend imputation system, and the US's generally lower tax rates and opportunities to shelter income from tax.

76 The difficulty is that the relevant tax structures in Australia and the US are those of the marginal investors that determine security prices and hence the forward-looking MRP. This issue is discussed in some detail in Appendix E on the value of imputation credits.

77 If the relevant investors in Australia are Australian resident taxpayers, then the tax advantages of the dividend imputation system are relevant. If the relevant investors are not Australians and/or not able to benefit from the dividend imputation system, then dividend imputation does not impact on the forward-looking MRP. In this case, the major tax advantage for Australia relative to the US is irrelevant.

78 If the marginal investor in Australia is domestic, the differences in taxation have the effect of being largely offsetting, although in my view there may be a marginal tax advantage in Australia. If the marginal investor is not Australian, then there is likely to be a marginal tax advantage in the US.

79 On balance, I do not see a clear case to be made for a measurable difference in favour of either country.

Market differences

80 The equity markets in the US differ in many ways from the Australian equity market. An incomplete list of factors that would support a higher MRP in Australia include being a smaller market, with less liquidity, smaller companies, less diversity and fewer risk management opportunities.

81 The Australian market has a larger representation of resource-based companies, which have high levels of systematic risk. The US market has more high-tech and leading edge companies, but the empirical evidence most commonly used to estimate the US MRP is based upon the Standard & Poor's 500 Index. This index is of a highly diverse set of companies that is not over represented by high-risk companies.

82 The ACCC agrees that the Australian market is riskier than the United Kingdom stock market in its report on the 1999 undertaking[29] when it says (para A4.6) the Australian market is "*… a higher risk, more resource-based, economy*".

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29 Australian Competition Consumer Commission, "A report on the assessment of Telstra's undertaking for the Domestic PSTN Originating and Terminating Access services," dated July 2000.

83 It is well known that small companies earn an average return that is greater than the return estimated using the CAPM.[30] The reasons for this are not all clear, but it is likely to be related to some measure of risk that is not captured by the CAPM. It is also well known that the size of firms is negatively related with their beta. Smaller firms tend to have higher betas.

84 The average size of listed companies in Australia is less than in the US. In a recent ranking by *Business Week* (July 14, 2003) of the 1000 largest companies in the world (by market value), Australia had 27 companies, which represented 1.7% of the market value of the 1000. The US had 488 companies, representing 56% of the total market value. The largest Australian company (Telstra) would have ranked 54th in the US. Clearly Australia's equity market is significantly smaller and, on that basis alone, would be expected to be higher risk.

85 There is no agreed model for adjusting MRP for size factors or industry composition. One of the best-known books on valuation[31] discusses the need for an adjustment for the smaller size of countries relative to the US as follows: "*If you use a beta relative to the local market, you should use a market risk premium that reflects the size of the local market.*" (p 371) In an example, they analyse Denmark and suggest an increment to that country's MRP of 1.5%.

86 The compositions of the markets in the two countries are consistent with the MRP in Australia being higher than the US MRP. The question is whether there is a reasonable way to estimate the magnitude of the higher risk in terms of return. An intuitive way to quantify the difference is to think of it in terms of systematic risk. If the firms in the Australian market were listed on an exchange with the S&P 500 firms, what would be the average beta of the Australian firms? In my opinion, the average beta would be in the range of 1.2-1.5. To convert this to a rate of return, assuming an MRP of 5.5% and applying the beta range estimate, would equal an addition to the benchmark MRP of 1.1% to 2.75%.

Country risk

87 The incremental risk of a country is often referred to as "country risk". This risk is related to the risk that a government will abruptly alter its policies with respect to investments in the country (including expropriations), shifts in monetary or fiscal policy, regulatory changes, defaults and tax changes.

88 The literature and empirical evidence support the conclusion that political risk is priced domestically. It is likely, however, that the country risk premium for a developed country such as Australia is priced in the risk free

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30 Evidence of this is provided for Australia in J. Halliwell, R. Heaney and J. Sawicki, "Size and Book to Market Effects in Australian Share Markets: A Time Series Analysis," *Accounting Research Journal*, 1999, pp 122-137; and C. Gaunt, P. Gray and J. McIvor, "The Impact of Share Price on Seasonality and Size Anomalies in Australian Equity Returns," *Accounting and Finance*, March 2000, pp 33-50.

31 McKinsey & Company, Ltd, "Valuation: Measuring and Managing the Value of the Companies," 2000 (John Wiley & Sons: New York).

return such that there is no additional premium necessary in the MRP. My preference is to not add to the benchmark MRP.

Summary[32]

89 To estimate a long horizon MRP for Australia, the information above is summarised 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

90 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%.

91 In my opinion, a conservative estimate of a long-horizon (10-year) MRP for Australia is 7.0%.

7. COST OF DEBT CAPITAL

92 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.

93 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 ("$\mathbf{R_f}$"), the debt risk premium ("**DRP**") and the annualised debt issuance cost ("$\mathbf{R_{IC}}$"). From this the cost of debt capital ("$\mathbf{R_d}$") can be expressed as:

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

94 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 of 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.

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32 There are two separable issues here; the appropriate MRP for the US and the premium over the US MRP that is appropriate for Australia.

95 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 the CAN.

7.1 Debt and Equity Proportions

96 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.

97 The correct measure to use in the WACC calculation is the company's optimal leverage ratio. However, the optimal leverage for a company is very difficult to assess, and even more so for an external observer. Therefore, in my opinion it is appropriate in this case to use the company's target proportions. The target proportions are usually close to, but not necessarily the same as, the current proportions. Perhaps more to the point, it is Telstra's responsibility to determine its target proportion. This proportion should be the gearing that Telstra management intends to pursue over the period for which the WACC is being estimated.

98 Although regulators may have views about capital structure for a firm, they do not have to face the economic consequences of their views. It seems presumptuous for a regulator to set policy based on an assumption that the management of a company does not know how to make capital structure decisions that are in the best interests of the company. Although there may be isolated cases where management are not acting wisely, I believe the burden of proof should be on the regulator, not the company, to establish that this is the case. I see no reason to assume that Telstra is not acting in its best interests in determining its capital structure, including its choice of maturities.

99 For purposes of estimating WACC, leverage should be measured with market values. The debt proportion is the market value of debt divided by the sum of the market value of debt and the market value of equity. However, Telstra's publicly stated target leverage ratio is expressed in accounting book values.

100 Telstra publicly announced in November 2005[33] that it was increasing its target gearing ratio from the range 45% to 55% to the range 55% to 75%. Telstra has advised me that it has converted this target book gearing to an

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33 See slide 28 of a presentation by John Stanhope, Telstra's Chief Financial Officer, on 15 November 2005. The presentation slides are available on - www.telstra.com.au/abouttelstra/investor/docs/tls372_stratrevjohnstanhope.pdf

indicative range in target market value terms, using an indicative market to book multiple for equity. Thus Telstra has increased its indicative target market value leverage for the whole of Telstra from 20% to a range of 25% to 45% in November 2005. However, it is clear from the public announcement that Telstra projects being at the lower bound of this range through the three years being estimated here.

101 The market value debt proportion (net debt divided by the sum of net debt plus equity) for Telstra, based on its financial reports and ASX share price data, was 16% at 30 June 2005, 24% at 1 July 2006 and 21% at 31 December 2006. The changes in the market value debt proportion across these dates are almost entirely attributable to changes in the market value of Telstra's ordinary shares. As Telstra has stated its target gearing in book value terms, these changes in leverage that result from changes in the market value of equity do not reflect a departure from its stated target.

102 On about 15 March 2007, Telstra issued 10-year Eurobonds to a total of about $1.6 billion. This issue will have increased Telstra's total interest bearing debt by about 12%. However, Telstra's share price has increased since 31 December so that the market value debt proportion is virtually unchanged.

103 For purposes of this report, I take Telstra's market value target leverage to have been 20% at 1 July 2005 and 25% for the following two years.

104 I see no reason to question the validity of Telstra's stated target debt ratio. However, as I note above, Telstra has not yet substantially increased its debt proportion since November 2005.

105 The information on leverage for Telstra is useful, but what is needed is to estimate the appropriate leverage for the CAN. I have been advised by Telstra that the CAN assets total over $30 billion with almost all of these assets being in the network. Thus, CAN is a very substantial portion of the whole of Telstra. The quality of security of the CAN assets to a lender would be comparable to the quality of security provided by the whole of Telstra. However, as will be discussed in depth in section 9.1, the cash flows from the services provided over the CAN would be somewhat more volatile than the cash flows of the whole of Telstra.

106 The nature of the assets and the volatility of cash flows should lead to an optimal capital structure for the CAN would be similar to the capital structure for the whole of Telstra. Although the target capital structure for Telstra has been increased, the increases have not yet eventuated. In my opinion, a reasonable leverage for the CAN is 20% as at 1 July 2005 and 25% as at 1 July 2006 and 2007.

107 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 Debt Risk Premium

108 Ideally the WACC for the CAN assets should be estimated on the basis of the services provided over the CAN, not the whole of Telstra. However, this cannot be directly estimated as there are not any debt securities directly attributable only to those services. The DRP can only be observed at the Telstra-wide level.

109 To estimate the appropriate debt risk premium, 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 CAN.

110 The DRP for the whole of Telstra as of the opening of business on 1 July 2005 and 1 July 2006 was 1.06% and 1.22% respectively.

111 As 1 July 2007 remains in the future, we cannot observe the DRP at that date. It is necessary to estimate the DRP that will be appropriate as of 1 July 2007.

112 The DRP for the whole of Telstra at 20 April 2007 was 1.24%. I not aware of any facts that would support a change in this DRP over the next two plus months.

113 What is needed is an estimate of the DRP for LSS, so adjustments from the Telstra DRP must be considered. In the preceding section I discussed the debt level appropriate for the CAN and estimated that it would be similar to that for the whole of Telstra.

114 I will assume that the debt risk premium for the CAN is approximately the same as for Telstra as a whole. I note that the market derived DRP for the whole of Telstra is based upon the actual gearing at the time, not a target gearing.

115 In my opinion, the best estimates of a single DRPs for the services provided over the CAN are as follows:

1 July 2005	1.06%
1 July 2006	1.22%
1 July 2007	1.24%

7.3 Debt Issuance Costs

116 The cost of debt capital in the WACC is the cost of debt to the entity, in this case the CAN. The market-based estimates of the debt risk premium provide the cost of debt to the investor. The rate to the issuer (the CAN) 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.

117 The ACCC has 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.

118 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.

119 As the value of the assets of the CAN, under either the CCA or TSLRIC costing model, is over $30 billion. Debt ratios of 20-25 percent indicate debt of around $7 billion. Further, normal financing practice would have this debt raised in more than one tranche. Therefore, a given issue of debt for the CAN would be over $1 billion.

120 A number of studies have investigated the issuance costs of debt offerings to the public. The study that is most cited estimated the total direct issuance costs as a percentage of the total proceeds for US corporations during the period 1990 to 1994.[34] The total costs for issues similar to that of the CAN are (proceeds in US$ millions):

Proceeds	Total Costs
$500 and up	1.53%

121 The issuance costs as a percent of the total proceeds of the issue can be converted into an equivalent cost of capital rate. The conversion will depend upon the maturity of the debt, as the longer the maturity, the more years there are over which to spread the costs. The appropriate maturity for the CAN, given the life of its assets, could be as long as 35 years. However, such long maturities are not generally available. For example, the recent debt issue discussed in section 7.1 above was for 10-years.

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34 I. Lee, S. Lochhead, J. Ritter and Q. Zhao, "The Costs of Raising Capital," *Journal of Financial Research*, Spring 1996, pp 59-74, table 2.

122 Using 10 years for the maturity, converting the total issuance cost estimate of 1.53% to an annualised cost of capital rate gives an amount of 0.22% annually. Using 20 years for the maturity gives an amount of 0.14% annually. Using 35 years for the maturity gives an amount of 0.12% annually.

123 The discussion in this section so far has implicitly been addressing the issuance costs when a debt issue is made to the public. An alternative way to issue debt is by private placement directly to a lender. Given its small size, this would arguably be the appropriate financing method for the LSS business.

124 The issuance costs of a direct placement are considerably lower than a public issue. However, the interest rates paid on private placements are usually higher than those on a public issue. So there is a trade-off when issuing debt by private placement – issuance costs are lower but interest rates are higher.

125 Brealey and Myers state, "*a typical differential (between the interest rate on public and private issues) is on the order of 50 basis points or 0.50 percentage point.*"[35] Hays, Joehnk and Melicher conducted an empirical study of the difference in rates between public and private debt issues and found that the yield to maturity on private placements was 0.46% higher than on similar public issues.[36]

126 Because both of these citations are about differences in rates of return rather than the quantum of issuance costs, the differences are quite large. Even if issuance costs of private placements were nil, which of course they are not, it would indicate issuance costs for private debt issues of about 0.50%. I note that the studies cited in the preceding paragraph were for larger debt issues than would be appropriate for LSS.

127 If private placements have such a higher interest rate, why does anyone issue debt that way? The major reasons are that private placements of debt have advantages in the debt contracts that can be used, and they can be done much faster. The debt contracts for public debt are quite standardised and allow almost no ongoing adjustments to the contract. Private placement debt contracts can be very flexible and can be tailored to the specific needs of the issuer and lender.

128 From Telstra's annual reports, about 25% of its long-term debt is in bonds and 75% is in loans. As the CAN business is very large, it is likely that the mix of debt types would be similar.

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35 R. Brealey and S. Myers, *Principles of Corporate Finance* (7th ed), 2003, (McGraw-Hill/Irwin: Boston), p 714.

36 P. Hays, M. Joehnk and R. Melicher, "Determinants of Risk Premiums in the Public and Private Bond Market," *Journal of Financial Research*, Fall 1979, pp 143-152.

129 Given the evidence cited above on the cost of debt issues and giving regard to the large size of a debt issue of the CAN, I believe the debt issuance cost, stated as a rate of return (R_{IC}), would be about 0.15%.

130 I see no reason why the issuance cost would change between the three periods under review. Therefore, I estimate that the debt issuance cost for the CAN is 0.15% for each of the three dates; 1 July 2005, 1 July 2006 and 1 July 2007.

7.4 Conclusion on Cost of Debt Capital

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

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

132 From the information above, my best estimates of the cost of debt capital for LSS are as set out below:

as at 1 July 2005:

$$R_d = 5.11\% + 1.06\% + 0.15\% = 6.32\%$$

as at 1 July 2006:

$$R_d = 5.79\% + 1.22\% + 0.15\% = 7.16\%$$

as at 1 July 2007:

$$R_d = 5.96\% + 1.24\% + 0.15\% = 7.35\%$$

8. TAXATION ISSUES

8.1 Tax Rate

133 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.

134 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).

135 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 the CAN is a forward-looking rate for the fiscal years being estimated.

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

137 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.

138 If accelerated depreciation is used for an asset with a 35 year life, the average life of the CAN assets, the book depreciation would exceed the tax depreciation in the tenth year of its life.

139 It seems clear to me that the difference between book and tax depreciation for the CAN assets would now have reversed so that the effective tax rate would be higher than the statutory rate of 30%. However, Telstra has advised me that it does not have data readily available to make this determination.

140 Aside from issues of the actual book–tax differences, it is the case that for the TSLRIC cost model all assets are assumed to be put in place at the beginning of the fiscal year being estimated. In that event, no accelerated depreciation could be available, and there should be no book-tax differences.

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

8.2 Value of Franking Credits (gamma)

142 The value of imputation credits has been set at 0.50 or less in all Australian regulatory decisions, and I have previously supported the ACCC position using a value of 0.5. I have noted however that a value of zero is consistent with recent empirical evidence and with the marginal shareholder being an international investor.[37] Since my last report on this issue, further evidence has emerged in support of the lower value.

143 I believe the wealth of evidence now solidly supports valuing imputation credits at zero, and I adopt that value in this report.

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37 For example, see Robert G Bowman, "Report on the Appropriate Weighted Average Cost of Capital for the ULLS Network," Appendix E, paragraph 21.

8.2.1 Background

144 Australia adopted a dividend imputation system of taxation on 1 July 1987. The purpose of the imputation system is to eliminate the double taxation of corporate profits where the profits are taxed at the corporate level and again at the personal level when dividends are paid.[38] The imputation system removed this double taxation for some investors. Dividends that are paid out of after-corporate-tax profits can be accompanied with a dividend imputation ("franking") credit to the extent of the corporate tax paid. The franking credits can then be used by the recipients as credits against their tax liability at their tax rates. The result is that the income of the corporation is ultimately taxed at the tax rate of the investors who receive the dividends.

145 For Australian resident taxpayers the franking credit has value of its full amount. So the income of the corporation is ultimately taxed at the tax rate of the Australian investors. However, investors that are not Australian resident taxpayers are not able to redeem their franking credits. As no tax relief is provided to non-resident taxpayers, the franking credits have no value in their hands.

146 Quantification of the value of franking credits is represented by the parameter gamma (γ). If the franking credit can be fully utilised as a credit against the investor's tax liability, as with Australian resident taxpayers, then the value of gamma to that investor is 1 (i.e., 100%). If the franking credit does not have value to the investor, as with non-resident taxpayers, gamma is equal to zero for that investor. The personal value will be determined at the level of the investors that receive the credits and thus will be influenced by the tax circumstances of those investors.

147 Although the value of franking credits to individual investors will be set by the tax circumstances of that investor, the value at the market level is what is relevant to the setting of WACC and determination of allowable costs. The value of franking credits at the market level, where security prices are set, will be determined by some process in the equity market.

148 Officer[39] discusses how franking credits affect the cost of capital of a company. He treats dividend imputation as reducing the effective corporate tax rate rather than changing the personal tax rate on dividend income. He utilises the parameter gamma (γ) to capture the proportion of the franking credit that can be claimed as a tax credit against the tax of the marginal investor. He develops a series of different formulations where gamma adjusts the cost of capital, the cash flows to be discounted or both.[40] As the defining factor is whether an investor is an Australian resident taxpayer, gamma will generally take a value of either zero or one.

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38 This is commonly referred to as the "classical tax system."

39 R. Officer (1994), "The Cost of Capital of a Company under an Imputation Tax System," Accounting and Finance, 34, 1-17.

40 For further discussion see R. Bowman and A. Marsden (1996), "Cost of Capital Under Imputation: An Analysis of Comparative Models," New Zealand Investment Analyst, 17, 27-32.

149 The value of franking credits is very importance as it may range from fully offsetting corporate tax or to being of no value to the marginal investors and hence of no relevance to security prices. Yet, there exists considerable disagreement on estimates of the value of the credits. In spite of the value being quite contentious, regulatory decisions have consistently adopted a value of 0.5 or less. This has likely occurred because at the time that the issue was first examined by Australian regulators, there was some evidence[41] suggesting that the value of gamma was about 0.5, particularly when taking into consideration the fact that not all imputation credits generated were distributed. This conveniently is the mid-point between the feasible values of zero and one.

150 Valuing gamma at 0.5 has now become regulatory precedent. However, evidence increasingly suggests that the value may now be zero, particularly following the introduction of the 45-day rule that essentially precludes foreign investors from deriving any benefit from their franking credits.

151 The next section discusses the relevant perspective on gamma for use in estimating WACC and/or cash flows. Key changes in tax law are then summarised. I then review empirical literature that estimates the value of gamma, with the emphasis on recent research. Then I present an analysis to test whether the market does in fact place some value on franking credits.

152 In all of my prior reports to Australian regulators I have taken the position that the true value of gamma is (close to) either one or zero. I have expressed my view that the correct value is likely to be zero. Although the regulatory precedent of gamma equal to 0.5 is almost certainly wrong, I have accepted the position that it is best not to make a change until the weight of evidence strongly supports the direction of change. When sitting on the fence, it is important to know the proper direction before one jumps.

153 I have now concluded that a substantial weight of evidence has accumulated to support that the market places no value on franking credits. Hence, I believe gamma should be set at zero.

8.2.2 Relevant investor perspective[42]

154 In relation to the value of franking credits, a major issue is: whose ability to redeem imputation credits is relevant for the assessment of the value of gamma? In his seminal research, Officer specified that gamma is the proportion of the *marginal* shareholder's personal income tax on dividend income that had been prepaid at the corporate level. The reason for Officer's specification is that the marginal shareholder is the price-setting investor. The price at which this shareholder transacts is the price that

41 In particular, see N. Hathaway and R. Officer (1992), "The Value of Imputation Credits," manuscript, University of Melbourne.

42 See R. Bowman, C. Cliffe and F. Navissi (1992), "Implications of Dividend Imputation for Equity Pricing in New Zealand," New Zealand Economic Papers, 26, 249-259, for a thorough discussion of the impact of a dividend imputation system on equity pricing and the role of the marginal investor.

equates the demand for capital with supply. It is this market-clearing price that determines the firm's cost of capital. The important point here is that the focus must be on the value to the marginal investor, not the average value across all investors. It is the *marginal* rather than *average* value of gamma that is likely to be more appropriate for setting a forward-looking value consistent with the aims of the CAPM.

8.2.3 The identity of the marginal investor

155 Who then is the marginal investor? In open capital markets such as Australia, which have large capital requirements but insufficient internal capital sources, external capital is required. Further, international investors will be attracted to investment in Australia for the diversification benefit that can result. In the context of imputation credits this means that both foreign and domestic investors will hold shares in Australian companies.

156 The identity of the marginal investors may have little relationship to the shareholder mix of a company at a point in time. In light of the extent of foreign ownership of Australian companies and the relative size of the Australian market in global terms, for most publicly listed Australian companies, the marginal investor is likely to be an international investor.

157 Of the total equity on issue by Australian enterprise groups at 30 June 2006, non-residents held equity valued at A$502 billion, which represents 27%.[43] Non-resident investors own around 37.5% of the value of the Australian Stock Exchange, the largest single shareholder group by far.[44]

158 Foreign investors clearly exert substantial influence on Australian stock market prices. Australia is a net importer of capital, and Australian equities only represent approximately 1% of the global market. The level of foreign ownership in Australian equity markets is significant and this can affect assumptions about the value of imputation credits since a foreign shareholder will at best experience considerable difficulty accessing imputation credits.[45]

159 Taken together, this suggests that an international investor, who cannot secure the benefit of imputation credits, sets the price for Australian securities. This is the case irrespective of the benefit that Australian investors can secure from imputation credits. The fact that Australians hold the bulk of securities is irrelevant here on account of the significance of

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43 Australian Bureau of Statistics, "Yearbook Australia 2006," under International Accounts and Trade, Foreign Ownership of Equity in Australia. The document is available at the website - http://www.abs.gov.au/AUSSTATS/abs@.nsf/bb8db737e2af84b8ca2571780015701e/BEB2B29B3938403CCA25723600052F16?opendocument

44 Information provided by Australian Stock Exchange. Figures for 19 September 2001.

45 As will be discussed below, recent tax changes require an investor to hold a stock for 45-days to be eligible for the franking credits. This effectively eliminated arbitraging and dividend stripping, resulting in the end of the secondary market for the credits and eroding the value of franking credits, particularly for foreign investors.

international investment (all but the 1% of global investment attributed to Australia) and the impact it thereby exerts (evidenced by the material presence already in the Australian market) in price setting. These factors suggest that gamma may be near zero.

160 Recent research in New Zealand[46] investigates a number of issues including the identity of the marginal investors for listed New Zealand companies since the introduction of dividend imputation in 1988. The extent of foreign ownership in New Zealand is comparable to that in Australia. The dividend imputation system changed over 14 years from one that did not permit streaming of imputation benefits to foreign shareholders to the point where foreign investors currently receive that benefit. Throughout this period, the marginal investors appear to have been non-resident investors.

161 Evidence that companies with substantial foreign ownership have a gamma of zero is not dissimilar to the outcome found in all competitive markets. For example, in any market, consumers pay for a product at the margin, irrespective of *their* valuation of the product. The difference between a consumer's valuation of a product (as determined by the demand curve) and the market price for the product (at the margin) is the well-known concept of consumer surplus.

162 This is precisely the outcome that is relevant in the context of the valuation of imputation credits. Whilst Australian taxpayers may gain the benefit of imputation, in the global market these benefits are simply not relevant to the valuation of Australian public companies. At the margin, the shareholders who set the price do not place a value on imputation credits. Australian shareholders receive a windfall gain by way of the tax system.

163 And it is in this context that imputation credits need to be considered – taxation (and by implication imputation) is but one of a host of factors that drive investment decisions. Other factors include diversification, opportunity, growth, synergistic benefits, etc.

164 If the dividend imputation system provides Australian resident investors a windfall gain, then we might expect to observe little or no overseas investment by these investors. The higher returns to Australians that result from the windfall gains would make domestic investment significantly more attractive than overseas investment. There does seem to be such an effect. Although there is substantial Australian investment abroad,[47] it is far less than one might expect to observe given the integration of world equity markets. Australia constitutes only about one percent of world markets, but far less than ninety-nine percent of equity investments are offshore. This is referred to as "home bias", and an obvious contributor to the existence of substantial home bias in Australia is the windfall gain from the dividend imputation system.

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46 C. Cliffe (2002), "Ex-Dividend Day Pricing in the New Zealand Equity Market," PhD dissertation, University of Auckland.

47 For example, total Australian overseas investment recently amounted to over $375 billion, approximately one half of the capitalisation of the Australian Stock Exchange.

165 The analysis above is consistent with gamma equal to zero. However, this is only a preliminary conclusion. A final conclusion should be determined after reference to the available empirical evidence. The next section discusses important changes in laws that may affect the value of franking credits. Then I review the available empirical evidence.

8.2.4 Key changes in the tax and legal environment

166 When the dividend imputation scheme was introduced in 1987, non-resident shareholders were able to derive indirect benefit from franking credits through the trading of shares around dividend dates. Schemes were established by investment banks to allow foreign investors to extract value from franking credits. These investors would sell their shares (cum-dividend) to domestic investors in the period leading up to the payment of the dividend. The domestic purchasers would then receive the cash dividend and franking credit and subsequently sell the share back to the foreign investor at a small premium. The transactions were completed within a day or two, thus involving minimal risk of unexpected share price movements.

167 The Commonwealth Government, some years after becoming aware of these schemes, changed the Australian taxation law to introduce a minimum holding period, requiring shareholders to be "at risk" for a period of time in order to obtain the benefit of franking credits. This amendment, called the 45-day rule, was effective from 1 July 1997, although it was not introduced until some time later (July 1999).

168 Investors are now required to hold shares for a period of 45 days during a qualification period around the dividend event (without substantial hedging) in order to be eligible to rebate franking credits against their tax liabilities. This significantly increased the period over which the trades between foreign and domestic investors could be made, to the extent that the extra price risk borne by the parties meant that such transactions were no longer economic.

169 Notice that foreign investors were never able to directly benefit from franking credits. The credits were only valuable to them to the extent that they could be sold to resident tax-paying investors that could utilise them. With the door effectively closed to the "laundering" of franking credits, the return to a foreign investor comprises dividends and capital gain only, whereas the return to a domestic investor comprises dividends, capital gain and franking credits. Ceteris paribus then the foreign investor would demand a lower price than the domestic investor, as the foreign investor receives a relatively lower return.

170 Therefore, in the presence of insufficient domestic capital and foreign demand for equity investments in Australia, it is expected that foreign investors shall be the marginal investors and that franking credits will have no value insofar as security prices are concerned. While they may have had

some value prior to the introduction of the 45-day rule, there is no longer any basis for foreign investors to derive benefit from these credits.

171 The view that the marginal investor is foreign has not necessarily been accepted by regulators. There are two arguments that have been made here by regulators. Firstly, many regulated businesses have a unique domestic shareholder base (e.g., they are government owned businesses), hence the marginal investor will not be a foreign investor. However, this argument lacks regulatory substance as WACC parameters are determined with reference to an efficient benchmark firm. For the reasons outlined above, it is appropriate to conclude that such a firm would have some of its shares held by foreign investors.

172 Secondly, some regulators have argued that if we are to consider the presence of foreign investors, we should be using an international CAPM to determine the WACC, not a domestic CAPM. All parameters would then need to be specified in a global market context. It is then asserted that the domestic CAPM will produce a lower WACC than would be the case with an international CAPM, implying that infrastructure owners would be disadvantaged if an international perspective were taken.

173 In fully integrated capital markets, an international version of the CAPM is preferred to the standard CAPM. However, the available empirical evidence shows that the standard CAPM is only marginally different from the multi-factor ICAPM in explaining historical returns.[48] The evidence also indicates that the single-factor ICAPM is an inferior model for this purpose.

174 The issue at hand is how best to estimate a forward-looking cost of equity, not how to best estimate historical returns. To estimate forward-looking cost of equity requires reliable estimates of the variables in the model. In the single-factor ICAPM that means we must be able to reliably estimate the world MRP. At the most we have 20 to 25 years of data for this purpose. To go back further than that in time, to assume that world security returns were generated in an international market would be tenuous at best. It is well accepted that such a short period as 20 to 25 years is not sufficient for a reliable estimate of MRP. Estimating MRP is always problematic. However, with respect to the ICAPM, the conclusion must be that we have no method of using historical returns to reliably estimate a world MRP.

175 Even if we overcome the problem of estimating a world MRP, the fact remains that the single-factor model does not provide an improvement over the standard CAPM. To achieve a significant improvement it is necessary to apply an ICAPM that incorporates exchange rate risk. To achieve this we

48 For examples of this research, see K. Koedijk, C. Kool, P. Schotman and M. van Dijk, "The Cost of Capital in International Financial Markets: Local or Global," Journal of International Financial Markets and Finance, 2002, v 21, pp 905-929; D. Mishra and T. O'Brien, "A Comparison of Cost of Equity Estimates of Local and Global CAPMs," The Financial Review, November 2001, v 36, pp 27-48; M. Dahlquist and T. Sällström, "An Evaluation of International Asset Pricing Models," 2002, Working Paper, Duke University.

must estimate a firm's sensitivity to exchange rate risk across all countries in the world economy. We are far from having a reasonable basis for this estimation in practice. Due to the problems associated with applying the ICAPM, we can conclude that the predictive properties of the standard CAPM should be at least as good as the ICAPM.

176 The most appropriate model to use is the domestic CAPM and standard practice is to recognise the presence of foreign investors in estimating parameters such as gamma (in other words, this application of the domestic CAPM serves as an appropriate proxy for an international CAPM where markets are partially, but not fully, integrated). Excluding their influence is both unrealistic and impractical.

177 In a recent paper Gray and Hall[49] find that the value of gamma maintained by regulators violates the deterministic relationship between the value of franking credits, the market risk premium and the corporate tax rate. Setting gamma to zero overcomes the inconsistency. Thus, assuming gamma of zero is both agreed to by the theory and empirical evidence and is robust to the applicability of this assumption.

8.2.5 Other Australian tax law changes

178 There are other changes to the Australian tax law that are also cited as potentially impacting the value of gamma. However, these changes will only impact the value of gamma from the perspective of domestic investors, not foreign investors. They will only impact the value of gamma if the marginal investor is a domestic investor.

179 The first is the change in the relative tax treatment of dividends versus capital gains. Historically, the payment of dividends was often preferred over capital gains by investors given the adverse taxation treatment of capital gains. However, since the capital gains tax treatment has been halved, the retention of dividends by companies has been viewed positively by investors, given the capital gains tax consequences of subsequent increases in the share price are less severe. This change could have resulted in a reduction in the value of gamma to domestic investors.

180 The introduction of a tax rebate for unused franking credits in 2000 was another significant change. Franking credits that previously could not be utilised (as they exceeded the individual's personal tax liability) now have some value. This should have increased the value of gamma to domestic investors.

181 Both of these changes have the potential to impact the value of franking credits to domestic investors. There will however be no impact on the value of gamma for cost of capital purposes if the marginal investor is not a resident tax payer. The changes are therefore of no relevance when estimating the value of gamma for cost of capital purposes.

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49 S. Gray and J. Hall (2006), "Relationship Between Franking Credits and the Market Risk Premium", Accounting and Finance, 46, 405-428.

8.2.6 Empirical evidence on the value of franking credits

182 Prior to the introduction of the 45-day rule (effective from 1997 but only introduced in 1999), non-resident investors could derive some benefit from franking credits by trading their shares with domestic investors around dividend dates. Although this benefit would likely have been less than the full value, the ability to "launder" the credits through such trading suggests that the franking credits had at least some value to foreign investors. The required 45-day holding period effectively removed any opportunity for these investors deriving value from the franking credits.

183 In examining the empirical research, I focus on more recent studies, particularly those undertaken since the introduction of the 45-day rule. Many studies include periods both before and after the introduction of the 45-day rule. To the extent this is the case, and if it is accepted that the value of gamma has been reduced by the rule, this will produce an upward bias in the results of these studies.

184 The value of franking credits to an investor is a function of that investor's tax circumstances. Hathaway and Officer[50] and Cannavan, Finn and Gray[51] identify two separate inputs to estimating gamma:

- the distribution rate (D); and
- the value of franking credits when distributed (V).

Gamma is then determined by the equation:

- gamma = γ = V x D.

185 Using data from the Australian Taxation Office, Hathaway and Officer estimated that approximately 69% of franking credits were distributed to shareholders.[52] However, only about half of the distributed franking credits were redeemed.[53] Apparently, roughly half of the investors did not utilise, or were unable to utilise, their franking credits. From this analysis, they estimated a value of franking credits of 0.35. It should be noted that this approach is actually an estimate of the average value of franking credits to investors. It provides no direct evidence of the value of franking credits to the marginal investors who set security prices.

8.2.7 Dividend drop-off studies

186 One of the most commonly applied methodologies used in studies that have sought to estimate the value of gamma is the dividend drop-off approach. A firm's share price will typically fall following the payment of a

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50 N. Hathaway and R. Officer (2004), "The Value of Imputation Tax Credits: Update 2004," Unpublished Working Paper, Capital Research Pty Ltd.

51 D. Cannavan, F. Finn and S. Gray (2004). "The Valuation of Dividend Imputation Tax Credits in Australia," Journal of Financial Economics, 73, 167-197.

52 N. Hathaway and R. Officer (2004), op.cit.

53 Australian Taxation Office (2005), "Taxation Statistics 2002-03," Australian Government.

dividend as the net assets of the company are reduced. Dividend drop-off studies examine the amount of the price change, the cum-dividend price minus the ex-dividend price, $P_{cum} - P_{ex}$. This is commonly called the drop-off. In some studies the drop-off is defined relative to the amount of the dividend (the drop-off ratio). That is,

$$\left(\frac{P_{cum} - P_{ex}}{D} \right)$$

187 The typical dividend drop-off study then tries to explain the drop-off (or drop-off ratio) using regression analysis, where the drop-off (ratio) is the dependent (left hand side) variable and the explanatory factors are the independent (right hand side) variables.

188 A major difficulty is that it is extremely difficult to decompose the price change into the value of the dividend itself and the value of the franking credits that are attached to that dividend. These two amounts are highly correlated, posing a number of methodological challenges for these studies. The reason for this correlation is that franking credits are linearly determined by the value of the cash dividend, as shown by:

$$FC = Div \times f \left(\frac{t}{1-t} \right)$$

where:

FC = franking credit

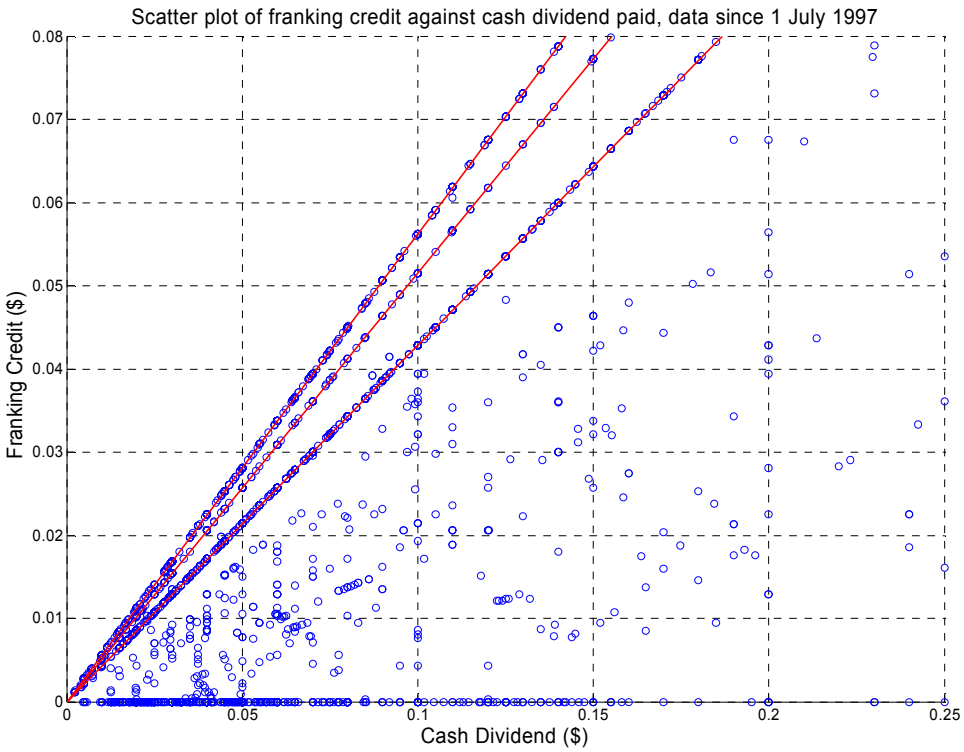
Div = cash dividend

f = franking proportion (or proportion of personal tax pre-paid at the corporate level)

t = the contemporaneous corporate tax rate.

189 The highly correlated relationship can be observed by plotting the two variables against each other, as shown in Figure 1 below.

Figure 1: Plot of Franking Credits against Cash Dividends Paid



Note: This data is for the ASX S&P 200.

190 The positive linear relationship between franking credits and cash dividends is clear in this figure. The three lines are the franking credits corresponding to fully-franked dividends at the 36%, 34% and 30% corporate tax rates experienced throughout the sample period (the slope of each line corresponds to the relevant tax rate).

191 Regression analysis is used to test the existence and strength of the relationship between a dependent variable and one or more independent variables. The results of the regression indicate the extent to which changes in the dependent variable are explained by the changes in the independent variables. When the independent variables are related, as shown above, there is a problem called multicollinearity, and its presence will significantly reduce the ability to interpret the value of the estimated parameter coefficients. It will not be possible to isolate the impact of each of the collinear independent variables on the dependent variable.

192 It is therefore extremely important to keep this issue in mind when examining the results of dividend drop-off studies.

193 It is also important to note that most studies (at least in the first instance) seek to establish a value for franking credits (V). As noted above, this must be multiplied by the distribution rate to obtain a value for gamma (γ). Where we have done this below, we have assumed a distribution rate of 71%.

8.2.8 Studies prior to 45-day rule

194 One of the first studies to apply the dividend drop-off methodology to Australian data after the introduction of dividend imputation was Brucker, Dews and White.[54] Their procedure involved regressing the drop-off (reduction in the share price) against the dividend and the face value of the franking credit. The estimated value of the franking credits was 33.5 cents per dollar of face value for the period 1987-1990, increasing to 68.5 cents per dollar of face value for the period from 1990 to 1993. Assuming a distribution rate of 71%, this equates to a value for gamma of 0.24 and 0.49 respectively.

195 Gray and Hall note four fundamental flaws with the methodology used by Brucker, Dews and White:[55]

1. The confidence intervals are too wide for the results to be able to be meaningfully interpreted.
2. Only two observations were available each year for each company, so a cross-section of results was produced across all companies. As gamma is likely to vary for each company depending on the nature of the shareholding, the results cannot be meaningfully interpreted.
3. Changes in price around the dividend date will be driven by short-term arbitrage traders. Any estimates would therefore represent the value of gamma to this class of investors. This is not necessarily the value that would be attributed to gamma by long-term investors, who are of most relevance in the context of estimating the cost of capital.
4. As noted above, the two explanatory variables, being dividends and franking credits, are highly collinear.

196 Gray and Hall conclude:[56]

> *The question is then one of how best to decompose this joint effect. A large body of evidence suggests that cash dividends are fully valued by those who trade around ex-dates. If this piece of evidence is coupled with the estimate of the joint effect of dividends and imputation credits, the implication is that imputation credits have negligible value. Thus, although this paper has been used to motivate the use of relatively large values for gamma, proper interpretation of the results would suggest the opposite.*

197 An important criticism of dividend drop-off studies such as above is that using ex-dividend day data to estimate the value placed on franking credits by the market may result in measurements that are not representative of the value that long-term providers of capital may place on gamma. Substantial

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54 Brucker, Dews and White (1994), Capturing Value from Dividend Imputation, McKinsey & Co Report.

55 S. Gray and J. Hall (2004), Evidence on the Value of Franking Credits: A Report Prepared for City West Water, Melbourne Water Corporation, South East Water and Yarra Valley Water, Strategic Finance Group, p.5.

56 Ibid., p.6.

price errors may also be present, as an entire trading day elapses between observations.

198 Partington and Walker examined what was a relatively new innovation in trading on the Australian Stock Exchange, namely the ability to trade shares cum-dividend in the ex-dividend period.[57] Their methodology compares the price of cum-dividend stocks (that will entitle the holder to dividends and franking credits) with the contemporaneous price of ex-dividend stocks (that don't carry such entitlements) in order to back out the instantaneous drop-off ratio.

199 Sample data used by Partington and Walker spanned the period from January 1995 to March 1997 and was restricted to shares which paid fully-franked dividends and to trades that were at most one minute apart (in order to capture the contemporaneousness). There sample was 1015 matched pairs of cum-dividend/ex-dividend trades. The fact that this sample contained data prior to the introduction of the 45-day rule is of great importance in terms of the results, which were that:

- 95.8% of trades result in a ratio between 1 and the upper bound for a fully-franked dividend with fully-valued franking credit. Those that do not lie within this range can be explained by the size of the dividend, so even small market movements could mask price changes due to the dividend;
- simple statistical tests (t-test and Wilcoxon signed rank test) confirmed that the mean drop-off was significantly greater than one at all commonly-accepted levels of significance; and
- the value the market places on franking credits was also backed out from these results and found to be 0.96 on average for trades, and 0.88 on average for events. These values were incorrectly reported as gamma. If the distribution rate of 71% is applied, the value of gamma would be 0.68 and 0.62 respectively.

200 Whilst these results are of questionable relevance to the period after the introduction of the 45-day rule, they help to reconcile the results of other studies. These results suggest that in the period prior to the introduction of the 45-day rule the market did indeed value franking credits.

201 Whilst these results are of questionable relevance to the period after the introduction of the 45-day rule, they help to reconcile the results of other studies. These results suggest that in the period prior to the introduction of the 45-day rule the market did indeed value franking credits.

202 In addition to the implications of the 45-day rule, there is the chance for substantial sampling bias. Cum-dividend trading in the ex-dividend period is only available at a stockbroker's request. Combined with Partington and Walker's evidence that this trading is driven by either investors looking to

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57 G. Partington and S. Walker (1999), "The Value of Dividends: Evidence from Cum-Dividend Trading in the Ex-Dividend Period," Accounting and Finance, 39, 275-296.

capture franking credits and dividends, or option traders who are restricted to stocks which paid only fully-franked dividends (and is skewed towards the banking sector), it is highly likely that the participants in these trades are not representative of long-term capital providers, on average.

8.2.9 More recent studies

203 Hathaway and Officer studied the relationship between the price change on the ex-dividend date and the cash dividend and franking credit paid. They used data from 1988 to 2002, which spans the adoption of the 45-day rule.[58] Their methodology sought to isolate the additional drop-off in the share price that is attributable to the franking component from the drop-off that is due to the cash component. This relies upon decomposing the ex-date price change and regressing it against its components, using the following equation:

$$\Delta P = Div + FC + e$$

where:

ΔP = price change on the ex-date

Div = cash dividend paid

FC = franking credit paid with the cash dividend

e = error term.

204 Hathaway and Officer tested a number of transformations of this equation to control for factors such as the market return on the ex-date and heteroskedasticity.[59] Regressions were run for all stocks in the ASX S&P 500 from August 1986 to August 2004, covering 6870 drop-off events. Also, regressions were run separately for small, medium and large firms as well as for high-yield stocks.

205 They draw conclusions from the large firms for the purposes of reliability, and conclude that franking credits are priced at around 50% of their face value, giving an estimate of gamma of 0.355. In addition, they find that the market values cash dividends at around 80% of their face value. They conclude that: [60]

> *We would be the first to admit that the value of imputation credits is not measured with any precision, but neither are many attributes of investment decisions which, by definition, must depend on future outcomes. Notwithstanding this lack of precision, ignoring them is tantamount to assuming a zero value for credits and this is certainly a gross error.*

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58 N. Hathaway and R. Officer (2004), The Value of Imputation Tax Credits: Update 2004, Unpublished Working Paper, Capital Research Pty Ltd.

59 Heteroskedasticity is where the error terms in an equation estimated from a data sample do not have constant variance. It is often caused by an incorrect specification of the regression equation (e.g., omitting a key variable).

60 ibid., p.25.

206 There are four key issues with this study. Firstly, the period studied spans the adoption of the 45-day rule. As it is likely that security prices such that the drop-off are determined differently before and after the rule became effective, the study is based upon changing relationships. The implications of mixing inconsistent relationships are not determinable from their study.

207 As noted previously, one of the main problems with studies of this nature is the collinearity between the two independent variables - dividends and franking credits. In fact, the two would be perfectly collinear if not for changes to the corporate tax rate during the sample period.

208 There are only five changes to the corporate tax rate in the sample data, and these only change the theoretical value of $1 of fully-redeemable credits by less than twenty cents. Indeed, for a sample of all firms in the ASX S&P 200 spanning the period between January 1996 and January 2006, the sample correlation coefficient between the cash dividend and franking credit was 94%, which is far above the typical econometric "rule of thumb" threshold of 80%.[61] As the estimation procedure breaks down for highly correlated values and produces unreliable standard errors, great caution is required when investigating the results estimated by Hathaway and Officer.

209 Thirdly, there are no levels of significance reported. Given the increase in standard errors encountered in regressions with high collinearity, the significance of the results is reduced. Furthermore, given the increased standard errors and strong linear association between dividends and franking credits, it is quite possible that the theoretical hypothesis that we have previously specified, being that the marginal investor is foreign and hence the value of gamma is zero, would not be able to be rejected.

210 Finally, the high degree of correlation between dividends and franking credits also means that a separation of their values is difficult. This is highlighted by the estimation of 80% as the market's value of the cash dividend, which lies in direct conflict with a large amount of academic literature. For example, Boyd and Jagannathan[62] suggest, with reference to the price decline for cash dividends, that a "one-for-one marginal price drop has been an excellent (average) rule of thumb" over the past few decades.

211 Hence, while they caution that assuming a value of zero for gamma could result in a "gross error", they do not provide sufficiently robust evidence to support that the value of franking credits is not zero.

212 Bellamy and Gray used a similar methodology to that of Hathaway and Officer, but made a variety of econometric extensions with an aim of

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61 This is rudimentary and covered in many basic econometric texts, for example, Hill, Griffiths and Judge (2001).

62 J. Boyd and R. Jagannathan (1994), "Ex-Dividend Price Behavior of Common Stocks", Review of Financial Studies, 7, 711-741.

improving robustness.[63] Whilst the rationale of Hathaway and Officer was preserved insofar as the stock price change was decomposed into cash dividend and franking credit (and in some instances market return), eight models were estimated. Data for the study was sourced from all stocks listed on the ASX between March 1995 and November 2002, containing a total of 5640 dividend events. The eight models differed in terms of whether:

- the ex-date price was kept raw or adjusted for expected returns;
- the dependent variable was defined as the drop-off ratio or the stock return; and
- the estimation was performed by ordinary least squares or weighted least squares. Under the latter approach, observations were weighted by their "informativeness", specifically, a higher weighting was given to higher yielding, low-volatility stocks.

213 Bellamy and Gray concluded that the securities market places no value on franking credits and fully values cash dividends. They concluded that the most robust approach to use was to adjust the ex-date price for expected returns, and give a higher weighting to more "informative" stocks (i.e., higher yield, lower volatility).

214 In arriving at this conclusion, they noted that significant noise in security prices can result in a high degree of sampling error, even for large samples. Different research designs and sampling procedures can result in estimates for the value of franking credits anywhere between zero and 60%.

215 While making some recommendations about research design, they note that it is not possible to separately and reliably estimate the value of dividends and franking credits. Irrespective of the adjustments made in an attempt to address multicollinearity, it will always be a problem. The correlation between the dividends and the related franking credits in their sample was 0.85.

216 Whilst this study specifically pertained to the estimation of the value of franking credits and not gamma, it follows that if franking credits have no value to the marginal investor then gamma must be zero, irrespective of the distribution rate.

217 Cannavan, Finn and Gray tested whether the introduction of the 45-day rule has impacted the value of gamma.[64] Rather than use the dividend drop-off method, they sought to infer the value of cash dividends and franking credits from the relative prices of share futures and the underlying shares on which these contracts are written. They examined two securities

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63 D. Bellamy and S. Gray (2004), Using Stock Price Changes to Estimate the Value of Dividend Franking Credits, Working Paper, University of Queensland.

64 D. Cannavan, F. Finn and S. Gray (2004). "The Valuation of Dividend Imputation Tax Credits in Australia", Journal of Financial Economics, 73, 167-197.

traded on the Australian markets, namely Individual Share Futures Contracts (ISFs) and Low Exercise Price Options (LEPOs).

218 In a no-arbitrage framework[65], the following methods are equivalent:

- acquiring the share at a set time via futures contracts; and
- replicating this transaction in the physical market (which involves borrowing funds and purchasing the share).

219 Under this framework, a relationship between the spot price of the share, futures price, cash dividend and franking credit is derived. The ISF data spans the period May 1994 to December 1999. Data on LEPOs from April 1995 to December 1999 is used. Futures trades are only included when the underlying stock trades within four minutes of a futures trade, so that the contemporaneousness effect mentioned previously is captured. In addition, the futures trades are made well-before the ex-date, so this reduces any affect that short-term arbitrageurs may have.

220 The authors noted that the data behaved well in-line with the no-arbitrage relationship, and as such the model is substantially reliable. This is an important advantage over estimation via the dividend drop-off technique. The sample size is relatively small, given that there are only a small number of companies on whose shares derivatives contracts are written in the Australian market, and only the most highly traded companies were included. These highly traded companies are also among the largest companies listed on the ASX. However, any implications from a small sample size are likely to be outweighed by the benefits of using a more robust methodology.

221 In terms of overall conclusions, it is again found that the market fully values cash dividends, consistent with the theory.

222 The most fundamental conclusion of Cannavan, Finn and Gray is that after the introduction of the 45-day rule, the market does not value franking credits. In a manner similar to that of Bellamy and Gray, a constraint is also imposed in which the franking credits are given zero value after 1 July 1997. They found that this constraint cannot be rejected, which provides further support for the hypothesis that gamma is no longer valued by the market.

223 Cannavan, Finn and Gray did find that franking credits may have been valued at up to 50% of their face value prior to the introduction of the 45-day rule (suggesting a value for gamma of up to 0.36). Since then, however:[66]

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65 A no-arbitrage framework means that the two alternative strategies would be priced so that an investor is indifferent between them. If this is not the case, there is a potential arbitrage opportunity which investors could exploit. The trading exploitation would continue until the advantage was eliminated.

66 ibid., p.192.

> *…we find no evidence of any positive value at all in imputation credits after the introduction of the 45-day rule. The increased costs and risks involved in transferring imputation credits make it infeasible to engage in this strategy even for the highest-yielding stocks… This means that in a small open economy such as Australia, the company's cost of capital is not affected by the introduction of a dividend imputation system. The company must produce the same return for the marginal stockholder whether an imputation system exists or not if the marginal stockholder receives no value from imputation credits.*

224 As mentioned above, a limitation of the research of Cannavan, Finn and Gray is that the sample consists of very large Australian companies. It has been suggested that the results can only be interpreted as applying to such major companies. Perhaps the marginal investors of small companies are domestic investors, and the value of gamma for these companies is positive. Although this sounds inticing, the difficulty is that sustaining the argument requires that the ASX is a segmented market. There are no mechanisms or institutional constraints that would enforce a segmentation of the ASX based upon size of companies. Given the ability of funds to move to capture the highest return for a level of risk, it seems implausible that only the prices of the very largest companies on the ASX would reflect that trading activity of international investors.

225 A similar approach to Hathaway and Officer was used by Beggs and Skeels, but with different results.[67] Using data from the Commsec Share Portfolio database over the period from 1986 to 2004, they tested six tax regime changes on the value of franking credits, being:

- superannuation funds can use franking credits (1988);
- provisions to stop dividend streaming (1990);
- limits to use of franking credits by life assurance funds (1991);
- provisions limiting related payments, holding periods and delta hedging (1997);
- the reduction in capital gains tax (1999); and
- tax rebate for unused franking credits (2000).

226 Their notable results included that:

- from 1988 to 2001, the hypothesis that the estimated drop-off for the dividend and franking credit components are equal was rejected. This is seen as reducing the validity of models based on the gross drop-off ratio;[68]
- from 1987 to 1997, and for 2000, the value of franking credits was not shown to be significantly different from zero;

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67 D. Beggs and C. Skeels (2006), "Market Arbitrage of Cash Dividends and Franking Credits" The Economic Record, 82, 239-252.

68 The gross drop-off ratio is the ratio of the change in price to the sum of the dividend and franking credit, that is, the change in price divided by the gross dividend.

- since the last tax change (being the rebate on unused franking credits), the value of unused credits was seen to significantly increase. From 2001-2004, the value of the drop-off was 0.57. This translates to a value for gamma of 0.41; and
- the majority of the sample failed to reject the hypothesis that cash dividends are fully valued.

227 These results were statistically significant, but they should be interpreted with caution as the independent variables are again highly collinear.

228 More importantly, it seems anomalous to find that gamma was approximately zero before the adoption of the 45-day rule but significantly above zero after that rule was adopted. The adoption of a rebate provision for unused franking credit certainly benefited those Australian investors that did not have sufficient tax liability to fully utilise their franking credits. These would be investors that had sufficient wealth to own shares but not sufficient taxable income to use the franking credits from those shares. It seems implausible that such investors could be the marginal investors in Australia.

229 Gray and Hall discuss the relationship between the market risk premium and gamma and the implications of this for the regulated WACC.[69] They highlight how estimates of the MRP reflect the value of dividends and capital gains, but not the third potential source of return for investors, being franking credits. Using the standard analytical framework developed by Officer, which is widely followed in Australian regulatory practice, they demonstrate that significant inconsistencies arise with respect to the underlying assumptions implied by adopting a value for gamma of 0.5, a tax rate of 30% and a MRP of 6%. In particular, the adoption of these parameter values, which are the standard assumptions of regulators in Australia, "is dramatically inconsistent with observed market data."[70]

230 They conclude that the most robust way of resolving the inconsistency is to set the value of gamma to zero. Setting gamma equal to zero "restores the internal consistency among the cost of capital parameters and with external data on dividend yields."[71]

231 Feuerherdt, Gray and Hall (FGH) empirically investigate the value of franking credits as disclosed through hybrid securities.[72] In Australia, Reset Preference Shares ("**RPS**") and Convertible Preference Shares ("**CPS**") are nominally equity securities that pay dividends but also have some debt-like features. They are classified as equity securities for tax purposes, so the

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69 S. Gray and J. Hall (2006), "Relationship between Franking Credits and the Market Risk Premium," Accounting and Finance, 46, 405-428.

70 ibid., p. 416.

71 ibid., p. 427.

72 C. Feuerherdt, S. Gray and J. Hall (2007), "The Value of Imputation Tax Credits on Australian Hybrid Securities," International Review of Finance, forthcoming. Hybrid securities have characteristics of both debt and equity.

regular distributions to the investors are considered dividends rather than interest payments. As a result, the dividends may have franking credits attached. The investors may receive both a cash dividend and a franking credit with the distribution.

232 FGH empirically estimate the value of the franking credits using the dividend drop-off methodology. The advantages of the hybrid securities for this research are that the estimates are more statistically reliable and the securities are market almost exclusively to domestic investors. If the investors are domestic, it provides a very strong test of whether the marginal investors are international investors. Data for the study is from July 1995 through December 2002. The sample includes dividends on ordinary shares as well as on RPS and CPS. They use a number of approaches to address the econometric issues discussed above (i.e., multicollinearity and heteroskedasticity).

233 They find no evidence that the mean dividend drop-off ratios are greater than one. That is, the value of a package of a $1 cash dividend and the associated franking credit is $1. This result holds for all three forms of equity that they test. They are not able to separate the value of the cash dividend from the franking credits. Rather, they note that if the cash dividend is fully valued, consistent with evidence from the United States, then the franking credit has no value. Any value attributed to the franking credit must be offset with attributing a lesser value to the cash dividend.

234 The research suffers from the data spanning the implementation of the 45-day rule and franking credits becoming rebateable to resident tax payers (1 July 2000). The sample is small when partitioned across the tax changes but there is weak evidence that the mean drop-off ratios have declined over time. This implies that the any value that could be attributed to franking credits has decreased over the sample period.

235 FGH's results are consistent with the marginal investor being international and with the value of franking credits, and gamma, equalling zero.

8.2.10 Evidence from independent experts' reports

236 Lonergan[73] reported the results of a survey of 122 independent experts' reports published between 1990 and 1999 which involved the use of a discounted cash flow methodology (and hence the estimation of a WACC) to assess the reasonableness of takeover bids. The purpose of this was to consider the extent to which adjustments had been made for dividend imputation. It is worth noting that this survey was of expert reports issued primarily before the implementation of the 45-day rule.

237 Only 39% of the reports revealed the underlying WACC methodology, and of these 88% made no adjustment for imputation. Lonergan cites the various conceptual reasons that were given for doing this, which included:

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73 W. Lonergan (2001), "The Disappearing Returns", Jassa, Issue 1.

- there is no evidence that acquirers of businesses will pay additional value for surplus franking credits;
- there is little evidence that the value effects of dividend imputation are being included in valuations being undertaken by companies or investors in the broader market;
- changes in tax legislation have made it much more difficult to trade in franking credits;
- foreign shareholders are the marginal price-setters of the Australian market and many such shareholders cannot avail themselves of the benefit of franchising credits; and
- "the evidence gathered to date as to the value the market attributes to franking credits is insufficient to rely on for valuation purposes."

8.2.11 Summary of results

238 The results of these studies are summarised in the following table:

Table 13 Summary of Key Studies

Study	Methodology	Time Period for Estimation	Value of franking credits (V)	Value of gamma (γ) *
Bruckner, Dews and White (1994)	Dividend drop-off	1987-1990 1990-1993	0.34 0.69	0.24 0.49
Partington and Walker (1999)	Contemporaneous pricing of shares with and without franking credits	1995-1997	0.96 (average)	0.68
Hathaway and Officer (2004)	Dividend drop-off	1988-2002	0.5	0.36
Bellamy and Gray (2004)	Dividend drop-off (adjusted)	1995-2002	0	0
Cannavan, Finn and Gray (2004)	Analysis of futures and physical market (no arbitrage framework)	Pre- 45 day rule	Up to 0.5 (high-yielding stocks)	0.36
		Post- 45 day rule	0	0
Beggs and Skeels (2006)	Dividend drop-off	1987-2000, 2001-2004	0 0.57	0 0.41
Gray and Hall (2006)	Consistency between WACC parameters and observed dividend and MRP data	Simulated data	0	0
Feuerherdt, Gray and Hall (2007)	Dividend drop-off for hybrid securities	1995-2002	0	0
Lonergan (2001)	Survey of independent experts' reports	1990-1999	0	0

* Assumes a distribution rate of 71%.

239 A number of studies have concluded that franking credits have some value, although the estimates vary considerably. There are a number of problems have plagued empirical attempts to estimate the value of franking credits, particularly those that find values significantly above zero.

240 Some of these studies include data from the period prior to the introduction of the 45 day-rule. This will produce an upward bias in the estimated value of gamma, given that franking credits may have had some value prior to this change, but zero value following the change.

241 There are also a number of methodological issues. One of the most significant ones that is consistently encountered is the multicollinearity that arises in dividend drop-off studies due to the strong relationship between the value of cash dividends and franking credits.

242 I have reviewed a number of studies that have concluded that the value of franking credits is zero (or, the hypothesis that they have no value cannot be rejected). One of the more notable recent works is the study by Cannavan, Finn and Gray, which used a more robust methodology than dividend drop-off studies. They concluded that since the introduction of the 45-day rule, franking credits are of no value to the marginal investor.

243 This study provides strong support for a gamma of zero. If the value of franking credits is zero, then so too must be gamma. However, for this to hold the marginal investor must be foreign and therefore unable to extract value from franking credits since the introduction of the 45-day rule. Tax law changes that only affect domestic investors, such as the introduction of a cash rebate for unused franking credits in 2002, should have no effect on the market's value of franking credits.

244 A relatively simple diagnostic test was undertaken by Synergies Economic Consulting as part of a report it prepared for GasNet.[74] It provides a further test of the hypothesis that the value of gamma is not different to zero. The following section is directly from that report.

8.2.12 A simple diagnostic[75]

245 To circumvent the host of econometric and sampling issues involved with estimating gamma, a basic and simple behaviour test can prove fruitful. The test aims to determine whether or not the market responds, on average, differently to franked dividends from how it responds to unfranked dividends. Whilst this may seem a different approach which does not measure the value of franking credits, it tests for the presence of their value.

246 In particular, it tests whether or not the ratio of the ex-date price change to cash dividends is significantly greater for franked dividends than unfranked dividends. That is, if it is found that shares with franked dividends behave in a manner that is not significantly different from shares with unfranked dividends on the ex-dividend date, this would lead to the conclusion that franking credits are valued at zero (leading to a zero value of gamma).

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74 Synergies Economic Consulting Pty Ltd, "Weighted Average Cost of Capital Review for GasNet Australia," November 2006.

75 This section is taken directly from the Synergies Economic Consulting report for GasNet, section 4.7.5.

247 If, on the other hand, shares with franked dividends do behave in a manner that is significantly different, it would be concluded that this difference is due to the market placing value on franking credits. If this were the case, gamma would not be zero and further empirical investigations would need to be undertaken to estimate its value.

248 The data used in this investigation was sourced from Bloomberg and contains observations on firms listed in the S&P ASX 200 from January 1996 to January 2006. Trusts and other entities which have a dissimilar tax structure to companies were excluded, resulting in 3188 observations in total. Whilst this sample only spanned the top 200 stocks, because ex-date behaviour is analysed it is important to exclude thinly-traded stocks from the dataset (otherwise large errors may be introduced due to lags).

249 There is still considerable thinness in trading in this sample: of the 3188 observations, 36% (1140) have a delay of more than one day in price observations about the ex-dividend date. However, only 96 observations have a delay of more than three days, which takes dividends paid on Mondays into consideration and these were excluded. Partially franked dividends were excluded from the examination as this avoids complications in selecting an appropriate level of franking as the cut-off point.

250 For the full period, there were 516 events with unfranked dividends and 2138 events with fully franked dividends. The sample standard deviations of the drop-offs ratios were such that a test for equality of variance would conclude that the standard deviations of the samples were unequal.[76] As a consequence, the common parametric test for equality of means is invalid so the simple, non-parametric paired test is used instead.

251 The sample of fully franked events is substantially larger that that of unfranked events, so a random sample of it is taken to produce the same number of observations, which was then paired with the full set of unfranked observations. If the theoretical hypothesis is true (that is, the market value of franking credits is zero), it should be the case that half of the fully franked drop-off ratios are greater than the unfranked drop-off ratios.

252 There was found to be insufficient evidence to reject this hypothesis[77] and as such it is concluded that the market responds equally to fully franked and unfranked dividends. The same test is used for the sample of data from 1 July 1997 onwards as the parametric test is invalid,[78] and the nonparametric test leads to the same conclusion.[79] This evidence that the market does, on average, respond equally to fully franked and unfranked

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76 F-test for variance equality: $s_1 = 5.6736$, $s_2 = 1.9994$, p-value < 0.0001

77 Paired sample test: sample proportion = 0.527, theoretical proportion = 0.50, p-value = 0.11

78 F-test for variance equality: $s_1 = 6.0972$, $s_2 = 2.0996$, p-value < 0.0001

79 Paired sample test: sample proportion = 0.528, theoretical proportion = 0.50, p-value = 0.12

dividends is further evidence that the market places no value upon franking credits.

253 This test can also be extended to see whether the drop-off for franked dividends behaves significantly differently from unfranked dividends if franking credits are valued at some proportion of their face value.[80] In this case, the proportional value will be 50% and 100%. In other words, rather than testing the hypothesis that franking credits do not have a value other than zero, we are testing the hypothesis that these credits have some value. In this case, we have tested three values, being:

- 0.5;
- 0.7 (which is the value implied by a gamma of 0.5 and a distribution rate of 71%); and
- 1.0.

254 It has already been found that the market behaves the same way for franked and unfranked dividends on the ex-date, by only moving on average by the amount of the cash dividend. Therefore, if it is found that these new ratios are significantly different across franked and unfranked dividends then the market must not value franking credits. The sample data was again restricted to observations after 1 July 1997 and to fully-franked and unfranked dividends. The same nonparametric test is used and it is found that the ratios are different across fully-franked and unfranked dividends with a half-valued franking credit[81], a value 0f 0.7[82] and a fully-valued franking credit.[83]

255 On this basis, we can reject the hypothesis that franking credits have a value of 0.5, 0.7 (which is implied by a value for gamma of 0.5 assuming a 71% distribution rate) or 1. In addition, we believe this is likely to be the finding irrespective of the value tested for the valuation of franking credits.

256 This inconsistency with the result for the ratio of price decline to cash dividend only is further evidence that the market does not value franking credits.

8.2.13 Conclusion

257 The estimation of gamma is important to the determination of WACC and/or the cash flows of companies. Regulators in Australia have consistently chosen a value of 0.5 or less. In previous reports, I have

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80 That is, rather than consider the ratio of price decline to cash dividend, the ratio of price decline to cash dividend and some proportion of the face value of the franking credit is considered.

81 Paired sample test: sample proportion = 0.590, theoretical proportion = 0.50, p-value < 0.0001

82 Paired sample test: sample proportion = 0.5907, theoretical proportion = 0.5, p-value<0.0001

83 Paired sample test: sample proportion = 0.595, theoretical proportion = 0.50, p-value < 0.0001

expressed my opinion that gamma is likely to be zero for the simple reason that the marginal investors in Australian equities markets are almost certainly international investors for whom franking credits have no value. I have, however, supported retaining the regulatory value of 0.5 until such time as the accumulated evidence strongly supports a change.

258 In this section on gamma I have presented a discussion of gamma, a discussion of why I believe the marginal investor is a non-resident tax payer, and a review of the more recent empirical evidence on the value of gamma.

259 As to the relevant empirical evidence, the adoption of the 45-day rule is very important. Before this rule was adopted there may have been some economic ways for foreign investors to stream or launder franking credits through specially constructed transactions. However, requiring a 45-day holding period around the dividend date has effectively made such transactions uneconomic. Therefore, I have focused primarily on evidence that uses data subsequent to the adoption of the 45-day rule. Studies that seek to estimate gamma using data prior to this date will almost certainly over-estimate the value of gamma. A number of studies use data from both before and after the adoption of the rule. The results are then a mix of the two, and interpretation of the results is difficult.

260 A number of the studies use the dividend drop-off methodology, where a key concern is the high collinearity between dividends and the associated franking credits. Bellamy and Gray adopted a methodology that attempted to adjust for this, but they concluded that it is not possible to unequivocally separate the value of the two.

261 Recent empirical investigations have mostly concluded that the value of franking credits is zero, at least since the introduction of the 45-day rule. There are two exceptions. Hathaway and Officer found that franking credits are valued at around 50% of their face value, so gamma should be estimated at 0.36. Whilst this is lower than the value being adopted by regulators, there are significant problems that limit the efficacy of the study. The study uses data across the period 1988-2002. Thus it is a mix of data from before and after the adoption of the 45-day rule. The study also has the problem of multicollinearity, so they are not able to separate the (potential) values of dividends and franking credits. It is a further concern that the study reports no significance levels. The increase in standard errors encountered in regressions with high collinearity means the statistical significance of the results is reduced. A study by Beggs and Skeels found mixed evidence on gamma. As I point out in the discussion of their study above, the result that gamma was about zero before the 45-day rule but may have increased to about 0.4 subsequently, is implausible.

262 Three studies have avoided the difficulties of the dividend drop-off methodology, and therefore are particularly important. Cannavan, Finn and Gray use a no-arbitrage approach to the pricing of the securities in the futures and physical market. Their results support gamma equal to zero.

Gray and Hall use a simulation approach to investigate the consistency between a range of WACC parameters and the observed data on dividend yields and MRP. The parameter values generally adopted by regulators (i.e., MRP of 6%, tax rate of 30% and gamma of 0.5) are shown to be inconsistent with market observations. They find that the most plausible value of gamma is zero. Lonergan takes a very different approach. He conducts a survey of independent experts' reports and finds that the big majority assume that franking credits have no value.

263 A basic but informative test of the market's behaviour with regards to the ex-date price response was conducted by Synergies Economic Consulting. It finds that for fully-franked and unfranked dividends, the market responded equally to the cash dividend, indicating that the franking credits were worthlessness. It also tested whether franking credits could have been valued by the market at 50%, 70% or 100% of their face value. All three alternative values were rejected. The report finds no evidence to reject the theoretical hypothesis that franking credits are worthless.

264 There is a strong theoretical foundation, particularly since the introduction of the 45-day rule, that the marginal foreign investor is a non-resident tax payer. This supports the conclusion that franking credits have no value. Considerable empirical evidence has accumulated to support a value for gamma of zero.

265 The two conclusions that the marginal investor is foreign and that the value of imputation credits is zero are jointly consistent. The weight of evidence is such that I believe that it is now appropriate to assume a value of zero for gamma.

9. CALCULATION OF COST OF EQUITY CAPITAL

266 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 the CAN.

9.1 Systematic Risk

267 The systematic risk (β 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.

268 There are three basic approaches to estimating systematic risk:

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

269 Ideally all three should be considered in the estimation and should reinforce each other. However, direct estimation of the beta for the CAN is not possible, as a separately listed company that provides only the CAN does not exist. Telstra is predominately a network company, as is the CAN. Also, the CAN constitutes a substantial part of the whole of Telstra. Therefore, data on the whole of Telstra is relevant to an estimate of the beta of the CAN.

9.1.1 Direct estimation

270 For each estimation date, I use share market data for the most recent five years to estimate the equity beta of Telstra, with the S&P ASX-200 as the market index. For the estimation as of 1 July 2007, I use five years of data to 20 April 2007. The results are highly sensitive to the measurement interval (daily, weekly or monthly). I also include the estimates supplied by the AGSM Risk Measurement Service (June 2005 and 2006), which are based upon 48 months of data.

	Daily	Weekly	Monthly	AGSM
1 July 2005	0.773	0.550	0.060	0.38
1 July 2006	0.618	0.486	0.242	0.24
1 July 2007 (estimate)	0.542	0.586	0.410	

271 The only beta calculations with an R^2 greater than 0.10 are the three estimations with daily data and the 1 July 2007 estimation for weekly data. The three estimations with monthly data all have R^2 less than 0.05. The estimations from the AGSM database have R^2 of 0.05 for 2005 and 0.02 for 2006. The AGSM results also report on betas estimated using a statistical correction technique referred to as the Scholes-Williams ("**SW**") betas and a statistical that indicates when the SW betas are preferred to the standard ordinary least squares estimation technique. In both years reported here, the Telstra beta estimate using SW 7is preferred and the estimates are 0.96 for 2005 and 0.76 for 2006.

272 There is an indication of a declining beta across the three years here, although this is not monotonic. In general, the "true" equity beta is thought to be stable, although the estimated betas often show deviations. I am not aware of any changes in the systematic risk profile of Telstra that would be consistent with a decline in its equity beta. As noted above, there has been no appreciable change in its actual gearing, and its mix of businesses is likely becoming more risky as new technologies become more important to its overall business.

273 I conclude that the best estimate of the historical equity beta of Telstra for all three dates is in the range 0.7 to 0.8. However, I note that the widely diverse estimates available provide little confidence in the estimate.

274 The range on equity betas can be converted to an asset beta range for Telstra. 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. The results vary slightly across the three years but indicate a range for asset beta between 0.55 and 0.66.

275 There is no reliable and systematic method to adjust the Telstra information on beta to an estimate of beta for the CAN. However, the CAN has much in common with the whole of Telstra, so the data on beta for Telstra is useful in reaching a final conclusion on the beta for the CAN.

9.1.2 First principles

276 The second approach to estimating the systematic risk of the CAN is to work from first principles. Relevant factors are those that will influence the correlation between the returns to the businesses that provide the services and the returns to the economy. The returns to the economy are proxied by the returns to a broad share market index; in this case the ASX-200. One way to analyse this is to refer to the Arbitrage Pricing Theory research, particularly the seminal empirical study by Chen, Roll and Ross[84]. They find that the factors that explain stock market returns are unexpected changes in real GNP, inflation, market risk aversion and long-term real interest rates. The latter three will usually have a similar impact on the systematic risk of firms, so the first factor is the most useful to analyse. The following firm characteristics should provide indications of a firm's sensitivity to unexpected changes in real GNP[85]:

- operating leverage;
- income elasticity;
- terms of contractual arrangements; and
- nature of regulatory regime.

277 The difficulty with conducting first principles analysis for the CAN is that the services provided over the CAN are quite diverse. As a practical matter, the services can be partitioned into those that are well established and growth is static or declining and those that are emerging and fast growing. In section 4 I listed the major activities that use the CAN. Local and long distance calls, LCS, and PSTN OTA are examples of well established activities. LSS, fixed to mobile calls and ADSL are examples of emerging and growth businesses.

278 I do not have data that allows me to accurately determine the relative size of the two groups. The established and no growth businesses are clearly a substantially larger group.

Operating leverage

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

85 The implications of financial leverage have been addressed separately.

279 The CAN involves a very high level of investment, and once these investments are made they are sunk, with little likelihood of recovery except through operations.

280 Operating risk will thus be high as fixed costs are a significant proportion of total costs. With costs largely fixed, the volatility that will drive systematic risk will come from the revenue streams of the CAN utilising businesses.

Income elasticity

281 In previous reports to the ACCC, I have reviewed evidence on the income elasticity of the established businesses.[86] That evidence is consistent with those businesses having moderate income elasticity that would be approximately one.

282 I do not have comparable income elasticity data on the emerging growth businesses that use the CAN. However, I have reviewed data on Telstra's ADSL and LSS businesses in a recent report.[87] This shows the explosive growth in these activities. As growth is highly correlated with systematic risk, this is consistent with a high systematic risk.

283 The difference in growth between the established and emerging businesses that use the CAN is illustrated in the table below, which shows revenue in A$million.

	Line Rental	Voice services[88]	ADSL
2003/04	$2,619	$5,217	$141
2004/05	$2,619	$5,229	$285
2005/06	$2,491	$4,917	$552

Contractual arrangements and regulatory regime

284 Long-term contracts add stability to the returns of a business. There are no significant long-term contracts for any of the services using the CAN. This is consistent with a higher than average asset beta.

285 The regulatory regimes that cover most of the services provided over the CAN are consistent with moderate systematic risk.

286 My judgement is that the first principles analysis indicates an asset beta for LSS in the range of 1.2 to 1.8. As the growth in LSS is moderating

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86 See for example, Appendix F of "Report on the Appropriate Weighted Average Cost of Capital for PSTN-OTA and LCS", dated March 2006.

87 Section 9.1.1 in "Report on the Appropriate Weighted Average Cost of Capital for LSS", dated May 2007.

88 Voice services includes local calls, long distance calls (national and international), and fixed to mobile calls).

somewhat, it may be appropriate to reflect a slight annual reduction in the asset beta over the three years in this report.

Conclusion on first principles

287 My judgement is that the first principles analysis indicates an asset beta for the established businesses in the range of 0.4 to 0.9 and for the emerging businesses in the range of 1.0 to 1.8.

288 The wide range indicates the lack of precise guidance from consideration of the first principles approach to estimating systematic risk in this case.

289 As the established businesses are substantially larger than the emerging businesses, I estimate that a reasonable asset beta range for the portfolio of services provided over the CAN, based upon first principles, is 0.5 to 1.0.

290 I do not see any clear indication that the first principles factors have changed across the three years such as to warrant differentiating them.

9.1.3 Comparable companies

291 As mentioned above, the portfolio of services provided over the CAN is quite diverse. However, there are a number of publicly listed telecommunications companies that have a range of businesses that would bear resemblance to the mix of activities of the CAN. In this section, I present data on the equity and asset betas of a range of telecommunications companies.

292 When searching for comparable companies for the established businesses within Telstra, it is usual to begin with the remaining Regional Bell Operating Companies ("**RBOCs**") in the US. Other major providers of communications services that have comparable characteristics include AT&T, BT Group, Deutsche Telekom AG, Telecom de Mexico and Telecom New Zealand.

293 I have collected data on the betas of the above companies, and others, using the following procedure. I first identified all companies in the public database maintained by Professor A. Damodaran[89] that are identified as in the telecommunications, telecommunications services, or integrated telecommunications industries.

294 As the CAN is very large, with over A$30 billion of assets, I eliminated all companies with less than US$10 billion of assets. I also reviewed the descriptions of the companies available on Yahoo Finance. I eliminated companies that were primarily mobile and/or wireless companies and companies that were primarily providers of manufactured telecommunications products.

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89 http://pages.stern.nyu.edu/~adamodar/. When I collected data from the website it had been updated as of January 2007.

295 There are a number of alternative methods of estimating betas that are considered acceptable. No single approach has been widely accepted as superior to others. Therefore, I collected data on betas from three alternative sources; ordinary least squares regressions reported by Damodaran, Value Line and Yahoo Finance. For some companies, there was only one beta estimate available. I have not included those companies.

296 The estimates are all for equity betas. I then used data available on Damodaran's website and on Yahoo Finance to transform these equity betas to asset betas. For the transformation I used what is commonly referred to as the Hamada equation with taxes.[90]

297 The data is shown in the table below. The first three companies are RBOCs. BellSouth Corporation was acquired by AT&T in late 2006, which is the reason that I was not able to obtain a current beta estimate on Yahoo. A fourth RBOC, SBC Communications, merged with AT&T in 2005, with AT&T being the surviving name.

	Asset Betas		
Company	OLS	Value Line	Yahoo
BellSouth Corporation	0.660	0.968	
Qwest Communications	0.861	0.994	0.765
Verizon Communication	0.569	0.842	0.521
AT&T Inc.	0.478	1.042	0.373
BT Group	0.749	0.704	
Deutsche Telekom	0.973	0.590	0.938
Hellenic Telecom Org. SA	1.013	0.605	0.945
Nippon Telegraph	0.658		0.380
Portugal Telecom	1.314		0.526
Swisscom AG	0.536		0.589
Telefonica SA	1.051	0.745	0.667
Telefonos de Mexico	1.224	0.708	1.432
Telecom New Zealand	1.228	0.485	1.187
Telekom Austria	0.520		1.326
Average	**0.845**	**0.768**	**0.804**

298 The average asset beta across the three methods is 0. 806.

299 The comparable company information above is based upon the full range of businesses in which these companies participate, not just for the equivalent of the services provided over the CAN. The purpose of this report is to estimate a WACC for the services provided over Telstra's CAN. An

90 $\beta_a = \beta_e / [1 + (1 - T_c)(D/E)]$

important question is whether the assets and services that are included in this analysis of the CAN have more or less systematic risk than the assets and services of Telstra that are not included in this analysis.[91]

300 The assets and services of Telstra that are not included in this analysis include businesses that have both more and less systematic risk than the businesses that provide services over the CAN. On average and for the three years being considered here, I believe there is no clear difference between the systematic risk of Telstra and the systematic risk of the CAN.

301 However, it seems reasonable to assume that the emerging and higher risk services being provided over the CAN are an increasing proportion of the business over the CAN, so I expect that the riskiness of the CAN will be increasing. I believe that is the case over the three years being estimated here, but I do not have sufficient detailed data to allow me to factor that into my estimates of the asset beta.

302 In my view, this comparable company evidence provides support for an asset beta for the CAN of 0.8.

9.2 Conclusions on Asset Beta and Equity Beta

303 The historical equity beta of Telstra for all three dates covered in this report is in the range 0.7 to 0.8, which converts to an asset beta range of 0.55 to 0.66. The first principles analysis supports a range for the asset beta of the CAN between 0.5 and 1.0. The comparable company analysis supports an asset beta of 0.8.

304 There is clearly estimation error in all three approaches to estimating beta. In this section, I will arrive at a point estimate. I will return to the issue of estimation error in section 11 below.

305 In my opinion, the information from the three analyses above supports a point estimate of the asset beta for the CAN of 0.75. I believe it is appropriate to use this estimate across the three dates 1 July 2005, 1 July 2006 and 1 July 2007.

306 From the estimation of an appropriate asset beta for the CAN, I then re-lever the asset beta to obtain the equity beta. I again use the Monkhouse equation for this task. This process results in an estimate of an equity beta for the CAN that reflects its leverage and tax circumstances.

307 I estimate that the appropriate equity betas for the services that are provided over the CAN are as follows.

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91 A related question is whether the comparable companies here are more or less risky than the whole of Telstra and what the mix of business is that relates to any difference in riskiness. From my review of the business descriptions of the companies, it seemed that on average the companies' diversification across business areas was similar to Telstra's.

	Asset beta	Equity beta
1 July 2005	0.75	0.910
1 July 2006	0.75	0.962
1 July 2007	0.75	0.962

308 The differences between 2005 and the other two years is a result of the change in leverage between those years.

9.3 Equity Issuance Costs

309 To raise its equity financing, a company will incur substantial costs. In its Final Decision on GasNet,[92] 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."

310 The allowance could be recovered in two different ways. ACCC decided for GasNet that equity issuance costs would be recovered as an annual non-capital cost cash flow. Alternatively, the costs could be treated as an increment to the cost of equity. My preference is to incorporate the allowance into the cost of equity capital.

311 The total direct issuance costs of public equity offerings have been studied for both initial public offerings ("IPO") and secondary offerings ("SEO"). The costs as a percent of the offering proceeds for relevant offering sizes (in US$ millions) are shown below.[93]

Proceeds	Total Costs - IPO	Total Costs - SEO
$500 and up	5.72%	3.25%

312 The average total cost percentage across the two categories above is 4.5%.

313 One textbook[94] reports that the average cost of initial public offerings in Australia in 1995 was 2.5% but does not provide support for this estimate and does not indicate the size of offerings being evaluated. Among other things, this does not recognise the underpricing cost.

314 It has been extensively documented that the issue price on IPOs is at a discount. Brealey and Myers[95] refer to underpricing as the hidden cost of

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92 "Final Decision, GasNet Australia access arrangement revisions for the Principal Transmission System", dated 13 November 2002, pp 143-151.

93 I. Lee, S. Lochhead, J. Ritter and Q. Zhao, "The Costs of Raising Capital," *Journal of Financial Research*, Spring 1996, pp 59-74, table 2.

94 R. Brealey, S. Myers, G. Partington and D. Robinson, *Principles of Corporate Finance* (Australian ed), 2001, (McGraw-Hill), p 432.

95 R. Brealey, and S. Myers, *Principles of Corporate Finance* (7th ed), 2003, (McGraw-Hill/Irwin: Boston), p 420.

share issues. The magnitude of the underpricing in Australia is reported in a recent textbook to average 15.2%.[96]

315 The IPO discount is another cost of issuance to investors. However, I have not attempted to explicitly factor that cost into my analysis here.

316 Certainly a company must have an initial raising of equity. However, it can be argued that the first equity offering is done privately and at lower, but not trivial, cost than above. Then subsequently there may be an initial public offering. Depending upon the circumstances it may or may not have a subsequent offering. Further, the amount of equity capital raised in the three possible methods is not clear.

317 The estimation of WACC for the CAN is as if they were a stand-alone business. Therefore, an allowance should be provided that permits it to recover the costs it would be expected to incur in raising equity if it was a separate entity. The quantum of issuance costs as a percent of the total proceeds of the issue can be converted into an equivalent cost of capital rate. The conversion will depend upon the maturity assumed for the equity, as the longer the maturity, the more years there are over which to spread the costs.

318 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 CAN, I believe it is reasonable to assume that the expected equity life approximates the life of the assets. For the CAN, that is 35 years.

319 If the 4.5% issuance costs as a percent of proceeds is recovered over 35 years, the annual allowance would be about 0.8%.[97] At least some equity would likely be raised privately at lower cost, however for an entity the size of the CAN, this would be relatively small. Being conservative, I estimate that the annual allowance for equity raising costs for the CAN should be at least 0.4% of equity value, and this will apply across the three dates; 1 July 2005, 1 July 2006 and 1 July 2007.

9.4 Conclusion on Cost of Equity Capital

320 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 the CAN. The estimate for 1 July 2007 is based on conditions at 20 April 2007:

321 The cost of debt capital can be estimated using equation 2 with the addition of equity issuance costs ("$\mathbf{R}_{EC}$"):

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96 P. Vernimmen, P. Quiry, M. Dallocchio, Y., Le Fur and A. Salvi, *Corporate Finance: Theory and Practice*, 2005, John Wiley & Sons, West Sussex, p 605.

97 The annualised amount is virtually unchanged if a perpetual life is assumed.

$$E(R_e) = R_f + [E(R_m) - R_f] * \beta_e + R_{EC}$$

322 My best estimates of the cost of equity capital for LSS, under either the CCA or the TSLRIC cost model, are as set out below.

as at 1 July 2005:

$$R_e = 5.11\% + 0.910 * 7.0\% + 0.4\% = 11.88\%$$

as at 1 July 2006:

$$R_e = 5.79\% + 0.962 * 7.0\% + 0.4\% = 12.92\%$$

as at 1 July 2007:

$$R_e = 5.96\% + 0.962 * 7.0\% + 0.4\% = 13.09\%$$

10. CALCULATION OF WACC

10.1 WACCs for the Three Dates

323 The nominal, post-tax vanilla WACCs for the CAN under either the CCA or the TSLRIC cost model, for the three dates, are estimated using equation 1 and the parameter estimates developed in the preceding sections:

as at 1 July 2005:

Vanilla WACC = 11.88% * 80% + 6.32% * 20% = **10.77%**

as at 1 July 2006:

Vanilla WACC = 12.92% * 75% + 7.16% * 25% = **11.48%**

as at 1 July 2007:

Vanilla WACC = 13.09% * 75% + 7.35% * 25% = **11.66%**

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

Report Section	Parameter	Comment	1 July		
			2005	2006	2007
6.1	Risk free rate	Commonwealth 10-year bond and the market rate-on-the-day	5.11%	5.79%	5.96%
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 LSS	20%	25%	25%
7.2	Debt risk premium	Estimated from Telstra's traded 10-year debt issues	1.06%	1.22%	1.24%
7.3	Debt issuance cost	Cost incurred to issue debt, annualised	0.15%	0.15%	0.15%
7.4	Cost of debt capital	Sum of the risk free rate, debt risk premium and debt issuance cost	6.32%	7.16%	7.35%
8.1	Tax rate	Use statutory rate	30%	30%	30%
8.2	Franking credits	Continue to use status quo value	0.0	0.0	0.0
9.2	Asset beta	Systematic risk for all-equity firm	0.75	0.75	0.75
9.2	Equity beta	Systematic risk for levered equity	0.910	0.962	0.962
9.3	Equity issuance cost	Cost incurred to issue equity, annualised	0.4%	0.4%	0.4%
9.4	Cost of equity capital	Use CAPM plus the equity issuance cost	11.88%	12.92%	13.09%
10.1	**WACC**	**Nominal, post-tax vanilla**	**10.77%**	**11.48%**	**11.66%**

11. ADDITIONAL CONSIDERATIONS IN SETTING THE WACC

325 The analysis above leads to the "best point estimate" of WACC for the CAN for the three dates. The WACC is used by the ACCC as an input to the process of determining an appropriate price for LSS. However, I do not believe the ACCC should use the best point estimate WACC for that purpose. In my opinion, the ACCC should use a higher WACC.

326 The Productivity Commission reviewed the national access regime and reported its findings including:[98]

> *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.*

327 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

328 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:

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98 Productivity Commission 2001, "Review of the National Access Regime," Report No. 17, AusInfo, Canberra.

- the chosen point estimate WACC reflects the "true" cost of capital, the provider of the services will earn a normal economic profit and will have adequate incentives for further investment;
- the chosen point estimate WACC is above the "true" cost of capital, 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 is below the "true" cost of capital, 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.

329 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.

330 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.

331 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 may 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 they can 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.

332 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.

333 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.

334 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.

335 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".[99]

336 This conclusion reflects my opinion that 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.

337 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)).*[100]

338 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%.

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99 I will discuss how this task should be approached in the following section.

100 ACCC, "Final Decision" (6 October 1998, p 60) with respect to access arrangements for GasNet and VENCorp.

This was noted as being consistent with its practice of setting the rate of return above the mid-point of the recommended range.[101]

339 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:[102]

> *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.*

340 The New Zealand Commerce Commission chose the 75th percentile in a range of WACC values rather than the mid-point to reflect uncertainty in the parameter estimates and to provide some protection against the relatively dire social consequences of under estimating WACC.

341 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

342 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*.

343 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.[103]

344 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.

345 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.

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101 IPART (2005), "Report on the Determination of Remaining Mine Life and Rate of Return," dated May 2005, page 12.

102 New Zealand Commerce Commission, "Gas Control Inquiry Final Report," dated 29 November 2004, para 9.92.

103 ACCC, "Final Decision" (6 October 1998, p 60) with respect to access arrangements for GasNet and VENCorp.

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.

346 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

347 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.

348 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 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.

349 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.

350 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.[104]

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104 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.

351 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.[105] 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.

352 In the context of the provision of services over the CAN, 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

353 Although there are issues that could be discussed, to a close approximation the risk free rates for 1 July 2005 and 1 July 2006 do not have estimation error.[106]

354 The risk free rate cannot be objectively observed as at 1 July 2007, so a forecasted amount has been used for the yield on the 10-year government bond at that date. I have estimated that the rate at the close of business on 20 April 2007 would be an unbiased forecast of that future rate.

355 Clearly my estimate for 1 July 2007 is uncertain. The question is - what is the one standard deviation on the estimate? 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.[107]

356 I calculated the changes in yields over non-overlapping periods of two months from this data. This is the approximate time period between my estimation date and the measurement date for the risk free rate at 1 July 2007.

357 The average absolute change in yields for these two month periods is 0.288%. The standard deviation of the 40 observations is 0.368. Conducting the same analysis over only the past five years gives an average absolute

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105 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.

106 There are issues that range could be raised such as the averaging procedure, but they are sufficiently minor that I believe that they can be ignored.

107 This is admittedly *ad hoc*. However, the resulting dataset is characterised by stable interest rates. Thus the standard deviation is likely to be lower than if I used a longer period, which will reduce the WACC range estimate from the Monte Carlo analysis.

change of 0.256% and a standard deviation of the 20 observations of 0.182. The length of the estimation period here is slightly longer than two months. I recommend a one standard deviation range for the risk free rate for of 0.3% for 1 July 2007.

11.3.2 Tax rate

358 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

359 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.

360 As explained in section 8.2, I estimate that gamma is equal to zero. Gamma has been widely estimated by regulators to equal 0.5. Although this was 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, depending upon the identity of the marginal investor in the Australian share market. This makes setting a range problematic, as the estimation error does not have a normal distribution.[108] The plausible values do not have a distribution that can be characterised with the statistical measure of a standard deviation.

361 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

362 There is clearly estimation error in the chosen debt proportion, but with the models used to estimate WACC wherein 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

363 The cost of debt capital requires the estimation of the debt risk premium and the debt issuance costs specific to the CAN, both of which are

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108 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.

measured with potential error. In my view, the ranges around these parameters should not be ignored. As Telstra debt is publicly traded, the DRP of that debt can be directly observed. However, the DRP for the whole of Telstra at a point in historical time should still have a small estimation error because the bonds are traded less than government bonds. I consider that a range on the order of ± 5 basis points (as one standard deviation) would be reasonable for the whole of Telstra DRP.

364 A major uncertainty with the DRP for the CAN relates to whether an adjustment to the Telstra DRP is appropriate. The estimation error is certainly higher than for the whole of Telstra, but not greatly so. A further source of estimation error with respect to the 1 July 2007 estimate is that I am forecasting the DRP. I believe a one standard deviation range in the estimate of DRP for the CAN is approximately ± 0.15%.

365 Estimation of the debt issuance costs for the CAN is subject to as much error as the DRP. Based on the analysis presented in section 7.3, I believe a reasonable one standard deviation range is ± 0.15%.

366 Equity also has an issuance cost for the CAN, 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 0.2% to 0.8%. I will state this as a range of ± 0.2% since the focus is on the upside.

367 The remaining parameters are the market risk premium and beta. Both of these parameters have substantial estimation error.

11.3.6 Market risk premium

368 I discussed the MRP in section 6.2. It is clear from that discussion that there is considerable uncertainty in reaching an estimate of the MRP for Australia.

369 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.

370 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.

371 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.[109] 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.

372 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,[110] which has stated that the standard error of the long-run historical estimates of MRP for the US is about 2.7%,[111] and Dimson, Marsh and Staunton who report that their estimate of MRP has a standard error of 2 %.[112]

373 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 ± 2.5% is appropriate.[113]

11.3.7 Asset and equity betas

374 There is a high degree of measurement error in any estimate of beta. For example, data from the September 2006 Risk Measurement Service of the Australian Graduate School of Management's Centre for Research in Finance ("**CRIF**") contains data for 1780 companies listed on the Australian Stock Exchange, but only 1,434 of those companies have sufficient data to enable betas to be estimated. The standard error of these equity beta estimates is 1.32. Even when beta is estimated at the level of industry portfolios, where on average there are about 50 companies in each industry, the standard error is 0.79.

375 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

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109 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).

110 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.

111 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/

112 E. Dimson, P. Marsh and M. Staunton ("Global Evidence on the Equity Risk Premium") also report a MRP over long term bonds of 6.5% for the period 1900 through 2005.

113 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.

predictive ability should provide additional insight into an appropriate range.

376 To address this issue in a current Australian context, I used data from CRIF for September 2005 and September 2006. I took the estimated betas from September 2005 and matched them with CRIF beta estimates for the same company from the September 2006 dataset. I then tested whether the September 2005 betas were good predictors of the betas one year later.

377 There are 1,192 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 0.72, while the median absolute beta change is 0.48.[114] Using the quartiles[115] of the distribution of beta changes, if the earlier estimated beta was one, the estimated beta one year later was as likely to be outside the range 0.52 to 1.51 as to be within that range.[116]

378 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 September 2006 estimate were also used in the September 2005 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.

379 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.

380 The distribution of estimation error for the CAN beta is likely to be positively skewed, meaning the range is likely to be wider on the high side than the low side. However, for simplicity and conservatism, I assume the distribution is normal. I regard a one standard deviation range of ± 0.4 as reasonable for the asset betas of the CAN. I further estimate that the asset beta range expands to a range of ± 0.45 for the equity beta estimate.

11.3.8 The CAPM and WACC models

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114 The beta change for an individual estimate of beta is the difference between the beta at September 2005 and the beta at September 2006. 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.

115 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.

116 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 mildly, positively skewed.

381 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.

382 The CAPM is almost universally admired as an elegant economic model, but not necessarily a complete characterisation of security pricing.[117] The process used by the ACCC to estimate WACC ignores risk factors other than systematic risk. Therefore, the ACCCs estimated WACC is downward biased.

383 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."[118] 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.[119]

11.3.9 Summary on one standard deviation ranges

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117 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.

118 ACCC, "Decision - Statement of principles for the regulation of electricity transmission revenues – background paper," dated 8 December 2004, p 94.

119 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.

384 My estimates of appropriate point estimates and one standard deviation ranges for the parameters used to estimate WACC for the three dates are summarised in the table below.

WACC Parameters and One Standard Deviation Ranges for the three 1 July dates

Parameter	Distribution	1 July 2005		1 July 2006		1 July 2007	
		Point	1sd Range	Point	1sd Range	Point	1sd Range
Risk free rate	Normal	5.11%	0.0%	5.79%	0.0%	5.96%	0.3%
Market risk premium	Normal	7.0%	2.5%	7.0%	2.5%	7.0%	2.5%
Debt ratio		20%		25%		25%	
Debt risk premium	Normal	1.06%	0.15%	1.22%	0.15%	1.24%	0.15%
Debt issuance costs	Normal	0.15%	0.15%	0.15%	0.15%	0.15%	0.15%
Tax rate		30%		30%		30%	
Gamma	Bi-modal	0.0	0 and 1	0.0	0 and 1	0.0	0 and 1
Asset beta	Normal	0.75	0.4	0.75	0.4	0.75	0.4
Equity beta	Normal	0.910	0.45	0.962	0.45	0.962	0.45
Equity issuance cost	Normal	0.4%	0.2%	0.4%	0.2%	0.4%	0.2%

385 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.[120] My estimates of the ranges on the WACC estimates have been informed by that analysis.

386 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:

	1 July2005	1 July 2006	1 July 2007
Vanilla WACC	14.1%	14.8%	15.1%

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

388 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.

389 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

390 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."

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

392 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

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120 Appendix C of the ACCC's "Assessment of Telsta's ULLS and LSS monthly charge undertakings" dated August 2005.

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.

393 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.

394 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.

395 In my opinion, if the asymmetric social consequences are recognised in the setting of WACC and a one standard deviation uplift is recognised, the appropriate nominal post-tax vanilla WACCs for the CAN on the three dates 1 July 2005, 1 July 2006 and 1 July 2007 should be 14.1%, 14.8% and 15.1% respectively.

11.5 Declaration

396 I have made all the enquiries which I believe are desirable and appropriate, and no matters of significance which I regard as relevant have, to my knowledge, been withheld from the ACCC.

DATED: 8 May 2007

ROBERT GERALD BOWMAN

Appendix A

CURRICULUM VITAE

Robert G. (Jerry) Bowman
Department of Accounting and Finance, University of Auckland
Private Bag 92019, Auckland, New Zealand
(649) 373-7599 (extn 87618), fax (649) 373-7406
e-mail: j.bowman@auckland.ac.nz

Educational Background

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

Employment Record

2007-Present	Bank of New Zealand Professor of Finance, University of Auckland
1987-Present	Professor of Finance, University of Auckland
2006-Present	Associate, Synergies Economics Consulting
2004-2005	Professor of Finance, University of Queensland (Australia)
2003-2004	Network Associate, Network Economics Consulting Group (NECG)
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 (now Ernst & Young).
1962-65	Line Officer, U.S. Navy - Honourably discharged as Lieutenant.

Publications

"Using Comparable Companies to Estimate the Betas of Private Companies" (co-author S. Bush), Journal of Applied Finance, Fall/Winter 2006.

"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.

"Estimating the Market Risk Premium," JASSA, issue 3, Spring 2001, pp 10-13.

"Regulatory Threats and Political Vulnerability" (co-authors F. Navissi and R Burgess), Journal of Financial Research, vol 23(4), Winter 2000, pp 411-420.

"The Effect of Price Control Regulations on Firms' Equity Values" (co-authors F. Navissi and D. Emanuel), Journal of Economics and Business, vol 51(1), January/February 1999, pp 33-47.

"A Change in Market Microstructure: The Switch to Electronic Screen Trading on the New Zealand Stock Exchange" (co-author M. Blennerhassett), Journal of International Financial Markets, Institutions & Money, vol 8, 1998, pp 261-276.

"Short-Run Overreaction in the New Zealand Stock Market" (co-author D. Iverson), Pacific-Basin Finance Journal, vol 6, November 1998, pp 475-491.

"Do Share Prices Overreact? A Review and Some New Zealand Evidence" (co-author D. Iverson), New Zealand Investment Analyst, no 17, December 1996, pp 7-13 (awarded prize for best article).

"Cost of Capital Under Imputation: An Analysis of Comparative Models" (co-author A. Marsden), New Zealand Investment Analyst, no 17, December 1996, pp 27-32.

"The Efficient Market Hypothesis - A Discussion of Institutional, Agency and Behavioural Issues" (co-author J. Buchanan), Australian Journal of Management, vol 20(2), December 1995, pp 155-166.

"Information Content of Financial Leverage: An Empirical Study: A Comment," Journal of Business Finance & Accounting, vol 22(3), April 1995, pp 455-460.

"Implications of Dividend Imputation for Equity Pricing in New Zealand" (co-authors C. Cliffe and F. Navissi), New Zealand Economic Papers, vol 26(2), December 1992, pp 249-259.

"Corporatisation and Asset Valuation for a Government Corporation" (co-author J. Buchanan), Financial Accountability and Management, vol 6(2), Summer 1990, pp 77-91.

"Understanding and Conducting Event Studies," Journal of Business Finance & Accounting, vol 10(4), Winter 1983, pp 561-584.

"The Theoretical Relationship Between Systematic Risk and Financial (Accounting) Variables: Reply," Journal of Finance, vol 36(3), June 1981, pp 749-750.

"The Debt Equivalence of Leases: An Empirical Investigation," The Accounting Review, vol 55(2), April 1980, pp 237-253.

"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

"Contagion in World Equity Markets and the Asian Economic Crisis" (co-authors K. Chan and M. Comer), submitted to Journal of Financial and Quantitative Analyis.
"Earnings Management: Evidence from the Pharmaceutical Industry" (co-authors V. Naiker and F. Navissi), revising for resubmission to the Journal of Business Finance and Accounting.
"Reverse Leverage Buyouts, Timing and Underpricing" (co-author L. Graves).
"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).
"Returns of Acquiring Firms in Horizontal Mergers and Acquisitions" (co-author E. Wong).

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

"Returns of Acquiring Firms in Horizontal Mergers and Acquisitions" (co-author E. Wong), Global Finance Association Conference, April 2007.
"Reverse Leverage Buyouts, Timing and Underpricing" (co-author L. Graves), Asia Finance Association Conference, July 2006.
"Reverse Leverage Buyouts, Timing and Underpricing" (co-author L. Graves), AFAANZ Conference, July 2006.
"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
Consulting Editor (Finance), Afro-Asian Journal of Finance and Accounting, 2006-
Associate Editor, International Review of Finance, 1998-
Associate Editor - Finance, Accounting and Finance, 1996-1999
Editorial Board, Accounting and Finance, 1999-2000
Editorial Board, The Accounting Review, 1981-84
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
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)