Estimating the cost of capital under the NGR

A report for Envestra

September 2010

Table of Contents

Table of Figures

Table of Tables

1. Executive summary

1.1. Terms of reference

1. I have been asked by Envestra to advise on a cost of equity that satisfies the requirements of the National Gas Rules. Specifically, I have been asked:

> *In respect of the rate of return, Envestra wishes to engage you to prepare an expert report addressing the following matters:*
>
> *a) what cost of equity you, as an expert economist, consider meets the criteria in rules 87(1) and 87(2) of the National Gas Rules;*
>
> *b) the appropriate financial model to apply in determining the cost of equity, having regard to the criteria in rules 87(1) and 87(2); and*
>
> *c) the appropriate manner in which to determine the cost of equity having regard to theprovisions of rules 87(1) and 87(2).*

Rules 87(1) and 87(2) are set out below:

> *(1) The rate of return on capital is to be commensurate with prevailing conditions in the market for funds and the risks involved in providing reference services.*
>
> *(2) In determining a rate of return on capital:*
>
> *(a) it will be assumed that the service provider:*
>
> *(i) meets benchmark levels of efficiency; and*
>
> *(ii) uses a financing structure that meets benchmark standards as to gearing and other financial parameters for a going concern and reflects in other respects best practice; and*
>
> *(b) a well accepted approach that incorporates the cost of equity and debt, such as the Weighted Average Cost of Capital, is to be used; and a well accepted financial model, such as the Capital Asset Pricing Model, is to be used.*

I have been provided with and have read and complied with the Federal Court of Australian Practice Note CM7.

1.2. Conclusions

2. I conclude that the capital asset pricing model (CAPM), dividend growth model (DGM) and Fama and French 3 factor model (FFM) are all well accepted financial models. Variants of each of these financial models have strong theoretical and empirical support in the academic finance literature and are used by finance practitioners to assess the level of risk, and required reward for risk, associated with investments. Fund managers use both CAPM betas and Fama-French value and size parameters to assess risk and to develop investment strategies. For example, the development of "small cap" funds that only invest in small companies is a direct response to the identified historically higher levels of returns from small companies identified by Fama and French (and others before them). Similarly, the DGM is fundamental to any assessment of the overall expected return on equities – and therefore is an essential tool for any active funds management activities.

3. The DGM is commonly used by regulators in the US as the primary method for setting the cost of equity for regulated gas businesses and the CAPM is commonly used in Australia, New Zealand and the UK for the same purpose. The FFM is, to the best of my knowledge, less commonly used by regulators as the primary method for setting the cost of equity.

1.2.1. The CAPM

1.2.1.1. The AER implementation of the CAPM does not satisfy Rules 87(1) and 87(2)

4. The AER adopts a 'static' version of the Sharpe Lintner CAPM that gives rise to a cost of equity estimate of around 8.9%. This is based on an MRP of 6.5% and the average 10 year government bond rate of 5.3% over June 2010. It is also based on an equity beta of 0.55 which is the midpoint of the AER's range of 0.4 to 0.7.

5. I note that the AER arbitrarily increases the equity beta to 0.8 on the basis that it is being 'conservative'. However, the resulting cost of capital estimate is not the result of the application of the financial model the AER adheres to.

> *Although reliance on market data suggests a value of between 0.4 and 0.7, the AER concludes that a conservative approach has merit, providing the service provider with a reasonable opportunity to at least recover efficient costs. Therefore, the AER considers that the value of 0.8 for the equity beta is a best estimate arrived at on a reasonable basis in the circumstances.* (AER Jemena Final decision page 173)

6. This approach involves an arbitrary upwards adjustment that the AER applies and justifies on the basis of regulatory cautiousness. The AER does not justify this adjustment on the basis that the underlying model is wrong and in need of adjustment. Neither does it justify it on the basis that other well accepted

financial models result in higher estimates of the cost of equity. (The AER has not identified any other model as being well accepted and has, therefore, not performed any cross checks of its model outputs.)

7. It follows that, to the extent that regulatory caution is a justification for an upward adjustment to a well accepted model estimate then it is equally a justification no matter what underlying model is being used (so long as it is a well accepted model). I therefore compare the results of models I regard as well accepted with the results that flow from the AER's model without the upward increment. This ensures that I am comparing like with like.

8. I do not consider that the AER's implementation of the CAPM results in an estimate of the cost of equity that satisfies Rules 87(1) and 87(2). On the contrary, it is well accepted that the manner in which the AER implements the CAPM fails to accurately estimate the risk adjusted return required by investors in the market for funds.

9. The empirical and theoretical basis for this conclusion is set out in this report and in Professor Grundy's accompanying report. In summary:

- While the CAPM is a well accepted finance model, not all methods of implementing the CAPM are equally well accepted. The particular way in which the AER implements the CAPM is well accepted, by both finance academics and other regulators to result in a downward biased estimate of the return on equity for stocks with low beta estimates;

- Based on the empirical findings in the Da, Guo and Jagannathan (2009) study, the most recent study of its kind which uses the longest data set and which was relied on by the AER to support its rejection of the FFM as well accepted, Professor Grundy estimates that the AER's method of implementing the CAPM will underestimate the cost of equity by2.2% even if there is no error in the estimation of the MRP and equity beta. If one averages all of the studies surveyed by Professor Grundy the level of bias is estimated at 1.4%;

- Cross checks against market based estimates of the prevailing cost of debt suggest that the prevailing level of underestimation is materially greater (in the order of 5% underestimation);

- Cross checks against the results of other well accepted financial models, namely the dividend growth model (DGM) and the Fama and French model (FFM), confirm a similar order of magnitude of underestimation;

- A more accurate implementation of the CAPM that is less prone to bias would result in an estimate more consistent with the cross-checks described above.

1.2.2. Conclusions

10. The table below describes my best estimate of the cost of equity derived from application of each of well accepted financial models. For comparison purposes I also provide an estimate of the cost of equity derived from the AER's 'static CAPM' which I do not regard as well accepted.

Table 1: Cost of equity estimates (June 2010)

Financial model	Range for cost of equity (55% to 60% gearing)
AER static CAPM	8.9% (7.9% to 9.9%)
AER model with AER's ad hoc upward adjustment	10.5%
FFM	11.6% to 14.4%
DGM based on Australian utility data	11.6% to 16.7%
DGM based on Australian market wide data*	12.4% to 17.5%
DGM based on US regulatory decisions	>12.2%
Estimate derived from the cost of debt	>14.4%
More accurate implementation of the CAPM**	11.4% to 13.3%

*Assuming an equity beta of 1.0 **Bottom of range is based on the application of the Black CAPM with Australian data and an equity beta of 0.55 and an MRP of 6.5%. Top of the range is associated with an equity beta of 1.0 and a MRP of 8.0%

2. Defining a well accepted financial model

11. I begin by identifying well accepted financial models that can be used to estimate the cost of equity. In order to do so, I must first adopt a workable definition of what constitutes a well accepted financial model.

12. First, I interpret 'well accepted' to imply that the financial model is 'well accepted' as a means for accurately estimating the cost of capital (presumably consistent with prevailing conditions in the market for funds as per r 87(1)). For example, it is not sufficient for a financial model to be 'well accepted' as a means for instructing finance students on the building blocks of finance theory. The model must be 'well accepted' for the purpose of actually estimating required returns on real world investment assets.

13. Second, I also conclude that the criteria for a financial model to be *well accepted* does not require that there is agreement amongst finance experts that the financial model is 'the best' model or even 'an accurate' model.

14. While finance experts have reached a consensus on what financial models perform poorly in explaining asset prices, there is currently very little agreement about what ultimately explains the returns investors demand and receive on equity investments, i.e., no consensus on the best financial model. It is therefore futile to adopt a definition of 'well accepted' that requires strong agreement amongst finance experts because such a definition would ultimately result in no financial model meeting this criterion.

15. I assume that the reference to the CAPM in r. 87(2)(b) is by way of example of a well accepted financial model.[1] I therefore conclude that it is sufficient for a financial model to be well accepted if it is accepted by as many finance experts as the CAPM. That is, whatever hurdle is placed on a financial model qualifying as *well accepted,* that hurdle must not be set so high such that the CAPM itself would fail.

16. I also conclude that the AER's recent final decision for Jemena Gas Networks falls into inconsistency when it concludes that the Fama French 3 factor model (FFM) is not a well accepted financial model. The AER's grounds for doing so primarily rely on a number of published theoretical and empirical criticisms of the FFM. However, applying this criterion consistently would see all variants of the CAPM rejected as not being well accepted financial models. Like the FFM, the CAPM is subject to a large number of published theoretical and empirical criticisms (of which the literature on the FFM is itself a part).

[1] Noting that an alternative interpretation is that the CAPM is provided as an example of a financial model rather than as an example of a well accepted financial model.

17. In my view, the only reading of r. 87(2) that would allow the AER to determine that the FFM is not 'well accepted' would be a reading that sets a different criteria for the FFM than for the CAPM. That is, r.87(2) would have to be interpreted as saying that in order to be 'well accepted' a financial model must be 'more accepted' than the CAPM.

3. Implications of model uncertainty

18. When considering any financial model it is important to recognise that their accepted use evolves over time with experience and research (both theoretical and empirical). In particular, the CAPM, and all modern financial models, have their genesis in the work of Markowitz (1952).[2] Markowitz identified that the covariance of asset returns was the major contributor to a portfolio's overall volatility of returns. Sharpe (1964) and Lintner (1965)[3] built on this insight to develop the first version of the CAPM.

19. Just as Markowitz laid the foundation for the work of Sharpe and Lintner, the work of Sharpe and Lintner is the foundation for almost all modern asset pricing theories (including the FFM). Since the work of Sharpe and Lintner there has been a great deal of empirical and theoretical refinement of financial models and there is still disagreement on what financial models best explain risk adjusted returns.

20. Given the level of uncertainty associated with what is the best model to use in any given market circumstance I consider that it is appropriate to have regard to the estimates that are derived from a number of different models. I consider that it would be a mistake to simply adopt one theoretical model, and one of the multiple possible ways of implementing that model, and to assume that the outputs of that process are all that one should have regard to.

21. In my view the approach described above is the approach that the AER has taken to estimating the cost of equity in recent decisions. In a very real sense it is a similar mistake to those which led to the global financial crisis. I concur with the sentiments of Reserve bank of Australia (RBA) Assistant Governor (Financial Markets) Guy Debelle as expressed in the below quote:

> *In the period prior to the onset of the crisis, hubris developed in parts of the financial sector, and in the investor community more generally, that everything could be precisely measured and priced. In particular, that risk was always quantifiable. To some extent, in the narrow sense, that is correct because, as just described, I see measurability as the key distinction between risk and uncertainty. But risk assessment needs to take account of both risk and uncertainty.*
>
> *…*

[2] Markowitz (1952) Portfolio selection, Journal of Finance 7,.

[3] Sharpe (1964) Capital asset prices: A theory of market equilibrium under conditions of risk, *Journal of Finance*. Lintner (1965) The valuation of risk assets and the selection of risky investments in stock portfolios and capital budgets, *Review of Economics and Statistics*.

But unfortunately even that is not good enough. From a risk point of view, ultimately you need to be able to measure what you don't know. That, I believe, is inherently impossible.

22. In the context of estimating the cost of equity using a financial model we cannot be confident that application of one model will give us the right answer. In fact, we can be confident that in many circumstances it will not and relying on such a model 'as if' it provided 'the truth' will lead to error. In the words of Mark Twain, also quoted by Mr Debelle, *"It ain't what you don't know that gets you into trouble. It's what you know for sure that just ain't so".*

4. The CAPM

4.1. AER static CAPM

23. The AER static CAPM cost of equity estimate is based on an equity beta of 0.55 and a market risk premium of 6.5%. The 0.55 beta estimate used is based on average historical equity betas estimated by Professor Henry using stock market data over 5 years. The AER's practice has been to adopt an equity beta of 0.8 despite this being above the range that Professor Henry estimated. This is justified on the grounds that:

> *Although reliance on market data suggests a value of between 0.4 and 0.7, the AER concludes that a conservative approach has merit, providing the service provider with a reasonable opportunity to at least recover efficient costs. Therefore, the AER considers that the value of 0.8 for the equity beta is a best estimate arrived at on a reasonable basis in the circumstances.* (AER Jemena Final decision page 173)

24. I consider that the AER is correct to adopt a higher cost of equity than that which falls out of the static CAPM it is using. This is because, as described below, the static CAPM as implemented by the AER is known to be biased.

25. However, the AER upward adjustment to its beta is *ad hoc* and is not based on the results of a well accepted financial model. Having regard to a well accepted financial model would require the AER to adjust upwards its beta estimate for the known bias in the static CAPM. However, the rationale provided by the AER is that it is being 'conservative' rather than that it is correcting a well known bias. Naturally, correcting a bias is not 'conservative'.

26. For this reason, I compare the outcomes of alternative financial models with the estimates derived from the AER model without the AER increment to the cost of equity. I then separately consider whether the increment to the cost of equity applied by the AER does actually result in a 'conservative' estimate. That is, whether the increment is sufficient to offset the pre-existing bias in the AER's implementation of the CAPM.

4.2. AER estimation process is biased as well as inaccurate

27. As described in Section 3, it cannot be expected that the outputs of a single model to always provide the right estimate. In this sense, all models have an element of inaccuracy. However, an inaccurate model may be just as likely to over or under-estimate the cost of equity. A distinction must be made between inaccuracy in a model and bias in a model – with the latter meaning that the model is more likely to under-estimate than over-estimate the cost of equity (or *vice versa*).

28. Even if one believed that the AER's model was unbiased, it would, for the reasons set out in Section 3, still be appropriate to have regard to other implementations of the CAPM and other financial models in order to arrive at an estimate of the cost of equity. However, the AER's implementation of the CAPM is well understood to result in a downward biased estimate of the cost of capital for low beta stock (stock with equity betas of less than 1.0). In this context, the sole reliance on this implementation of the CAPM is demonstrably problematic.

29. The existence of bias in the AER implementation of the CAPM can reasonably be regarded as being universally accepted by those who have examined the empirical data. The New Zealand Commerce Commission has accepted the existence of such a bias in its recent decisions as

> *In particular, the Commission is aware that most CAPM models are believed to underestimate the cost of capital for low beta cases…*[4]

30. This is one of the few areas of consensus amongst finance experts. Specifically, implementing the CAPM by setting beta for an investment equal to the company's average historical beta estimated from stock market data will provide a biased estimate the risk adjusted returns required by investors (unless the estimated beta happens to be 1.0).

31. It is important to note that it is not the CAPM *per se* that is known to underestimate the return on low beta stocks. Rather, it is the particular form of implementation undertaken by the AER that is known to underestimate returns for low beta stocks. This implementation has the following characteristics:

    i. the prevailing government bond rate is used as a proxy for the risk free rate;

    ii. the value of beta is estimated using average returns on listed companies as a proxy for the 'market return';

    iii. the forward looking value of equity beta is proxied by a historical average estimated beta with no attempt to give more weight to observations from periods when market risk was at its highest; and

    iv. the market risk premium (MRP) is estimated based on an estimate of a long run average market risk premium rather than a specific estimate for the period in question.

32. This is described as a 'static' implementation of the CAPM because, with the exception of the risk free rate, it is assumed that the other parameters are static over time. That is, it is assumed that an unweighted average of past betas is the

[4] Paragraph 6.5.31 on page 231 of the Commerce Commission's June 2010 Draft Reasons Paper relating to Input Methodologies electricity distribution services.

best estimate of investors' forward looking beta and similarly that a long run average MRP is the best estimate of investors' prevailing assessment of risks.

33. The acceptance of a bias in static implementation of the CAPM has given rise to a significant literature that attempts to explain why this is the case. Unlike the consensus that the static CAPM is biased, there is no clear consensus on which is the most important explanation for why this bias exists. Professor Grundy comprehensively sets out the assumptions underlying the AER's implementation and why making more realistic assumptions helps explain the empirical observation of bias for low beta stocks. The explanations for the bias provided in the finance literature include flaws in each of the four implementation characteristics described above.

34. First, in the Sharpe-Lintner version of the CAPM the risk free rate is the interest rate at which private investors can borrow to invest in risky equities. The AER's use of the Government bond rate to proxy the CAPM risk free rate involves an implicit assumption that investors can borrow at the Government bond rate and use that borrowing to invest in equities. The true rate at which investors can borrow is materially above the Government bond rate. This means that, for low beta assets, the AER's model assumes that investors will accept a lower rate of return on their investment than the cost to them of borrowing to invest in that asset. This flaw is corrected in the Black version of the CAPM[5] developed in 1972 by Fischer Black (also famous for the development of Black-Scholes option pricing theory). Fama and French summarise the accepted superiority of the Black CAPM as follows:

> *The bottom line from the early cross-section regression tests of the CAPM, such as Fama and MacBeth (1973), and the early time-series regression tests, like Gibbons (1982) and Stambaugh (1982), is that standard market proxies seem to be on the minimum variance frontier. That is, the central predictions of the Black version of the CAPM, that market betas suffice to explain expected returns and that the risk premium for beta is positive, seem to hold. But the more specific prediction of the Sharpe-Lintner CAPM that the premium per unit of beta is the expected market return minus the risk-free interest rate is consistently rejected.*
>
> *The success of the Black version of the CAPM in early tests produced a consensus that the model is a good description of expected returns. These early results, coupled with the model's simplicity and intuitive appeal, pushed the CAPM to the forefront of finance.*[6]

[5] Black, F., 1972, "Capital market equilibrium with restricted borrowing," Journal of Business, 1972 (45), pp. 444-454.

[6] Eugene F. Fama and Kenneth R. French, The Capital Asset Pricing Model: Theory and Evidence *Journal of Economic Perspectives*, Volume 18, Number 3, Summer 2004, Pages 25–46.

35. Second, the CAPM is built on the assumption that investors measure beta risk against movements in total wealth. However, the AER estimates betas relative to movements in the stock market return. In effect, this assumes that investors' total wealth is limited to their ownership of listed equities. Roll [1977][7], points out that stock market capitalisation is only a very small proportion of total wealth which also includes human capital, unlisted equity, debt, and housing and commercial property assets. Roll concludes that the bias observed when the CAPM is implemented using stock market data does not invalidate the CAPM – just the implementation of it using stock market betas.

36. Third and fourth, it has been argued that the CAPM parameters beta and MRP are not static and that this may explain the observed bias. In particular, it has been argued that stocks that mostly have low betas (such as utility stocks and other mature industrial stocks) might nonetheless have high betas in periods that really matter to investors, i.e., in periods of high risk. If this is the case we may measure low historical average betas for a company but these will not measure the beta risk investors assign to that company – which will be the beta they expect the company to have in the event of an economic crisis or other high risk period. Jagannathan and Wang summarise the literature as follows:

> *Most empirical studies of the static CAPM assume that betas remain constant over time and that the return on the value weighted portfolio of all stocks is a proxy for the return on aggregate wealth. The general consensus is that the static CAPM is unable to explain satisfactorily the cross-section of average returns on stocks.*
>
> *… stocks with betas that are prone to vary with the market risk premium and hence are less stable over the business cycle also have higher unconditional expected returns.*[8]

37. In this statement, Jagannathan and Wang point out that if a stock has a high beta when market risk is high, e.g., in periods of economic crisis, and a low beta when market risk is low, e.g., in periods of steady growth, then the unweighted average measured beta for that stock will underestimate the true 'unconditional beta' that investors assign to that stock. Intuitively, investors care most about the value of beta during periods of economic crisis because this is when they are most concerned about volatility in their wealth.

---

[7] Roll, Richard. 1977. "A Critique of the Asset Pricing Theory's Tests' Part I: On Past and Potential Testability of the Theory." Journal of Financial Economics. 4:2, pp. 129–76.

[8] Jagannathan and Wang The Conditional CAPM and the Cross-Section of Expected Returns, The Journal of Finance, Vol. 51, No. 1. (Mar., 1996), pp. 3-53

4.2.1. Universal acceptance of bias

38. There is a clear consensus amongst experts that the CAPM as implemented by the AER is biased. In my view this consensus is as close to universal as it is possible to come in an inexact science such as capital asset pricing theory.

39. I note that the AER, in recently responding to the proposed use of the FFM model in the context of the 2010 Jemena Gas Networks Final Decision, concluded that the CAPM is a superior model to the FFM. It did so largely on the basis of academic studies that found more support for the CAPM than the FFM. However, as noted by Professor Grundy, those same studies also demonstrate the existence of a bias in the CAPM as implemented by the AER.

> *The empirical evidence that the AER uses to reject the FFM also demonstrates that the CAPM as approved by the Final Decision is itself not a well accepted financial model. Each of the 9 papers presents empirical evidence that the CAPM as approved by the Final Decision, namely an unconditional variant of the Sharpe-Lintner CAPM, is not supported by the data. The papers cited do provide evidence that the Black version of the CAPM provides a better explanation of stock returns than the Sharp-Lintner variant of the CAPM and that implementing the CAPM using conditional estimates of beta provides a better fit to the data than is provided by the CAPM implemented using unconditional estimates.*

40. The fact that the same papers relied on by the AER to reject the use of the FFM simultaneously demonstrate that the version of the CAPM implemented by the AER is biased is consistent with the universality of this result. The papers cited by the AER and surveyed by Professor Grundy are set out below.

i. Ferson, Sarkissian and Simin, 1999, "The alpha factor asset pricing model: A parable," Journal of Financial Markets 2, pp. 49-68

ii. Lo, Andrew W. and A. Craig MacKinlay, 1990, "Data-snooping biases in tests of financial asset pricing models," Review of Financial Studies 3(3), pp. 431-467.

iii. Roll, Richard, 1977, "A critique of the asset pricing theory's tests Part I: On past and potential testability of the theory," Journal of Financial Economics 4(2), pp. 129–176.

iv. Roll, Richard and Stephen A. Ross, 1994, "On the cross-sectional relation between expected returns and betas," Journal of Finance 49(1), pp. 101-121.

v. Schrimpf, Andreas, Michael Schröder and Richard Stehle, 2007, "Cross-sectional tests of conditional asset pricing models: Evidence from the German stock market," European Financial Management 13(5), pp. 880–907.

vi. Ang, Andrew and Joseph Chen, 2007, "CAPM over the long run: 1926–2001," Journal of Empirical Finance 14, pp. 1–40.

vii. Grauer, Robert R. and Johannus A. Janmaat, 2010, "Cross-sectional tests of the CAPM and Fama–French three-factor model," Journal of Banking & Finance 34, pp. 457–470.

viii. Gregory, Alan and Maria Michou, 2009, "Industry cost of equity capital: UK evidence," Journal of Business Finance & Accounting 36(5) & (6), pp. 679–704.

ix. Black, Fischer, 1993, "Beta and return," Journal of Portfolio Management, 1993, 20(1), pp. 8–18.

x. Schwert,G. William, 2003, "Anomalies and market efficiency," in Handbook of the Economics of Finance, editors G. Constantinides, M. Harris and R. Stulz, Elsevier Science, ch. 15, pp. 937–972.

xi. Morana, Claudio, 2009, "Realized betas and the cross-section of expected returns," Applied Financial Economics, 19, pp. 1371-138.

xii. Daniel, Kent, Sheridan Titman and K.C. John Wei, 2001, "Explaining the cross-section of stock returns in Japan: factors or characteristics', Journal of Finance, 56(2), pp. 743–767

xiii. Da, Zhi, Re-Jin Guo and Ravi Jagannathan, 2009, "CAPM: Interpreting the evidence," NBER working paper 14889.

xiv. Kothari, S., Jay Shanken and Richard G. Sloan, 1995, "Another look at the cross-section of expected returns," Journal of Finance, 50(1), pp. 185–224;

41. These studies are motivated by explaining why the implementation of the CAPM used by the AER is biased and/or attempting to identify versions of the CAPM that are free from such bias.

4.3. The Black CAPM

42. I estimate a range for cost of equity derived from a well accepted version of the CAPM. The bottom of this range is associated with the adoption of the Black CAPM. The Black CAPM is a more realistic theoretical model than the original CAPM developed by Sharpe and Lintner in that it does not assume that investors can borrow at the risk free rate (government bond rate). This gives rise to a CAPM formula where the return on a zero beta investment is higher than the risk free rate and, consequently, the sensitivity of required returns to beta is lower. This more realistic theoretical model is, unsurprisingly, much better supported by the data from equity markets.

43. At the turn of the millennium, John Campbell was asked by the Journal of Finance to survey the state of play in modern asset pricing theory in an article entitled *Asset Pricing at the Millennium*.[9] In that article he states:

> *Early work on the Sharpe–Lintner Capital Asset Pricing Model (CAPM) tended to be broadly supportive. The classic studies of Black, Jensen, and Scholes (1972) and Fama and MacBeth (1973), for example, found that high beta stocks tended to have higher average returns than low-beta stocks and that the relation was roughly linear. Although the slope of the relation was too flat to be consistent with the Sharpe–Lintner version of the CAPM, this could be explained by borrowing constraints of the sort modelled by Black (1972).*

44. I estimate the Black CAPM using Australian data. I estimate[10] that, based on the returns for the 200 largest equities listed on the Australian Stock Exchange over the period from 1964 to 2007, the intercept of the Black CAPM is below the average market return by 14.6% of the market risk premium measured relative to the Government bond rate. In the nomenclature used by Professor Grundy this associated with a value for $\frac{Rm - R0}{Rm - Rf}$ = "α" of 0.146.

45. Following the logic set out in Professor Grundy's report, if the MRP (measured relative to the Government bond rate) is 6.5% then the Black CAPM risk premium for an asset with a 0.55 equity beta will be 6.1%. With a Government bond rate of 5.3%, based on the average yield on 10 year Australian Government bonds over June 2010, then the Black CAPM cost of equity will be 11.4%.

46. Professor Grundy also examines international studies of the value of "α" over different time periods. The most recent estimate and the one that covers the largest time period, that by Da, Guo and Jagannathan (2009). This study uses data on US stocks over the period 1932 to 2007 and its results are relied on by the AER in rejecting the FFM as a well accepted model. The study concludes that the average value of "α" is 0.232. Using this value with a static beta of 0.55, risk free rate of 5.3% and an MRP of 6.5% gives rise to a cost of equity of 11.1% - which is 2.2% higher than the estimate derived from the static application of the Sharpe CAPM. The highest estimate of α is 0.761 from Black Jensen and Scholes (1972). If this estimate is used then the cost of equity is estimated to be 9.6% (again with an equity beta of 0.55, MRP of 6.5% and a Government bond rate of 5.3%).

---

[9] Campbell, Asset Pricing at the Millennium, *The Journal of Finance*, Vol LV, No. 4, August 2000.

[10] Based on results reported in Table 4 of CEG, 15 September 2008, *Estimation of, and correction for, biases inherent in the Sharpe CAPM formula* (a report prepared for the JIA and submitted to the AER in the context of the electricity WACC review).

4.4. The conditional CAPM (properly sourcing beta from periods of high market risk)

47. The other well accepted version of the CAPM that I employ is the conditional CAPM. The conditional CAPM attempts to explain the bias associated with the static CAPM by virtue of the fact that what matters most is not the average historical beta (as assumed in the static CAPM) but the beta that prevails in periods when risk premiums are high. Jagannathan and Wang describe the conditional CAPM as follows (note that the motivation for the conditional CAPM is the failure of the static CAPM).

> *In their widely cited study, Fama and French (1992) empirically examine the CAPM given above and find that the estimated value of γ, is close to zero. They interpret the "flat" relation between average return and beta as strong evidence against the CAPM.*
>
> *While a "flat" relation between average return (the sample analog of the unconditional expected return) and beta may be evidence against the static CAPM, it is not necessarily evidence against the conditional CAPM. The CAPM was developed within the framework of a hypothetical single-period model economy. The real world, however, is dynamic and hence, as pointed out earlier, expected returns and betas are likely to vary over time. Even when expected returns are linear in betas for every time period, based on the information available at the time, the relation between the unconditional expected return and the unconditional beta could be "flat." The following example illustrates this point.*
>
> *Consider a hypothetical economy in which the CAPM holds period by period. Suppose that the econometrician considers only two stocks and that there are only two possible types of dates in the world. The betas of the first stock in the two date-types are, respectively, 0.5 and 1.25 (corresponding to an average beta of 0.875). The corresponding betas of the second stock are 1.5 and 0.75 (corresponding to an average beta of 1.125). Suppose that the expected risk premium on the market is 10 percent on the first date and 20 percent on the second date. Then, if the CAPM holds in each period, the expected risk premium on the first stock will be 5 percent on the first date and 25 percent on the second date. The expected risk premium on the second stock will be 15 percent on both dates. Hence, an econometrician who ignores the fact that betas and risk premiums vary over time will mistakenly conclude that the CAPM does not hold, since the two stocks earn an average risk premium of 15 percent, but their average betas differ.*[11]

[11] Jagannathan and Wang The Conditional CAPM and the Cross-Section of Expected Returns, The Journal of Finance, Vol. 51, No. 1. (Mar., 1996), pp. 3-53

48. The fundamental point here is that historical average betas estimated from stock market data cannot naively be applied to an average market risk premium – unless neither of those factors vary through time. If a type of investment tends to have a high beta in periods of economic uncertainty (when total risk premiums are high) then an average historical beta will underestimate the true average risk premium. Equally, if an asset has a very low beta when perceived risk is low then an average historical beta will give too much weight to that beta.

49. If we don't know what the future holds (and that is the basis of risk in the first place) then when estimating betas we should give most weight to the betas that exist in periods when risk is high. It is these betas that matter most for investors – not the betas that exist when there is little perceived risk. This is illustrated in the above example provided by Jagannathan and Wang, despite having a historical average beta of 0.875 (less than 1.0) the first stock requires the same average return as the market because its beta is above 1.0 at times when market risk is high.

50. Of course, this is only relevant if regulated utilities tend to have higher betas than average when market risk is higher than average. In order to analyse this I have examined the behaviour of regulated utility stock prices over the period of the global financial crisis. I find that over this period, the six Australian listed companies that are primarily regulated asset owners had higher risk than the market (measured in terms of their beta and in terms of the losses associated with holding regulated utility stocks over this period). The below table describes the fact that, during the crisis, regulated utility stocks actually performed worse than the market as a whole (consistent with a beta of greater than 1.0).

Table 2: Market vs. utility returns: 2 January 2008 to 6 March 2009 (nadir of the market return)

	Return
Market	**-47%**
Mean for regulated utilities	**-52%**
Median for regulated utilities	**-54%**
Individual regulated utility	
SPN	-27%
ENV	-66%
HDF	-83%
APA	-27%
SKI	-55%
DUE	-54%

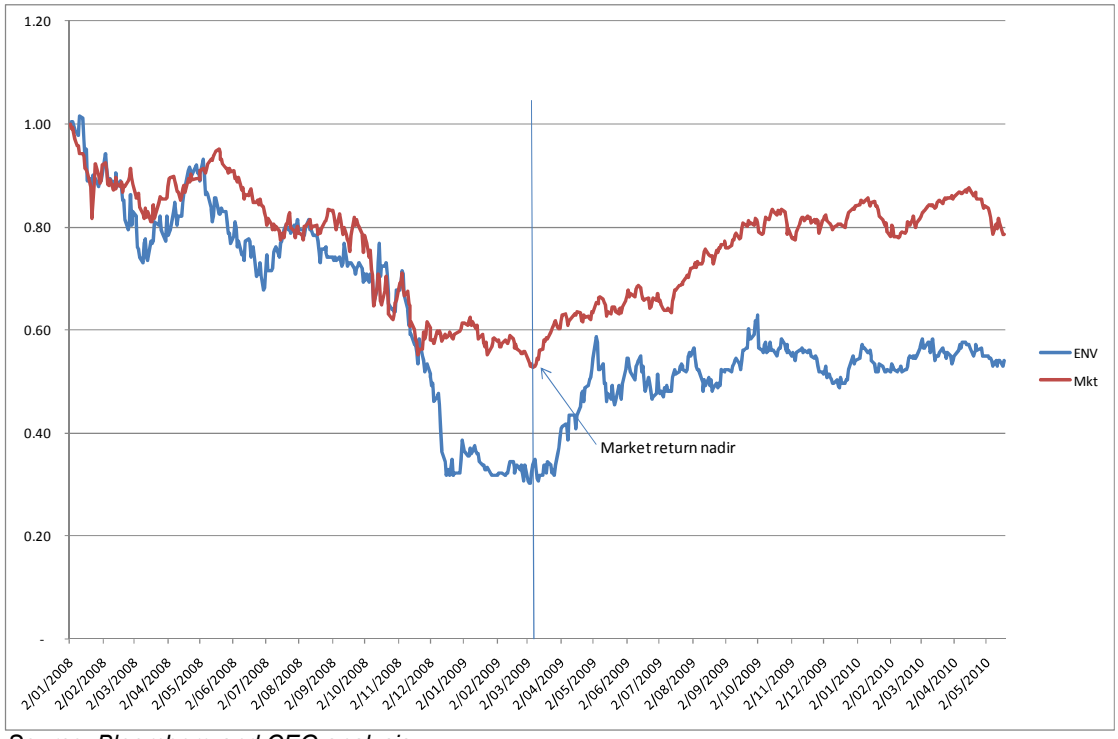
Source: Bloomberg, CEG analysis

51. This high risk was largely driven by the regulated utilities exposure to the systemic risks associated with refinancing heavily geared businesses during a

financial crisis. This high level of risk during the crisis is picked up in beta historical average beta estimates confined to this period.

52. The experience of Envestra itself was typical of the experience of other regulated businesses. As can clearly be seen from Figure 1 below, Envestra's stock price performed materially worse than the overall market in the lead up to the worst of the crisis and then rebounded better than the overall market as the crisis eased (Envestra's share price more than doubled between its lowest level on the 4th of March 2009 and the 1st of October before falling below this peak again). Consistent with the above average beta estimates, rather than protecting an investor against the systemic shock element of the GFC, holding Envestra stock would have actually amplified that shock.

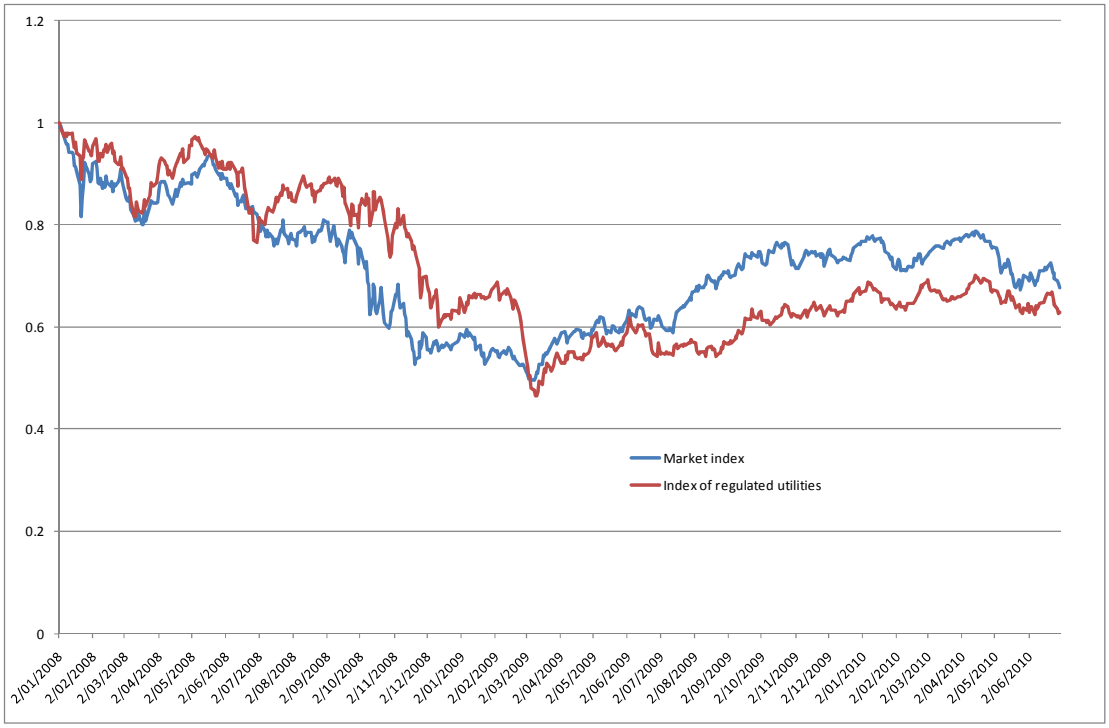
Figure 1: Envestra vs. Market returns from 2 January 2008



Source: Bloomberg and CEG analysis

53. This was not a unique experience for Envestra. The below chart compares the return on an index of regulated utilities versus the return on the ASX 200. It can be seen that the regulated utilities, on average, perform worse over the crisis than the ASX200.

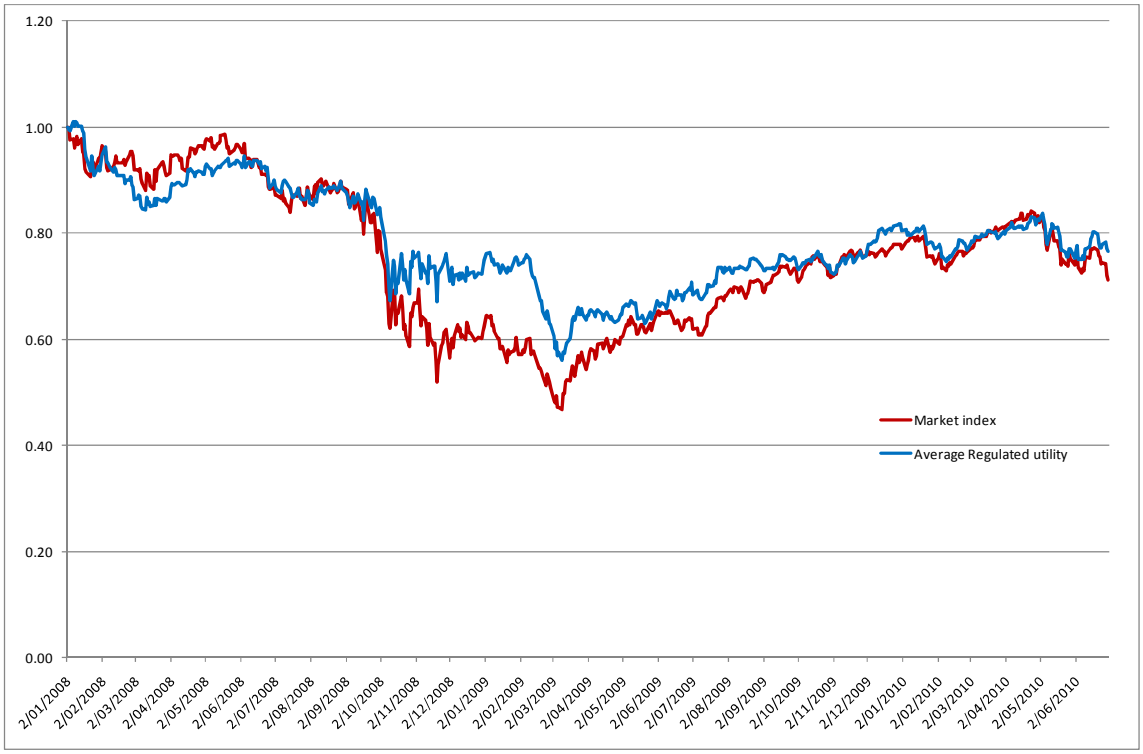
Figure 2: Aus regulated utility stocks vs. ASX200 from 2 January 2008



Source: Bloomberg and CEG analysis. The 6 Australian stocks included in the index of regulated businesses are those detailed in Table 2 above.

54. The above is not an experience restricted to Australian regulated energy utilities. The NZ Commerce Commission has recently used a sample of 46 US regulated energy utilities to inform its choice of equity beta. The same chart is prepared for an index of these utilities relative to the S&P 500 US stock market index.

Figure 3: US regulated utility stocks vs. S&P 500 from 2 January 2008



Source: Bloomberg and CEG analysis. The 46 US stocks included in the index of regulated businesses are those used by the NZ Commerce Commission and as listed in its June 2010 Draft Reasons Paper relating to Input Methodologies electricity distribution services.

55. It can be seen that holding regulated utility stocks offered investors little or no protection against the market losses associated with the GFC.

56. Statistical estimates of beta cannot be relied on to capture all the information conveyed in the above charts due to the need to break up the above data into sampling periods which are then used to mechanistically produce beta estimates. This process can lead to the loss of information that is clearly discernible in the above charts – namely that holding utility stocks did not protect investors against the systemic shock to the economy associated with the GFC.

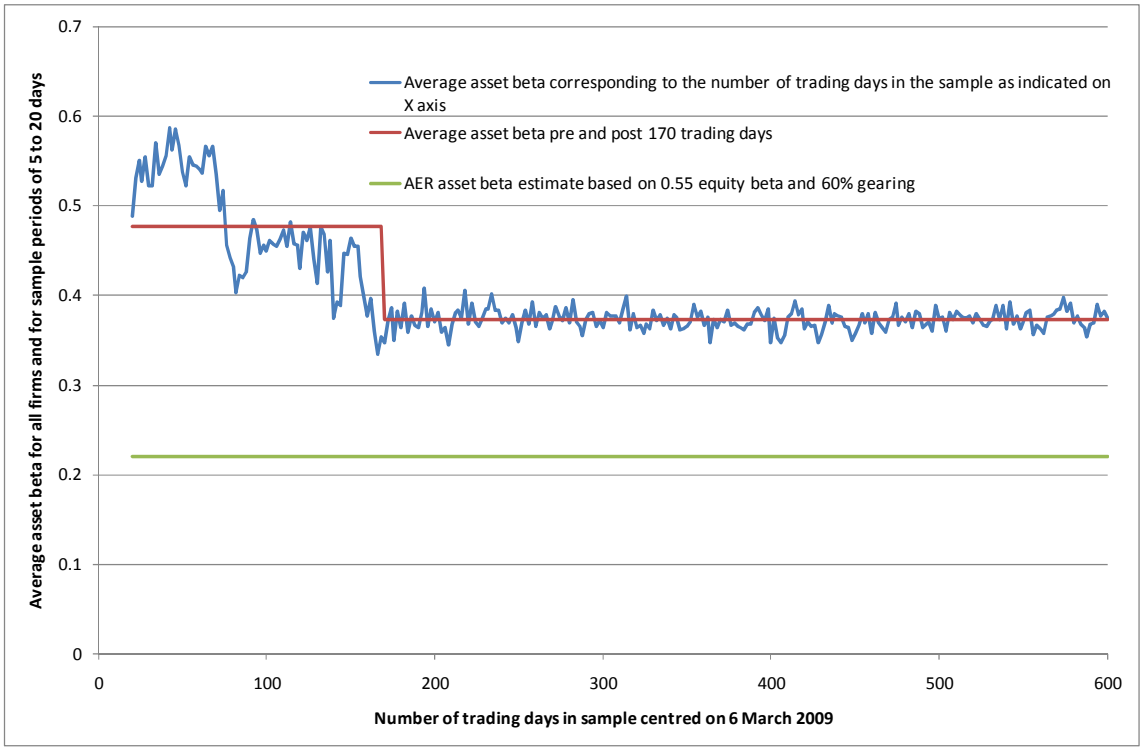
57. That said, when one estimates the average asset beta for the full sample of 55 companies[12] then one does observe a heightened average asset beta in the midst of the crisis of around 0.48 - with the average asset beta falling back to a

[12] The full sample of Companies used in this report is the same as the sample used by the NZ Commerce Commission in its Draft Reasons paper excluding Horizon Energy and Southern but with the addition of the Australian companies Envestra , APA and HDF. I exclude Horizon Energy because it is not a regulated utility and its stock is extremely thinly traded – with 45% of all trading days in the five year sample having no price information available from Bloomberg. I have been unable to obtain the relevant data to perform the analysis for Southern. These are listed in the appendix to this report.

level of around 0.38 as the period of measurement is extended further forwards and backwards from the crisis.

58. Figure 4 describes the path of asset betas measured over a fixed number of trading days centred on March 6 2009 (the nadir of stock market prices internationally).[13] The beta figures reported are the averages of 5 to 20 trading day betas with the total sample size varying from the first 20 days centred on the 6th of March to the largest sample size of 600 trading days centred on the 6th of March. The 600 trading days corresponds to a period from December 2007 to May 2010. This corresponds to an average of approximately 20 trading days per calendar month.

Figure 4: Average asset betas measured with the sample period centred on the crisis



Source: Bloomberg and CEG analysis

[13] The asset betas have been calculated by de-levering using average gearing over the five years to June 2010. I have not attempted to calculate different gearing levels for each of the smaller sample periods centred on March 6th 2009. It is correct that the gearing of utilities was likely at its highest following the collapse in equity prices during the worst of the GFC. However, the same is true of the average gearing of the market – see Figure 3and Figure 2 which show the market fell by the same or more than regulated utilities. Thus, an asset beta measured during the GFC relative to the equity market during the GFC (by estimating equity beta during the GFC and delivering using utility gearing during the GFC) can only be applied to a market risk premium that is consistent with the heightened *market gearing* during the GFC. Given the close correspondence with falls in market wide equity value and utility equity value it is reasonable to simply adopt the average gearing of the utility on the basis that this stayed relatively constant relative to the average gearing on the market.

59. Figure 4 above describes the average beta over a range of different sampling periods each centred on 6 March 2009. The highest average beta estimate of 0.59 is the average of the 5 to 20 trading day beta estimates using a sample period beginning 23 trading days before 6 March 2009 and ending 23 trading days after 6 March. The lowest average estimate is 0.33 corresponding to a sample period beginning 83 days prior to 6 March and ending 83 days after 6 March. The average asset beta measured across all sample periods of less than 170 trading days is 0.48. The average across all sample periods of more than 170 trading days is 0.38.

60. For the sake of clarity about what is represented in the above figure, I report constituent betas that form the highest and lowest average betas described above.

Table 3: Constituent elements of highest and lowest average asset beta

Number of trading days per sampling period	Highest average asset beta	Lowest average asset beta
5	0.52	0.35
6	0.52	0.35
7	0.54	0.39
8	0.57	0.42
9	0.59	0.31
10	0.54	0.31
11	0.55	0.27
12	0.55	0.34
13	0.82	0.24
14	0.64	0.39
15	0.79	0.20
16	0.68	0.44
17	0.57	0.45
18	0.46	0.25
19	0.44	0.28
20	0.60	0.38
Average	**0.59**	**0.33**

61. The highest/lowest asset beta estimate of 0.59/0.33 is the average of a further 16 betas estimated using different sampling periods (5 to 20 trading days) within the relevant aggregate period to estimate returns. Each of these 16 betas is itself the average of 55 different betas estimated for each of the companies in the sample.

62. The AER's beta estimates, based on the work of Professor Henry, are unreliable precisely because they are taken from a period when market risk was relatively low (a period that did not include the GFC).

63. The AER data suggests that regulated businesses gave investors very high 'insurance value' against variation in the market returns in a period when market risk was low (and share prices generally were increasing). But this is not something that investors place material value on. What investors care most

about is the ability of a stock to provide stability when the market return is highly uncertain and risk premiums are high.

64. A useful analogy is the value of an insurance policy against earthquakes. Imagine that the insurance policy pays out for all damage associated with earthquakes that measure less than 4.9 on the Richter scale (of which there are many hundreds of thousands a year and which rarely cause any material damage even to poorly constructed structures). However, imagine that the policy does not cover for any damage associated with larger earthquakes (of which there are fewer but which cause the vast majority of damage).

65. If we observe the protection against earthquakes that the insurance policy provides over a period when all earthquakes are lower than 4.9 on the Richter scale then we may be tempted to wrongly conclude that the insurance policy provides 100% insurance against the risk of earthquakes. Only if the measurement period includes, and gives most weight to, periods of major earthquakes will we properly measure the fact that the insurance policy provides close to zero insurance against risk.

66. The same is true for beta estimates. The reason that the CAPM predicts that low beta equity is low risk is because it provides insurance against swings in the market return. A beta of 0.5 means that that when the market falls 1% the asset in question only falls on average by 0.5% (half of 1%). If we measure a low beta in a period when market volatility is low this is the equivalent of measuring the performance of the earthquake insurance when only small tremors occur. But what investors really care about is the beta in periods when market uncertainty is high (e.g., when the market is falling by 50% rather than 1%). This is the period when market risks are high and this is the period when investors value protection against market volatility.

67. For this reason one must give most weight to estimates of CAPM risk (beta) associated with period of high market risk. As described above the asset beta at the height of the GFC was around 0.48 falling to around 0.38 after that. Based on these estimates and the need to give greater weight to the period of crisis in a conditional CAPM, I conclude that the asset beta that should be used in a conditional CAPM[14] is in the range of 0.40 to 0.45 (associated with an equity beta of at 1.0 at gearing of 55% to 60%). When this is combined with my best estimate of the forward looking market risk premium (of 8.0%) and a risk free rate of 5.3% (the average 10 year CGS yield over the month of June 2010) I estimate a cost of equity of 13.3%.

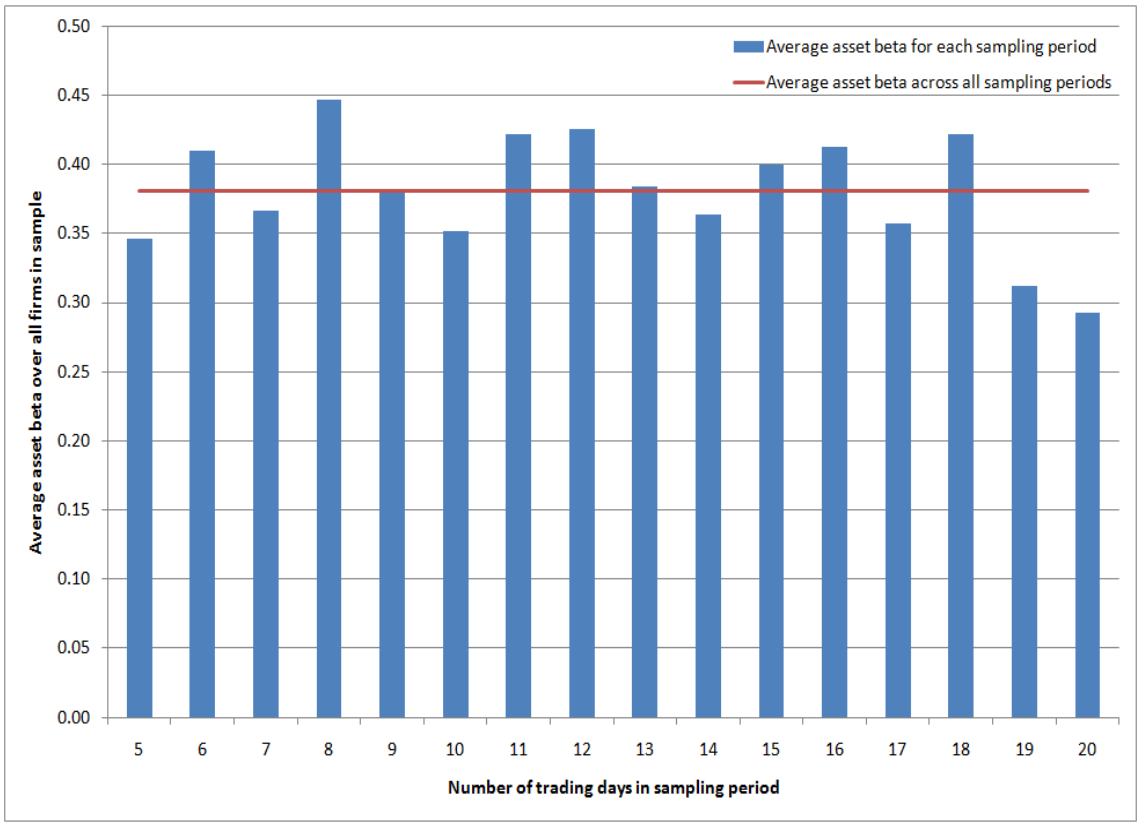
[14] This is the weighted average of past asset betas where greater weight is given to estimates drawn from higher risk periods.

4.5. Updated static CAPM beta estimate

68. Professor Henry's five year beta estimates are now aged by around 2 years. Figure 5 below describes the different beta estimates using a single 5 calendar year period. I have estimated 16 different average beta estimates each one corresponding to a different sampling period where I have measured returns (from 5 trading days, roughly a "weekly" beta to 20 trading days, roughly a "monthly" beta). However, I update this period to end on 30 June 2010.

69. It can be seen that the average of all 5 to 20 day asset betas is 0.38. However, there is a great deal of dispersion around this mean estimate.

Figure 5: 5 to 20 day mean asset betas over 55 companies measured over 5 years to June 2010



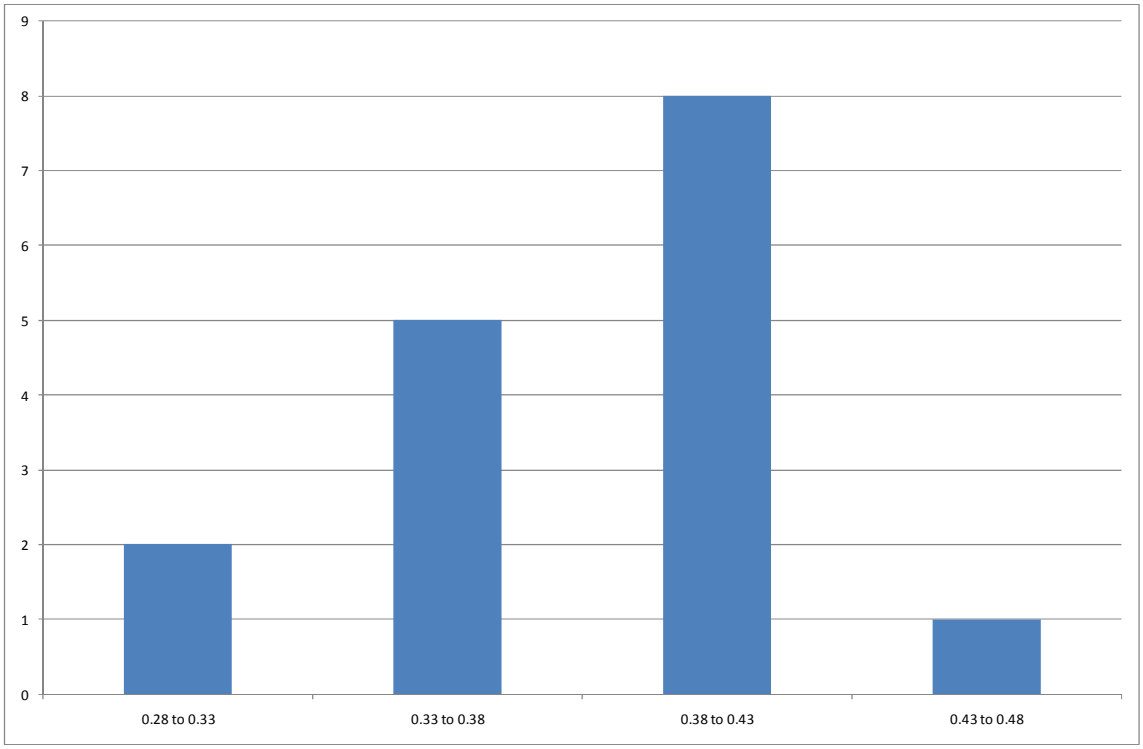
Source: Bloomberg, CEG analysis

70. This figure demonstrates that if a five trading day sampling period is used the asset beta estimated is 0.35 but if a 6 trading day period is used then average asset beta estimated is 0.41 (17% higher). At 0.45 (8 trading days) the highest average asset beta is more than 50% higher than the lowest (0.29 at 20 trading days).

71. It would be a serious error to simply adopt one or the other of these estimates (0.45 or 0.29) without performing an assessment of whether the estimate was representative of the average asset beta derived using other similar sampling periods.

72. The data in the above table can also be illustrated using a frequency distribution. The data underlying the above table (individual equity and asset betas per company per sampling period) are provided in a separate spreadsheet.

Figure 6: Frequency distribution for 5 to 20 day mean asset betas measured over 5 years to June 2010



Source: Bloomberg, CEG analysis

73. I consider that the range of estimates for the 5 year asset beta is consistent with the asset beta estimate of 0.40 to 0.45 derived from the conditional CAPM in the previous section.

74. Rather than being the mean of 55 estimated company betas for a single sampling period, these estimates are derived from 880 beta estimates (55 firms multiplied by 16 different sampling frequencies). This is a robust sample, using data from considerably more firms than used by Professor Henry.

5. Cross-check with the cost of debt

75. The AER's estimated cost of equity is unrealistically low compared with the prevailing cost of debt observed in finance markets. This is true of the AER's 'best estimate' cost of equity and also true of the cost of equity actually allowed by the AER – which includes an increment for claimed 'conservatism' on the part of the AER.

5.1. 'Best estimate' AER cost of equity compared to the prevailing cost of debt

76. Using the AER's point estimate for the equity beta of 0.55 and the AER's GFC adjusted MRP of 6.5% the AER equity risk premium (ERP)[15] is 3.6%. That is, the AER assumes that regulated businesses can attract equity investors by offering 3.6% return above the risk free rate. By contrast since January 2009 the AER has set the debt risk premium at between 2.9% and 3.5%. (Other Australian regulators have set the debt risk premium as high as 4.45% over the same period.)

77. For the AER's position to be internally consistent a 60% geared regulated utility must be able to attract equity investors by offering a mere 0.1% to 0.6% more than is promised to debt investors. In my view these are internally inconsistent estimates. A debt investor has the first right to cash-flows and will only not be paid his or her promised return if equity holders have already had the entire value of their investment destroyed.

78. That is, a debt investor promised a 3.5% premium above the Government bond rate only receives less than this if equity investors have not only made a zero return but have lost the entire value of their investment (i.e., made a negative 100% return). It is simply not credible to assume that an equity investor would willingly expose themselves to be the first in line to absorb all company losses simply in the expectation of receiving 0.1% more than promised to debt providers.

5.2. 'Conservative' AER cost of equity compared to the prevailing cost of debt

79. The standard practice of the AER is to adopt an equity beta of 0.8 which is above the range of the beta estimates it argues to be relevant based on the work of Professor Henry (0.4 to 0.7). The AER argues that this uplift represents a conservative approach.

80. It is wrong to presume that by adding an increment to the equity beta estimated by Professor Henry the resulting cost of equity estimated is conservative. This would be the case if the cost of equity estimated without the increment was itself

[15] Note that the ERP is for a specific firm and is not the same as the MRP which is the risk premium for the average of the market as a whole.

a reasonable estimate. However, as described above, the equity risk premium without the increment is manifestly unreasonably low (it results in a cost of equity that is only fractionally higher than the cost of debt).

81. Adding an increment to an estimate that is manifestly too low cannot be presumed to result in a 'conservative' or 'generous' estimate. Whether this is the case depends on whether the magnitude of the increment is larger than the magnitude of the original underestimation. In its regulatory decisions to date the AER has not investigated this empirical question. This is consistent with the fact that the AER has not acknowledged the existence of any such underestimation in the cost of equity without the increment to the equity beta it applies.

82. In order to examine this issue I have collected all debt premia allowed in regulatory decisions since January 2009 by the Australian Energy Regulator (AER) and the Queensland Competition Authority and by US regulators of firms in the equity beta sample used in this report.

Table 4: Debt premiums in regulatory decisions from January 2009 onwards

US Firms	DRP	Decision Date	Australian Firms	DRP	Decision Date
American Elec. Power	3.1%	July 10	Qland Rail (Draft)*	4.4%	June 2010
Ameren	2.7%	June 10	Jemena Gas (draft)	2.9%	May 10
Central Hud. Energy	1.8%	June 10	ETSA Utilities	3.0%	April 10
DTE Energy	2.9%	June 10	Citipower (Draft)	3.3%	March 10
Entergy	2.9%	June 10	Powercor (Draft)	3.3%	March 10
Northeastern Utilites	2.8%	June 10	Jemena Elec (Draft)	3.3%	March 10
Scana	2.9%	June 10	SP AusNet (Draft)	3.3%	March 10
CMS Energy	2.2%	May 10	United Engy (Draft)	3.3%	March 10
Consolidated Edison	2.5%	May 10	W. W. gas	3.4%	March 10
Pepco	3.5%	May 10	Ergon Energy	3.3%	April 09
Unisource Energy	2.6%	April 10	Energex	3.3%	April 09
Florida Power & Light	1.9%	March 10	Integral Energy	3.5%	March 09
Progress Energy	2.6%	March 10	ACT, Q and P gas	3.4%	March 09
Idacorp	2.3%	February 10	TransGrid	3.5%	February 09
Southern	2.6%	February 10	ActewAGL	3.5%	February 09
Alliant Energy	3.0%	January 10	Country Energy	3.5%	February 09
Duke Energy	2.0%	January 10	EnergyAustralia	3.5%	February 09
Integrys Energy	1.4%	January 10			
MGE Energy	2.9%	December 09			
Pinnicle West	2.5%	December 09			
Wisconsin Energy	2.1%	December 09			
Xcel Energy	3.0%	December 09			
Dominion Resources	2.5%	November 09			
PNM Resources	3.5%	July 09			
Black Hills	3.5%	June 09			
NV Energy	3.4%	June 09			
Teco	3.5%	June 09			
Allete	3.0%	April 09			
Edison International	3.2%	March 09			
UIL Holdings	3.6%	February 09			
First Energy	4.1%	January 09			
Average	2.8%			3.4%	
Average of all decisions				**3.0%**	

*Source: US and Australian regulatory decisions, CEG analysis. *Note that this decision sets a risk premium relative to a five year risk free rate but based on the costs of issuing 10 year debt.*

83. It can be seen that the average debt premium allowed in Australia is around 3.4% which is higher than the average allowed in the US. This is consistent with Australian regulators assuming a materially higher level of gearing. Australian decisions typically assume 60% gearing. By contrast the average level of gearing assumed by US regulators in the US decisions listed in Table 4 is 52%.[16]

[16] As estimated by SNL Financial, a leading source of financial information for United States business sectors.

84. The average allowed debt risk premium of 3.4% for Australian decisions is 1.8% lower than the 5.2% equity risk premium actually allowed by the AER over the same period. It is therefore relevant to ask whether this level of difference between a debt and equity premium is consistent with the higher level of risk that equity providers face.

85. In order to answer this question I follow the financial logic set out in Professor Grundy's report. Standard finance theory suggests that the equity risk premium (ERP)[17] for a 60% geared business will be *at least* 2.67 times the debt risk premium (and at least 2.82 times for a 55% geared business).[18] The general formula for the relationship between the equity and debt risk premia is given by:

$$\frac{ERP}{DRP} \geq \frac{1/L - L}{E}, \text{ where:}$$

L = the proportion of debt in the finance structure, i.e., gearing; and

E = the proportion of equity = 1-L

86. This follows mathematically from two well accepted propositions. The first is the application of the Modigliani-Miller result that the WACC (total firm level risk adjusted return) is unaffected by financial structure (i.e., WACC is invariant to L). The second is that the debt risk premium is convex in the level of gearing. That is, the debt risk premium increases slowly initially but then increases more rapidly as more and more debt is issued (increasing the probability of default on debt).[19] Note that these propositions allow us to define the *minimum* ratio for the ERP to the DRP. The actual ratio of ERP to DRP will likely be higher than this lower bound.

87. With debt risk premiums in the order of 3.4% being estimated for the notionally 60% geared benchmark BBB+ regulated firm the corresponding lower bound ERP is 2.67 times this level - or 9.1%. When combined with a 5.3% risk free rate this gives a cost of equity of at least 14.4%. This compares with the AER's allowance of 5.2% (including the AER's ad hoc adjustment to equity betas

[17] Note that the ERP is for a specific firm and is not the same as the MRP which is the risk premium for the average of the market as a whole.

[18] Note that this is 2.67 times the true debt risk premium (ie, measured relative to the true risk free rate). If the Government bond rate is an underestimate of the true risk free rate then the DRP will be overestimated by the extent of this bias. It follows that multiplying the DRP so estimated by 2.67 will tend to overstate the ERP by 2.67 times the bias in the risk free rate. This will lead to an overestimate of the cost of equity – with the ERP overestimation being greater than the risk free rate underestimation. For example, if the government bond rate is 1% below the true risk free rate then the minimum ERP will be 2.67% overestimated using this method. The net effect will

[19] It is standard practice to assume that the cost of debt is convex (rises at an increasing rate) with the level of gearing. This relationship is commonly taught to undergraduate finance students. For example, see Figure 18.5 in Damodaran, Aswath, 2001, Corporate Finance: Theory and Practice, 2nd edition, (John Wiley and Sons, Inc., NJ).

estimated by Professor Henry) - which is 4.7% lower than the minimum equity risk premium implied by the debt risk premium.

88. Using US regulatory decisions debt risk premium of 2.8% and average gearing of 52% the implied minimum equity risk premium in the US is at least 8.2%. The average equity premium allowed by US regulators in the above decisions is 6.9%. While 1.3% lower than the level consistent with the debt risk premium it is much closer to consistency with the debt data than the Australian decisions.

89. In my view this is sufficient information to conclude that the increment the AER applies to its equity beta does not give rise to a conservative estimate of the cost of equity.

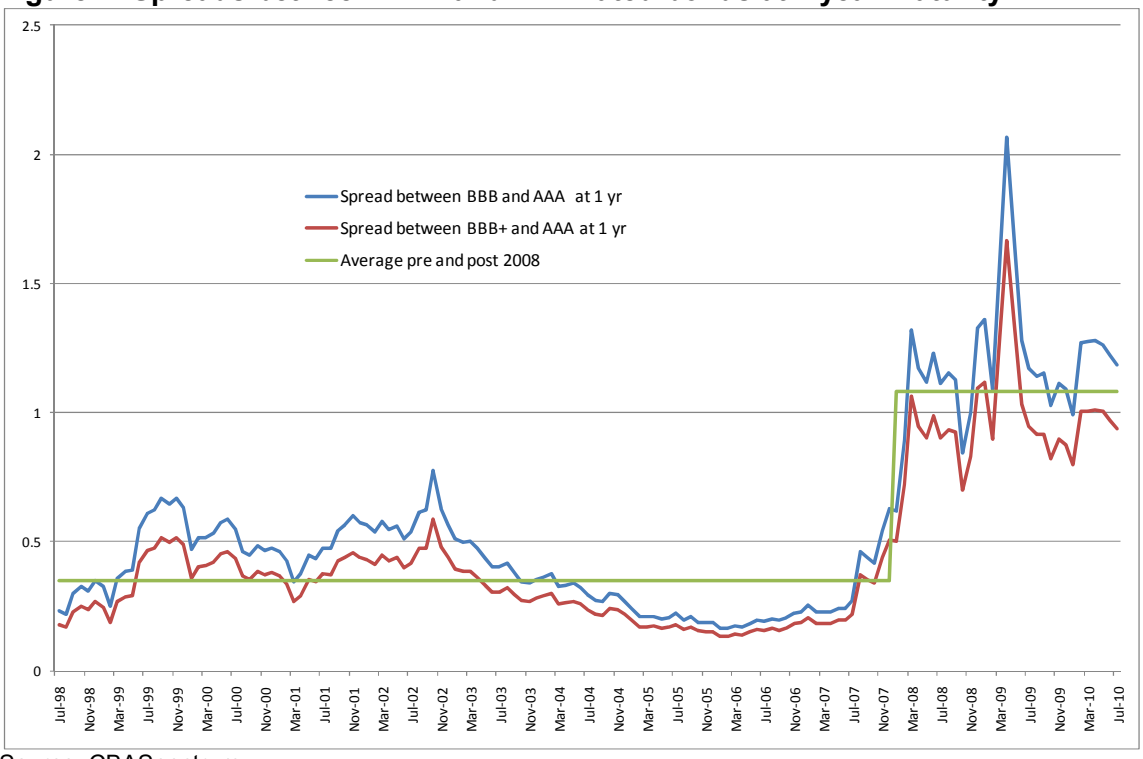
5.3. Other debt based proxies for equity MRP

90. A common proxy for the level of the market risk premium is the difference between yields on AAA and BBB rated bonds. Jagannathan and Wang (1996) use this as an indication of the forward looking market risk premium and note that it is widely accepted method in finance.

> *Based on these findings, I choose the yield spread between BAA- and AAA-rated bonds, denoted by R_{t-1}^{Prem} as a proxy for the market risk premium. The variable R_{t-1}^{Prem} … has been used extensively in finance.*

91. In the above quote Moody's credit ratings are being referred to. The equivalent Standard and Poor's credit ratings are AAA and BBB. When I examine the same measure in Australia using the longest history of fair value estimates available from CBASpectrum I observe the following history for the spread between Standard and Poor's AAA and BBB rated bonds with one year to maturity.

Figure 7: Spreads between BBB and AAA rated bonds at 1 year maturity



Source: CBASpectrum

92. It can be seen that the level of the spread between BBB and AAA rated bonds with one year maturity prior to 2008 was almost always less than 0.5% and averaged 0.35% (0.38%/0.31% for BBB/BBB+ bonds). Since 2008 the average spread has been over three times higher at 1.08% (1.20%/0.97% for BBB/BBB+ bonds). While it is true that these spreads spiked in April 2009 at 2.1%/1.7% for BBB/BBB+ they have not fallen back to pre-crisis levels and are currently almost exactly the same as their post 2008 average.

93. At the time of writing CBASpectrum is estimating that July 2010 yields are still more than 3 times (200% higher than) pre 2008 average yields.[20] This is consistent with equity risk premiums being similarly elevated above their pre GFC levels.

[20] BBB/BBB+ yields for July 2010 are estimated at 1.

Table 5: AAA to BBB spreads

Sampling period	BBB	BBB+
Average pre 2008	0.39%	0.31%
Average post 2009	1.20%	0.97%
Ratio pre and post 2008	**3.07**	**3.16**
July 2010	1.19%	0.94%
Ratio July 2010 to pre 2008 Average	**3.04**	**3.07**

Source:CBASpectrum, CEG analysis

6. The DGM

6.1. Formulaic description of DGM

94. The dividend growth model (DGM) estimates the prevailing cost of equity by estimating the discount rate required to explain current share prices given current projections of future dividends. In the case of equity, the future payments from the asset are in the form of dividends (D_t) paid at future points in time "t". The present value of a dividend stream is given by the following formula – where "k" is the discount rate applied to equity (which is also assumed to be constant).

$$Value\ of\ a\ series\ of\ payments\ D_t = \sum_{t=1}^{T} \frac{(D_t)}{(1+k)^t} \qquad (1)$$

If it is assumed that, beyond time T, dividends will grow perpetually[21] at a constant rate "g" then today's value of payments beyond T is given by :

$$Value\ of\ D\ growing\ at\ g\ beyond\ time\ T\ = \frac{D_T \times (1+g)}{(k-g)} \times \frac{1}{(1+k)^T} \qquad (2)$$

95. If we have a finite set of forecasts up to time T and a perpetually growing forecast beyond time T can estimate the value of the equity as:

i. the present value of dividends D_1 to D_T from equation (1); plus

ii. the present value of dividends beyond D_T using equation (2).

96. This gives the following formula for the value of the equity.

$$Present\ value\ of\ all\ dividends = \left[\sum_{t=1}^{T} \frac{(D_t)}{(1+k)^t}\right] + \left[\frac{D_T \times (1+g)}{(k-g)} \times \frac{1}{(1+k)^T}\right] \qquad (3)$$

97. The first term in square brackets on the right hand side of equation (3) is the present value of a series of dividend forecasts covering dividends from now to period t=T. The second term in square brackets is the present value of all dividends beyond time T.

[21] Note that an investor does not have to expect to hold an equity perpetually to benefit from perpetual dividend growth. They simply have to be able to sell the equity to another investor at a price that reflects the future dividends that investor will receive. Thus, the valuation of perpetual dividends is consistent with the valuation of a finite holding period followed by a sale where the sale price is determined by future dividends at that time.

98. If future dividends are forecast accurately then application of formula (3) should result in a value equal to the market price of the equity. Consequently, if the markets' expectations of dividends are accurately forecast then it is possible to 'back out' of equation (3) the markets' implied cost of equity (k). This simply requires solving equation (3) for a value of k that gives a present value of future dividends equal to the market price.

6.2. Application of the DGM model to Australian utility stocks

99. I have sourced Bloomberg consensus dividend forecasts out to 2014 from the six listed ASX firms that derive the majority of their revenues from electricity and gas transport activities. These firms had average gearing of 60.0% over the five years to June 2010 (as set out in the Appendix A to this report). Average gearing reported for June 2010 (March 2010 for SP AusNet) was 62.4%. I have also sourced average share prices from Bloomberg. Both the dividend forecasts and the share price data was sourced over the month of June 2010.

100. I have then employed a range of forecasts for dividend growth beyond that date and the associated DGM discount rates are set out in the below table. I have also conservatively assumed that all distributions are fully taxable in the hands of investors (i.e., not imputation credits are attached and the distributions do not include any tax free return of capital). This is equivalent to assuming that investors place zero value on imputation credits (or 'gamma' equals zero in regulatory terminology).

Table 6: DGM discount rate – gamma equals zero

Firms	AER discount rate	Implied cost of equity with assumed nominal dividends growth rate post 2014 of:			
		GDP (5.5%)	Inflation (2.5%)	Zero (0.0%)	Negative 3.5%
Aust Pipeline Trust (APA)	8.9%	15.7%	13.3%	11.4%	8.7%
DUET (DUE)	8.9%	17.9%	15.7%	13.8%	11.3%
Envestra Limited (ENV)	8.9%	16.2%	13.9%	12.1%	9.5%
Hastings Div Utils (HDF)	8.9%	14.5%	12.1%	10.1%	7.3%
SP AusNet (SPN)	8.9%	15.5%	13.1%	11.1%	8.4%
Spark Infrast. Grp (SKI)	8.9%	15.3%	12.9%	11.0%	8.3%
Average	**8.9%**	**15.8%**	**13.5%**	**11.6%**	**8.9%**

Source: CEG Analysis

101. The above table states that even if dividends were expected to grow only with inflation beyond 2014 (the last year for which Bloomberg dividend forecasts are available) then the average implied cost of equity would be 13.5%. This compares with a cost of equity calculated using the AER model of 8.9%. In order for the average implied DGM cost of equity to be equal to 8.9% then it must be the case that dividends are expected to fall by 3.5% per annum in perpetuity after 2014 (i.e., a real reduction in dividends of 6.0% per annum at a 2.5% inflation rate).

102. If I instead assume that regulated utility distributions distribute imputation credits to the same value that the AER assumes when it models these businesses costs of tax then the implied DGM discount rates are even higher (gamma equals 0.65). These are reported in the below table.

Table 7: DGM discount rate – gamma equals 0.65

Firms	AER discount rate	Implied cost of equity with assumed nominal dividends growth rate post 2014 of:			
		GDP (5.5%)	Inflation (2.5%)	Zero (0.0%)	Negative 9.0%
Aust Pipeline Trust (APA)	8.9%	18.8%	16.6%	14.8%	8.4%
DUET (DUE)	8.9%	21.7%	19.6%	17.9%	12.2%
Envestra Limited (ENV)	8.9%	19.3%	17.2%	15.5%	9.7%
Hastings Div Utils (HDF)	8.9%	17.2%	14.9%	13.0%	6.6%
SP AusNet (SPN)	8.9%	18.5%	16.3%	14.4%	8.1%
Spark Infrast. Grp (SKI)	8.9%	18.1%	15.9%	14.2%	8.0%
Average	**8.9%**	**18.9%**	**16.7%**	**15.0%**	**8.8%**

Source: CEG Analysis

103. This table demonstrates that, in order for the DGM estimate of the cost of equity to be the same as the AER estimate would be necessary to assume that dividends fell at almost 9% per annum (11.5% in real terms) beyond 2014.

104. Based on this DGM analysis I conclude that the prevailing cost of equity for regulated utilities is in the region of 11.6% to 16.7%. The lower bound of this range is determined by the conservative assumption that investors value imputation credits at zero and dividends are expected to remain constant in nominal terms beyond 2014. The upper end of this range is based on the assumption that investors receive the same tax credits as the AER assumes in its cost modelling and that dividends rise with inflation beyond 2014.

105. This analysis supports the conclusion derived from application of the Black CAPM and the conditional CAPM that an estimate of the cost of equity derived from AER static CAPM is too low.

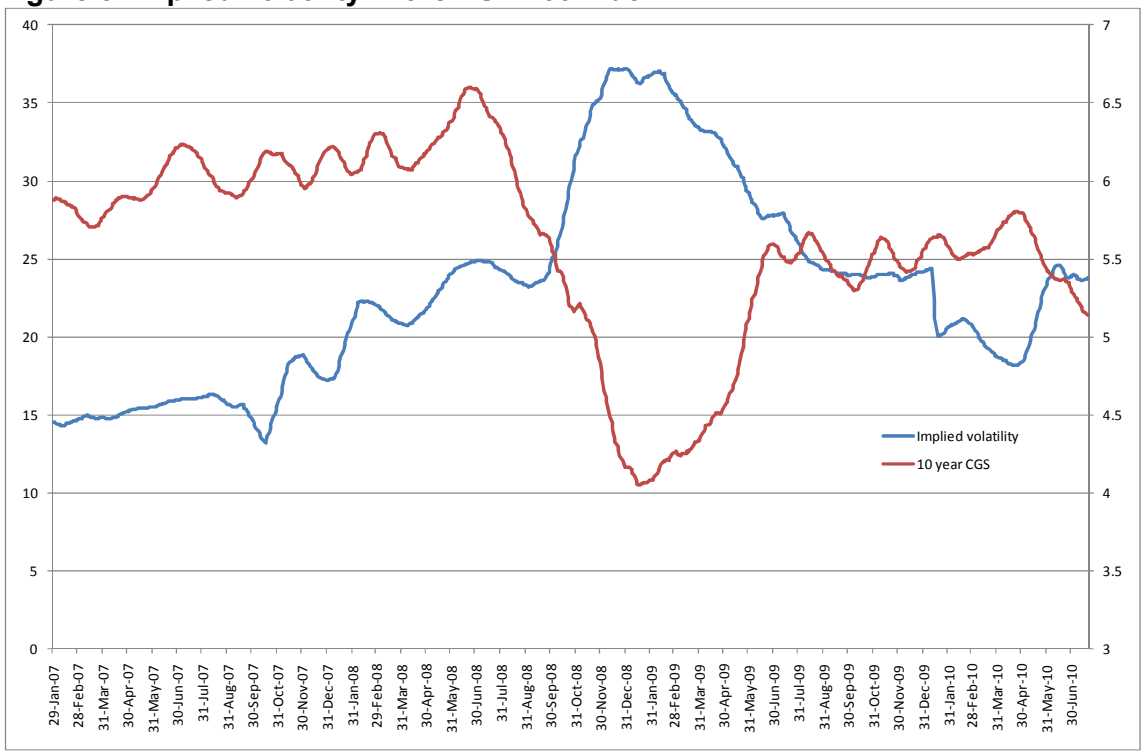
106. I note that I have applied the same DGM analysis to Bloomberg forecasts of market wide dividends for the ASX 200. When I do this my best estimate of the prevailing market risk premium is 8.0% (i.e., 1.5% higher than the AER estimate of 6.5%).

6.3. Application of the DGM to the market as a whole

107. One indicator of the forward looking risk premiums in the market currently is implied volatility of market returns that can be solved from option trades on the ASX200 futures. According to the Black Scholes theorem for any given option it will be more valuable the greater is the expected volatility in the underlying asset. The implied forward looking volatility on the ASX 200 calculated in this manner

over a prospective 12 month period is graphed in Figure 8 below. It can be seen that implied volatility is currently at historically high levels – only exceeded during the depths of the global financial crisis. It is reasonable to assume that when investors expect a historically high level of volatility in equity returns they will require a historically high return for investing in equities.

Figure 8: Implied volatility in the ASX 200 index



Source: Bloomberg and RBA, CEG analysis

108. Also demonstrated in this figure is the inverse relationship between perceived market risk and Commonwealth Government Security yields (CGS yields).[22] At the peak of the GFC implied market risk was at a historically high level and CGS yields were at a historically low level. Similarly, as market risk fell from the heights of late 2008 and early 2009 CGS yields recovered. However, neither market risk nor CGS yields have returned to their pre-crisis levels. The fact that perceived market risk is still unusually high is relevant to any assessment of prevailing conditions in the market for funds.

109. I have performed a DGM analysis for the market as a whole (proxied by the ASX200) using Bloomberg dividend forecasts up to 2014 and an assumed real rate of growth in dividends beyond 2014. These data were sourced from Bloomberg on 4 June 2010.

[22] 10 year Australian Commonwealth Government Security (CGS) yields

110. The Bloomberg forecasts cannot be directly compared to market capitalisation in order to estimate an implied rate of return because these are forecasts of cash dividends, and as such do not include the value of imputation credits to investors. I include the value of imputation credits consistent with the implied 0.65 value of gamma now adopted by the AER. I do this by assuming that 100% of dividends are distributed with franking credits but investors only value these at 65% of their face value. This would mean that each dollar of dividends had attached to it imputation credits with a face value of 42.8 cents (0.3/0.7) but these would be valued by investors at 27.8 cents (42.8*0.65).

111. Accordingly, I have applied a factor of 1.278 to the Bloomberg cash dividend forecasts to reflect the value of imputation credits to investors.

112. The forecast cash amount and value of the dividends of this sample of firms over the period from 2011 to 2014 is shown in Table 8 below.

Table 8: Forecast dividends, 2011 to 2014

	2011	2012	2013	2014
Total cash dividends ($ billions)	55.91	61.88	66.91	71.20
Total value of dividends ($ billions)	71.57	79.21	85.64	91.14

Source: Bloomberg

113. There are generally no direct forecasts of dividends per share beyond the 2014 financial year. To enable an estimate of the required rate of return, I have extended the path of dividends into perpetuity based on an assumed long run rate of growth from the 2014 forecast.

114. There is general consensus that long run dividend growth is best proxied by long run economic growth. This is the assumption that is made by AMP,[23] Davis,[24] Lally[25] and Damodaran[26]. I consider this approach is appropriate and I have developed a range for this parameter of 3.2% to 3.9% based on two differing methodologies.

[23] AMP Capital Investors (2006), *The equity risk premium – is it enough?* Oliver's insights, Ed.13, 4. This methodology uses the long term average nominal growth in GDP as a proxy for long term average nominal growth in dividends).

[24] Davis, The weighted average cost of capital for the gas industry, Report prepared for the ACCC and ORG, 18 March 1998, p.15-16.

[25] Lally, The cost of capital under dividend imputation, Prepared for the ACCC, 2002, pp.29-34.

[26] Damodaran, op cit, page 53.

115. The average annual rate of real growth in gross domestic income between 1959 and 2008 was 3.9%.[27] Combined with an average long run inflation forecast of 2.5%, based on the middle of the RBA's target band for inflation, this is equivalent to nominal economic growth of 6.5%. This is also consistent with the 6.9% average expected rate of growth in dividend per share in the US from 1946 to 2008.[28] By way of comparison, equivalent real economic growth in the US since 1929,[29] starting immediately prior to the great depression, was 3.3%. If the data series begins instead at 1933 the real average growth rate is 4.0%.

116. An alternative estimate bases the future real growth of the economy on long term real interest rates, as is predicted by a number of neoclassical macroeconomic models. However, the problem with implementing this outside a theoretical model is that one needs to identify the appropriate real interest rate in the economy despite there being several to choose from.

117. As a lower bound estimate I choose the real yield on the longest dated inflation indexed CGS bond of 2.82% maturing on 20 September 2005. I regard this as a lower bound estimate on the basis that it is materially below the historical average level of economic growth (as discussed above) and also it is below the actual real rate of interest available of extremely low risk assets (such as State Government debt and Government guaranteed bank debt). I also note the views of the AER[30] and the RBA[31] that lack of supply in indexed CGS has caused their yields to be

---

[27] The Australian Bureau of Statistics (ABS) publishes economic growth figures on its website starting in 1959. Here I use growth in real domestic income of 3.9% (A2304314X of ABS Catalogue 5206.0) rather than nominal growth, since future expectations of inflation are not consistent with the high levels of inflation that was experienced at various times over this period. The income measure is preferable to gross domestic product because it captures the impact of price movements for imports (just as CPI does) while the production measure does not.

[28] The appropriate data for Australia is not easily accessible – noting that I wish to track dividend *per share* growth not dividend growth *per se*. This means I require an estimate of the dividends an investor would receive if they never reinvested dividends nor participated in share buy backs. Also, I wish to be able to calculate dividend per share growth on a portfolio that is constantly being reweighted to match the market portfolio over time. Data is available to perform these calculations from the US. The average mean continuously compounding growth rate for dividends, measured on this basis, on the New York Stock Exchange was 6.10% over this period. The standard deviation of the annual continuously compounded growth rate was 11%. Assuming the dividend growth rates are log normally distributed the expected annual dividend growth rate is $e^{\mu+0.5\sigma^2}$ where μ is the expected annual continuously compounded growth rate and σ^2 is the variance of the annual continuously compounded growth rate.

[29] The longest published series by the Bureau of Economic Analysis at the US Department of Commerce http://www.bea.gov/national/index.htm#gdp.

[30] On page 226 of October 2008 NSW draft distribution determination the AER states:

> *Historically, the AER has used an objective market-based approach to forecast the expected inflation rate—calculated as the difference between the CGS (nominal) and the indexed CGS yields. However, since late 2006 a downward bias in the indexed CGS has become evident due to the limited supply of these securities.*

[31] RBA Assistant Governor, Guy Debelle, states in a letter to the ACCC dated 9 August 2007 that

> *"The issue of insufficient supply is relevant, however, for the indexed bond market. In contrast to the regular issuance of nominal bonds that underpins the futures market contracts, there have been no indexed bonds issued since February 2003. Outstandings are now limited to just three issues, just one of which has maturity in excess of 10 years. Moreover, demand for these bonds has increased as supply has fallen. An indication of this problem can be gleaned from the measure of inflation expectations… Such an observation would also imply that the indexed bond yield may no longer offer be the best estimate of a risk-free real rate."*

downward biased (also consistent with the view that this is a lower bound estimate).

118. I note that the average annual growth in dividends forecast by Bloomberg over the period from 2010 to 2014 is 9.8% in nominal terms. No obvious upper bound scenario presents itself and I do not report one. However, my best estimate of the MRP will be an underestimate to the extent that investors expect dividend growth to continue to outstrip economic growth beyond 2014 (I have modelled dividends as being expected to fall immediately from the 9.8% Bloomberg estimate prior to 2014 back to long run economic growth levels in 2015).

119. Using the extended dividend forecast based on Bloomberg data, I can estimate the nominal rate of return that is consistent with the average capitalisation of $1,172 billion on 4 June 2010. If I subtract the prevailing risk free rate in June 2010 (5.3%) I derive the following estimates for the implied market risk premium – which can then be compared to the AER's assumed MRP of 6.5%.

Table 9: Implied market risk premium

Long run dividend growth assumption	Long run dividend growth	Implied MRP	
		Current level is permanent	Current level is temporary for 7 years
Best estimate	3.9%	8.0%	12.2%
Lower bound estimate	2.8%	7.1%	8.8%

Source: Bloomberg, CEG Analysis.

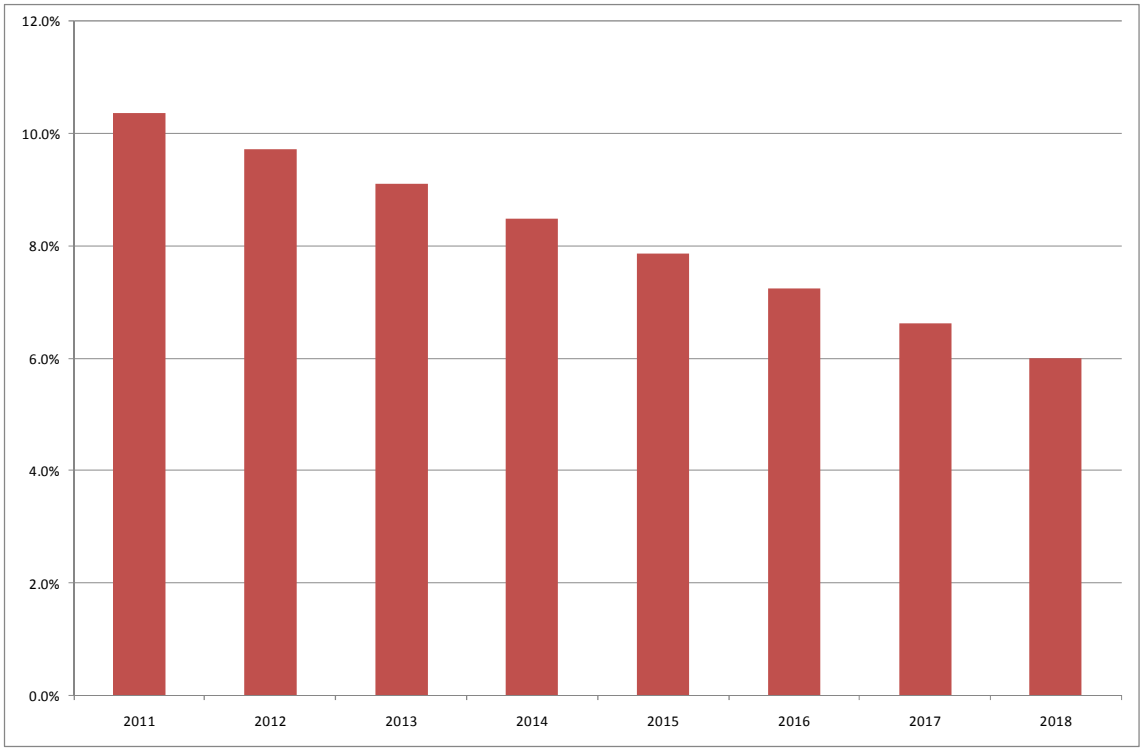
120. The results in this table can be summarised as follows. If I assume investors apply a single discount rate (cost of equity) to all future years then the best estimate of the MRP is 8.0% (lower bound estimate is 7.1%).

121. However, it appears likely that investors currently believe that equity markets are riskier than the long run average and that this riskiness will reduce over time. I model this by using two discount rates, one associated with an MRP of 6% beyond 2017 (i.e., beyond the end of Envestra's regulatory period) and then using the DGM to solve for the discount rate between now and 2017. This allows me to make the observation, as reported in the above table, that the best estimate of the implied MRP over the next 6 years is 12.2% if I assume investors believe that the MRP will be 6% in 2018 and beyond (lower bound estimate of the MRP over the next six years is 8.8%).

122. From the estimates in Table 9 and the average Government bond rate in June 2010 (5.3%) and an estimated equity beta of 1.0 I can estimate a range for the cost of equity from 12.4% to 17.5%

123. I can also model the implied MRP based on the assumption of gradually declining risk premium from its current level to a value of 6% in 2018. The figure below describes the path that MRP must be expected to take if the MRP declines in a linear fashion from its current levels to 6% in 2018.

Figure 9: Path of MRP it transitions smoothly to 6% in 2018

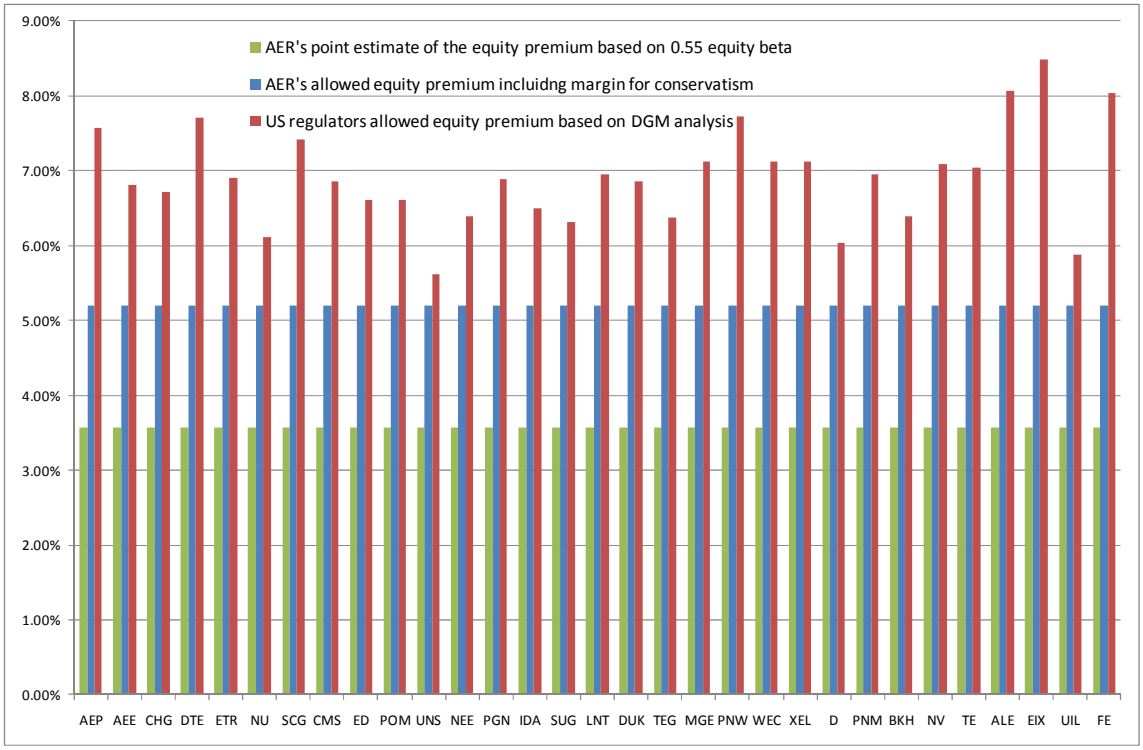


6.4. DGM estimates applied by US regulators

124. US regulators overwhelmingly use the DGM model to estimate the cost of equity for regulated utilities. From January 2009 to July 2010, 20 different US regulators have made regulatory determinations for 31 of the 48 US businesses in my sample of firms used to estimate equity betas. The average leverage of these companies is well below 60%. Therefore, one would expect the equity risk premium to be *lower* for these firms (assuming US utilities' underlying 'ungeared' risk is no higher than Australian utilities). However, the actual average premium allowed was 6.9% measured relative to the 10 year US Government bond rate prevailing at the time of the US regulatory decision. This is 1.7% *higher* than the premium the AER allows (5.2% = 0.8*6.5).

125. The individual decisions are graphed in Figure 10 which compares each US decisions since January 2009 with the AER's point estimate for the cost of equity (based on a 0.55 equity beta and a MRP of 6.5%) and the AER's cost of equity after its increment for conservatism is added (raising the equity beta from 0.55 to 0.8).

Figure 10: US regulatory equity premiums since 2009 vs. AER proposed equity premium



Source: US regulatory determinations, US Treasury, CEG analysis.

126. This provides further evidence that the equity risk premium allowed by the AER is not conservative. It is materially below that allowed by US regulators. If I add the average equity premium allowed by US regulators (relative to US Government bond rates) to the Australian Government bond rate of 5.3% in June 2010 then I estimate an Australian cost of equity of 12.2%. However, this is implicitly for a gearing level of less than 60%. At 60% gearing the equivalent equity premium would be higher still.

7. The Fama French Model

127. The Fama French model is a widely used alternative to the CAPM by both finance academics and market practitioners. The Fama French model states that small capitalisation stocks and stocks that have low market valuations relative to their book value of assets tend to be higher risk than other stocks. This conclusion is based on empirical regularities exhibited across a range of studies and a number of different time periods.

128. The Fama French model adds these measures of risk to the CAPM beta to arrive at an estimate of risk adjusted returns. The most recent and most thorough application of this model to Australian regulated utilities has been by NERA in the context of the Jemena regulatory review. [32] [33]

129. This report has been independently reviewed by both the UK economic consulting company Oxera and me. [34] I agree with the conclusions of Oxera that this is a robust and appropriate application of the Fama and French model. NERA estimated a range of 11.6% to 14.4% in their study (associated with a range for the equity premia of 6.1% to 8.9%). I adopt this range for my report.

[32] NERA, 31 March 2010, The Required Rate of Return on Equity for a Gas Transmission Pipeline, A Report for DBP.

[33] NERA, 12 August 2009, Cost Of Equity - Fama-French Three-Factor Model Jemena Gas Networks (NSW).

[34] OXERA, Estimating the cost of equity from the Fama–French model, April 28th 2010.

8. Conclusions

130. The table below describes my best estimate of the cost of capital derived from application of each of the well accepted financial models that I have identified. For comparison purposes I also provide an estimate of the cost of capital derived from the AER's 'static CAPM' which I do not regard as well accepted or as providing the best estimate of the cost of equity in the prevailing market conditions.

Table 10: Cost of equity estimates (June 2010)

Financial model	Range for cost of equity (55% to 60% gearing)
AER static CAPM	8.9% (7.9% to 9.9%)[35]
AER model with AER ad hoc upward adjustment	10.5%[36]
FFM	11.6% to 14.4%[37]
DGM based on Australian utility data	11.6% to 16.7%[38]
DGM based on Australian market wide data*	12.4% to 17.5%[39]
DGM based on US regulatory decisions	>12.2%[40]
Estimate derived from the cost of debt	>14.4%[41]
More accurate implementation of the CAPM**	11.4%[42] to 13.3%[43]

*Assuming an equity beta of 1.0. **Bottom of range is based on the application of the Black CAPM with Australian data and an equity beta of 0.55 and an MRP of 6.5%. Top of the range is associated with an equity beta of 1.0 and a MRP of 8.0%

131. The range of estimates for the cost of capital estimated by the AER model (7.9% to 9.9%) is simply not credible. The lower end of this range is less than the 8.8% cost of debt that the AER allowed for Jemena Gas Networks in its June 2010 Final Decision. To suggest that the reasonable range for the cost of debt is less than the cost of equity is demonstrably unreasonable.

132. The top of the range is only 1.1% above the same cost of debt. This also assumes a simply unrealistic willingness of equity holders to expose themselves to materially higher risks of equity for only slightly higher returns. And

[35] Based on an equity beta range of between 0.4 to 0.7, a risk free rate of 5.3% and an MRP of 6.5%.

[36] Based on an equity beta of 0.8, a risk free rate of 5.3% and an MRP of 6.5%.

[37] As set out in paragraph 129.

[38] As set out in paragraph 104.

[39] As set out in paragraph 122.

[40] As set out in paragraph 122.

[41] As set out in paragraph 87.

[42] As set out in paragraph 45.

[43] As set out in paragraphs 67 and 73.

inconsistent with the predictions of well accepted financial models and current market conditions.

133. This underestimation by of the cost of equity by the AER model is consistent with the identified flaws in that model which mean it does not accurately reflect prevailing conditions in the market for funds. These flaws are well understood to result in a negative bias in the estimation of the return on equity for equity that has historical average betas below 1.0. Leaving these flaws uncorrected means that the AER's application of the CAPM cannot be considered a well accepted finance model or the best estimate of the cost of equity in the prevailing market conditions.

134. The AER's ad hoc adjustment to the model is justified by the AER on the grounds of conservatism. However, this justification is hollow unless the starting point has been established as reasonable in its own right. It is certainly not conservative to start with a cost of equity estimate that is too low and then to partially correct this error by increasing that estimate towards, but not up to, a reasonable level.

135. Based on the application of well accepted financial models, including well accepted versions of the CAPM, the FFM and the DGM, the cost of equity should be set at least at 11.4% and could reasonably be set at 14.4% or even higher.

Appendix A. Companies used in beta analysis

Company	Code	Gearing*	Asset beta	Equity beta at 60% gearing
Vector	VCT	55%	0.27	0.68
Envestra	ENV	72%	0.20	0.51
Hastings	HDF	39%	0.66	1.64
Australian Pipeline	APA	59%	0.21	0.54
DUET	DUE	76%	0.14	0.34
Spark Infrastructure	SKI	54%	0.21	0.53
SP AusNet	SPN	61%	0.05	0.14
National Grid	NG	49%	0.28	0.69
Allegheny Energy	AYE	41%	0.58	1.46
Allete	ALE	23%	0.51	1.28
Alliant	LNT	35%	0.45	1.13
Ameren	AEE	45%	0.48	1.19
American Electric Power	AEP	48%	0.36	0.90
Black Hills	BKH	40%	0.61	1.52
Central Vermont Public Service	CV	37%	0.49	1.23
CH Energy	CHG	34%	0.42	1.06
Cleco	CNL	36%	0.39	0.98
CMS Energy	CMS	66%	0.23	0.58
Consolidated Edison	ED	44%	0.25	0.63
Constellation Energy	CEP	47%	0.75	1.88
Resources	D	41%	0.36	0.91
DPL	DPL	31%	0.36	0.89
DTE Energy	DTE	54%	0.36	0.90
DukeE nergy	DUK	36%	0.38	0.95
Edison International	EIX	39%	0.50	1.24
ElPaso Electric	EE	42%	0.43	1.06
Empire District Electric	EDE	47%	0.41	1.03
Entergy	ETR	36%	0.39	0.96
Exelon	EXC	25%	0.57	1.42
FirstEnergy	FE	43%	0.36	0.90
FPL	NEE	39%	0.46	1.14
Great Plains Energy	GXP	45%	0.45	1.12
Hawaiian Electric	HE	18%	0.53	1.33
Idacorp	IDA	47%	0.29	0.73
Integrys Energy	TEG	43%	0.52	1.31
MGE Energy	MGEE	30%	0.34	0.86

Northeast Utilities	NU	53%	0.31	0.77
NSTAR	NST	46%	0.30	0.74
NV Energy	NVE	61%	0.30	0.76
OGE Energy	OGE	38%	0.53	1.33
Pepco	POM	56%	0.39	0.99
PG&E	PCG	41%	0.31	0.77
Pinnacle West	PNW	47%	0.36	0.90
PNM Resources	PNM	60%	0.48	1.19
PPL	PPL	34%	0.43	1.08
Progress Energy	PGN	48%	0.28	0.70
Public Service Enterprise	PEG	37%	0.46	1.16
Scana	SCG	46%	0.36	0.89
Teco Energy	TE	50%	0.39	0.98
UIL Holdings	UIL	42%	0.48	1.21
Unisource Energy	UNS	62%	0.28	0.70
Unitil	UTL	54%	0.11	0.29
Westar Energy	WR	50%	0.37	0.93
Wisconsin Energy	WEC	46%	0.27	0.68
Xcel Energy	XEL	48%	0.26	0.66
Average		**45%**	**38%**	**95%**

*Gearing has been estimated following the NZ Commerce Commission's approach where gearing is estimated at short and long term debt less cash and cash equivalents divided by market value of equity plus short and long term debt less cash and cash equivalents. Removing cash and cash equivalents ensures that the underlying asset beta estimated is for the non-cash component of the businesses assets. This is appropriate because these are the only assets that regulators, such as the AER, allow to enter the regulatory asset base and, consequently, which earn a regulated return.

Appendix B. Description of beta estimation

136. I have performed my own econometric analysis from the raw data in order to establish the historical relationship between the returns of comparable firms and the market.

137. The basic form of the Sharpe CAPM is frequently expressed as:

$$R_e = R_f + \beta_e \cdot (R_m - R_f) \quad \text{(i)}$$

where: R_f is the risk free rate (generally proxied by the prevailing yield on nominal Commonwealth Government bonds less an estimate of expected inflation);

β_e is the equity beta and is proportional to the expected covariance between the return on the equity and the return on the market as a whole; and

$(R_m - R_f)$ is the expected market risk premium (MRP) being the expected return on the market less the risk free rate.

138. Econometrically, this may be estimated as the following equation with no constant term:

$$R_{e_{i,t}} - R_{f_t} = \beta_{e_i} \cdot (R_{m_t} - R_{f_t}) + u_{i,t} \quad \text{(ii)}$$

139. However, in practice, an alternative form that is frequently used for econometric estimation, which avoids the need to find a proxy for the risk-free rate whilst returning an unbiased estimate of the equity beta, is:[44]

$$R_{e_{i,t}} = \alpha_i + \beta_{e_i} \cdot R_{m_t} + \epsilon_{i,t} \quad \text{(iii)}$$

140. The results that follow have, in their entirety, been estimated with application of the ordinary least squares method to equation (iii) above.

141. I have collected Bloomberg data of share price movements and dividend payments for listed firms that derive most income from operating as a regulated utility across New Zealand, Australia, the United Kingdom and the United States.

[44] For example, see Ólan Henry's report to the Australian Energy Regulator in its recent review of regulatory WACC parameters for electricity networks - Henry, *Econometric advice and beta estimation*, November 2008.

142. For each firm, I constructed a daily accumulation index of returns over the period from 1 July 2005 to 30 June 2010 using changes in share prices and dividend payments over that period. Changes in these accumulation indices can be used to estimate returns on a daily, weekly, monthly or any other basis. In each market I use a broad based share market index as a proxy for the return on the market. In Australia I use an accumulation index for the S&P200 index. In all other jurisdictions where accumulation indexes are not readily available I use a price index for the market (S&P 500 in the US, FTSE100 in the UK and NZX 50 in NZ).

143. Raw equity betas are estimated from series of returns by estimating equation (iii) above.

144. These were converted to unlevered (asset) betas using the following equation:

$$\beta_a = \beta_e(1 - L) + \beta_d L \qquad \text{(iv)}$$

where β_d is the debt beta, which we assume to be zero, and *L* is the leverage, which I estimate for each firm using Bloomberg data.

Tom Hird is a founding Director of CEG's Australian operations. In the three years since its inception CEG has been recognised by Global Competition Review (GCR) as one of the top 20 worldwide economics consultancies with focus on competition law. Tom has a Ph.D. in Economics from Monash University. Tom is also an Honorary Fellow of the Faculty of Economics at Monash University and is named by GCR in its list of top individual competition economists.

Tom's clients include private businesses and government agencies. Tom has advised clients on matters pertaining to: competition policy issues and merger clearance processes, regulatory design and cost modeling, valuation, cost of capital,

In terms of geographical coverage, Tom's clients have included businesses and government agencies in Australia, Japan, the UK, France, Belgium, the Netherlands, New Zealand, Macau, Singapore and the Philippines. Selected assignments include:

Recent

Advising NSW, ACT and Tasmanian electricity transmission and distribution businesses on the cost of capital generally and how to estimate it in the light of the global financial crisis.

Advice in relation to the appeal by the above businesses of the AER determination.

Expert testimony to the Federal Court of Australia on alleged errors made by the Australian Competition and Consumer Commission (ACCC) in estimating the cost of capital for Telstra (the incumbent telecommunications provider). Testimony quoted approvingly in the judgment found against the applicant.

Advice to T-Mobile (Deutsche Telekom) on the cost of capital for mobile operators operating in Western Europe.

Advising Optus and TERRiA on the cost of capital to be used in developing their tender to build the next generation fibre to the node (FTTN) broadband network in Australia.

Advising Vivendi on the correct cost of capital to use in a discounted cash flow analysis in a damages case being brought by Deutsche Telekom.

Advising the Energy Networks Association on cost of capital issues in the context of the Australian Energy Regulator (AER) five year review of the cost of capital in the NER.

Advising Telecom New Zealand on cost of capital issues associated with the cost of providing the New Zealand universal service obligation (TSO).

Advising Queensland Rail on its cost of capital submission to the QCA.

2007

Advising the Victorian gas distributors in relation to their response the ESCV's draft decision on the cost of capital (four reports).

Advising the Energy Networks Association on the appropriate estimation technique for the risk free rate used in CAPM modeling (two reports).

Advising on the cost of capital for Victorian electricity distributors' metering operations.

Earlier

Advising the Australian Energy Regulator on the cost capital issues in relation to the RBP pipeline access arrangement.

Advising the ENA on the relative merits of CBASpectrum and Bloomberg's methodology for estimating the debt margin for long dated low rated corporate bonds.

Advising the Australian Competition and Consumer Commission, Australia on the correct discount rate to use when valuing future expenditure streams on gas pipelines.

Tom Hird | Director | C E G

| T: + +61 3 9505 3828| M: 0422 720 929
| E: tom.hird@ceg-ap.com

Detailed Project Experience

Market Design and Competition Analysis

2009 **Webb Henderson, Australia**
Setting reserve prices for auction of digital radio spectrum
Provided advice, which was adopted, in relation to the appropriate reserve price for the November 2009 auction of digital radio spectrum across Australia.

2009 **AMP, Australia**
Analysis of competition in the market for superannuation services
Providing advice to AMP for submission to the Cooper Review into the governance, efficiency, structure and operations of Australia's superannuation system. This included as survey of the competitive structure of the industry and an assessment of how, if at all, competition was less effective at serving customer needs in this market than other unregulated markets.

2009 **JWS, Australia**
Analysis of a 'competitive margin' in contract resetting
Providing expert statements on the appropriate estimate of a risk adjusted margin in the context of services provided by United Water to SA Water where the contract specified that the margin must be reset consistent with what would be found in a competitive market.

2009 **Gilbert + Tobin, Australia**
BHPB proposed joint venture with Rio Tinto
Providing expert statements and empirical analysis on the likely impact of the merger on the prices of iron ore and coking coal. Expert statements to be provided to ACCC, European Commission and US regulators. Also providing commentary and advice on the formulation of reports by NERA (in Japan and the US) and Frontier (in Europe).

2009 **Chapman Tripp, New Zealand**
Advice on the proper design of a multiproduct imputation test
Providing advice on the conceptual design and practical implementation of an imputation test for a client of Chapman Tripp with multiple retail and wholesale products where a position of dominance in the provision of some, but not all, wholesale products.

2009 **AGCOM, Italy**
Design of imputation test
Providing expert advice to AGCOM (the Italian Communications Authority) on the design of an imputation test to be applied in relation to Telecom Italia's retail and wholesale prices.

2009 **Gilbert + Tobin, Australia**
Analysis of proposed transaction in relation to small industrial packaging
Providing expert statements and empirical analysis on the substitutability between different types of small industrial packaging.

2009 **Chapman Tripp, New Zealand**
Expert testimony in Vodafone appeal of Commerce Commission decision
Providing expert testimony on the correct economic interpretation of a competitive price level (and price path) in relation to services provided by Telecom New Zealand.

2009 **Minter Ellison, Australia**
Interpretation of 'promotion of economically efficient use of infrastructure'
Advice on the proper interpretation of 'promotion of economically efficient use of infrastructure' in the context of Telstra's claim that it should be exempted from supplying regulated wholesale services to Optus in areas where Optus, it was argued, could commercially extend its competing HFC cable.

2009 **Van Bael & Bellis, EU**
Proposed transaction between GSK and Astra Zeneca
Provided market modelling of the effect of a concentration between Glaxo Smith Kline and Astra Zeneca in relation to certain common pharmaceutical product lines.

2008 **Gilbert + Tobin, Australia**
BHPB proposed merger with Rio Tinto
Providing expert statements and empirical analysis on the likely impact of the merger on the prices of iron ore and coking coal. Outputs included submissions made to the European Commission, the ACCC and the KFTC (Korean competition regulator) and responses to detailed questions from the European Commission.

2008 **Scottish Power, UK**
Purchase of British Energy Nuclear Power Plants
Providing electricity market modelling, to inform a competition law assessment, of the impact on competition if Scottish Power were to purchase various combinations of British Energy's nuclear power plants.

2008 **Gilbert + Tobin, Australia**
Industrial Packaging
Providing an expert report to Gilbert + Tobin on the competitive implications of a merger involving large industrial packaging.

2008 **Vivendi, European Union**
Damages in Mobile Telephony Market
Providing expert critique of a proposed damages claim being brought by Deutsche Telecom against Vivendi in relation to alleged unlawful activity in a Polish mobile telephony joint venture.

2008 **MGF Webb, Australia**
Mobile Termination
Advising on a range of competition matters relating to mobile termination including an assessment of the potential basis for company specific exemptions from regulation of mobile termination.

2007 **"G9" Group of Telecommunications Carriers**
Regulatory Undertaking to Build and Operate a FTTN Network in Australia
Advising the G9 on competition analysis associated with the construction and operation of a FTTN network. Developing an regulatory Undertaking under the Australian Trade Practices Act describing the proposed operation of the FTTN. Providing an expert report on the economic benefits associated with the proposed undertaking.

2007 **Gilbert + Tobin, Australia**
Merger Analysis – New Steel Drum Manufacture
Providing expert opinion to Gilbert + Tobin on the competitive implications of a merger involving new steel drum manufacture.

2006 **Melbourne Water Industry, Australia**
Market Design – Bulk Water Sector
Developing reform proposals to facilitate the introduction of tradeable bulk water rights to the Melbourne system – including the specification of operational market rules.

2006 **Australian Competition and Consumer Commission, Australia**
Merger Analysis – Electricity Industry
Advising the Australian Competition and Consumer Commission (ACCC) on the competitive implications of a proposed merger in the electricity sector.

2006 **Minter Ellison, Australia**
Section 46 of the TPA - Telecommunications
Providing expert opinion in relation to an action under Section 46 of the Trade Practices Act.

2005 **Philips Fox, Australia**
Merger Analysis - Telecommunications Industry
Advising the merging firms on the competitive implications of that merger.

2005 **AirServices Australia (ASA), Australia**
Review of Pricing Conduct
Providing expert opinion to ASA on pricing for its services at Australian Airports. Including an examination of allegations that pricing contravened National Competition Agreements.

2001-05 **TransGrid, Australia**
Market for transmission
Analysis of the design of the National Electricity Market (NEM) and its implications for efficient investment in generation and transmission assets. This work has involved providing private advice to TrnasGrid as well as public policy documents such as drafting TransGrid's submission to the US energy regulator (FERC) on market design.

2005 **Confidential, Australia**
Competition Assessment of Pricing Strategy
Advising a large corporate on the economic implications of the Trade Practices Act for its pricing conduct.

2005 **Australian Competition and Consumer Commission, Australia**
Competition Assessment of Electricity Generation Merger
Advised the ACCC on the competition concerns (and potential remedies) associated with a specific proposed merger of electricity generation interests.

2004 **Australian Competition and Consumer Commission, Australia**
Competition Impact of Exclusive Rights to Content
Provided a public report to the ACCC on the competition concerns (and potential remedies) associated with the use of exclusive rights to content by incumbent telecommunications infrastructure owners.

2004 **Australian Competition and Consumer Commission, Australia**
Empirical Evidence of Predatory Pricing in Telecommunications
Provided the ACCC with an expert report that developed an imputation test framework and empirical model to test allegations of predatory pricing of broadband services.

2003-04 **Singtel Optus, Australia**
Expert Report on Market Definition and Existence of Market Power in Mobile Termination
Provided Optus with an expert report on the appropriate market definition to use in analysing competition between mobile network operators in providing terminating access.

2003-04 **Singtel Optus, Australia**
Expert Economic Advice on Competition Complaint
Providing Optus advice on a confidential competition complaint relating to the exercise of market power by one of Optus' competitors.

2001-03 **Qantas**
Advice on Competition Law and Predation Allegations
Provided input into NERA's advice in relation to allegations of anticompetitive behaviour under section 46 of the Trade Practice Act.

2002 **National Competition Council (NCC), Australia**
Exploitation of Market Power by a Gas Pipeline
Provided a report to the NCC in which we developed a number of tests for whether current transmission prices were evidence of the exploitation of market power by a gas transmission pipeline. Also provided a separate report that applied these tests. This analysis was used to

inform the NCCs decision on whether to recommend the pipeline in question be subject to regulation under the Australian Gas Code.

2002 **Screenrights, Australia**
Advice on methodologies used to estimate the value of retransmitting copyright content contained in local free-to-air broadcast.

Cost of Capital Issues

2010 **Envestra, Australia**
Cost of Capital
Advising the Envestra on the appropriate cost of capital under the National Gas Code.

2010 **ActewAGL, Australia**
Cost of Capital
Advising the ActewAGL on an appeal of the AER's decision in relation to the cost of debt under the National Gas Code.

2010 **DHA, Australia**
Cost of Capital
Advising the DHA on the cost of capital it should use in assessing the NPV of potential projects.

2010 **T-Mobile, France**
Cost of Capital
Advising the T-Mobile on the appropriate cost of capital for mobile telecommunications services in France.

2010 **Jemena Gas Networks, Australia**
Cost of Capital
Advising on the cost of capital for gas distribution business and AER's Final Determination.

2010 **Citipower and Powercor, Australia**
Cost of Capital
Advising on the cost of capital for electricity distribution business and the appropriate response to the AER's Draft Determination.

2009 **ETSA, Australia**
Cost of Capital
Advising ETSA on the cost of capital for its South Australian electricity distribution business and the appropriate response to the AER's Draft Determination.

2009 **NSW, Tasmanian and ACT electricity businesses, Australia**
Cost of Capital
Advising NSW, ACT and Tasmanian electricity transmission and distribution businesses on the cost of capital generally and how to estimate it in the light of the global financial crisis.

2009 **Gilbert and Tobin, Australia**
Cost of Capital
Advice in relation to the appeal by the above businesses of the AER determination. With expert advice quoted approvingly in the ACT judgment in favour of the applicants.

2009 **Philips Fox, Australia**
Cost of Capital
Expert report submitted to the AER on the issue of how to estimate the cost of 10 year BBB+ debt (as required under the NER) given divergence between fair value estimates from the Bloomberg and CBASpectrum data services. The context was a decision in relation to Advanced Metering Infrastructure.

2009 **Envestra, Australia**
Cost of Capital
Advice on the implications of the global financial crisis on methodologies for estimating of the cost of capital.

2009 **Herbert Geer and Rundle, Australia**
Cost of Capital

Expert testimony to the Federal Court of Australia on alleged errors made by the Australian Competition and Consumer Commission (ACCC) in estimating the cost of capital for Telstra (the incumbent telecommunications provider). Testimony quoted approvingly in the judgment.

2009 **T-Mobile, European Union**
Cost of Capital
Advice to T-Mobile (Deutsche Telekom) on the cost of capital for mobile operators operating in Western Europe.

2009 **Joint Industry Associations, Australia**
Cost of Capital
Advising the Energy Networks Association on cost of capital issues in the context of the Australian Energy Regulator (AER) five year review of the cost of capital in the NER. Multiple reports covering issues such as: dividend growth estimates of the market risk premium, appropriate selection of the risk free rate, appropriate term for the measurement of equity and debt costs, impact of the financial crisis on the cost of capital, empirical testing of the accuracy of the capital asset pricing model (CAPM), conceptual discussion of the theoretical purity of the implementation of the CAPM in AER analysis.

2009 **Telecom New Zealand, Australia**
Cost of Capital
Advising Telecom New Zealand on cost of capital issues associated with the cost of providing the New Zealand universal service obligation (TSO).

2009 **Queensland Rail, Australia**
Cost of Capital
Advising Queensland Rail on its cost of capital submission to the QCA.

2009 **Gilbert + Tobin, Australia**
Cost of Capital
Advising Gilbert+Tobin/Japanese Steel mills on competitive impact of proposed transactions between BHPB and Rio Tinto. Including analysis of the impact of the global financial crisis on this analysis. Reports provided to both Australian and European regulators.

2009 **Gilbert and Tobin, Australia**
Cost of Capital
Advice on estimation of the cost of capital in the context of the AER's regulatory review of revenues for ETSA, Ergon and Energex.

2008 **Optus/TERRiA, Australia**
Cost of Capital
Advising Optus and TERRiA on the cost of capital to be used in developing their tender to build the next generation fibre to the node (FTTN) broadband network in Australia.

2008 **Vivendi, Poland**
Cost of Capital
Advising Vivendi on the correct cost of capital to use in a discounted cash flow analysis in a damages case being brought by Deutsche Telekom.

2008 **The Energy Networks Association, Australia**
Cost of Capital
Advising the Energy Networks Association on cost of capital issues in the context of the Australian Energy Regulator (AER) five year review of the cost of capital in the NER.

2008 **Telecom New Zealand, Australia**
Cost of Capital
Advising Telecom New Zealand on the appropriate estimation of the cost of capital associated with capital assets used to provide its universal service obligations.

2008 **Queensland Rail, Australia**
Cost of Capital
Advising QR on the appropriate estimation of the cost of capital associated with capital assets used to provide rail transport services

2008 **Transend, Australia**
Cost of Capital
Advising Transend on the appropriate estimation of the cost of capital associated with capital assets used to provide electricity transmission services.

2008 **Energy Australia, TransGrid, Country Energy and Integral Energy, Australia**
Cost of Capital
Advising on the appropriate estimation of the cost of capital associated with capital assets used to provide electricity transmission and distribution services.

2008 **ActewAGL, Australia**
Cost of Capital
An expert report describing the appropriate method for deriving a real risk free rate in the CAPM.

2007 **Electranet, Australia**
Cost of Capital
An expert report describing the appropriate method for deriving a real risk free rate in the CAPM.

2007 **Envestra, SP Ausnet and Alinta, Australia**
Cost of Capital
Three expert reports in response to the Victorian Essential Services Commission's cost of capital decision for Victorian gas distributors. Issues covered included: estimation of the appropriate equity beta, the appropriate form of the CAPM to be used, the use of non-CAPM asset pricing models, the estimation of the risk free rate from Government bond data.

2007 **Energy Networks Association, Australia**
Cost of Capital
Two expert reports with Professor Grundy identifying and quantifying the existence of a bias in the use of Australian Government bond yields as a proxy for the CAPM risk free rate.

2006 **ACTEW Corporation, Australia**
Cost of Capital
Advising on the cost of capital for ACTEW's water and waste water operations.

2006 **AER, Australia**
Cost of Capital
Advising on the cost capital issues in relation to the RBP pipeline access arrangement.

2006 **Integral Energy, Australia**
Cost of Capital
Advising on the cost of capital for Integral's retail operations.

2006 **Telecom New Zealand, New Zealand**
Cost of Capital
Advising on the cost capital issues in relation to TSO.

2005 **Energy Networks Association, Australia**
Debt Margin
Advising on the relative merits of CBASpectrum and Bloomberg's methodology for estimating the appropriate debt margin for long dated low rated corporate bonds.

2005 **The Victorian ESC, Australia**
Cost of Capital

Advice on the cost of capital for electricity distribution network assets.

2005 **Prime Infrastructure, Australia**
Weighted Average Cost of Capital
Provided a report for Prime Infrastructure critiquing the QCA's draft cost of capital decision for Queensland electricity distribution.

2004 **The Australian Competition and Consumer Commission, Australia**
Cost of Capital
Provided a report advising on the correct discount rate to use when valuing future expenditure streams on gas pipelines.

2004 **ETSA Utilities, Australia**
Weighted Average Cost of Capital
Provided a report for ETSA examining the use of historical proxy betas.

2004 **ActewAGL, Australia**
Weighted Average Cost of Capital
Provided a report for ActewAGL estimating its weighted average cost of capital for regulated activities (gas distribution).

2004 **TransGrid , Australia**
Debt Margin
Provided a report critiquing CBASpectrum's methodology for estimating the appropriate debt margin for long dated low rated corporate bonds.

2004 **Prime Infrastructure, Australia**
Weighted Average Cost of Capital
Provided a report for Prime Infrastructure the weighted average cost of capital for its regulated activities (coal shipping terminal).

2004 **ActewAGL, Australia**
Debt Margin
Provided a report for ActewAGL advising on the appropriate calculation of debt margins for BBB+ ten year bonds.

2003 **Electricity Transmission Service Providers, Australia**
Expert Report on the Use of Historical Proxy Betas
Critique of the ACCC's statistical interpretation of historical proxy beta in its review of the Statement of Principles for the Regulation of Transmission Revenues.

2003 **Orion, New Zealand**
Cost of Capital
Critique of Associate Professor Lally's advice on the Cost of Capital for New Zealand Electricity Distribution.

2003 **TransGrid, Australia**
Expert Report on TransGrid's WACC
Advising TransGrid on the appropriate weighted average cost of capital (WACC) for its regulated assets

2003 **EnergyAustralia, NSW, Australia**
Advice on Financial Capital Maintenance
Advising EnergyAustralia on issues relating to its appropriate WACC and the modelling of cash flows to ensure the expected present value of future net revenues was equal to the value of the regulated asset base.

2002 **Rail Access Corporation, Australia**
Hurdle Rates of Return

Advising rail access corporation on the appropriate hurdle rates of return that should be applied when assessing competing investments.

2002 **Integral Energy, Australia**
Return on Capital
Advising Integral Energy on what risk adjusted regulatory return on capital is necessary to provide sufficient incentive to invest in new infrastructure assets.

2001 **TransGrid, Australia**
Advice on ACCC's Powerlink WACC decision
A report critically appraising the ACCC's decision regarding Powerlink's weighted average cost of capital (WACC).

2001 **Optus, Australia**
Affidavit on Telstra's PSTN WACC
Providing expert testimony to the Australian Competition Tribunal on Telstra' use of the CAPM model to determine an appropriate rate of return on PSTN assets.

2001 **Australian Competition and Consumer Commission, Australia**
International Comparison of WACC Parameters
Preparation of a report on international and domestic WACC parameters and the potential impact of variations in declared WACCs on incentives to invest in various regulatory jurisdictions.

General Regulatory Analysis

2009 **ETSA, Australia**
Cost modelling
Advice to ETSA on modelling of its cost of service.

2009 **Digicel, Samoa**
Cost modelling
Developing a cost model for Digicel in relation to the cost of providing mobile termination in Samoa.

2009 **ActewAGL, Australia**
Cost modelling
Advice to ActewAGL on modelling of its cost of service including in relation to forecasts for costs faced by its gas distribution business over the forthcoming regulatory period.

2009 **Country Energy, Australia**
Cost modelling
Advice to Country Energy on modelling of its cost of service including in relation to forecasts for costs faced by its gas distribution business over the forthcoming regulatory period.

2009 **Vodafone, Fiji**
Cost modelling
Developing a cost model for Vodafone in relation to the cost of providing mobile termination in Fiji.

2009 **Jemena, Australia**
Cost modelling
Advice to Jemena on modelling of its cost of service including in relation to forecasts for costs faced by its gas distribution business over the forthcoming regulatory period.

2009 **Integral, Australia**
Cost modelling
Advice to Integral on whether their pricing structure was consistent with the requirements of the National Electricity Rules in relation to, inter alia, consistency with reflecting long run marginal cost and each tariff being set at a level between standalone and avoidable cost.

2008 **Telecom New Zealand, New Zealand**
USO Reform
Advise Telecom NZ on all aspects of universal service obligation reform, including: the appropriate level of obligations; the use of contestable models of provision, alternative funding models, costing of the obligations.

2008 **Envestra, Australia**
Related party transaction
Expert statement assessing the reasonableness of an alleged related party transaction entered into by Envestra to outsource its operating and maintenance activities to Origin Energy.

2008 **Energy Australia, TransGrid, Country Energy and Integral Energy, Australia**
Cost modelling
Advice to these businesses on modelling of its cost of service including in relation to forecasts of costs over the forthcoming regulatory period.

2008 **Digicel, PNG**
Cost modelling
Developing a cost model for Digicel in relation to the cost of providing mobile termination in Fiji.

2008 **Transend, Australia**
Cost modelling
Advice to Transend on modelling of its cost of service including in relation to forecasts for costs over the forthcoming regulatory period.

2008 **Electranet, Australia**
Cost modelling
Advice to Electranet on modelling of its cost of service including in relation to forecasts for costs over the forthcoming regulatory period.

2007 **T-Mobile, UK**
Mobile termination cost modelling
Advise T-Mobile on BT's appeal of the UK Commerce Commission's determination on teh cost of mobile termination (specifically in relation to the treatment of 3G spectrum).

2008 **SingTel Optus, Australia**
Mobile cost modelling
Advise SingTel Optus on the (TSLRIC) cost of mobile termination in Australia. This involves detailed telecommunication cost modelling and conceptual analysis. CEG's cost model is to be used to underpin SingTel Optus' price undertaking to the Australian Competition and Consumer Commission.

2007 **GSME, Europe**
USO reform
Developing and drafting of submission to the European Commission by the GSME on all aspects of universal service obligation reform, including: the appropriate level of obligations; the use of contestable models of provision, alternative funding models, costing of the obligations.

2007 **SingTel Optus, Australia**
FTTN
Advise SingTel Optus on all regulatory and competition issues associated with the construction of a FTTN network. Issues include – costing, form of price controls, capital raising and the cost of capital, drafting of undertakings, expert reports submitted to the regulator (Australian Competition and Consumer Commission).

2007 **Communications Alliance, Australia**
USO reform
Developing and drafting of submission to Government by the Communications Alliance (an industry body covering incumbent and new entrant fixed and mobile carriers) on all aspects of universal service obligation reform, including: the appropriate level of obligations; the use of contestable models of provision, alternative funding models, costing of the obligations.

2006-07 **GDSE, Macau, SAR PRC**
Efficient Electricity Tariff Reform
Advise the Macau regulator (GDSE) on efficient tariff reform for the vertically integrated generation and network provider. This involved estimating the LRMC on maximum demand and translating this into efficient tariff designs given relevant constraints (eg, metering constraints).

2005-06 **Integral Energy, Australia**
Efficient Electricity Tariff Reform
Advise Integral Energy on its LRMC of meeting growing network demand and on how this could be reflected in efficient tariff design (including design of critical peak pricing).

2005 **Telecom New Zealand, New Zealand**
Modelling of New Entrant Costs for TSO
Provide expert reports on the correct methodology for calculating the cost of providing the TSO (universal service obligation) using new entrant costs.

2005 **Telecom New Zealand, New Zealand**
Operating Cost Benchmarks
Advised Telecom on appropriate operating cost benchmarks for telecommunications services

2005 **TransGrid, Australia**
Capital Expenditure Indexation
Advised TransGrid on the development of a price index to reflect movements in the unit costs of inputs into its capital expenditure program.

2005 **TransGrid, Australia**
Forecast of Capital Expenditure
Advised TransGrid on appropriate adjustments to forecast capital expenditure to take account of material increases in demand for investment in future Australian electricity infrastructure.

2005 **TransGrid, Australia**
ACCC's Capital Expenditure Regime
Advised TransGrid on the ACCC's proposed regulatory regime to apply to capital expenditure.

2005 **Actew, Australia**
Financing of New Infrastructure
Advised Actew on options for financing new infrastructure.

2004 **Telecom New Zealand, New Zealand**
Avoided Retail Cost Study
Developing an avoided cost study associated with Telecom's fixed line retail activities.

2004 **TransGrid, Australia**
Fair Sharing of Efficiency Gains
Provided a report to TransGrid advising on whether the ACCC's draft decision was consistent with the National Electricity Code's requirement that there be a 'fair sharing' of efficiency gains.

2004 **Australian Competition and Consumer Commission, Australia**
Asset Valuation Report
Provided an expert report to the ACCC on the calculation of depreciated optimised replacement cost (DORC) in the context of the EAPL's appeal of the ACCC's valuation of its Moomba to Sydney pipeline.

2004 **ESCOSA, Australia**
Incentive Regulation
Provided ESCOSA with a report on the appropriate mechanism to provide ETSA Utilities with an incentive to achieve cost reductions in operating and capital expenditure.

2004 **Perisher Blue Ltd, Australia**
Review of Municipal Services
Assisted PBL with its submission to IPART on the review of municipal services (roads, waste, water and sewerage) at the Perisher Blue Resort.

2004 **TransGrid, Australia**
ACCC Regulatory Review
Assisted TransGrid in drafting its Application to the ACCC for regulated revenues and in its response to the ACCC's draft decision.

2003 **Telecom New Zealand, New Zealand**
Expert Report on Efficient Recovery of CSO Costs
Provided Telecom with a report stepping through all the information necessary to administer SO costs in a manner consistent with "Ramsey efficient" pricing. The purpose of this was to inform the NZ Commerce Commission of the practical difficulties associated with pursuing such an outcome.

2003 **EnergyAustralia, NSW, Australia**
Advice on Financial Capital Maintenance
Advising EnergyAustralia on issues relating to its appropriate WACC and the modelling of cash flows to ensure the expected present value of future net revenues was equal to the value of the regulated asset base.

2003 **Optus, Australia**
Critique of Telstra's Access Undertaking for PSTN Services
Advising Optus in relation to the reasonableness of Telstra's cost modelling assumptions underlying its access undertaking for PSTN services.

2003 **Optus, Australia**
Indicative Pricing Principles
Advising Optus in relation to appropriate pricing principles the ACCC should adopt when establishing indicative prices for access to PSTN services.

2003 **Optus, Australia**
Estimation and Recovery of Telstra's Access Deficit
Provided a report to the ACCC on behalf of Optus addressing the appropriate measurement of any 'access deficit' that may exist between the cost to Telstra of its access network and the revenues associated with that network. Also examined the most appropriate recovery methodology for any access deficit.

2003 **Rail Infrastructure Corporation, NSW, Australia**
Expert Report on Hurdle Rates of Return
Advising RIC on the appropriate WACC each division should use as a hurdle rate of return when assessing competing capital projects.

2003 **Telecom New Zealand, New Zealand**
Expert at Commerce Commission Hearing
Provided expert testimony to the NZ Commerce Commission on the appropriate calculation of a wholesale discount for regulated services.

2002 **Telecom New Zealand, New Zealand**
'Intelligent' Wholesale Benchmarking Report
Carried out a benchmarking survey and provided a report to the New Zealand Commerce Commission on behalf of Telecom New Zealand. This report adjusted wholesale prices in the United States for differences in cost drivers (in terms of the cost of capital and labour) compared to New Zealand.

2003 **TransGrid, NSW Australia**
Submission to the ACCC's Review of the Regulatory Test
Advised TransGrid in response to the ACCC's Discussion Paper on the review of the regulatory test. Tom prepared a report which commented both on the ACCC's proposal to amend the regulatory test to improve clarity and to ensure consistency with the provisions in the National Electricity Code, and also on the ACCC's proposed options for incorporating 'competition benefits' in the regulatory test.

2003 **Clayton Utz, TransGrid, NSW, Australia**
Murraylink's Application for Regulated Status
Tom advised TransGrid and Clayton Utz in responding to Murraylink's Application to the ACCC for regulated status, and, in particular, Murraylink's use of the regulatory test to derive a regulatory asset value.

Tom also advised TransGrid in responding to the ACCC's Preliminary View on Murraylink's Application, and helped draft a further report commenting on aspects of the ACCC's approach.

2001-03 **TransGrid, NSW, Australia**
Application of the regulatory test to network augmentation in the Western Area
Advised TransGrid on the application of the regulatory for intra-regional network augmentation planned for the Western Area of NSW. The application highlighted issues in applying the regulatory test in a situation where an agreed reliability standard is not currently met.

2002 **Telecom New Zealand, New Zealand**
Interconnection Pricing
Advised Telecom New Zealand on the potential forms of price control the New Zealand Commerce Commission could adopt in regulating PSTN interconnection prices.

2002 **Telecom New Zealand, New Zealand**
'Intelligent' Interconnection Benchmarking Report
Carried out a benchmarking survey and provided a report to the New Zealand Commerce Commission on behalf of Telecom New Zealand. This report adjusted interconnection prices in Europe, Australia and the United States for differences in cost drivers (in terms of switching and transmission economies of scale, transmission link lengths and the cost of capital and labour) compared to New Zealand.

2002 **SPI PowerNet, Australia**
Design of Efficiency Carryover Mechanism
Advised SPI PowerNet on the appropriate design of an efficiency carryover mechanism intended to share efficiency gains between a regulated business and its customers.

2002 **SPI PowerNet, Australia**
ReOptimisation of Transmission Assets
Advised SPI PowerNet on the appropriate approach to calculating the value of assets previously optimised out of its regulatory asset base and now being "un-optimised" due to greater utilisation levels of those assets.

2002 **SPI PowerNet, Australia**
Adviser on Revenue Reset Application
Advised SPI PowerNet on a range of high level issues in relation to their regulated revenue reset application, including appropriate drafting and consistency of argument throughout the document. Presented aspects of SPI PowerNet's application to the ACCC and in an ACCC sponsored regulatory public forum.

2002 **Telecom New Zealand, New Zealand**
Review of Interconnection Benchmarking Report
Advised Telecom New Zealand on issues arising out of an Interconnection Benchmarking report commissioned by the Commerce Commission of New Zealand for the purpose of setting interim interconnection charges. This role included the submission of a report to the Commerce Commission and presentation of the findings of that report at a Commerce Commission hearing.

2002 **Australian Pipeline Trust, Australia**
Expert Advice on CPI Indexation
Advised APT in relation to a dispute with customers on the appropriate CPI indexation adjustment of prices for the impact of the GST required under the Trade Practices Act.

2002 **EnergyAustralia, Australia**
Pricing Strategy Under a Price Cap
Advised EnergyAustralia on the commercial implications for pricing strategies under a weighted average price cap.

2001 **IPART, Australia**
Minimum Standards in Regulation of Gas and Electricity Distribution
Advised the NSW regulator on the appropriate role of minimum standards in regulatory regimes and how this could be practically implemented in NSW.

2001-03 **Rail Infrastructure Corporation, New South Wales**
Preparation of access undertaking
Advised on all economic aspects arising in the preparation of an access undertaking for the New South Wales rail network. Issues arising include: pricing principles under a `negotiate and arbitrate' framework, asset valuation, efficient costs, capacity allocation and trading, and cost of capital.

2001 **Australian Competition and Consumer Commission, Australia**
Determination of Local Call Resale Prices
The ACCC's expert regarding the determination of local call resale prices from Telstra's fixed line network. This involved the application, and manipulation, of the Australian incumbent's (Telstra's) regulatory accounting framework to determine appropriate wholesale prices.

2001 **All NSW electricity distribution businesses, Australia**
Form of Price Control
Advice on the economic efficiency implications of various forms of price control that can be applied under the National Electricity Code.

2001 **Wesfarmers, Australia**
Expert Advice on Reasonable Cost Recovery
Advising Wesfarmers in relation to a dispute with customers on reasonable recovery of costs of coal production.

2001 **Integral Energy, Australia**
Pricing Strategy Paper
Advising on appropriate pricing strategy for Integral's electricity distribution business, including advice on an appropriate regulatory engagement strategy.

2001 **TransGrid, SPI PowerNet and GPU GasNet, Australia**
CPI Indexation Adjustment
Advice on the appropriate CPI indexation adjustment for the impact of the GST required under the Trade Practices Act.

2001 **All NSW gas and electricity distribution businesses, Australia**
CPI Indexation Adjustment
Advice on the appropriate CPI indexation adjustment for the impact of the GST required under the Trade Practices Act.

2000 **One.Tel, Australia**
ULL Pricing
Advising OneTel in their arbitration with Telstra on pricing for access to the unbundled local loop.

2000 **Electricity Supply Association of Australia and Australian Gas Association,**
Adjusting the Regulatory Regime for the Impact of Tax Reform
Advised the peak energy bodies on the implications of tax reform on their members under the Trade Practices Act.

2000 **Victorian Department of Treasury and Finance, Australia**
State Business Tax Reform
Advised the Department of Treasury and Finance on State business tax reform including in relation to the relative economic costs associated with payroll, stamp duty and other transaction taxes.

1999 **Independent Pricing and Regulatory Tribunal of NSW**
Various energy regulation issues
Advice on a range of issues in regulation of the NSW energy sector.

1990-99 **Commonwealth Treasury, Australia**

Various economic policy issues
Provided input in the formulation of a number of economic policies. These included: the year 2000 reforms of the Australian indirect and corporate tax regimes; reform of the social security system and labour market regulation; economic forecasting and monetary policy monitoring; reform to the regulation of the Australian financial system.

General Policy Analysis

2007 **Brotherhood of St Laurence, Australia (*pro bono*)**
Analysing disadvantage by electorate
An analysis of the social disadvantage by Australian federal electorate. The objective was to promote a program ("HIPPY") aimed at tackling disadvantage. The then opposition Labor party (now Government) announced it would fund the program the same afternoon as our report released.

2007 **Menzies Institute, Australia**
Hidden Costs of Stamp Duty
An analysis of the hidden economic costs of state government stamp duty on residential property transactions – including in terms of labour force mobility.

2003 **Betfair, UK**
The Impact of Internet Betting Exchanges on the Racing Industry
This project involved estimating bounds for the price elasticity of demand for wagering in Australia and using these to determine the likely impact of licensing internet betting exchanges to compete with existing TAB wagering operations. This project also involved modelling the impact on wagering tax rates required to achieve revenue neutrality under various prices elasticity scenarios.

2002 **Marsh, Australia**
The Impact of Taxation on Levels of Property Insurance
This project involved estimating the number of uninsured households destroyed in the recent NSW bushfires that would otherwise have been insured if the only tax insurance premiums were subject to was GST. The methodology used was based on evidence from studies of the price responsiveness of demand for property insurance in the US and Australian evidence on the proportion of people without home or contents insurance.

Educational Services

2006 **RMIT University, Australia**
Economics Unit for MBA
Developed the course materials for the economics unit in RMIT's MBA course.

Speeches and presentations

2010 **Energy Networks Association, Melbourne**
Setting the cost of debt for Australian energy businesses

2007 **Energy Networks Association, Melbourne**
Setting the cost of capital for Australian energy businesses

2005 **International Telecommunications Society regional Conference, Perth**
Stepping over the Competitive Line

2005 **ACCC Regulatory Conference, Gold Coast**
Exclusive Rights to Content and Competition in Telecommunications

2004 **Office of the Water Regulator, Perth**
Cost Benchmarking – Practical Pitfalls

2004 **Macquarie Bank, Terrigal**
Internal presentation on regulatory risk across jurisdictions and industries

2003 **ACCC Regulatory Conference, Gold Coast**
Anticompetitive Pricing in Telecommunications

2003 **ACCC Conference on SPI PowerNet Regulatory Decision**
Operation of the efficiency carryover

2002 **International Telecommunications Society regional Conference, Perth**
TSLRIC Regulation and Leverage of Market Power

JOHNSON WINTER & SLATTERY
LAWYERS

Partner: Anthony Groom +61 8 8239 7124
Email: anthony.groom@jws.com.au
Associate Jessica Teoh +61 8 8239 7173
Email: jessica.teoh@jws.com.au
Our Ref: A3170

27 September 2010

Dr Tom Hird
Competition Economists Group
408/147 King Street
SYDNEY NSW 2000

Dear Dr Hird

Envestra Limited – South Australian and Queensland Access Arrangement Reviews

We act for Envestra Limited in relation to the AER's review of Envestra's Access Arrangement for South Australia and Queensland.

As you have discussed with Envestra, Envestra Limited wishes to engage you to prepare an expert report in connection with the AER's review of Envestra's Access Arrangement for South Australia and Queensland.

This letter sets out the matters which Envestra Limited wishes you to address in your report and the requirements that report must comply with to be capable of use in the AER review.

Terms of Reference

The charges and terms upon which Envestra provides access to its network are subject to five yearly reviews by the AER.

A key input into the determination of the charges Envestra is entitled to levy is the rate of return on the capital employed by Envestra. This rate of return is to be determined by the AER having regard to the criteria set out in the National Gas Law and National Gas Rules.

In respect of the rate of return, Envestra wishes to engage you to prepare an expert report addressing the following matters:

(a) what cost of equity you, as an expert economist, consider meets the criteria in rules 87(1) and 87(2) of the National Gas Rules;

(b) the appropriate financial model to apply in determining the cost of equity, having regard to the criteria in rules 87(1) and 87(2); and

(c) the appropriate manner in which to determine the cost of equity having regard to the provisions of rules 87(1) and 87(2).

Use of Report

It is intended your report will be included by Envestra in its access arrangement submission to the AER. The report may be provided by the AER to its own advisers.

The report must be expressed so that it may be relied upon both by Envestra and by the AER.

The report will be reviewed by Envestra's legal advisers and will be used by them to provide legal advice to Envestra as to its rights and obligations under the National Gas Law and National Gas Rules. You will be required to work with these legal advisers and Envestra personnel to assist them prepare Envestra's access arrangement submission and submissions in response to the draft and final decisions made by the AER.

Compliance with the Code of Conduct for Expert Witnesses

Attached is a copy of the Federal Court's Practice Note CM 7, entitled "Expert Witnesses in the Federal Court of Australia", which comprises the code of conduct for expert witnesses in the Federal Court of Australia (**the Code of Conduct**).

Please read and familiarise yourself with the Code of Conduct and comply with it at all times in the course of your engagement by Envestra.

In particular, your report prepared for Envestra should contain a statement to the effect that the author of the report has read the Code of Conduct and agrees to comply with it.

Your report must also:

1. give details of the expert's qualifications and of the literature or other material used in making the report;

2. state all of the questions or issues that the expert has been asked to address;

3. state all of the factual premises upon which the report proceeds; and

4. otherwise comply with the Code of Conduct.

It is also a requirement that the report be signed by the expert and include a declaration that the expert has made all the inquiries which the expert believes are desirable and appropriate and that no matters of significance which the expert regards as relevant have, to the expert's knowledge, been withheld from the report.

Please also attach a copy of these terms of reference to the report.

Terms of Engagement

Your contract for the provision of the report will be directly with Envestra Limited. You should forward to Envestra Limited any terms you propose govern that contract as well as your fee proposal. Your invoices for the production of the report are to be addressed and sent to Envestra Limited.

Contact with us

We request that you contact us or Envestra Limited by telephone in the first instance to discuss any requests for the provision of data or your preliminary conclusions. All enquiries to Envestra Limited should be made to Greg Meredith on (08) 8418 1127 or greg.meredith@envestra.com.au.

Please sign a counterpart of this letter and forward it to Envestra Limited to confirm your acceptance of the engagement by Envestra.

Yours faithfully

Johnson Winter & Slattery

Enclosed: Federal Court of Australia Practice Note CM 7, "Expert Witnesses in Proceedings in the Federal Court of Australia"

T. Hird

.....

Signed and acknowledged on behalf of Competition Economists Group

Date 29 September 2010