WACC Estimation

A report for Envestra

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1. Executive summary

1. There are three areas of primary importance where I disagree with the AER's estimate of the cost of capital. These are:

   - the estimate of the equity beta to be used in the CAPM formula;
   - the weight given to forward looking evidence in determining the equity risk premium; and
   - the reliance given to a small number of observations, particularly the APA bond yield, when estimating the cost of debt.

1.1. Estimate of the equity beta used in the CAPM

2. In my opinion the AER's adoption of an equity beta of 0.8 is flawed on three grounds:

   (i) The AER's estimate is derived from reliance on just six, highly volatile, Australian observations for regulated energy distributors' betas. Moreover:

   - most of these firms have a limited time series of available data; and
   - the AER attempts to give less weight to the highest estimated beta for the Australian sample (HDF) on spurious grounds.

   (ii) The AER's estimate gives little or no weight to up to 77 other equally relevant observations from US regulated energy distributors – the weight of which strongly points towards a beta of 1.0 or more.

   (iii) There is compelling and uncontested evidence, supported by the AER's own experts, that the way in which the AER estimates betas will underestimate the risk for firms with betas less than 1.0 (low beta bias). However, the AER makes no adjustment for this fact.

3. In my view, no reasonable person would constrain the information that they gave weight to in the manner described in points (i) and (ii) above. Similarly, no reasonable person would fail to adjust their methodology for the uncontested fact that it is biased as described in point (iii).

1.2. Estimate of the forward looking risk premium

4. The AER allows a forward looking risk premium for regulated utilities equal to 4.8% (0.80 beta multiplied by a 6.0% MRP) above the 10 year government bond rate. However, forward looking estimates of equity risk premiums for regulated utilities are much higher. Forward looking risk premiums can be estimated from stock prices for regulated utilities and analyst forecasts of dividend payments.

5. For the same regulated utilities that the AER uses to justify a beta of 0.8, the implied forward looking equity risk premiums are at least 7.4% (based on the assumption of

zero long run growth in utility dividends (i.e. falling real dividends)). A 7.4% equity risk premium is consistent with a beta of at least 1.0 in conjunction with an MRP of 7.4%.

1.3. Estimate of the forward looking cost of debt

6. The AER places 50% weight on a single bond, issued by APA Group, and 50% weight on the Bloomberg BBB fair value curve in estimating the cost of debt. It departs from relying only on the Bloomberg fair value curve because it believes that the yields on bonds with maturity greater than 7 years are not consistent with this curve.

7. This methodology places extreme weight on bonds issued by two issuers above the guidance provided by the wider population of 105 bonds and 49 issuers. It relies further upon the exclusion of the relevance of yields on bonds issued by DBCT. In my opinion, neither of the bases to the AER's conclusion can be reasonably sustained, and the best estimate of the debt premium is the Bloomberg BBB fair value curve, extrapolated forward to 10 years.

2. Estimation of the equity beta to be used in the CAPM formula

2.1. Accounting for bias in the AER implementation of the CAPM

8. Consistent with the opinions expressed by Professors Grundy, Davis and Handley:

   i. it is a well accepted empirical fact that the approach to implementing the CAPM used by the AER underestimates the cost of equity for firms with an estimated beta of less than 1.0. That is, low beta firms will have actual returns that are closer to the average of all firms (beta = 1.0) than predicted by the AER's implementation of the Sharpe CAPM;[1] and

   ii. there is a great deal of uncertainty in the theoretical and empirical literature about why this is the case.

9. These two undisputed facts suggest that one should tend to favour a cost of equity estimate that is closer to the 'normal' or 'average' market return (associated with a beta of 1.0) rather than one that follows by a mechanical plugging in of the estimated beta into the CAPM formula. Based on these facts one should tend to implement the CAPM using a beta estimate that is closer to 1.0 than the beta actually estimated from stock market data.

10. The commonly used 'Blume' adjustment does precisely this. Professors Franks and Myers recommended that adjustments of this type be made by the New Zealand Commerce Commission.[2]

> ***Recommendation 33*** *Professors Franks and Myers agree that some form of Bayesian adjustment to beta estimates may be sensible, but do not strongly recommend a specific adjustment method.*

11. Professor Myers explicitly advises the New Zealand Commerce Commission that:[3]

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[1] The AER implements a version of the CAPM that estimates beta using recent stock recent stock market observations over a period of years. It is important to distinguish between this particular implementation of the CAPM and 'the CAPM' in general. This is because, in the AER draft decision and in Handley and Davis' reports, there is considerable discussion devoted to the fact that that one can't be sure that the CAPM, implemented in a different manner, would produce such biased results.

That is, there appears to be confusion about whether the point at issue is:

- Can one be sure that the AER's method of implementing the Sharpe CAPM will result in bias; versus
- Is there some other way of estimating beta such that that implementation of the Sharpe CAPM will be free from bias.

Clearly, only the first issue is relevant to an assessment of the AER's decision. The fact that, in theory and with better information, a different method for implementing the Sharpe CAPM might be proved to be 'right' is irrelevant.

[2] Franks, J., Lally, M. and Myers, S., *Recommendations to the New Zealand Commerce Commission on an Appropriate Cost of Capital Methodology*, December 2008, p. 27.

[3] Ibid, p. 9.

Empirical evidence shows that average returns for low-beta firms are higher than predicted by the classical CAPM.

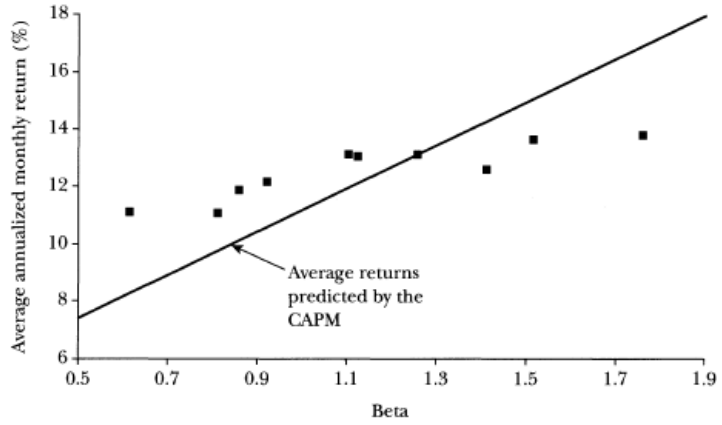
12. The source of this bias is best illustrated by examining the figure from Fama and French (2004) referenced by Professor Handley. Professor Handley states, in relation to the empirical finding that low beta stocks tend to earn higher returns than predicted by the mechanical implementation described above, that:[4]

This empirical finding is well illustrated by Figure 2 in Fama and French (2004) who updated the evidence to the end of 2003.

13. Professor Handley goes on to state that there is disagreement about *why* this empirical relationship exists. However, the uncertainty about *why* the empirical relationship exists does nothing to alter the existence of the relationship. The existence of this relationship is all that is required to conclude that the AER's implementation of the CAPM will underestimate required returns on low beta stocks. Figure 2 in Fama and French referred to by Handley above is reproduced here.

Figure 1: Figure 2 from Fama and French (2004)

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



14. In Figure 2 above, the solid line shows the predicted returns of the CAPM as implemented by the AER – showing a strong positive relationship between measured beta (horizontal axis) and the return on the stock (vertical axis). The dotted observations represent the average actual relationship observed over the 75 years between 1928 and 2003. The actual relationship, while positive, is much weaker (flatter) than the predictions that arise from the AER's implementation of the CAPM. The weaker relationship between measured beta and actual returns has been found

[4] Handley, *Peer Review of Draft Report by Davis on the Cost of Equity*, January 2011, p. 2.

repeatedly over different time periods and in different countries (including in Australia)[5]. In the words of Handley:[6]

> *"… there is no dispute concerning the results reported by Black, Jensen and Scholes (1972), Fama and MacBeth (1973) and Fama and French (2004)…"*

15. While both Handley and Davis propose implementations of the CAPM that might be free from this downward bias, the AER does not implement these. The AER incorrectly concludes that:

- because Davis and Handley state that there might be an implementation of the CAPM that is free from this bias; then
- it follows that the AER's implementation is or might be free from bias.

16. The second clearly does not follow from the first. The papers surveyed by Handley and Davis are consistent with those surveyed by Grundy (and those surveyed by the AER itself when arguing that the CAPM is superior to the Fama-French 3 factor model). There is simply 'no dispute' that if one estimates beta in the way that the AER estimates beta (from historical stock market returns) and one simply plugs this estimate into the standard CAPM formula, then this will underestimate required returns on low beta stocks.

2.2. "Black" versus "Sharpe" CAPM

17. When I use the term the "Black CAPM" I am referring to an estimate of the cost of equity where:

- equity betas are estimated from historical stock market data (e.g. the last five years of data);
- these betas are assumed to be relatively stable – such that the historical estimate can be used as a forward looking estimate; and
- the relationship between returns and beta (so estimated) is given by the relatively flat dotted observations depicted in Figure 1 above – such that zero beta equity earns more than the Government bond rate.

18. That is, I am referring to an estimate of the cost of equity that is derived having regard to the empirical evidence. Specifically, the empirical evidence that actual equity returns for low beta stock are higher than predicted by the standard implementation of the Sharpe CAPM - where the standard implementation of the Sharpe CAPM, including as implemented by the AER, involves:

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[5] CEG (September 2008); *Estimation of, and correction for, biases inherent in the Sharpe CAPM formula*

[6] Handley, *Peer Review of Draft Report by Davis on the Cost of Equity*, January 2011, p. 3.

- equity betas are estimated from historical stock market data (eg, the last five years of data); and
- the relationship between returns and beta (so estimated) is given by the relatively steep black line depicted in Figure 1 above – such that zero beta equity earns a return equal to the Government bond rate.

19. The "Black CAPM" and the "Sharpe CAPM" are used as short hand for these implementations of the CAPM. My recommendation of the Black CAPM does not mean that I believe that the reason the empirical relationship demonstrated in Figure 1 above exists is because the assumptions of the Black CAPM are 'true' in some absolute sense. I do not believe this is the case (although the assumptions of the Black CAPM are more realistic than the assumptions of the Sharpe CAPM). My recommendation of the Black CAPM is purely based on the empirical evidence.

20. Similarly, when I reject the "Sharpe CAPM" as biased for low beta firms I am rejecting the standard implementation used by the AER. This does not mean that I reject all other possible implementations of the Sharpe CAPM. There may be other implementations of the Sharpe CAPM that eliminate this bias.

21. One such implementation examined by Davis is a conditional version of the Sharpe CAPM where betas vary overtime. For example, betas for some firms might be high in some economic conditions and low in others. If we could accurately estimate how betas vary over time it might be possible to implement a version of the Sharpe CAPM that did not exhibit low beta bias. However, this is not what the AER does nor is it what the AER is proposing to do. Therefore, the possibility that doing so might remove the low beta bias and might 'save' the Sharpe CAPM provides not support for the AER's implementation. Professor Grundy makes the same point at paragraphs 2 and 3 of his most recent March 2011 report for Envestra.

22. Similarly, the Sharpe CAPM may perform better if it were implemented using betas estimated from cash flow data rather than stock market data. Davis refers to a paper from Cohen, Polk and Vuolteenaho (2009) which concludes that precisely this may be the case. However, this is not the AER's method of implementing the Sharpe CAPM and, as such, provides no support for that method. Professor Grundy discusses this paper in more detail in his March 2011 report. He shows that, even with this non-standard method for estimating beta, 17 of the 18 estimates values for the zero beta rate exceed the 4% average risk-free rate observed over the sample period – as predicted by the Black CAPM.

2.3. Grundy, Davis and Handley

23. In addition to the classic papers that demonstrate the low beta bias associated with the AER's implementation of the CAPM, Professor Grundy's February 2011 report also surveyed the set of papers that the AER had used in the Jemena Gas Networks decision in order to conclude that the CAPM was a superior model to the Fama-French 3 factor model. Professor Grundy set out a summary of these papers in Part B of Table 1 on page 13 of his February 2011 report.

24. Professor Grundy demonstrated that almost all of these papers provided direct support for the existence of the low beta bias. This is of no surprise as there is, in the words of Professor Handley, no dispute that the actual relationship between beta estimated using stock market data and returns is flatter than assumed by the AER (associated with the Sharpe CAPM). One paper even examines the Gas Water and Multi Utility Industry and finds:[7]

> *For the Gas, Water and Multi-utility Industry returns are statistically significantly higher at the 5% level than predicted by the Sharpe CAPM.*

25. This sample was chosen for examination by Professor Grundy on the basis that the AER was already relying on these papers and, as such, there could be no basis to believe that Professor Grundy had selectively chosen them. The AER has responded that:

> *Grundy and CEG appear to select empirical evidence from the set of papers used in a previous AER decision, which was concerned with the evaluation of the FFM proposed by JGN. While clearly relevant to the evaluation of the FFM, it is not the case that these papers were selected to give an assessment of the empirical evidence on the CAPM.* [8]

26. This is factually not true. The relevant sample of papers examined by Professor Grundy includes the first four listed at footnote 785 of the Jemena Gas Networks Final Decision (page 158). The text of that decision to which the footnote belongs is provided below.

> *the CAPM has empirical support, particularly over long periods and under the conditions relevant for the regulated firm.*[785]

27. Moreover, the relevant sample of papers examined by Grundy includes all of the papers listed at footnote 786 on the same page of the Jemena Gas Networks decision. The text of that decision to which the footnote belongs is provided below:

> *Further, there are sound theoretical reasons why some conflicting empirical results do not invalidate the CAPM*[78]

28. It is plain to see from these references that the AER was referring to this literature in the context of an evaluation of the CAPM. I note that none of the results from the literature surveyed by Professor Grundy have been contested by Professor's Handley and Davis.

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[7] Gregory and Michou (2009) as described in Professor Grundy's February 2011 report for Envestra (see page 13).

[8] AER, Qld Draft Decision for Envestra, 2011, page 67.

29. Having dismissed the relevance of the Grundy survey on this incorrect ground, the AER then goes onto make the following statement, reproduced in full below:[9]

> *In contrast, Professor Davis surveys relevant recent academic literature on the CAPM itself. Professor Davis notes a number of limitations with the empirical testing of the CAPM, including:*
>
> - *inappropriate statistical testing;*
> - *use of a time horizon that is too short;*
> - *use of realized returns, which are a biased proxy for expected returns;*
> - *defining a market portfolio that is not mean-variance efficient.*
>
> *It is worth noting the conclusion of Professor Davis in full:*
>
> > *This brief overview of a number of recent studies in well regarded academic journals suggests a number of conclusions. First, there is ongoing debate about the statistical tests appropriate and suitable for discriminating between and rejecting alternative asset pricing theories. Second, there is a wide range of additional explanatory variables which have been added to the standard CAPM as additional risk factors. While some have theoretical underpinnings, there remains disagreement on whether they are capturing priced risk factors. Third, the evidence is mixed on whether alternative models outperform the static CAPM, although recognition that the CAPM is conditional with parameters which can vary over time is important.*
>
> *In summary, the AER considers that Envestra and its consultants have not presented any compelling empirical evidence to suggest that the CAPM produces a rate of return that is not the commensurate with prevailing conditions in the market for funds and the risks involved in providing reference services*.

30. The first sentence of this statement involves the continuation of the previous error in the AER concluding that the literature Grundy previously summarised did not relate directly to the CAPM.

31. Nonetheless, it is correct that Davis has cited an additional 10 papers in his report not previously examined by Professor Grundy. Professor Grundy has divided these papers into three categories. Specifically, papers that:

[9] AER, Qld Draft Decision for Envestra, 2011, page 67.

a. contain no information about the relative superiority of the Black CAPM and the Sharpe CAPM as descriptors of expected returns (Pastor, Sinha and Subrahmanyam (2008); Ray, Savin and Tiwari (2009); Adrian and Rosenberg (1993); Levy (2010); and Subrahmanyam (2010));

b. contain the observation that the Black CAPM can provide a better descriptor than the Shape CAPM does (Levy and Roll (2010));

c. contain information that suggests that the Black CAPM does provide a better empirical predictor of expected returns than the Sharpe CAPM does (Cohen, Polk and Vuolteenaho (2009); Llewelyn, Nagel and Shanken (2010); Campbello, Chen and Zhang (2008); Da, Guo and Jagannathan (2010)).

32. None of these papers provide a basis for rejecting the overwhelming evidence of downward bias in estimated returns when:

- betas of less than 1.0 are estimated using stock market data in the manner estimated by the AER (and myself in this report); and
- these betas are then used, without adjustment, in the Sharpe CAPM formula as used by the AER.

33. In fact, the one paper that comes closest to lending any support for the AER's approach is the paper by Ray, Savin and Tiwari (2009), which reports that the results of a new statistical test fails to reject a null hypothesis that average returns are described by the Sharpe CAPM. Of course, this does not imply that the Sharpe CAPM is a better predictor than the Black CAPM – only that one cannot prove with a high level of confidence that the Sharpe CAPM is not true.[10] However, the Ray, Savin and Tiwari (2009) paper is relevant for their assessment of what the consensus view is. On page 732 they state:

> *"the evidence for the statistical rejection of the CAPM is weaker than the consensus view suggests."*

34. I agree that the consensus view is that the Sharpe CAPM is rejected by the data because the true relationship between beta and investors demanded return is flatter than predicted by the Sharpe CAPM. It is the existence of this consensus view that the AER does not acknowledge.

35. Finally, I note that the quote from Davis that the AER relies on in the above passage says nothing in support of its view that low beta bias does not exist, and should therefore not be adjusted for. The quote from Davis, along with most of the Davis and

[10] As Professor Grundy notes this is not a strong endorsement of the CAPM. A failure to reject the Sharpe CAPM does not imply that the same test would not also fail to reject the Black CAPM (which the same test almost certainly would not). These results are only strong relative to the vast majority of studies, being studies previously relied on by the AER in support of its implementation of the Sharpe CAPM, that do reject the Sharpe CAPM at very high confidence levels (see Part B of Table 1 on page 13 of Professor Grundy's February 2011 report).

Handley reports, simply states that in asset pricing theory there is very little agreement in regards to:

- what the right asset pricing model is; and
- different measures of implementing the CAPM might improve its performance as an asset pricing model.

36. If one reads the Davis and Handley reports one is left with the clear impression that there are many unanswered questions in asset pricing theory. This impression is, in my view, correct.

37. However, the AER's statement about Envestra's evidence not being 'compelling' appears to be made in the context of this general uncertainty. The AER appears to believe that general uncertainty in asset pricing theory can be pointed to in some sort of general manner to justify any position. Put colloquially, "nobody really knows what the answer is so you can't prove that my answer is wrong".

38. However, this is not correct. There are many unanswered questions in asset pricing theory, but there are also some questions that have been answered with something approaching certainty. One of those answers, as demonstrated in the uncontested advice of Professor Grundy relying on papers the AER or its experts have cited, is that estimated returns will be downward biased if one:

- estimates betas of less than 1.0 using stock market data; and
- uses these betas, without adjustment, in the Sharpe CAPM formula.

2.4. Conclusion

39. The important conclusion for the implementation of the CAPM by the AER is that if the AER estimates a beta of less than 1.0, then simply plugging this into the Sharpe CAPM formula will underestimate investors required return (the opposite is true if the estimated beta is greater than 1.0 – plugging this into the Sharpe CAPM formula will overestimate investor's required returns). This bias can be offset by scaling empirically estimated betas towards 1.0

3. Quality of data and source of beta estimates

3.1. Impact of the GFC

40. The AER states that, in its view, beta estimates derived from data either before 2002 or after the end of 2007 are unreliable as they are affected by the unrepresentative events associated with the technology boom and bust and GFC. The AER goes on to state: [11]

> *Further, the AER's consultant in the WACC review, Olan Henry, noted that the estimates after September 2008 and any estimate after this period (GFC period) are unlikely to be consistent with the capital asset pricing model. Olan Henry notes that the period post 2008–09 are unlikely to be consistent with the equilibrium condition required and should be excluded form the sample period under consideration. As a result, the AER considers that the GFC period should not be relied upon in estimating beta for Envestra. Further, Envestra has not provided any evidence that investors develop expectations on periods when volatility is high.* ***The AER considers that beta should be estimated on the period 2002-2007, which is a period that it considers is a representative period of prevailing market conditions over the next ten years.*** (Emphasis added)

41. In my previous report I demonstrated that it was clear that regulated utilities stock prices fell to the same or a greater extent than the market over the GFC. I argued, and continue to be of the opinion, that this was powerful evidence that regulated utilities had the same risk as the market when it mattered. That is, when investors really desire protection for large movements in their wealth holding, utility stocks did not give them that protection – and actually exaggerated the movements in wealth they experienced in the GFC. This is powerful and intuitive evidence of a beta of at least 1.0 that does not rely on econometric regression analysis which, as I will demonstrate below, can provide counterintuitive and misleading results.

42. Nonetheless, both the AER and its experts have argued that the experience in the GFC should not be relied on. The AER has argued for regression analysis of beta to be confined to the six year period from 2002 to 2007. Professor Henry, whose beta estimates the AER relies on, uses regression analysis ending 1 September 2008 – effectively defining a different beginning to the GFC than the AER posits above.

43. For the purpose of this report I adopt the same period as Henry for beta estimation. This provides a set of beta estimates that are proximate to the AER's position on the correct period to use, whilst providing comparability with Henry's beta estimates.

[11] AER Envestra SA Draft Decision, pp. 266-267

3.2. Measured equity betas are highly sensitive to assumptions

44. Beta estimates are highly volatile and highly sensitive to the data used. In particular, estimates of beta are sensitive to:

    i. the length of time used to estimate the betas – the 'estimation period';

    ii. the end of the estimation period used (e.g. ending 31 December 2007 vs. 1 September 2008);

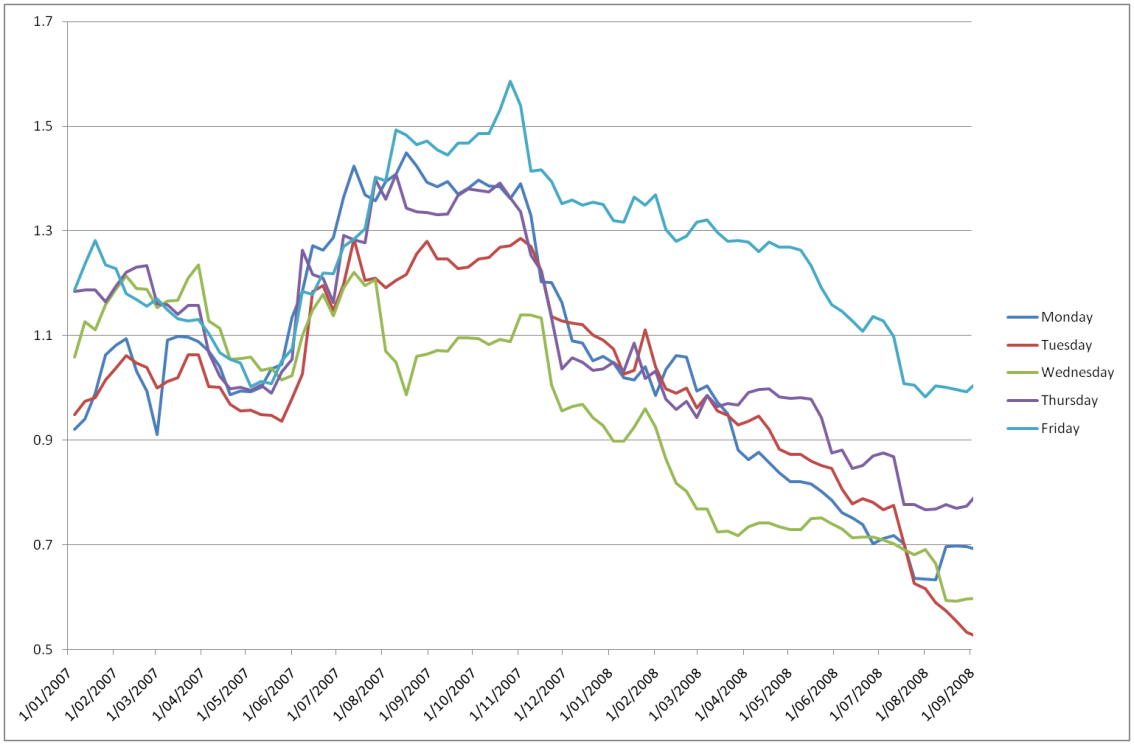
    iii. the units of time within the estimation period used to measure stock returns (e.g. daily weekly or monthly returns) – the 'sampling period'; and

    iv. the firms included in the sample.

45. The sensitivity to assumptions is usefully illustrated in the chart below. The betas (re-levered to 60 percent) in the chart are based on an estimation period of one year (i.e. one year of prior data is used to generate each beta estimate), and covers the period from the 1 January 2007 to the 1 September 2008. The betas are sourced from five different weekly 'sampling periods', that is, a 'week' ending on a Monday, Tuesday, Wednesday, Thursday and Friday respectively. The betas have further been calculated as an average for a sample of 11 US regulated businesses, corresponding to the sample used by Professor Henry in his work for the AER[12].

[12] Henry's 2008 report for the AER includes beta estimates for 11 companies. I include all of these companies in the averages presented in the tables and charts in this report. However, POM does not always have the requisite amount of data (e.g., 5 years when 5 year betas are reported). In this circumstance I do not estimate betas using a shorter period of data which is in contrast to Henry who does. I also note that in Henry's 2009 report he includes a new firm in his sample "PORT" which we assume is Portland General Electric. PORT was only listed on 6 April 2006 (http://www.nyse.com/about/listed/por.html) and so there is insufficient data to run 5 year regressions on this data. Nonetheless Henry reports beta estimates for PORT and states that he has used 5 years of data (see the last row 'n' of Table 6.3 of his 2009 report). This appears to be a mistake in the Henry report.

Figure 2: Re-levered weekly one year betas – Henry sample

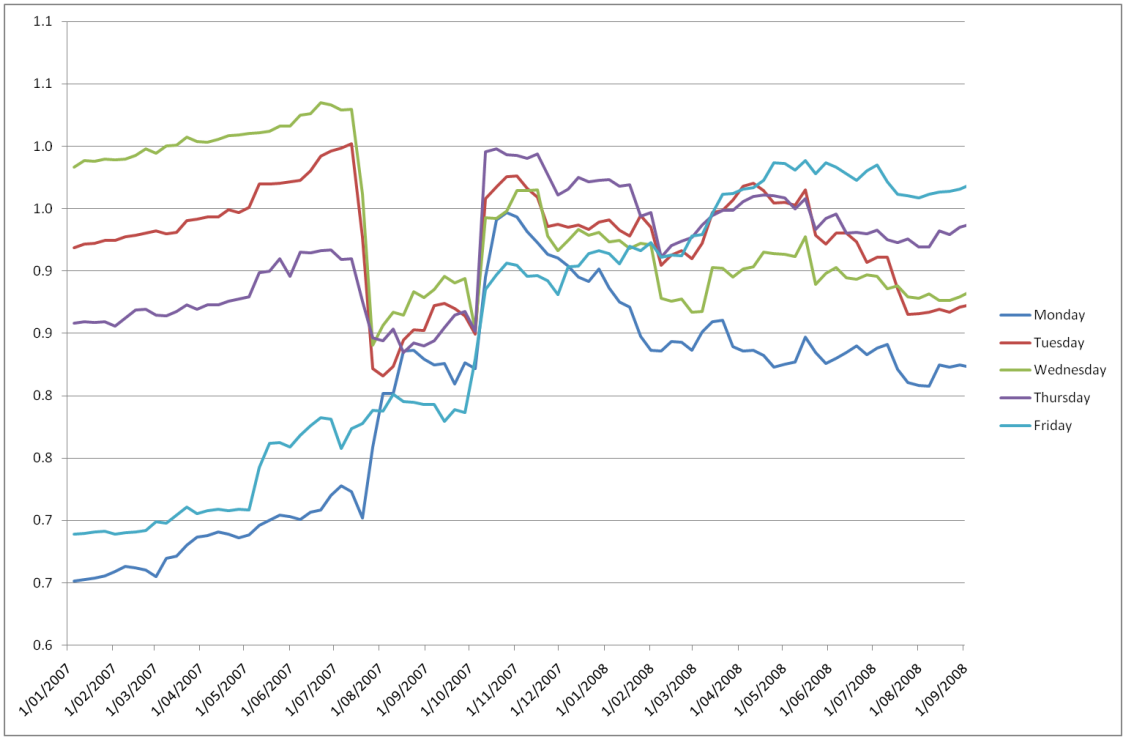


Note: The betas have been re-levered to 60 percent
Source: Bloomberg, CEG analysis

46. Figure 2 illustrates how the choice of seemingly very similar estimation periods/sampling periods can give rise to very different results. For example, the average weekly beta for Henry's 11 firms was 0.55 for the estimation period ending 22 August 2008 defining the week to end on a Tuesday. However, if the week was defined as ending on a Friday the corresponding beta estimate for the same sample would be 1.00. One can see from the chart that this is not the only date where very significant differences exist depending on the definition used for the end of a week. This demonstrates the sensitivity of the beta estimates to the choice of sampling period – even when one is averaging across a number of firms.

47. The problems associated with sensitivities are not eliminated by using a longer sampling period. The chart below is the same as Figure 2, except each underlying beta has been estimated using five years of weekly returns rather than one year of weekly returns.

Figure 3: Re-levered weekly five year betas – Henry sample



Note: The betas have been re-levered to 60 percent
Source: Bloomberg, CEG analysis

48. The above chart shows less volatility in each estimate, but it also shows that, for example, the Friday betas are among the lowest at the start of 2007 and among the highest at the start of 2008.

49. The above chart is particularly relevant because Henry's 2009 report, which the AER relied on to set equity betas, reports US equity beta estimates that appear to be consistent with selecting a Monday beta for the 5 year estimation period ending 1 September 2008. This happens to be the lowest of the five possible sampling periods. Had Henry reported weekly betas for the week ending Friday (being the natural interpretation of a week) then he would have estimated an average beta of 0.97 for the US sample. Instead, Henry reports a beta for these 10 firms of 0.85.[13] As explained in Appendix A, it is apparent that this is because Henry uses a definition of the week ending Monday in that report. As can be seen in Figure 3 above, Monday gives the lowest beta estimate of all of the possible definitions of a 'weekly' beta for the five years ending 2009.

[13] This is the average for Henry's full sample of 11 firms including POM and PORT. See table 6.3 on page 43 of Henry's 2009 report, the re-levered OLS betas at the third row of numbers.

50. It is also the case that Henry's 2009 report has lower raw weekly betas (for exactly the same estimation period) than in Henry's 2008 report.[14] This is consistent with Henry changing the sampling period between the 2008 and 2009 reports. That particular estimation period (6.75 years ending 1 September 2008) and defining the 'week' as ending on a Monday once again gives the lowest weekly beta. In his 2008 report it appears clear that Henry used the natural definition of a week being a week ending Friday. However, in his 2009 report it is equally clear that he has used the week ending Monday. In neither report does Henry state how he has defined a week or that he has changed this definition between reports.

51. Moreover, it is not obvious to the casual reader that the numbers have changed – as the 2008 report only provides raw betas and the 2009 report only provides betas levered to 60% gearing. In order to establish that the numbers are different one must perform some calculations (using Henry's gearing data and Henry's leverage formula) so that they are expressed on the same basis. Appendix A steps through this process.

52. Unlike Henry I do not report monthly beta estimates in this report. In order to present this data in a reasonable and balanced manner one would have to estimate betas for every possible definition of a month (e.g. ending the 31st, ending the 30th etc). If one did not do this then one could not be sure that one had not simply alighted on a sampling period that gave an artificially high/low beta estimate. Moreover, I note that monthly betas have, for any given estimation period, less observations than weekly betas and, other things constant, a larger number of observations are desirable.

53. Similarly, in contrast to Henry, I do not report betas using data from 1990 to 1998 (before the technology bubble). This data is now 13 to 21 years old. Using such aged data is problematic unless one has reason to believe that the conditions in the period 1990 to 1998 are likely to be more informative of the conditions going forward than recent data. Henry provides no basis for believing this to be the case and the empirical evidence that he presents suggests that measured betas using 1990 to 1998 data are much lower for his sample than using more recent data. In this regard I note that Professor Franks warned the NZ Commerce Commission against the use of long time series to estimate beta.[15]

> *Professor Franks argues that there is much judgment involved when estimating betas (particularly when indirectly estimating these), but this is unavoidable. He also suggests that where there has been significant volatility in capital markets, as is the case currently, the real asset betas of some regulated companies may have undergone changes which will not be captured by a long historical time series.*

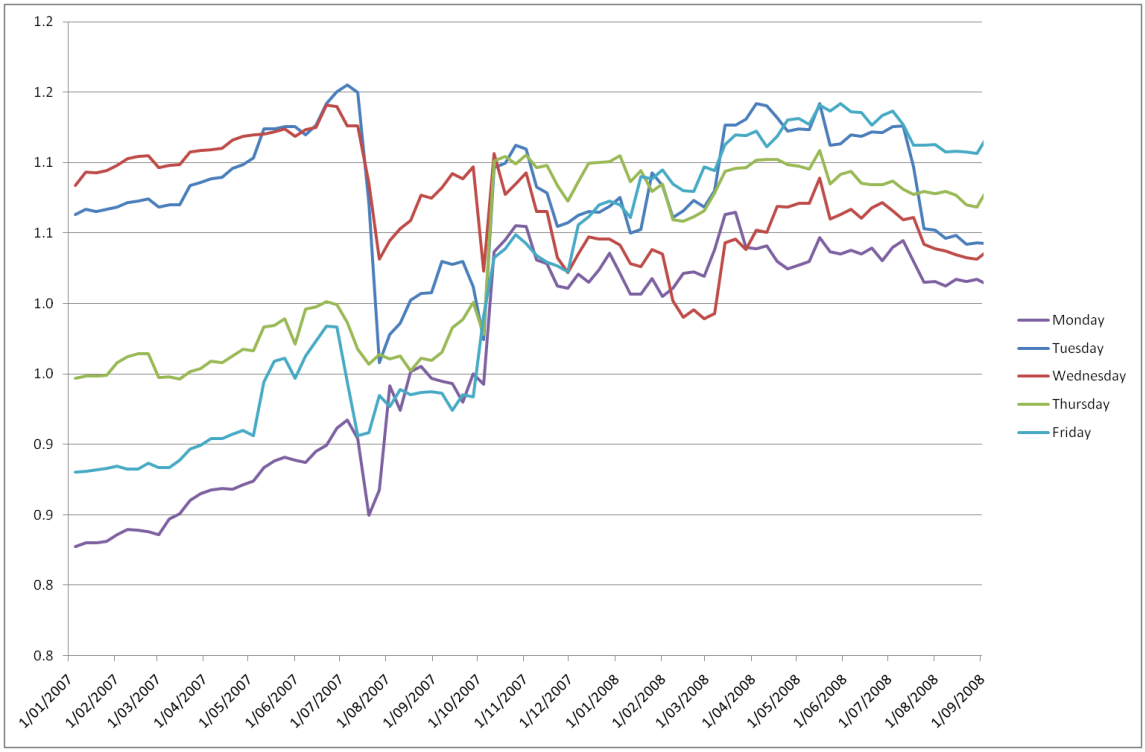
54. The problems with the volatility in beta estimation are reduced by the use of a larger sample. Rather than using only 11 firms, as Henry does, I have estimated the average

[14] This is not disclosed or discussed by Henry.

[15] Franks, J., Lally, M. and Myers, S., *Recommendations to the New Zealand Commerce Commission on an Appropriate Cost of Capital Methodology*, December 2008, para. 27.

beta for 77 US regulated gas and electricity businesses, 75 of which are identified as such by US analysts Regulatory Research Associates (RRA) and 2 further comparators which have previously been used for regulatory purposes.[16] The chart below is the same as Figure 3 except it uses an average of 77 firms rather than 11.

Figure 4: Re-levered weekly five year betas – RRA sample



Note: The betas have been re-levered to 60 percent
Source: Bloomberg, CEG analysis

55. It can be seen that there is less volatility over time in these estimates. However, a material dispersion remains between different sampling periods, that is, different definitions of when a 'week' ends.

56. The figure below also compares the average of all five weekly sampling periods using both the RRA sample and Henry's sample. This figure also includes two further samples. The first is a sample of 46 US companies used by the NZ Commerce Commission in its beta estimation (NZCC sample).[17] The second is a sample of 12 US

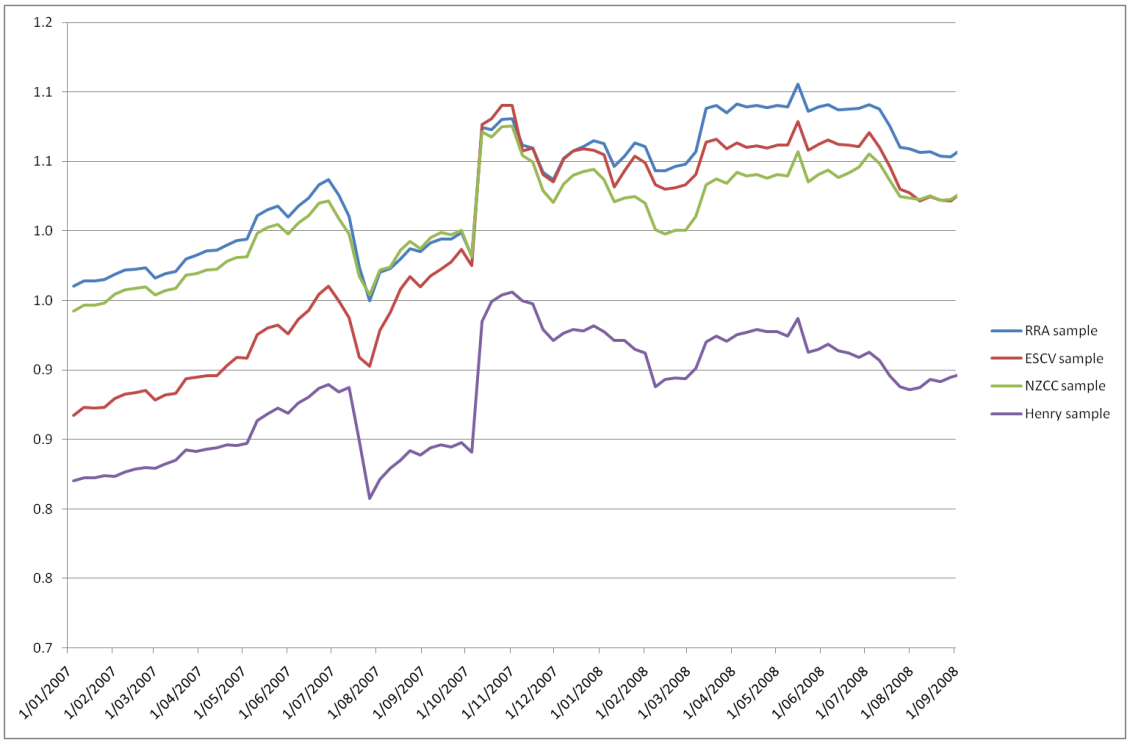
[16] That is, EAS which is identified by Henry and MGEE which is identified by the ESCV and the New Zealand Commerce Commission.

[17] NZ Commerce Commission, *Input Methodologies electricity distribution services Draft Reasons Paper,* June 2010, Appendix F.

companies used by the Victorian Essential Services Commission (ESCV sample)[18]. The specific companies contained in each sample are summarised in Appendix C.

57. The additional samples help illustrate the impact of sample selection on the estimated betas. The following two figures illustrate the four samples sourced from the RRA, Henry, the NZCC and ESCV together.

Figure 5: Re-levered average weekly five year betas – RRA, Henry, NZCC and ESCV samples



Note: The betas have been re-levered to 60 percent
Source: Bloomberg, CEG analysis

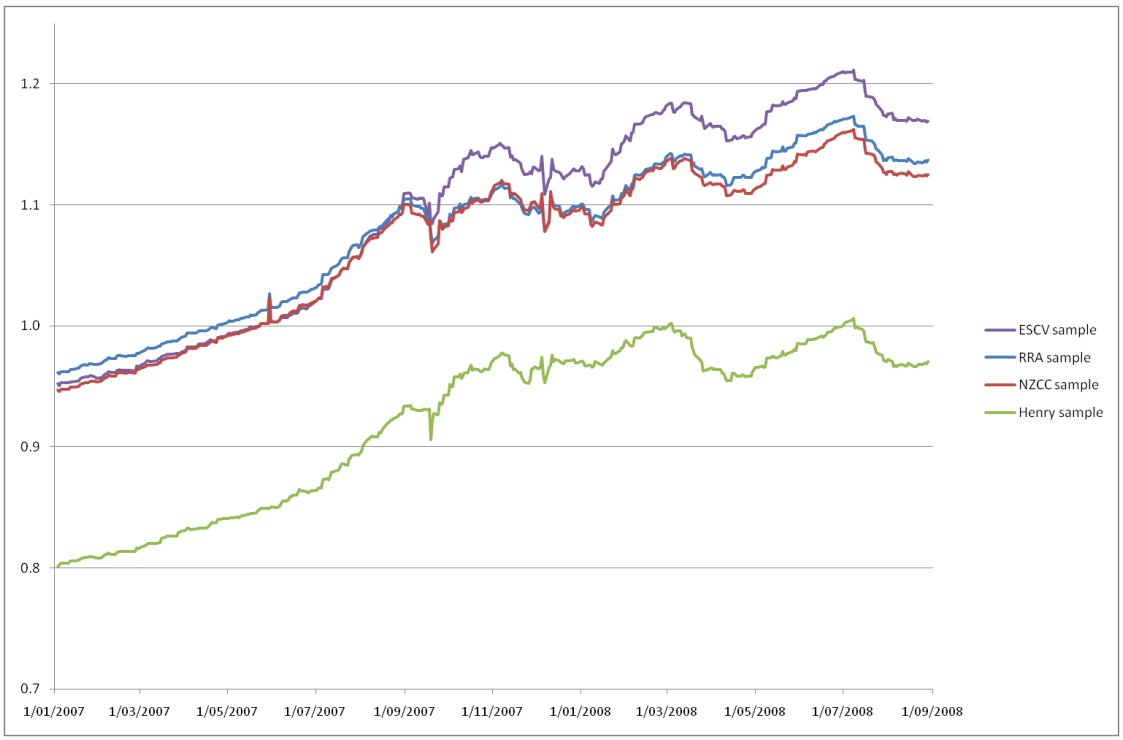
58. It is notable that five year weekly betas (averaged over the five different definitions of a 'week') appear to fall fairly consistently in a range of between 0.85 and 1.1. I note that measured prior to the onset of the GFC, in this case defined as the end of 2007, these weekly betas were all close to or above 1.0 using all samples except for Henry's sample.

59. Finally, I provide a similar figure below using a five year estimation period, except this time I have estimated daily betas (rather than weekly betas). This figure again contains four different samples, as defined by the RRA, Henry, NZCC and ESCV respectively. Notably, with daily betas there is no scope to choose alternative

[18] ESCV, Gas Access Arrangement Review 2008-2012, Draft Decision, 28 August 2007, p. 309.

sampling periods (there is only one definition of when a day starts and ends), although there may be additional potential sources of econometric bias such as from thin trading. This shows a broadly similar story to the weekly betas (when averaged over all five possible sampling periods).

Figure 6: Re-levered daily five year betas – RRA, Henry, NZCC and ESCV samples



Note: The betas have been re-levered to 60 percent
Source: Bloomberg, CEG analysis

60. Figure 5 and Figure 6 above clearly show that the Henry sample has the lowest average beta for any of the samples. The RRA, NZCC and ESCV samples have average betas that are consistently above the Henry sample – although all samples support the selection of a beta that is greater than 0.80. I note that Henry did not select this sample but it was provided to him by the ACCC. Henry states:

> *The list of companies examined in this section was provided to the consultant by the ACC, as were the selected sample dates.*[19]

61. With no explanation for the selection of the sample there is the possibility that this sample gives rise to non-representative beta estimates – in the same way that Henry's selection of Monday weekly betas gives rise to non-representative beta estimates. The higher beta estimates for the other samples (including samples selected by other

[19] Henry, O., *Estimating β*, April 2009, p. 40.

regulators) tends to support a conclusion that the Henry sample gives artificially low beta estimates.

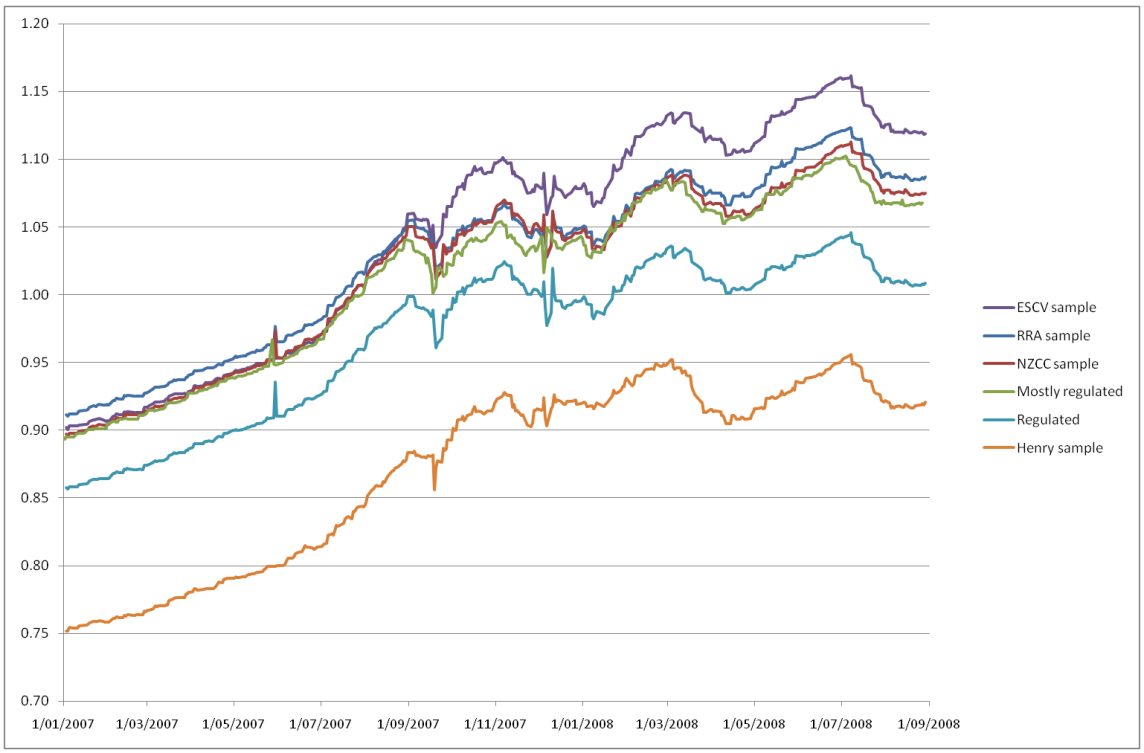
62. In this regard, I note that there is a basis for giving more weight to the RRA and ESCV samples. The RRA source provides a full list of regulated gas and electricity businesses involved in distribution. This is therefore the largest sample and also the only sample from which businesses have not been excluded – such that cherry picking in the selection of the sample is not a concern.

63. Similarly, the ESCV sample was chosen some time before August 2007 (the date of the 2007 GAAR 2008-2012 draft decision). Consequently, this sample could not have been cherry-picked in the knowledge of the actual betas estimated using data to December 2010. Moreover, the ESCV as a regulator had no incentive to cherry pick this sample to give rise to artificially high beta estimates. I note that the ACCC and NZCC samples were selected by regulators with knowledge of actual betas at the time of the sample selection (2008/2009 for the ACCC and June 2010 for the NZCC).

64. Finally, I also report two additional potential samples of US regulated businesses derived from an Edison Electric Institute (EEI) categorisation of businesses. EEI categorises publicly listed utility holding companies into 'regulated' businesses (sample size 34) and 'mostly regulated' businesses (sample size 50).[20] The former category are businesses with 80% or more regulated assets as at 31 December 2008 and the latter is businesses with 50% or more regulated assets as at 31 December 2008 (the latter including the former as a subset). The specific companies categorised as 'regulated' or 'most regulated' by EEI are summarised in Appendix C.

[20] Edison Electric Institute, Credit Ratings, Q1 2010 Financial update quarterly report of the U.S. shareholder-owned electric utility industry, is available on:http://www.eei.org/whatwedo/DataAnalysis/IndusFinanAnalysis/Documents/2010_Q1_Credit_Ratings_Final.pdf

Figure 7: Re-levered daily five year betas – All samples



Note: The betas have been re-levered to 60 percent
Source: Bloomberg, CEG Analysis

65. The above figure suggests that that the 'regulated' and 'mostly regulated' samples have average daily betas that are materially in excess of the average for the Henry sample (the lowest curve on the graph). Both of these samples have betas that are greater than 1.0 prior to the GFC. However, these beta estimates are lower than the other samples over that period.

3.3. Australian firms provide little information for a robust estimate

66. There are only six listed Australian firms whose assets are mostly regulated – Envestra, APA, HDF, SPN, DUET, and Spark Infrastructure (SKI). There are only two years of available data for SPN and SKI up to the end of 2007 (both were listed in December 2005). For HDF and DUET, which were listed in December and August 2004, there is only three years and three years and four months respectively of available data.

67. As noted by the AER, other things constant, it is desirable to have a long period of data from which to estimate beta. The AER has rejected the relevance of beta estimates I presented because they were only based on 600 trading days[21] (or around

[21] AER Draft Decision, p. 268.

2.4 years).[22] The combination of these two restrictions (excluding post 2007 data and requiring beta estimates to have at least 600 trading days) means that beta estimates for SPN and SKI cannot be used (as these had been listed for materially less than 600 trading days before the end of 2007). This leaves only four Australian beta estimates.

68. Moreover, HDF and DUET had only been listed for around 750 to 850 trading days (HDF was listed in December 2004 and DUET was listed in August 2004). The AER explicitly states that 600 trading days is not long enough for a 'statistically reliable beta estimate', but does not specify what it regards as sufficiently long. It would appear that, by the AER's criteria, DUET and HDF beta estimates from before the GFC are, at best, on the borderline of delivering a 'statistically reliable beta estimate'.

69. In fact, there are only two beta estimates for Australian regulated utilities that have five years of data preceding the GFC – whether that be defined to begin at the end of 2007 or the end of 2008. By contrast, there are 75 US beta estimates for regulated utilities available over this time period with a full 5 years of data.

70. This means that one is faced with two choices:

- Attempting to derive a beta estimate solely from the very limited Australian data. With this approach one can have only little confidence about the estimates derived, and it cannot be stated with confidence that the true beta for a 60% geared regulated utility is less than 1.0 (see Appendix B on statistical accuracy below);
- Give weight to US beta estimates – which, unless there is reason to believe that US regulated utilities are higher risk than the benchmark Australian regulated utilities, very strongly support a beta estimate of 1.0 at an assumed gearing of 60%.

71. As already noted, Ólan Henry in the electricity WACC review states that he estimated betas for the Australian firms up to September 2008 – well into the global financial crisis and well past the time period specified by the AER as reasonable (2002-2007). Moreover, I note that the Henry estimates for SPN and SKI only covered periods of approximately 685 trading days and 380 trading days.[23]

72. Comparability of US beta estimates

73. The AER dismisses the estimates from the US market on the basis that:

> *The sample is primarily made up of foreign firms and as was the case in the WACC review limited weight should be placed on foreign estimates. For instance, in the WACC review the AER noted that the difference in the regulation*

[22] Based on five trading days per week and eight public holidays per year.

[23] Henry, O., *Econometric advice and beta estimation*, November 2008, p. 5. Without, explanation, Henry uses a much shorter period for estimation of the SKI beta than the SPN beta although both were listed at nearly precisely the same time.

of businesses, the regulation of the domestic economy, geography, business cycles, weather and a number of different factors are likely to result in difference between equity beta estimates for similar businesses between countries. As a result, the AER considers that foreign estimates should only be used a cross check of the domestic equity beta estimates. (AER, Envestra Queensland Decision, p. 247)

74. In response to this statement I make the following observations:

- To the extent that US betas are not comparable to Australian betas, including for the reasons provided above, the best estimate is that US betas will underestimate the risk of an Australian regulated utility;
- My understanding of the operation of a 'cross check' is such that:
  - the estimated parameter is compared with another estimate that is expected to be similar;
  - if it is found that they are similar, greater confidence can be attached to the adoption of the first estimate;
  - if it is found that the estimates are dissimilar, there is a greater risk of the first estimate being flawed and should not be adopted or should only be adopted with caution.
- It does not appear to me that the AER has actually performed a 'cross check' as described above.

3.3.1. US beta estimates tend to underestimate Australian betas

75. To the extent that the economic and market factors listed by the AER are likely to have any impact on the beta estimates they are likely to reduce the estimates in the US compared with Australia. In this regard, I note that, in the Expert Panel advising the New Zealand Commerce Commission, Professor Franks argues that the US regulatory regime is lower risk relative to 5 year regulatory regimes such as exist in Australia.[24]

Professor Franks is also sympathetic to the arguments raised by Boyle et al. Alexander et al. (1996)[25] provide a classification of jurisdictions by regulatory risk. They find that the US, where rate revisions occur frequently, has low regulatory risk, whereas utilities in the UK, with its five year regime, are exposed to higher risk. These cross-country differences would drive intrinsic variation in asset beta estimates.

[24] Franks, J., Lally, M. and Myers, S., *Recommendations to the New Zealand Commerce Commission on an Appropriate Cost of Capital Methodology*, December 2008, para. 140.

[25] Alexander, I., Mayer, C., Weeds, H. (1996), "Regulatory Structure and Risk and Infrastructure Firms: An International Comparison", *Policy Research Working Paper Series,* 1698, World Bank.

76. I note that the New Zealand Commerce Commission has, in 2010, relied almost solely on betas from US regulated companies to set its beta. In those regulatory proceedings the issue about comparability of US beta estimates was focused around whether these estimates should be increased and, if so, by how much in order to make them comparable to New Zealand – noting that the New Zealand regulatory regime being adopted involves 5 year (or shorter) reviews similar to Australia. The New Zealand Commerce Commission stated:

> *6.9.68 While the Commission considers that regulatory differences can affect the systematic risks faced by the regulated suppliers,* ***and has previously adjusted US estimates upward*** *to account for regulatory differences, it finds that in contrast to previous evidence (e.g. Alexander et al.), the current asset beta estimates in Table 6.14 for US electricity utilities now appear to be higher than the estimates from the UK, Australia and New Zealand.*[26] [Emphasis added.]

77. The New Zealand Commerce Commission ceased to make this upward adjustment in this decision on the basis that it could not find reliable empirical evidence that differences in regulatory regimes affected the beta of the regulated businesses. Certainly, there was no suggestion by the New Zealand Commerce Commission that US betas should be adjusted downwards to make them comparable to New Zealand five year price cap regulation.

78. I also note that Professor Martin Lally has, in January of this year, advised the Queensland Competition Authority that betas for rate of return regulated US energy and water companies are likely to underestimate the betas for comparable firms subject to price cap regulation in Australia. Lally first starts by describing revenue cap regulation as having the least systemic risk and proceeds to state:

> *A second form of regulation, faced by Australian gas network businesses and some electricity distribution businesses, is "price capping". This regime matches revenue capping except that prices rather than revenues are fixed (typically for five years). Accordingly, firms subject to this regime would face exposure to demand shocks. Since these are partly systematic in nature, the betas of price capped firms should be larger than those of revenue capped firms. A third form of regulation, faced by most US electric utilities, is "rate of return regulation".*
>
> *Under this regime, prices are set consistent with the firm's actual costs (subject to the possibility of some costs being disallowed) and a prescribed rate of return. In addition, prices are reset if the actual rate of return deviates materially from the prescribed rate, with resetting initiated by either the firm or its customers. The US water companies are subject to the same regime.*
>
> *In comparing systematic risks under these three regimes, the exposure to demand and cost shocks is fundamental. In respect of demand shocks, revenue-*

[26] New Zealand Commerce Commission, *Input Methodologies Electricity Distribution Service Draft Reasons Paper*, June 2010, p. 293.

capped firms are not exposed to these shocks, rate-of-return regulated firms face these for shocks for less than five years (because the output price would be reset more quickly than this in response to a demand shock), and price capped firms with a five year regulatory cycle would be exposed to these shocks for up to five years. In respect of cost shocks, the exposure of firms to these shocks seems similar under the three regulatory regimes. ***Thus, revenue-capped firms are likely to have the lowest asset betas followed by rate-of-return regulated firms, and then price-capped firms.*** *In all cases, asset betas should be low because exposure to systematic risk is low.*[27]

79. I also note that US stock market volatility is also higher over the period than Australian stock market volatility.

- From 1 January 2002 to 31 December 2007, the standard deviation of returns on the ASX are 0.75%, compared to 1.01% for the SPX. For the same period the weekly (Friday) standard deviations are 1.50% and 1.96% respectively.

80. Higher market volatility implies a riskier market investment. Beta is a measure of risk *relative* to the market. This means that any US beta measured in the US over the period post 2002 will be a measure of risk *relative* to a riskier market. Consequently, that implies a still higher beta relative to a less risky market. Naturally, the relative volatility in the indexes observed was not necessarily expected nor is it necessarily expected to continue in the future. Nonetheless, this is further evidence to the effect that any adjustment to US betas estimated post 2002 in order to make them comparable to betas that regulated Australian firms would experience over the same period should be upwards, not downwards.

81. Of course, it would be ideal if there were large numbers of regulated Australian utilities for which we had a long history of beta estimates – in which case one would not have to theorise about comparability. However, compared with the limited Australian data in practice, and as observed by the Victorian Essential Services Commission when estimating betas in its 2006-20011 Electricity Distribution Price Review (EDPR):

Analysis of equity betas of firms in the US has the advantage of being able to make use of a much larger set of listed entities, as well as information over a longer period (Page 351, Final Decision)

82. By contrast, I regard the AER's offhand dismissal of this evidence on the basis that factors such as 'the regulation of the domestic economy', 'geography' and 'weather' are likely to be different as unsound. I note that the AER appears to apply a very different standard of evidence to submissions by myself and Bruce Grundy concerning theoretical reasons to expect bias in the AER's implementation of the CAPM. The AER dismisses those submissions on the grounds that:

[27] Lally, *The estimated WACC For The SEQ Interim Price Monitoring*, 5 January 2011, pp. 22-23.

The AER considers that in all four cases, the magnitude of the bias is not established and is likely to be immaterial. Furthermore, in two cases the direction of the potential bias is ambiguous.

83. The AER does not attempt to even explain why differences in 'the regulation of the domestic economy', 'geography' and 'weather' would be expected to affect US equity betas differently to Australian equity betas. Naturally, without having described a basis for expecting a difference, the AER cannot and does not attempt to test the materiality of such differences or the direction of such differences. In the one case where there is a basis to expect a difference, the form of regulation, the AER does not identify the consensus view that this influence will tend to depress US equity betas relative to Australian ones (rather than vice versa). Moreover, the geography and weather associated with APA's Australian assets is likely to be different to the geography and weather associated with SPN's Australian assets. Nonetheless, the AER proposes to treat these companies betas as comparable.

3.3.2. US estimates as a more reliable alternative

84. Given the very small number of observations and the very large range in those observations I do not consider that it is appropriate to rely on an estimate of the average for these observations. That is, the range is the most instructive statistic for this sample.

85. By comparison, a large sample of US regulated firms is available and, as described in numerous figures earlier in the report, these tend to centre around or above an estimate of 1.0. The AER states that it proposes to use US equity betas as a 'cross check' on Australian equity betas. I consider that the Australian data is too small and volatile to provide reliable estimates. I consider that US data can be better used for this purpose.

86. The five year equity betas estimated to the end of December 2007 and 1 September 2008 are given in the following table. These end dates match the AER's stated preference for only using data up to the end of 2007 and Henry's use of data up to 1 September 2008 (noting that the AER oddly relies on the Henry data while at the same time proposing a different estimation period).

Table 1: Equity betas measured using 5 years of data up to a specific date

	RRA sample	Henry sample	NZCC sample	ESCV sample	EEI wholly regulated sample	EEI mostly regulated sample
Observations	**75**	**10**	**44**	**12**	**34**	**50**
5 year betas estimated at 31 December 2007 (AER period)						
Weekly beta*	1.07	0.93	1.04	1.06	0.98	1.05
Daily beta	1.05	0.92	1.05	1.08	1.00	1.04
5 year betas estimated at 1 September 2008 (Henry period)**						
Weekly beta*	1.06	0.90	1.03	1.03	0.96	1.03
Daily beta	1.09	0.92	1.08	1.12	1.01	1.07

** Average of five sampling periods (Monday, Tuesday etc)*
*** The 1 September 2008 was a public holiday in the US so the daily beta estimates refer to the 29 August 2008*
Source: Bloomberg, CEG analysis.

87. The above estimates are for betas measured on a particular date. As I have demonstrated, the betas estimated can vary depending on the date chosen. The table below is the same as the table above except I report average 5 year beta estimates over the period 1 January 2007 to 31 December 2007 and 1 January 2007 to 1 September 2008. The 1 January 2007 start date is chosen to ensure that 5 year betas included in the average do not use data from prior to 1 January 2002 (the AER's definition of when the technology bubble ended). The different end dates correspond to different definitions of when the global financial crisis began.

Table 2: Average 5 year equity betas excluding the GFC

	RRA sample	Henry sample	NZCC sample	ESCV sample	EEI wholly regulated sample	EEI mostly regulated sample
Average 5 year betas 1 Jan 07 to 31 December 2007						
Weekly beta*	1.01	0.87	1.00	0.95	0.95	0.98
Daily Beta	0.99	0.83	0.98	0.99	0.97	1.01
Average 5 year betas 1 Jan 07 to 1 September 2008						
Weekly beta*	1.03	0.89	1.01	0.99	0.95	1.01
Daily Beta	1.03	0.87	1.02	1.05	0.97	1.01

** Average of five sampling periods (Monday, Tuesday etc)*
Source: Bloomberg, and CEG analysis.

3.4. Conclusion

88. It can be seen from the above tables that all average beta estimates are above 0.80. Only the Henry sample has estimates that are materially below 1.0.

89. Having performed a cross-check of the Australian data with the US data I conclude that:

i. The average of US equity betas are close to, and, if anything, above 1.0;

ii. This falls within the range of equity betas estimated using Australian data;

iii. The greater number of, and longer time series for, US equity betas gives me greater confidence in their average estimate than in the average of the Australian estimates; and

iv. Consistent with both the Australian and US evidence an estimate of 1.0 is the best available estimate.

90. This conclusion means that the need to adjust the beta estimate for low beta bias is avoided. If the estimated beta is 1.0 then that beta estimate can be used in the Sharpe CAPM without creating a bias (upwards or downwards) in the estimated cost of equity. Only if the estimated beta is less than 1.0 (or more than 1.0) is it necessary to perform an adjustment to offset this bias. Put another way, the Sharpe and the Black CAPM are the same for a beta of 1.0. As such, there is no need to choose between them.

4. Cross checks on the equity premium estimated

4.1. Forward looking estimates of beta and MRP

91. The AER assumes a market risk premium of 6%. Coupled with the AER's equity beta of 0.80, this implies an equity risk premium of 4.8% for the benchmark regulated business.

92. To further examine whether the AER's parameters accord with market evidence on the required equity risk premium by Australian regulated utilities, I have undertaken an analysis based on a dividend growth model (DGM) using dividend and share price data from six Australian utilities businesses, including APA Group, DUET Group, Envestra, Hastings Diversified Utilities Fund, SPAusNet and Spark Infrastructure, obtained from Bloomberg. The DGM analysis is based on weekly dividend forecasts and daily share price data during the month of June 2010.

93. The basis of DGM analysis is to examine the forecast future distributions of businesses and to derive the discount rate (or cost of equity) that makes these consistent with the market valuation of the equity of those businesses as manifested in the current share price.[28] Since dividend forecasts are only made over the medium term, it is necessary to make an assumption about the future path of dividend growth/decline beyond this horizon. Because this assumption is necessarily

[28] These estimates are scaled up by the value of these imputation credits assuming taxation of 30% and gamma of 50%. This scale-up factor is 21%, or t*gamma/(1-t).

subjective, I have shown a range of assumptions, including those that would be necessary to support the AER's estimated 4.8% percent equity risk premium.

94. The results of the DGM analysis show that, to arrive at an average equity risk premium of 4.8%, the assumed growth rate for dividends in the future has to be materially negative (around negative 3.5%). Even at an assumed growth rate for dividends of zero, the average equity risk premium is estimated at 7.4%, 2.6% higher than implied by the AER assumptions. The results of the DGM analysis at varying growth rates are summarised in Table 3 below.

Table 3: DGM analysis - ROE and ERP with dividend growth rates assumptions

Growth rate		APA	DUET	ENV	HDF	SPN	SKI	Average
-3.50%	ROE	9.7%	13.4%	11.9%	8.4%	9.6%	9.5%	10.4%
	ERP	4.1%	7.7%	6.7%	2.7%	3.9%	3.9%	4.8%
0%	ROE	12.4%	15.8%	14.4%	11.1%	12.2%	12.1%	13.0%
	ERP	6.7%	10.1%	9.2%	5.4%	6.5%	6.5%	7.4%
2.50%	ROE	14.3%	17.5%	16.2%	13.0%	14.1%	14.0%	14.9%
	ERP	8.7%	11.8%	11.0%	7.4%	8.5%	8.4%	9.3%
5.50%	ROE	16.7%	19.7%	18.4%	15.4%	16.5%	16.3%	17.2%
	ERP	11.0%	14.0%	13.2%	9.7%	10.8%	10.7%	11.6%

Source: Bloomberg, RBA, CEG analysis

95. The following table shows the equity beta estimate which would be consistent with a market risk premium of 6% at alternative dividend growth rate assumptions. The table indicates that an equity beta of at least 1.23 would be required, at an MRP of 6%, if one assumed that dividends were not to fall over time.

Table 4: Beta implied by AER market risk premium

Dividend growth rate (%)	ERP (%)	AER MRP (%)	Implied beta estimate
-3.5	4.80%	6.0	0.80
0.0	7.4%	6.0	1.23
2.5	9.3%	6.0	1.55
5.5	11.6%	6.0	1.93

Source: Bloomberg, RBA, CEG analysis

96. Put another way, the AER's equity beta estimate of 0.8 together with the equity risk premiums estimated in the DGM model, results in a significantly higher market risk premium than the 6% assumed by AER. This is illustrated in Table 5 below.

Table 5: Market risk premium implied by the AER beta estimate

Dividend growth rate (%)	ERP (%)	AER beta estimate	Implied MRP (%)
-3.5	4.80%	0.8	6%
0	7.4%	0.8	9%
2.5	9.3%	0.8	12%
5.5	11.6%	0.8	14%

Source: Bloomberg, RBA, CEG analysis

4.2. Beta estimates consistent with the cost of debt

97. Both Professor Grundy and I noted that the AER's estimate of the cost of equity was internally inconsistent with its estimate of the cost of debt. The AER has responded, based on the advice of Professor Handley, that this internal inconsistency could be explained by:

- *an integrated market and the equity risk premium is too low;*
- *an integrated market and the debt risk premium is too high; and*
- *in segmented markets and so the Modigliani and Miller theorem cannot be used to infer that the equity is mispriced relative to the debt.*

Taking into account Handley's advice, the AER considers Professor Bruce Grundy has not demonstrated which of the three situations above is most likely to be present. The Modigliani and Miller theorem could imply that the debt risk premium is excessive or that equity and debt is priced in segmented markets.

98. The AER does not appear to give any material weight to the first explanation – which is odd because the AER's experts do not dismiss this possible explanation. Consequently, the AER would appear to believe that the second or third dot points are true.

99. In relation to the second dot point, I note that the debt risk premium is estimated directly from information provided by independent financial markets participants and information providers. Other things equal, this would suggest that it is more likely that the way the AER's theoretically arrived at equity risk premium is wrong (i.e. the first dot point). The AER's draft decision proposes to set the debt risk premium at 3.93%. The inconsistency exists so long as the debt premium is more than 1.97% (i.e. the AER ERP divided by 2.67, $4.8/2.67 = 1.97\%$). It does not appear reasonable that the inconsistency is explained by the AER overestimating the DRP.

100. In relation to the third dot point, I note that if capital markets are segmented in this manner it is not only the Modigliani Miller theorem that cannot be used but the CAPM model as well. This is not a valid basis for rejecting the evidence that the AER's cost of equity is set artificially low relative to the cost of debt.

101. The only other approach taken by the AER to support its conclusion is to take Envestra's proposed equity beta of 1.1, de-lever this to an asset beta and then apply this asset beta to an 8% MRP. This would give the cost of capital for a fully equity financed company. The effect of this is to give a cost of capital that is only 8.82% - less than the AER estimates (9.96%).[29]

102. The AER concludes that this demonstrates the reasonableness of their cost of capital estimate. I disagree, all this shows is that Envestra's proposed equity beta and market risk premium are themselves too low relative to the observed cost of debt.

103. I also note that, applying precisely the same logic, the implied asset beta in the AER's 9.96% cost of capital is 0.71.[30] This translates to an equity beta of 1.78 (0.71/0.4), however, the AER only allows an equity beta of 0.80. That is, the AER is allowing an equity beta that is only half of that implied by its cost of capital estimate. This is just another way of saying that the cost of equity is too low relative to the cost of debt.

4.3. RAB multiples

104. The AER argues in s.5.4.1.1. (and Appendix C) that there are factors that may justify a difference between the RAB and prices paid for the assets, but then argues that the premiums paid in three recent sales "are unlikely to be explained by the factors". The AER instead believes that the premiums reflect that the actual cost of capital faced by businesses is not higher than the regulated cost of capital so that the regulated firms are not being undercompensated.

105. The AER's analysis places greatest weight on the purchase of Country Energy's Wagga Wagga gas network by Envestra. However, it is unclear why the AER regards there as being any RAB multiple paid by Envestra.

106. Envestra paid a purchase price of $107 million for the gas network.[31] This is very close to the total book value of the assets of $102 million reported in Country Energy's Annual Report 2010 (p. 11) of 31 October 2010. This is less than a 5% premium to book value paid for the assets. Such a small premium to book value could easily be explained by a host of factors. These include:

    i. Envestra expects to be able to lower costs at Country Energy (both in terms of regulated and unregulated activities) due to the superior scale of its operating and maintenance activities. I note that in the same market presentation the AER refers to Envestra states that Envestra is Australia's largest gas distributor - a market position which is itself evidence that Envestra is likely to bring superior

[29] AER, Envestra Draft Decision, Queensland, 2011, pages 244 to 245.

[30] This is given by the difference between the cost of capital and the risk free rate all divided by the market risk premium (9.96%-5.68%)/6%= 0.71.

[31] It was the case that in the ASX release, Envestra used a discount rate similar to the SA-QLD WACC proposal in October 2010

management capability to running gas distribution networks. Envestra's presentation on the acquisition of Country Energy notes that the acquisition "leverages Envestra's core competency as Australia's leading gas distribution company" and offers the "ability to exploit economies of scale".[32]

ii. Envestra expects to be able to grow the volumes of gas purchases and number of gas connections (especially as Country Energy had little incentive to compete with its own electricity services);

iii. Any other synergies or growth options that Envestra perceives in relation to the unregulated activities.

107. The AER also appears to have made an error in its estimate of the RAB multiple paid by Envestra. The AER has sought to draw inferences from figures put forward in an Envestra market presentation on 26 October 2010 to suggest that the component of the price relating to the regulated assets was $74.9 million, which is $11.7 million above the 2011 RAB and some $15.3 million above the 2010 RAB.

108. However, the book value of the unregulated assets was $44.4 million, which when added to the RAB of just under $61 million[33] is in line with the overall book value reported by Country Energy which, as discussed, was only slightly below the actual sale price. The AER's alternative argument requires not only an imputed component of the sale price that relates to the regulated assets being above the RAB but also imputing that the unregulated assets were acquired at a substantial discount to their book value. It is clearly more likely that the imputed breakdown of the sale price is wrong, rather than assuming that the regulated assets have been acquired at a premium and the unregulated assets just happened to have been acquired at an offsetting discount. Moreover, even with the assumption that there was a premium paid in the order of $11.7-15.3 million, this could easily be explained by the circumstances set out above.

109. The AER performs a less detailed analysis of RAB multiples implied by share market prices for four regulated utilities including Envestra.[34] However, these estimates do not attempt to remove the market value of unregulated assets nor the market value applied to embedded debt. These alone could easily explain the RAB multiples observed.

110. The AER also refers to RAB multiples in asset sales from January 1999 to December 2006. These RAB multiples suffer from the same sort of problems as described above plus one important further problem. Namely, these estimates are all from the period prior to the GFC when:

- it is generally accepted that risk premiums in capital markets were artificially low;

[32] Envestra, Market presentation on Envestra's acquisition of Country Energy's New South Wales Gas Networks business, slides 9 and 11.

[33] As at end of October 2010

[34] AER Envestra SA Draft Decision, Table C.2, p. 257,

- regulatory rates of return were higher than they are now (beta was generally set at 1.0 or above and gamma was set at between zero and 0.5); and
- liquidity and refinancing risks were non-existent.

111. It may be the case that, in that period, the regulated rate of return was above investors' required rates of return. However, that does not imply that this is still the case. I do not consider that the AER's use of reported RAB multiples sourced from the Grant Samuel report establishes what the AER attributes to it.

5. Estimation of the cost of debt

112. In previous regulatory decisions the AER's approach has been to set the cost of debt based on fair value curves published by Bloomberg and CBASpectrum. The methodology applied by the AER to choose between these curves was to choose the curve which was 'best aligned' to a sample of observed yields on bonds that the AER considered relevant to the benchmark bond.

113. CBASpectrum has since ceased publication of its fair value curve and the AER now proposes to set the cost of debt based on the average of the Bloomberg fair value curve and the estimated yield on a 10 year BBB rated APA bond (referred to by the AER as the "APT bond"[35]). In relying only on the Bloomberg BBB fair value and the yield on the APA bond, the AER's proposed methodology relies on much less information than that which it previously relied upon.

114. The AER's proposed methodology, by its own description, is to draw a distinction between bonds of seven years maturity or less, and those with more than seven years to maturity. In the AER's view, the Bloomberg BBB fair value curve is consistent with the former set of data, but the latter set of data is consistent with the yield on the APA bond. This is the basis upon which the AER seeks to give equal weight to the Bloomberg fair value curve and the yield on the APA bond.

115. The flaw in the AER's methodology is that the sample of bonds upon which the AER relies to conclude that the yield on the APA bond is representative of all such 7+ year bond yields consists of just two: APA itself and a bond issued by Stockland Group – the AER excludes from consideration DBCT which does not support its conclusion. Conversely, there is a very wide sample of bonds with less than seven years to maturity.

116. Excessive reliance on observations from a small sample carries risks because of the possibility that the sample relied upon may not be representative of the unobserved population at large. Although the benchmark cost of debt is for 10 years, and hence it is natural to give greater weight to bonds with similar maturities, the extent of the implicit weight given to just two bonds in the AER's methodology against all other information (comprising over 100 bonds) is inappropriate and unreasonable.

117. Accordingly, I remain of the opinion that the Bloomberg BBB fair value curve at 10 years gives the best estimate of the benchmark cost of debt

5.1. Placing significant weight on a single bond

118. The AER seeks to draw a distinction between bonds of more than seven years maturity, of which it can identify bonds issued by just three separate issuers, and bonds with less than seven years to maturity of which there are many. Whilst the AER

[35] This reference is inaccurate because the issuer of the bond is APT's parent company, APA Group.

appears to regard the Bloomberg BBB fair value curve as representative of this second class of bonds, it states that:[36]

> *To some extent, the limited market data that has recently become available further suggests that Bloomberg's series may not be representative of bond spreads beyond 7 years.*

119. The data that the AER is referring to in this statement is the yield on just two bonds issued by APA Group and Stockland Group respectively. However, the AER excludes from its consideration two DBCT bonds which provide evidence pointing to much higher yields.

120. The AER's decision gives 50% weight to the yield on the APA bond, and 50% weight to the Bloomberg fair value curve which it considers to align with the majority of the other 105 bonds issued by 49 separate issuers. I consider that this style of methodology, in relying so heavily upon such a small and selective (with the exclusion of DBCT) sample of bonds is likely to lead the AER into error. The evidence from yields on bonds with less than seven years suggests, in my opinion, that the sample of bonds that the AER seeks to apply such significant weight to is not representative of the broader population of similar bonds.

121. Furthermore, the Bloomberg fair value curve is, one must assume, set having regard to the weight of evidence from all relevant bond yields. In my view the AER is acting unreasonably in placing such significant weight on the APA bond because it is likely already incorporated into the Bloomberg fair value estimate.

5.2. How to take into account information provided by lower maturity bonds

122. Missing from the AER's assessment is a useful analysis of what bond yields apart from APA, DBCT and Stockland have to say about the cost of debt. Figure C.3 of the AER's Draft Decision does show a number of bonds set against the Bloomberg fair value curve. However, this chart does not adequately set out a useful description of the population of bonds because the AER:

- does not provide CBASpectrum estimate of yields on bonds without explanation for why this is the case;
- does not provide any details of the bonds that have been included and/or excluded from this chart, or the reasons for this. For instance:
  - it does not provide any information for bonds that it has taken into account, meaning that in some cases I have been unable to locate data for these bonds; and
  - the chart appears to include bonds with special features, such as callable bonds (BKQLD), make-whole callable bonds (DBCT) and bonds with

[36] AER Envestra SA Draft Decision, p. 271

downgrade options (such as SPI E&G). The AER has not described whether it has made adjustments for these features or not.

- does not provide any details about the source of maturity for bonds in the chart and appears to use a mix of sources; and
- arbitrarily cuts off the chart at a maturity of five years, meaning that the context of a large number of other observations is not observed.

123. For the above reasons, in my view, Figure C.3 cannot usefully indicate whether bonds other than the three specifically considered by the AER (APA, DBCT and Stockland) are generally supportive of its overall conclusion.

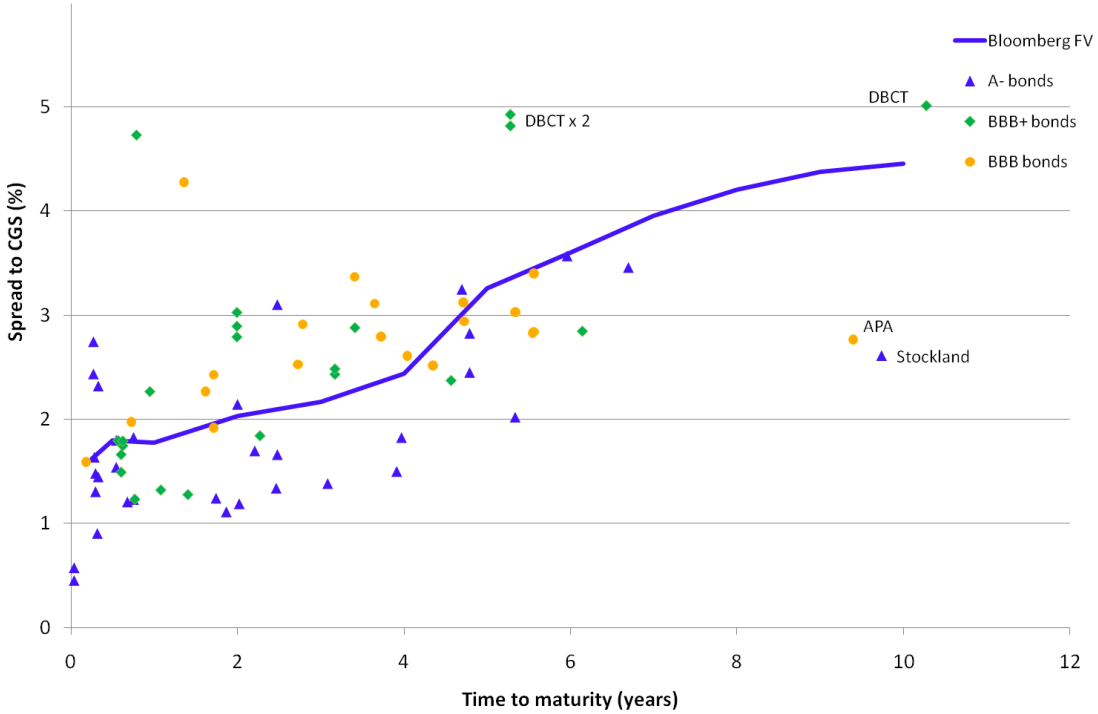
124. Figure 8 below presents the entirety of the yields from the population of BBB to A- bonds, excluding all non-standard bonds except those with make-whole call options (where the value of the option can be assumed to be negligible). Note that one DBCT bond is not shown in Figure 8 because of its long maturity.[37]

125. In all charts in this section, I report median yields and spreads to CGS, being the median calculated over UBS, Bloomberg and CBASpectrum observed yields for those that are reported. In my view, this is the best way to take into account data from all three providers. Although UBS reports the widest range of yield information, Bloomberg and CBASpectrum provide additional yield data that should be taken into account where they are available.[38]

[37] Given time constraints in producing this report, it has only been possible to source data for the 10 days to 10 March 2011.

[38] In addition to the data that I have considered in this section, there are also three Sydney Airport credit-wrapped floating rate notes maturing in 2021, 2022 and 2027 respectively. Yields for these bonds have become available from UBS since 24 February 2011, despite the fact that all three bonds were issued in December 2006. Additionally, the reported yields for these bonds display peculiar characteristics, with the 2021 and 2022 BBB rated bonds having similar yields to the 2027 AA+ rated bond. These facts potentially indicate that these bonds are not comparable to other bonds that I have regard to and that their yields may not relevant in determining the cost of debt. In the time available in preparing this report, I have not been able to obtain a sufficient understanding of the nature of these bonds to determine whether they should properly be considered in this section. Accordingly, I do not give any weight to these bonds in my analysis of the debt premium.

Figure 8: Median yields on all BBB to A- bonds, excluding non-standard bonds

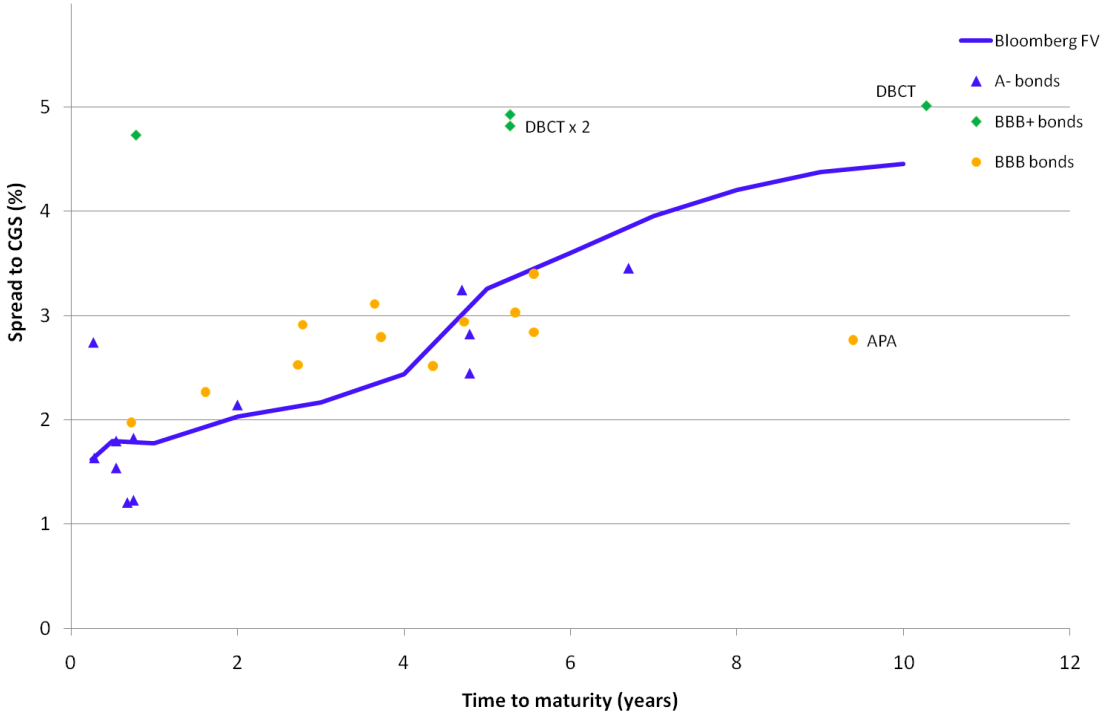


Source: UBS, Bloomberg, CBASpectrum, RBA, CEG analysis.
Note: Bonds with make-whole call options are included in this chart

126. Figure 8 indicates that the broader sample of bonds supports the Bloomberg BBB fair value curve. I note that there are a number of A- bonds that lie beneath the Bloomberg BBB fair value, but this is to be expected given the rating and type of these bonds. The figure provides more context for the choice of weight that the AER has given to the APA and Stockland bonds, shown on the right of the chart with debt premiums of approximately 3%.

127. I consider it particularly relevant to restrict attention to a subset of these bonds, being those issued by infrastructure providers. As discussed at section 5.3 below, this approach is consistent with views expressed by the AER and its consultant, Oakvale Capital. Figure 9 below indicates the results of looking at just these bonds. It is notable that the broad population of lower yielding A- bonds are excluded from Figure 9 because they are not infrastructure bonds. As discussed below, this may be because infrastructure providers face different risk in providing services from firms with diversified operations.

Figure 9: Median yields on infrastructure BBB to A- bonds, excluding non-standard bonds



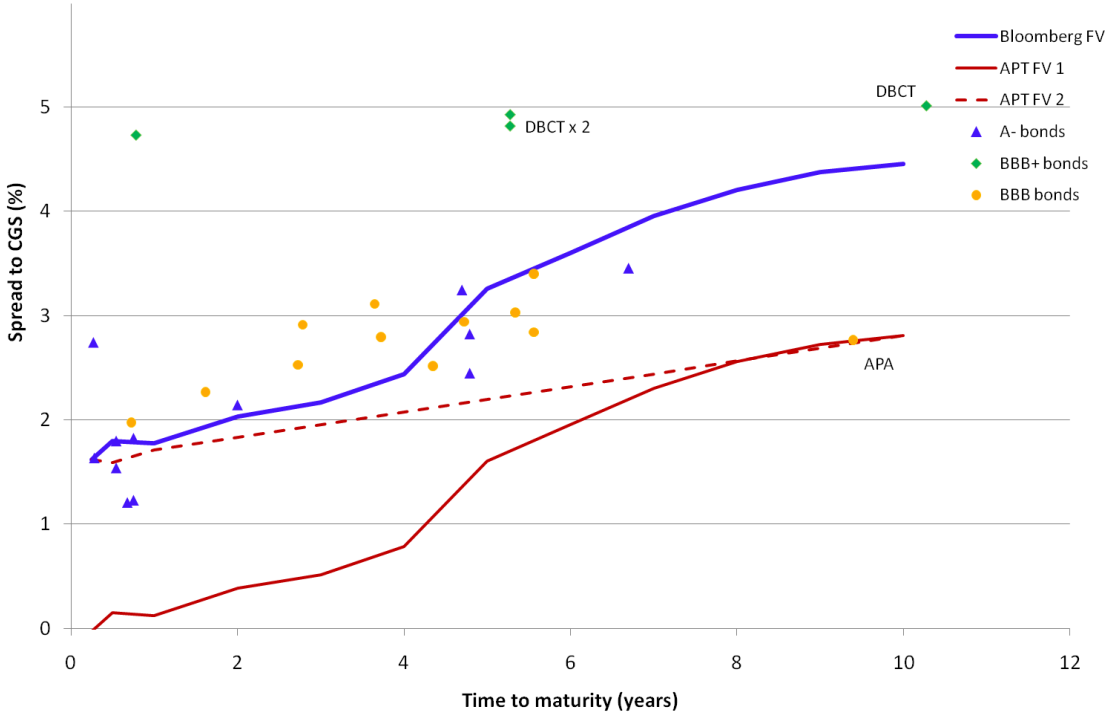
Source: UBS, Bloomberg, CBASpectrum, RBA, CEG analysis.
Note: Bonds with make-whole call options are included in this chart

128. Having regard to Figure 8 and Figure 9, it is clear that the yield on the long dated APT bond is not representative of the population of BBB bonds at large, whether infrastructure bonds or otherwise. Specifically, one can see that the debt premium on the APT bond is *lower* than many of the BBB bonds with lower maturity, including the four with the longest maturity outside APT, as well as several others. To accept that the yield on APT was representative of 10-year BBB bonds, one would have to accept that the debt premium must *decrease* between six years and ten years.

129. An alternative way of testing whether the APA bond yield is representative of the population of bonds at large is to ask whether a fair value curve that passed through the APA bond yield would also be able to fit the shorter maturity observations. As Figure 10 below demonstrates, if one accepts the shape of the Bloomberg fair value curve as a reasonable estimate, then the APA observation must be deemed unrepresentative. The reason being that the only bond observation that is not above the fair value curve is the APA observation itself.

130. Even if one adopted a flatter fair value curve shape as appropriate, also shown in Figure 10, it would still be the case that the vast majority of observations fell below the APA fair value curve, labelled as “APT FV 2”.

Figure 10: Median yields on infrastructure BBB to A- bonds, excluding non-standard bonds, with APA FV curves



Source: UBS, Bloomberg, CBASpectrum, RBA, CEG analysis.
Note: Bonds with make-whole call options are included in this chart

131. This highlights that the AER cannot reasonably give the same weight to both the Bloomberg fair value curve, and the large number of bonds that support this curve, and the small sample of low-yielding long-dated bonds at ten years. Put simply, the evidence provided by the former set of bonds contradicts the evidence provided by the latter. In the circumstances, I consider that the most reasonable methodology is to continue to rely upon the 10-year estimate from the Bloomberg fair value curve. Naturally, one should remain open to the possibility that further new information will come forward over time to support an alternative view. However, the existence of the APA bond does not, in my view, provide sufficient evidence to reach an alternative conclusion.

5.3. Reliance on infrastructure bonds

132. The AER expresses the view that:[39]

> *…the APA Group is an owner of various regulated and unregulated energy network assets. The nature of the underlying risk and markets in which the APA*

[39] AER Envestra SA Draft Decision, p. 93

Group operates resemble those of the benchmark gas pipeline service provider. To the extent that credit ratings are an imperfect indicator of default risk, the APT bond is suitable for deriving a DRP that reflects the risks involved in providing reference services.

133. The same reasoning implies that in general, more weight should be given to the yields on infrastructure bonds in assessing the benchmark cost of debt because these are more likely to reflect similar risks to those borne by Envestra. I note that this view is also expressed by Oakvale Capital in its report for the AER.[40]

134. In this regard I also note that there is a 10 year BBB+ rated infrastructure bond in the form of the DBCT bond which lies above the Bloomberg fair value curve. The logic of giving specific weight to the APA bond yield should, in my opinion, also require the AER to give the same weight to the DBCT bond.

135. The AER takes some comfort in its decision from the yield on an A- rated Stockland bond of close to 10 years maturity, which is similar to the yield on the APA bond. Specifically, the AER cites the yield on the Stockland bond as one of two reasons justifying its change in weight on the APA bond to increase from 25% to 50% in this decision.[41] However, unlike APA and DBCT, Stockland Group is not an infrastructure provider and its yield is lower than the A- rated infrastructure providers shown with lower maturity (between 4 and 8 years) in the above Figure. As such one can have less confidence about the comparability of its yields to an infrastructure provider. Furthermore, Stockland's bond is rated A- and might therefore be expected to have a lower yield than the benchmark bond. I do not therefore consider that the Stockland bond provides a useful cross-check to the AER's decision.

5.4. Exclusion of DBCT

136. In giving 50% weight to a very small sample of long-dated bonds, the AER only does so having excluded from its consideration the two DBCT bonds with maturities greater than 10 years. The AER's considerations are as follows:[42]

The AER, however, has previously expressed concerns over the reliability of this bond in comparative analysis. Specifically, Bloomberg has intermittently published observations for the DBCT bonds in the past and they have been previously excluded from Bloomberg's fair value estimates given divergent data feeds.4

Further, while the voluntary trading suspension and subsequent market recapitalisation of BBI occurred in the past, market perceptions of the BBI/DBCT

[40] Oakvale Capital, *Report on the cost of debt during the averaging period: The impact of callable bonds*, February 2011, p. 3.

[41] AER Envestra SA Draft Decision, p. 94.

[42] AER Envestra SA Draft Decision, p. 273

bonds may have shifted, despite the official credit rating assigned by Standard and Poor's remaining unchanged.

137. The issue of whether Bloomberg does or does not publish yields for the DBCT bond is immaterial in my opinion. Many of the bonds previously analysed by both myself and the AER did not have yields reported by Bloomberg, including the majority of floating rate notes. Furthermore, the exclusion of DBCT from Bloomberg's fair value curve suggests that this bond provides support independent of this curve (unlike for APA) confirming the level of that extrapolated curve at 10 years.

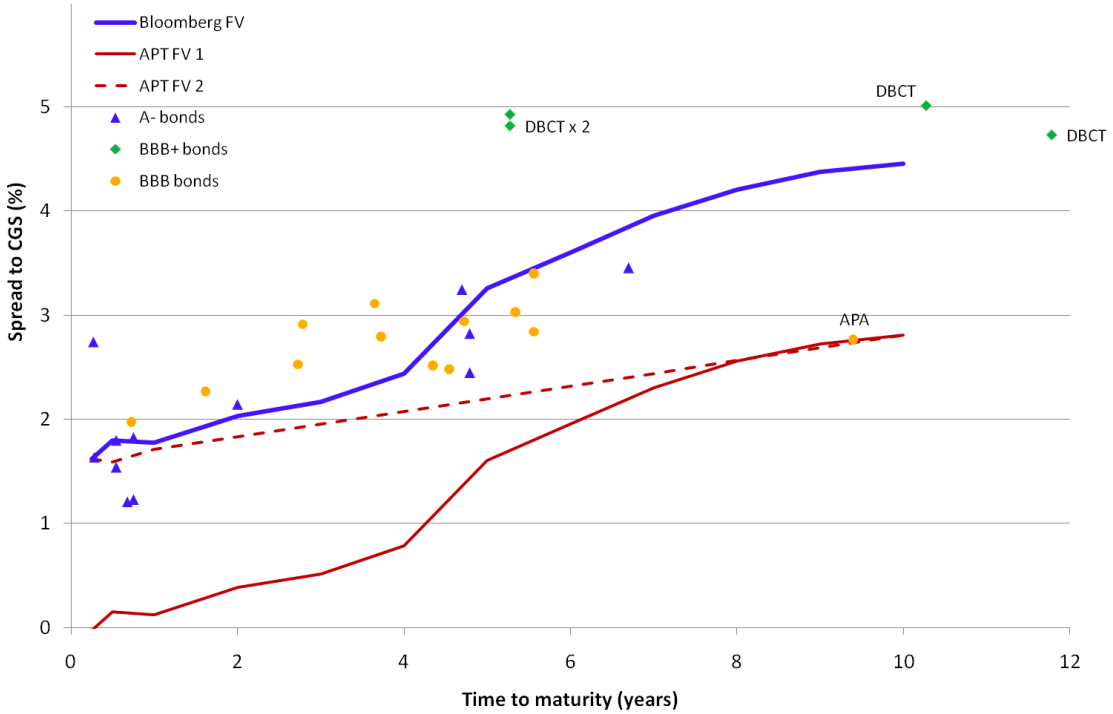
138. I agree that the AER has consistently maintained that the DBCT bond ought to be excluded. Over time, its reasons for this have traversed the bond's high yield, the liquidation of BBI and its intermittent reporting by Bloomberg. However, as acknowledged by the AER in the statement above, Standard and Poor's have maintained the rating of DBCT at BBB+ as recently as 26 October 2010. The AER has not identified any events occurring since that date that would lead me to consider that this rating is not appropriate at the current time. In my view, the AER's substitution of its inferred "market perception" for Standard and Poor's actual rating is subjective and an unreasonable basis on which to exclude the yield information provided by DBCT.

5.5. Bonds with special features

139. The AER's Draft Decision does not raise or discuss the issue of bonds with special features (such as call options), and it is unclear what steps, if any, the AER has taken to adjust the yields of bonds with these features in support of its final conclusion. I note that the Oakvale Capital report commissioned by the AER does put forward a methodology by which yields for bonds with call options may be adjusted to take into account the value of these features.

140. I have replicated this methodology and used it to take into account the information provided by these bonds. This chart is not significantly different from Figure 10 above and does not provide any evidence that changes my conclusion that the Bloomberg fair value curve remains the best fit to the bond yield data.

Figure 11: Median yields on infrastructure BBB to A- bonds, with APA FV curves



Source: UBS, Bloomberg, CBASpectrum, RBA, CEG analysis.
Note: Excludes bonds with downgrade options, for which I have not been able to source any useful data from Bloomberg with which to adjust their yields

Appendix A. Olan Henry reports

141. The AER has set an equity beta based on the work of Professor Olan Henry in the context of its review of electricity transmission and distribution WACC parameters.[43] Henry estimated beta estimates for both Australian and US companies. Henry concluded that:[44]

> *Re-estimation of the various regression models using US and UK data does not alter the conclusions one would draw about the magnitude of the point estimates β [for Australian companies]. Similarly delevering does not lead to a revision of the conclusions about the magnitude of β. Rather it is the case that the balance of the evidence points towards the point estimate of β lying in the range 0.4 to 0.7.*

142. I describe in section 3.2 above that there is significant variation in beta estimates depending upon the sampling period that is used and the sampling interval used within this period.

143. In his two reports for the AER, Professor Henry presents daily, weekly and monthly betas calculated over his preferred sampling period. He concludes, somewhat arbitrarily, that the "sampling frequency" is not significant to his estimate of beta in all cases including for Australian, UK and US betas.[45] I disagree with Henry's conclusion in most of these cases, since he seemingly ignores differences in average betas that appear to me to be significant. For example, he calculates average raw betas for his US stocks at daily, weekly and monthly frequencies to be 0.66, 0.70 and 0.83 respectively, but dismisses these differences as "not important".[46]

144. Such variation in beta estimates can be tested by reference to the data presented in Henry's reports. However, another category of variation discussed at section 3.2 above is not presented or raised at all in Henry's reports – specifically the basis used for calculating weekly and monthly betas (e.g. week ending Friday versus week ending Monday, month ending 30th vs. Month ending 15th etc). Any reader of these reports unaware of the potential for such variation would be left with the impression that either:

- Henry did not consider this type of variation at all in estimating beta; or
- Henry did consider this type of variation (despite never discussing it) but did not present his results because he concluded that such variation was not significant.

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[43] Henry, O., *Econometric advice and beta estimation*, November 2008.

Henry, O., *Estimating β*, April 2009.

[44] Henry, O., *Econometric advice and beta estimation*, November 2008, p. 21.

[45] See for example, Henry, O., *Econometric advice and beta estimation*, November 2008, pp. 13, 15-17; and Henry, O., *Estimating β*, April 2009, p. 47.

[46] Henry, O., *Econometric advice and beta estimation*, November 2008, p. 17.

145. In my opinion, on the basis of the analysis that I present at section 3.2 above, it is not possible to sustain a view that this type of variation is insignificant. Furthermore, I have come to the conclusion in examining Professor Henry's reports that it is likely that he has changed the basis of his estimates of US weekly betas from a Friday to Friday measure in his November 2008 report to a Monday to Monday measure in his April 2009 report. It seems unlikely that this could have occurred without Professor Henry being aware that he was making such a change and that this change significantly altered his estimates of raw equity betas.

146. As I discuss at section 3.2 above and Appendix B below, I believe that the econometric evidence presented in Professor Henry's reports alone is an insufficient basis upon which to make a reliable empirical estimate of beta. Professor Henry relies on a very small number of comparable Australian firms with sparse time series data available, and uses only a few US firms as a cross-check on these results.

147. I further believe that the weight accorded to Professor Henry's econometric estimates of beta should be reduced further still until the basis upon which he has estimated his weekly and monthly betas in his 2008 and 2009 reports is fully disclosed.

A.1. Change in weekly beta estimates from Friday to Monday

148. In his first and second reports for the AER, Professor Henry presented weekly betas for US firms estimated over the period from 1 January 2002 to 1 September 2008. These estimates are presented in Table 6 below.

Table 6: Henry's estimates of weekly US equity betas

Firm	Raw beta (2008)	Re-levered beta (2009)	Raw beta (2009)*	Change in raw beta
CHG	0.7054	1.0359	0.6114	0.0940
CNP	0.6142	0.3345	0.5000	0.1142
EAS	0.4801	0.5440	0.4748	0.0053
NI	0.6802	0.7138	0.6803	-0.0001
NJ (NJR)	0.9593	0.9909	0.5808	0.3785
NST	0.5322	0.6029	0.4554	0.0768
NU	0.5966	0.5518	0.5565	0.0401
SRP (NVE)	0.9684	0.6494	1.0088	-0.0404
UIL	0.7191	0.7308	0.5166	0.2025
POM	0.7447	0.6100	0.5957	0.1490
PORT		0.6919	0.5933	

Source: Henry, November 2008, pp.17 , April 2009, pp. 41
** Not disclosed in report but calculated using gearing reported by Henry and levering/delivering formula reported by Henry.*

149. Table 6 shows that Henry's raw weekly beta estimates for the same firms, over the same period, have change significantly between his November 2008 and April 2009

reports. I note that Professor Henry has not disclosed any reason in his April 2009 report as to why his raw beta estimates might have changed. Indeed, Professor Henry does not directly report raw beta estimates in his April 2009 report – I have calculated these from his re-levered equity betas (using gearing reported by Henry and levering/delivering formula reported by Henry).

150. However, apart from NJR (and POM to a much lesser extent) his monthly betas have not changed, as shown in Table 7 below.

Table 7: Henry's estimates of monthly US equity betas

Firm	Raw beta (2008)	Re-levered beta (2009)	Raw beta (2009)*	Change in raw beta
CHG	0.4402	0.7458	0.4402	0.0000
CNP	1.4706	0.9835	1.4701	0.0005
EAS	0.3657	0.419	0.3657	0.0000
NI	0.6143	0.6446	0.6143	0.0000
NJ (NJR)	0.8806	0.4005	0.2348	0.6458
NST	0.4658	0.6167	0.4659	-0.0001
NU	0.5209	0.5165	0.5209	0.0000
SRP (NVE)	1.7964	1.1562	1.7960	0.0004
UIL	1.1663	1.6499	1.1664	-0.0001
POM	0.6091	0.6368	0.6219	-0.0128
PORT		0.9048	0.7758	

Source: Henry, November 2008, p.17 , April 2009, p. 41
** Not disclosed in report but calculated using gearing reported by Henry using gearing reported by Henry and levering/delivering formula reported by Henry.*

151. It is important to note that although the AER has changed the gearing assumptions that it supplied to Henry between his two reports, this has no effect on the raw betas calculated by Henry, only on the re-levered betas. Therefore I would expect the raw betas reported by Henry in 2008 and 2009 to be exactly the same if he had not changed the basis for his estimation of beta.

152. In Table 8 below I compare Henry's 2008 report and his 2009 report estimates of US weekly raw betas (estimates that relate to identical periods) to estimates I obtain from the same period but on five different bases from Bloomberg (week ending Monday, Tuesday etc). I have not been able to obtain full five year estimates of beta for POM and PORT from Bloomberg so I have not included these in the table. The differences between each set of Henry's estimates and each set of Bloomberg estimates is summarised in terms of the sum of differences and the sum of absolute differences at the bottom of the table.[47]

[47] I have excluded NJ from my summary of the 2008 data because it is clear from the data that the very significant change in NJ between 2008 and 2009 is due to reasons other than changing the estimation basis. Although not explained by

Table 8: Comparison of Henry's weekly US betas to Bloomberg betas

Firm	Henry Raw beta (2008)	Henry Raw beta (2009)	Monday raw beta	Tuesday raw beta	Wednesday raw beta	Thursday raw beta	Friday raw beta
CHG	0.71	0.61	0.62	0.75	0.75	0.68	0.71
CNP	0.61	0.50	0.51	1.12	1.43	1.02	0.63
EAS	0.48	0.47	0.47	0.61	0.65	0.60	0.48
NI	0.68	0.68	0.66	0.73	0.79	0.65	0.67
NJ (NJR)	0.96	0.58	0.58	0.63	0.58	0.54	0.61
NST	0.53	0.46	0.45	0.62	0.59	0.52	0.53
NU	0.60	0.56	0.54	0.65	0.70	0.55	0.58
SRP (NVE)	0.97	1.01	0.99	1.25	1.16	1.34	0.95
UIL	0.72	0.52	0.52	0.64	0.76	0.79	0.72
POM	0.74	0.60					
PORT		0.59					
Comparison to Henry 2008							
Sum of differences excl NJ			0.54	-1.07	-1.51	-0.84	**0.02**
Absolute sum of differences excl NJ			0.57	1.24	1.51	1.08	**0.08**
Comparison to Henry 2009							
Sum of differences excl NJ			**0.04**	-1.62	-2.01	-1.30	-0.50
Absolute sum of differences excl NJ			**0.09**	1.62	2.01	1.46	0.65

Source: Bloomberg, Henry, November 2008, p.17, April 2009, p. 41.

153. Table 8 strongly suggests that Henry has calculated his 2008 US raw weekly betas on a Friday to Friday basis and his 2009 US raw weekly betas on a Monday to Monday basis. It can be seen that the Friday raw betas presented are, with the exception of NJ (NJR) very similar to Henry's 2008 reported raw betas. This is reflected in the very small sum of differences and sum of absolute differences shaded in the far right column. By comparison, the Monday raw betas are very close to Henry's reported betas in his 2009 report.[48] . This is reflected in the very small sum of differences and sum of absolute differences shaded in the bottom rows under the "Monday" column.

154. Whilst there are slight variances between the estimates, these are small and might be expected given that these estimates are obtained from different sources. The differences between his estimates and all other methods of weekly estimation are degrees of magnitude higher than Friday to Friday and Monday to Monday for 2008 and 2009 respectively.

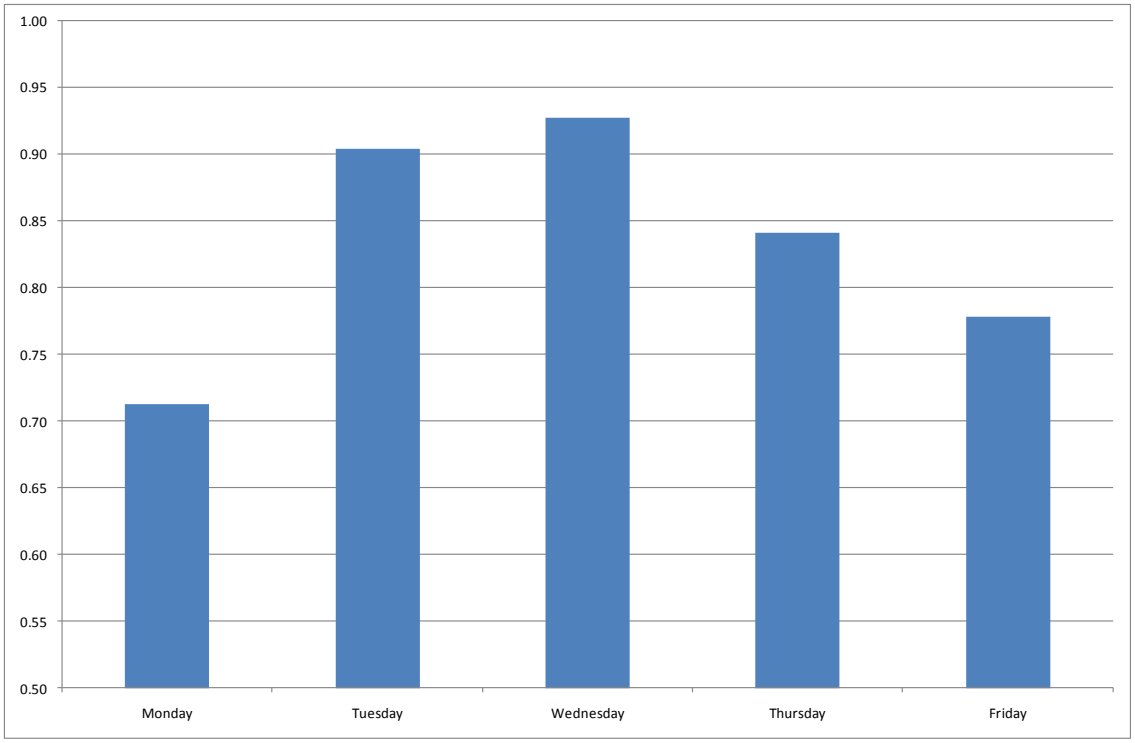
Professor Henry in his report, this may be due to an error, since the betas sourced from Bloomberg are more in line with his 2009 estimates.

[48] After they have been de-levered from 60% gearing back to the original gearing.

155. There are two important observations that must be drawn from this in relation to the Henry estimates. The first is that, in moving from a Friday beta to a Monday beta Henry has substantially reduced the estimated beta – the average 60% geared beta falls by 0.07 excluding POM and PORT for which I do not have data.

156. Secondly, and more importantly, this involves a move from the second lowest to the lowest beta. Had Henry moved from Friday to Wednesday rather than Monday the estimated beta would have been 0.21 higher. Henry's failure to report this is a material problem with his report.

Figure 12: Alternative estimates of weekly beta based on Henry's sample, 1 January 2002 to 1 September 2008



Source: Bloomberg, CEG analysis

Appendix B. Confidence in equity beta estimates

B.1. AER's criticism

157. In my previous report for Envestra, I produced a chart showing average asset betas for a sample of 56 Australian, New Zealand, UK and US listed electricity and gas transport firms. This is reproduced at Figure 13 below.

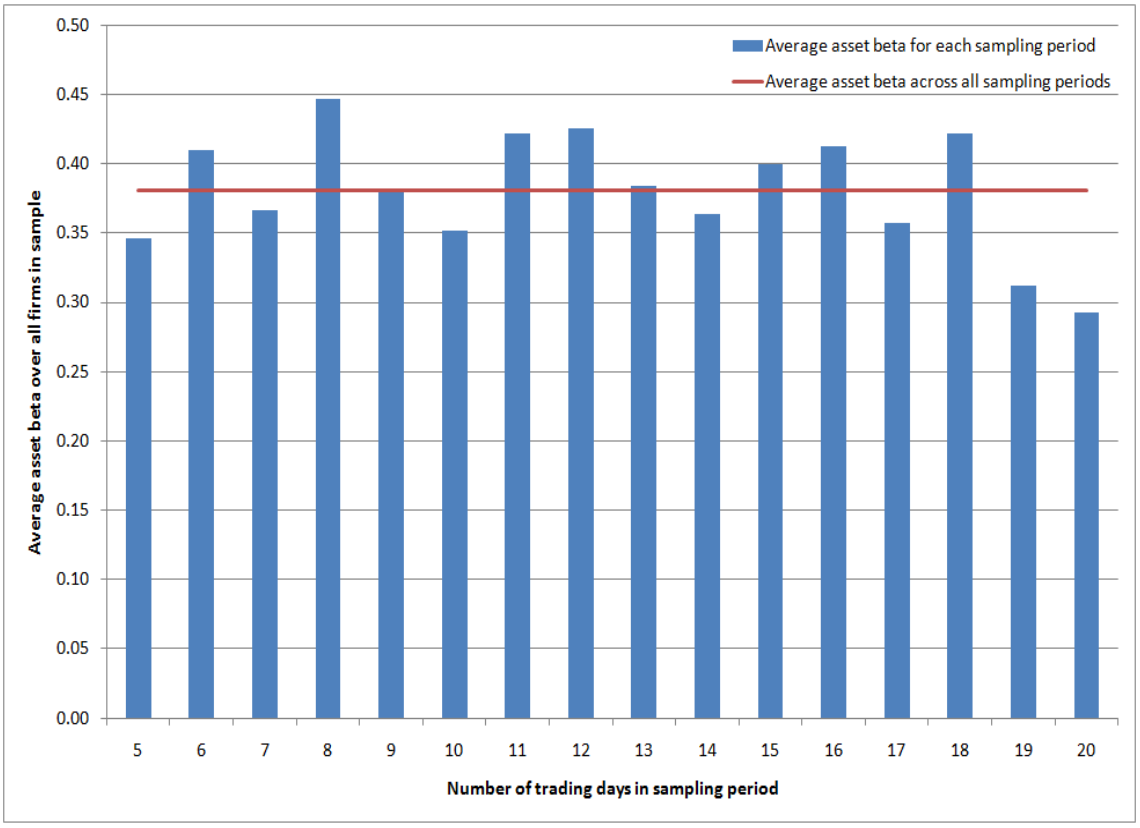
158. The AER has raised a number of issues about the reliability of my estimates of equity betas. The AER states in relation to this chart that:[49]

> *Given CEG has not presented any information that thick trading is not an issue (e.g. the Dimson approach) and other robustness test to demonstrate observation period is appropriate (e.g. test for autocorrelation and heteroskedasticity), the AER considers that only the monthly observation period should be used. CEG's five year asset beta estimate using monthly observations is 0.29, which translates into an equity beta estimate of 0.725. This would indicate that the AER beta estimate of 0.8 is sufficient to give Envestra an opportunity to earn a return on capital that is commensurate with prevailing conditions in the market for funds and the risks involved in providing reference services. Further, as was the case with the asset beta estimate for the small estimation period, CEG has not provided t-statistics to demonstrate the beta estimates for the five year estimation period are statistically significant.*

159. The monthly observation that the AER is referring to is the 20-day observation at the far right of Figure 13 below. Coincidentally, this is the lowest observation of the sixteen figures that I presented (at 0.29), compared to the mean across the observations of 0.38 (consistent with a re-levered equity beta of 0.95).

[49] AER Envestra SA Draft Decision, pp. 268-9.

Figure 13: 5 to 20 day mean asset betas over 56 companies measured over 5 years to June 2010



Source: Bloomberg, CEG analysis

160. I do not consider that the reasons put forward by the AER for relying on the lowest equity beta in the chart above in support of its own estimate are credible. In my view, none of the issues raised by the AER are relevant to the equity betas that I estimated in my report for Envestra.

161. The AER has argued that because of the potential for "thick trading" that only monthly betas should be used and, on the basis of this chart, state:

> *CEG's five year asset beta estimate using monthly observations is 0.29, which translates into an equity beta estimate of 0.725. This would indicate that the AER beta estimate of 0.8 is sufficient to give Envestra an opportunity to earn a return on capital that is commensurate with prevailing conditions in the market for funds and the risks involved in providing reference services.*

162. The 0.29 estimate is based on the 20 trading day estimate in this chart (20 trading days being approximately one month). However, the 18 trading day estimate is clearly of a similar period but its asset beta estimate is 0.42 which translates to an equity beta of 1.05 at 60% gearing.

163. The purpose of the presentation of this chart in my earlier report was to demonstrate the considerable sensitivity of average equity betas depending on sampling period chose. I therefore find it highly peculiar that the AER would alight on the lowest number in this chart on a basis that, even if it had any validity, would still suggest that regard was given to the nearby 0.42 asset beta. (I discuss below why the AER's 'thick trading' rationale for monthly betas is unsound)

B.1.1. Existence of thin trading

164. The AER states that I have not established that "thick trading" is not an issue or attempted to adjust for it, for example by the Dimson approach.

165. It is important to understand in interpreting the AER's criticism what thick trading, and its opposite, thin trading, are. Thin trading occurs where a stock trades illiquidly, such that it is not possible to rely upon its most recent traded price to estimate returns from an earlier period because there have been few (or no) trades from which to establish a different price.

166. Thin trading of individual stocks may lead to estimates of beta that are *biased downwards*. This is because infrequent trading in a stock may lead to systemic shocks to the economy only showing up in its share price with a lag – such that measured betas underestimate the extent to which it was affected by the same systemic shock that affected the market.

167. Because the average beta of the market is, by definition equal to one, if betas of thinly traded stocks are biased downward then the betas of thickly traded stocks must be biased upward. This appears to be the basis for the AER's concerns that betas for stocks with less than 20-day sampling intervals may not be robustly estimated. The AER is concerned that regulated energy utilities are more heavily traded than the average stock in the market and, as a result, measured betas will be biased upwards.

168. This is a peculiar concern for two reasons:

- It does not appear likely that regulated energy stocks are likely to be more thickly traded than the average stock on the market; and
- Even if they were, the upward bias would be very small.

169. In relation to the second dot point, it is also important to understand that there is a material difference in the magnitude of the downward bias for betas of thinly traded stocks and the upward bias for betas of thickly traded stocks. Thinly traded stocks do not account for a high proportion of value in a market – almost by definition, the most thickly traded stocks are those with the greatest value.[50] It follows that to the extent that the betas on thinly traded stocks are underestimated, the magnitude of the

[50] This remains true in a relative sense even in a market that is thinly traded in general.

corresponding overestimate of betas on thickly traded stocks must be much less in order for the average beta in the market to remain one.

170. The AER has expressed concern that some of the stocks in my sample may be thickly traded and therefore suffer from upwardly biased betas. The reasoning above demonstrates that we can expect any such upward bias to be very small. On the other hand, the AER does not voice any concerns that these same stocks may be thinly traded so that their betas may have been underestimated. However, the same reasoning above indicates that the magnitude of the downward bias would be much larger were this to be the case.

171. Overall, I do not consider that the AER has made a convincing *a priori* case that betas of less than 20 days sampling intervals are likely to materially biased upward. In fact, the risk of downward bias should be of greater concern.

172. In assessing this bias. I note that the empirical evidence indicates that OLS estimates may actually be superior to Dimson estimates for thinly traded stocks (and by inference for thickly traded stocks as well).[51] I note that Henry performs the Dimson test on weekly and monthly betas for Australia. He finds that APA fails the illiquidity test but does not propose any actions to mitigate potential concerns from this finding. I therefore consider that there may be little value in conducting the Dimson test on the estimates of equity beta underlying Figure 13 above.

B.1.2. Reporting of standard errors and t-statistics

173. In my previous report for Envestra, as well as the spreadsheets that I supplied the AER with to accompany the report, I did not report standard errors on individual beta estimates. This is because I did not use these standard errors or conduct inference on individual beta estimates

174. As I set out at section 3.2 above, there is great variability attached to estimates of equity betas depending on the mode of measurement. In this context, standard errors reported for these equity betas may give a false sense of the precision of these estimates. For example, Henry's 2008 report presents estimates of daily betas for Australian firms, indicating standard errors of between 0.0392 and 0.0696.[52] These standard errors imply that the true estimate of beta is known, at a 95% level of confidence, to be within an interval with a width of between 0.15 and 0.27. However, the results of section 3.2 clearly indicate that the range of possible estimates is much wider than this.

175. In many cases standard errors on beta estimates clearly give an unreliable estimate of the precision of beta estimates, having regard to the variability of these estimates and

[51] Riding, A., (1994) "Thin trading and estimation of betas: the efficacy of alternative techniques", *Journal of Financial Research*, 17(2), pp. 241-54.

[52] Henry, O., *Econometric advice and beta estimation*, November 2008, p. 14.

comparison to estimates for other firms. Rather than rely on confidence intervals established about a very small number of beta estimates, as Henry does, my preference is to rely upon a much larger number of relevant beta comparisons in order to make inferences about the likely range of the underlying beta.

176. Additionally, the AER states that I have not provided t-statistics that would establish whether my estimates of beta are 'statistically significant'. In my view, this statement indicates a lack of understanding by the AER of fundamental aspects of statistical inference. Even if one considered the standard errors from beta estimation to be reliable and useful (which as stated above I do not) it would not make any sense to report t-statistics as required by the AER.

177. To use a t-statistic to test whether an estimate of beta is 'statistically significant', as the AER would have me do, is to test a null hypothesis (or prior belief) that this beta is equal to zero, against an alternative hypothesis that it is significantly different from zero. The nature of such a test is that some weight of statistical evidence is required (typically 95% confidence) to reject the proposed null hypothesis.

178. Applying a null hypothesis of zero is commonly used to test coefficient estimates in regression analysis where one is investigating whether the independent variable (in this case, the return on the market) has a statistically significant effect on the dependent variable (in this case, the return for an individual firm).

179. There is no basis in the AER's analysis for establishing a prior belief that a beta would be zero, and it is nonsensical to apply a statistical test of a beta against zero that then requires an evidentiary hurdle to overcome this null hypothesis. If there is statistical inference to be made, it can only reasonably be against a null hypothesis that the beta for the firm is equal to the average beta in the market, which is by definition one.

180. In conclusion, I do not regard the AER's concerns over the absence of standard errors or t-statistics in my previous report for Envestra to be valid. Even if I had considered standard errors to be reliable, I do not consider that testing the statistical significance of individual estimates of beta against zero would have been a relevant exercise in the context of my report.

B.1.3. Tests for autocorrelation and heteroscedasticity

181. The AER asserts that I have failed to conduct tests such as those for autocorrelation and heteroscedasticity that would justify my choice of observation period as appropriate. In my opinion these conditions have little bearing on the choice of observation period and, in any case, do not result in biased estimates of beta. It follows that the absence of such tests has no bearing on the robustness of my reported results.

182. Introductory textbooks of econometrics teach undergraduate students that the existence of autocorrelation and heteroscedasticity do not lead to biased OLS estimators, but may cause the estimates of standard errors to be biased.[53] The existence of these conditions may then lead statistical inference, eg, hypothesis testing and confidence intervals, to be invalid.

183. As I set out in response to the AER's criticism immediately above, I have not used or reported standard errors for beta estimates in my previous report for Envestra (or this one). As such, even if such issues were present in the data that I used, they did not lead to biased estimates of beta or to me making inappropriate statistical inferences. For these same reasons, I do not consider that there is any reason for me to investigate these issues in this report.

184. I note in this regard that Professor Henry's reports that were relied upon by the AER in setting an equity beta of 0.8 extensively report and use confidence intervals based on standard errors estimated in the usual way. Professor Henry investigates the use of White and Newey-West standard errors to use for inference testing but rejects the use of these in the absence of any "clear motivation" for this adjustment.[54] If the AER is concerned about the existence of such conditions in the equity beta data then these concerns are likely to be more relevant to Professor Henry's report given his use of standard errors.

[53] See for example, Griffiths, W.E., Hill, R.C. and Judge, G.G., *Learning and practicing econometrics*, 1993, Chapters 15 and 16.

[54] Henry, O., *Estimating β*, April 2009, pp. 6-7.

Appendix C. Regulatory Research Associates beta estimates

185. I have also calculated asset betas using raw equity betas and gearing levels sourced from the US Regulatory Research Authorities (RRA). The sample includes all businesses currently classified by RRA as listed electric and/or gas distributors. The one and three year equity betas are calculated as daily betas relative to the S&P 500 over a 250/750-trading-day period respectively. The gearing is calculated as a one/three year average respectively. The equity beta and gearing levels have subsequently been used to derive an asset beta for each business. The data is summarized in the below table.

Table 9: United States electric and gas utilities asset and equity betas

	Raw beta	Gearing	Asset beta	Re-levered beta	Raw beta	Gearing	Asset beta	Re-levered beta
	One year betas				Three year betas			
CHG	0.75	48.2%	0.60	1.24	0.67	47.4%	0.54	1.10
CNP	0.79	76.2%	0.57	1.17	0.76	80.2%	0.55	1.10
EAS	0.19	55.3%	0.17	0.25	0.39	56.4%	0.32	0.58
NI	0.82	59.4%	0.63	1.30	0.79	59.3%	0.61	1.25
NJR	0.80	46.5%	0.65	1.33	0.63	46.1%	0.52	1.03
NST	0.63	58.8%	0.49	0.98	0.60	60.8%	0.47	0.92
NU	0.69	58.3%	0.54	1.08	0.61	60.7%	0.47	0.94
NVE	0.73	63.2%	0.56	1.13	0.68	62.4%	0.52	1.05
UIL	0.76	50.6%	0.61	1.24	0.72	55.8%	0.57	1.15
POM	0.66	57.4%	0.52	1.04	0.78	58.0%	0.60	1.24
POR	0.72	53.7%	0.57	1.16	0.64	51.5%	0.51	1.03
AES	1.50	65.3%	1.10	2.37	1.34	71.6%	0.97	2.06
AGL	0.77	56.6%	0.60	1.23	0.64	56.4%	0.50	1.01
AYE	0.72	58.2%	0.56	1.13	0.87	59.0%	0.67	1.38
ALE	0.79	43.5%	0.65	1.33	0.60	42.4%	0.50	1.00
LNT	0.79	47.5%	0.64	1.31	0.70	43.1%	0.58	1.17
AEE	0.70	49.5%	0.56	1.14	0.78	51.3%	0.62	1.27
AEP	0.66	58.0%	0.52	1.03	0.68	59.4%	0.53	1.06
ATO	0.76	49.8%	0.61	1.24	0.56	51.3%	0.45	0.89
AVA	0.82	53.9%	0.64	1.33	0.65	53.3%	0.52	1.04
BKH	0.98	54.5%	0.76	1.60	0.90	50.9%	0.71	1.48
CPN	0.92	68.8%	0.68	1.41	1.14	69.7%	0.83	1.75

	Raw beta	Gearing	Asset beta	Re-levered beta	Raw beta	Gearing	Asset beta	Re-levered beta
	One year betas				Three year betas			
CV	0.76	42.7%	0.63	1.28	0.74	45.3%	0.60	1.23
CPK	0.89	38.6%	0.74	1.55	0.88	44.2%	0.72	1.49
CNL	0.76	52.1%	0.60	1.23	0.70	52.1%	0.56	1.13
CMS	0.69	70.5%	0.52	1.03	0.74	70.9%	0.55	1.11
ED	0.50	51.2%	0.41	0.79	0.49	50.8%	0.40	0.77
CEG	1.02	34.0%	0.86	1.82	0.67	49.2%	0.54	1.09
CVA	1.01	65.3%	0.75	1.57	0.78	64.8%	0.59	1.20
D	0.70	58.9%	0.54	1.10	0.64	61.3%	0.50	0.99
DPL	0.75	53.0%	0.59	1.21	0.54	57.8%	0.43	0.83
DTE	0.71	54.7%	0.56	1.13	0.70	56.7%	0.55	1.11
DUK	0.54	44.9%	0.45	0.88	0.57	42.3%	0.48	0.94
DYN	1.24	61.9%	0.93	1.98	1.44	60.6%	1.08	2.32
EIX	0.71	51.2%	0.57	1.15	0.79	53.8%	0.62	1.27
EE	0.78	53.3%	0.62	1.26	0.75	53.6%	0.59	1.21
EDE	0.64	52.8%	0.51	1.02	0.65	55.3%	0.51	1.03
EGN	1.04	21.0%	0.93	1.99	1.24	24.0%	1.10	2.35
ETR	0.69	57.7%	0.54	1.09	0.67	58.6%	0.52	1.05
EQT	1.24	39.7%	1.02	2.18	1.24	44.2%	1.00	2.14
EXC	0.64	48.5%	0.52	1.04	0.86	52.1%	0.68	1.40
FE	0.61	63.0%	0.47	0.93	0.76	62.1%	0.58	1.18
GEN	1.11	35.6%	0.93	1.98	0.99	39.0%	0.82	1.73
GXP	0.68	57.0%	0.53	1.07	0.63	55.3%	0.50	0.99
HE	0.74	49.7%	0.59	1.21	0.50	53.2%	0.40	0.78
IDA	0.88	50.8%	0.70	1.45	0.64	52.0%	0.51	1.03
TEG	0.82	46.0%	0.66	1.37	0.74	47.7%	0.60	1.22
ITC	0.65	69.9%	0.49	0.97	0.76	70.3%	0.56	1.15
LG	0.83	47.2%	0.67	1.38	0.65	50.2%	0.52	1.05
MDU	0.98	36.6%	0.82	1.73	1.06	37.8%	0.88	1.87
NFG	1.18	40.9%	0.97	2.06	0.97	41.2%	0.80	1.67
NEE	0.59	59.6%	0.46	0.91	0.75	59.0%	0.58	1.18
GAS	0.89	40.4%	0.74	1.53	0.75	44.1%	0.61	1.26
NWN	0.82	52.5%	0.65	1.33	0.60	51.8%	0.48	0.96
NWE	0.88	56.4%	0.68	1.41	0.68	54.3%	0.54	1.08
NRG	0.87	52.8%	0.68	1.42	1.12	53.9%	0.87	1.84

	Raw beta	Gearing	Asset beta	Re-levered beta	Raw beta	Gearing	Asset beta	Re-levered beta
	One year betas				Three year betas			
OGE	0.97	54.4%	0.76	1.58	0.81	55.5%	0.63	1.30
OKE	1.13	55.6%	0.87	1.84	1.06	62.5%	0.80	1.67
ORA	1.05	42.9%	0.85	1.80	1.26	37.7%	1.04	2.24
PCG	0.55	54.8%	0.44	0.86	0.57	54.8%	0.45	0.89
PNY	0.80	49.0%	0.64	1.32	0.70	52.2%	0.56	1.13
PNW	0.68	51.9%	0.54	1.10	0.63	52.3%	0.50	1.01
PNM	1.01	49.8%	0.80	1.68	1.02	52.1%	0.80	1.68
PPL	0.56	55.8%	0.45	0.87	0.72	57.9%	0.56	1.14
PGN	0.52	56.4%	0.42	0.80	0.58	56.6%	0.46	0.90
PEG	0.72	48.7%	0.58	1.18	0.82	51.8%	0.65	1.34
PSD	0.35	58.3%	0.29	0.51	0.40	56.8%	0.33	0.60
STR	1.17	36.8%	0.98	2.08	1.39	32.6%	1.18	2.54
SCG	0.72	57.7%	0.56	1.14	0.62	58.0%	0.49	0.97
SRE	0.70	48.5%	0.57	1.15	0.78	46.9%	0.63	1.30
SJI	0.81	50.2%	0.65	1.33	0.62	49.2%	0.50	1.00
SO	0.45	55.5%	0.36	0.69	0.47	56.8%	0.38	0.72
SUG	1.05	59.2%	0.80	1.68	1.10	60.1%	0.83	1.76
SWX	1.06	48.9%	0.84	1.77	0.82	52.9%	0.65	1.33
TE	0.93	61.6%	0.71	1.47	0.83	61.7%	0.63	1.30
UGI	0.73	51.2%	0.58	1.18	0.63	55.4%	0.50	0.99
UNS	0.79	71.0%	0.58	1.19	0.76	72.4%	0.56	1.14
UTL	0.65	63.6%	0.50	1.00	0.21	64.2%	0.18	0.27
VVC	0.73	55.8%	0.57	1.16	0.61	55.8%	0.48	0.96
WR	0.74	56.4%	0.58	1.18	0.72	55.0%	0.57	1.15
WGL	0.70	37.7%	0.59	1.20	0.68	41.4%	0.57	1.15
WEC	0.67	57.2%	0.53	1.05	0.49	58.0%	0.39	0.75
XEL	0.60	54.6%	0.48	0.95	0.55	55.1%	0.44	0.86

Appendix D.Sample and beta estimates

Company	Ticker	AU	RRA	Henry	NZCC	ESCV	Reg.	Mostly reg.	Daily 5 year betas		Average weekly 5 year betas	
									28/12/2007	1/09/2008	28/12/2007	1/09/2008
Envestra Limited	**ENV**	X							0.47	0.40	0.32	0.36
SP AusNet	**SPN**	X							N/A	N/A	N/A	N/A
DUET Group	**DUE**	X							N/A	N/A	N/A	N/A
Hastings Div. Utilities Fund	**HDF**	X							N/A	N/A	N/A	N/A
APA Group	**APA**	X							0.83	0.83	0.58	0.67
Spark Infr. Group	**SKI**	X							N/A	N/A	N/A	N/A
National Grid plc	**NG**								0.82	0.76	0.74	0.66
Xcel Energy	**XEL**		X	X		X		X	0.93	0.92	0.78	0.81
Wisconsin Energy Corp.	**WEC**		X	X		X		X	0.75	0.76	0.84	0.82
Vectren Corp.	**VVC**		X	X				X	0.95	0.92	1.05	0.93
Unitil Corp.	**UTL**		X	X		X		X	0.04	0.01	0.05	0.03
UniSource Energy Corp.	**UNS**		X	X		X		X	0.50	0.59	0.42	0.56
UIL Holdings Corp.	**UIL**		X	X	X	X		X	1.29	1.28	1.34	1.15
UGI Corp.	**UGI**		X						0.88	0.87	1.08	1.08
Integrys Energy Group Inc.	**TEG**		X	X		X			0.96	1.01	0.98	0.97
Sempra Energy	**SRE**		X	X					1.32	1.29	1.40	1.41
SCANA Corp.	**SCG**		X	X		X			1.05	1.02	0.86	0.90
PPL Corp.	**PPL**		X			X			0.93	1.00	1.10	1.05

Company	Ticker	AU	RRA	Henry	NZCC	ESCV	Reg.	Mostly reg.	Daily 5 year betas		Average weekly 5 year betas	
Pepco Holdings	**POM**		X	X	X	X			0.75	0.79	0.82	0.90
Public Service Ent. Group Inc.	**PEG**		X	X		X			0.90	1.00	1.12	1.03
PG&E Corp.	**PCG**		X	X		X		X	1.16	1.16	1.06	1.02
OGE Corp.	**OGE**		X	X		X			1.27	1.17	0.99	1.11
NorthWestern Corp.	**NWE**		X	X				X	1.03	1.00	N/A	N/A
NV Energy, Inc.	**NVE**		X	X	X	X		X	N/A	N/A	0.89	0.84
Northeast Utilities System	**NU**		X	X	X	X		X	1.15	0.98	0.63	0.66
NSTAR	**NST**		X	X	X	X		X	0.81	0.81	0.73	0.81
NiSource Inc.	**NI**		X	X	X				0.66	0.70	0.96	0.81
Alliant Energy Corp.	**LNT**		X	X		X		X	1.00	1.10	0.97	1.12
Exelon Corp.	**EXC**		X	X		X	X		1.27	1.41	1.24	1.25
Entergy Corp	**ETR**		X	X		X	X		1.05	1.07	1.25	1.11
Empire Dist. Electric Comp.	**EDE**		X	X		X	X	X	1.05	1.11	0.97	0.95
Consolidated Edison, Inc.	**ED**		X	X		X		X	0.99	1.03	0.76	0.80
Duke Energy Corp.	**DUK**		X	X		X			1.11	1.21	1.35	1.04
DTE Energy Company	**DTE**		X	X		X	X	X	0.65	0.68	0.68	0.70
Dominion Resources, Inc.	**D**		X	X					1.14	1.06	0.81	0.88
Chesapeake Utilities Corp.	**CPK**		X						0.42	0.69	0.66	0.84
CenterPoint Energy, Inc.	**CNP**		X	X	X		X		0.57	0.62	0.65	0.65
CMS Energy Corp.	**CMS**		X	X		X		X	0.80	0.64	0.97	0.70
CH Energy Group	**CHG**		X	X	X	X		X	1.44	1.59	1.54	1.52

Company	Ticker	AU	RRA	Henry	NZCC	ESCV	Reg.	Mostly reg.	Daily 5 year betas		Average weekly 5 year betas	
Constellation Energy Group	**CEG**		X						1.33	1.41	1.32	1.34
Black Hills Corp.	**BKH**		X	X		X			1.29	1.38	1.28	1.36
Avista Corp.	**AVA**		X	X				X	0.98	1.01	1.03	0.93
ALLETE, Inc.	**ALE**		X	X		X		X	1.62	1.61	1.90	1.82
Ameren Corp.	**AEE**		X	X		X		X	0.87	0.95	0.93	0.99
WGL Holdings, Inc.	**WGL**		X						1.34	1.37	1.23	1.21
Southern Union Company	**SUG**		X						0.83	0.86	0.91	1.07
Questar Corp.	**STR**		X						1.48	1.67	1.65	1.74
South Jersey Industries	**SJI**		X						1.15	1.34	1.15	1.23
ONEOK, Inc.	**OKE**		X						0.84	0.86	0.94	0.89
National Fuel Gas Co.	**NFG**		X						1.03	1.10	1.13	1.16
Nicor Inc.	**GAS**		X						1.62	1.59	1.63	1.51
EQT Corp.	**EQT**		X						1.24	1.33	1.42	1.58
Atmos Energy Corp.	**ATO**		X						0.88	0.83	0.94	0.91
Southwest Gas Corp.	**SWX**		X						0.98	1.08	0.90	0.92
Piedmont Natural Gas Company	**PNY**		X						1.29	1.42	1.22	1.23
Northwest Natural Gas	**NWN**		X						1.27	1.34	1.19	1.08
New Jersey Resources Corp.	**NJR**		X						1.34	1.39	1.19	1.22
The Laclede Group, Inc.	**LG**		X						1.40	1.43	1.23	1.13
Energen Corp.	**EGN**		X						1.42	1.62	1.60	1.75
AGL Resources, Inc.	**AGL**		X						0.95	0.93	1.05	1.04

Company	Ticker	AU	RRA	Henry	NZCC	ESCV	Reg.	Mostly reg.	Daily 5 year betas		Average weekly 5 year betas	
Westar Energy, Inc.	**WR**		X			X	X	X	0.92	0.95	0.83	0.96
The Southern Company	**SO**		X					X	0.90	0.92	0.74	0.74
Portland General Elec. Comp.	**POR**		X		X			X	N/A	N/A	N/A	N/A
Pinnacle West Capital Corp.	**PNW**		X			X		X	0.91	0.88	0.88	0.82
PNM Resources, Inc.	**PNM**		X			X		X	1.02	1.15	1.01	1.23
Progress Energy, Inc.	**PGN**		X			X	X	X	0.89	0.88	0.83	0.82
NRG Energy, Inc.	**NRG**		X						N/A	N/A	N/A	N/A
NextEra, Inc.	**NEE**		X			X	X		0.93	1.00	0.83	0.95
IDACORP, Inc.	**IDA**		X			X		X	1.04	1.07	1.07	0.98
Hawaiian Electric Ind., Inc.	**HE**		X			X			1.25	1.34	1.47	1.55
Great Plains Energy Incorp.	**GXP**		X			X		X	0.87	0.84	0.90	0.90
FirstEnergy Corp.	**FE**		X			X	X		0.89	0.95	0.94	0.82
Edison International	**EIX**		X			X			1.10	1.14	0.99	1.00
El Paso Electric Company	**EE**		X			X	X	X	1.20	1.28	1.15	1.26
DPL Inc.	**DPL**		X			X		X	1.10	0.92	1.15	1.04
Central Vermont PS Corp.	**CV**		X			X		X	1.58	1.95	1.58	1.69
Cleco Corp.	**CNL**		X			X	X	X	1.46	1.46	1.68	1.42
Allegheny Energy, Inc.	**AYE**		X			X			1.00	1.12	1.45	1.41
The AES Corp.	**AES**		X						1.03	0.97	1.16	1.08
American Elec. Power Comp.	**AEP**		X	X		X		X	1.06	0.97	1.10	0.91
MGE Energy, Inc.	**MGEE**					X	X		2.04	2.02	1.66	1.46

Company	Ticker	AU	RRA	Henry	NZCC	ESCV	Reg.	Mostly reg.	Daily 5 year betas		Average weekly 5 year betas	
Eastern Energy	**EAS**				X				0.69	0.60	0.83	0.73
MDU Resources	**MDU**		X						1.45	1.55	1.43	1.48
TECO	**TE**		X	X				X	0.85	0.86	0.95	0.77