WACC Estimation

A report for South East Queensland water businesses

Tom Hird (Ph.D)

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1. Introduction

1. The Queensland water distributor/retailers businesses ('the businesses') have asked me to advise them on an appropriate methodology for estimating the cost of capital for their regulated operations. In particular, I have been asked to consider this issue in the context of the Queensland Competition Authority's (QCA) recent Draft Report[1] setting a nominal cost of equity of 8.85% and a nominal cost of debt of 9.69% for a 60% geared benchmark business.

2. I understand that the nature of the regulation applied to the businesses is still evolving but that it will initially involve price monitoring by the QCA. I understand that this may evolve into formal price setting/approval regulatory framework in the future – similar to that which operates for other regulated energy and water distribution businesses in Australia.

[1] QCA, *Draft Report: SEQ Interim Price Monitoring for 2010/11*, February 2011.

2. Estimate of the weighted average cost of capital

3. The following sections of this report provide advice on which methodology I believe should be used to estimate the weighted average cost of capital, and why I reach this conclusion. However, in this section, I simply summarise the methodology and provide the results associated with its application. Where I make a recommendation that differs from the QCA recommendation I also summarise the reasons why.

4. Table 1 below outlines the WACC parameters proposed by the QCA and the WACC parameters that I recommend, including comments on the reason for any differences between the two.

Table 1: WACC parameters

Parameter	Hird	QCA	Comment
Gearing	60%	60%	N/A
Nominal risk free rate	5.45%	4.91%	I recommend use of ten year benchmark
Equity beta	1.00	0.66	I use updated estimates and corrects calculation error in Lally. I also give greater weight to Black CAPM.
Market risk premium	6.50% (7.04%)	6.00%	My 6.50% estimate is relative to the ten year risk free rate. It has greater regard to forward looking estimates than the QCA estimate. My 7.04% estimate is the estimate of MRP defined relative to a three year risk free rate.
Nominal return on equity	**11.95%**	**8.85%**	**Difference primarily reflects higher equity beta**
Debt margin on ten year debt	4.48%	4.48%	NA
Cost of hedging to three year "regulatory period"	0.00%	-0.37%	I disagree with the QCA that its proposed hedging strategy is efficient or properly costed.
Debt refinancing allowance	0.125%	0.125%	NA
Cost of debt	**10.06%**	**9.69%**	**Difference solely reflects disagreement on hedging strategy**
Nominal vanilla WACC*	**10.81%**	**9.35%**	**Yes**

**The nominal vanilla WACC is an estimate of the required return on capital of investors after the cost of company tax has already been paid by the corporation.*

5. Table 1 summarises the main areas of disagreement with the QCA's Draft Report. The four material differences relate to:

i. A higher equity beta estimate: My 1.0 estimate of beta adds 2.86% to my cost of equity estimate (given our 6.50% MRP) compared to using the 0.66 beta adopted by the QCA.

ii. The selection of a risk free rate to be used in the CAPM: My use of the ten year CGS yield adds 0.54% to my estimate of the cost of equity compared to the QCA's use of the three year CGS yield.[2]

iii. A higher MRP estimate: The adoption of an MRP of 6.50% (compared to 6.0%) adds 0.33 to the cost of equity at the QCA's equity beta of 0.66.

iv. The assumed debt hedging strategy for the businesses: I do not assume any net costs are able to be saved by adopting a debt hedging strategy whereby businesses attempt to create exposure to three year risk free rates. The QCA assumes that such a strategy will lower the cost of debt by 0.37%.[3]

2.1. Equity beta

6. The QCA adopts an asset beta of 0.35 based on a debt beta of 0.11 and the Conine leverage transformation. When this asset beta is re-levered to 60%, this results in an equity beta of 0.66. The primary reason for my higher equity beta estimate is that I have used more up-to-date estimates than the QCA (relying on estimates provided by Lally) which support an asset beta of at least 0.50. The table below summarises the updated asset betas that I have estimated.

Table 2: Update to Lally's estimated asset betas

	No. obs	Data period	$\beta_d = 0.11$
Lally's firms			
UK water sample	2	2006-2011	0.46
US water sample	8	2006-2011	0.53
US electric utilities	9	2008-2011	0.54
All firms			
UK water sample	4	2006-2011	0.36
US water sample	10	2006-2011	0.60
US electric and gas utilities	83	2008-2011	0.60

Source: Bloomberg, SNL Financial and CEG analysis

7. On the basis of the table above, it would be reasonable to conclude that an asset beta of at least 0.50 is representative of the sample. Only the UK water companies have a lower asset beta (and there are only 2/4 of these in the Lally/CEG sample) while the average of the 8/10 US water companies is 0.53/0.60 and the average of the 9/83 US energy utilities is 0.54/0.60.

2 This assumes that no adjustment is made to the MRP estimate for the fact that it is measured relative to lower risk free rate proxy. This is consistent with the actual practice of the QCA.

3 This is the difference between 10 and 3 year risk free rates (54bp) less the QCA's estimate of the transaction costs of that hedging strategy (17.4bp).

8. An asset beta of 0.50 is associated with an equity beta of 1.0 when re-leveraged to 60% gearing using the Conine formula with a debt beta of 0.11. I also consider that an equity beta of 1.0 is an appropriate default assumption given that the Sharpe CAPM formula is well known to provide biased estimates of the cost of equity the further that the empirically estimated equity beta departs from 1.0.

2.2. Risk free rate proxy

9. I consider that the term of the risk free rate used in the CAPM should be 10 years in order to achieve:

   i. consistency with how the MRP has been estimated;

   ii. consistency with the objective of limiting volatility in the cost of capital allowance (protecting both customers and businesses from this volatility);

   iii. consistency with the objective of not underestimating the cost of equity; and

   iv. consistency with the long life of the underlying assets (and the non CAPM risks shared by those assets and long lived Government debt).

10. I consider that the grounds provided by Lally to the QCA for adopting a shorter period are, in general, flawed. Professor Grundy also provides a consistent view on this matter.[4]

11. I also note that in the specific context of the price monitoring regime these flaws are compounded. Specifically, the logic for Lally's position is that there is a stable regulatory cycle with revenues reset every three years based on prevailing three year interest rates. This is not the case.

12. The problems inherent in this approach can be illustrated by an example. Imagine that if businesses are found to have priced above the levels consistent with the QCA cost of capital a five year regulatory regime is imposed. Imagine that five year risk free rates are 5.0% and three year risk free rates are 4.0%, and that a business was pricing at a level consistent with risk free rates of 4.5%.

13. If this was the case, then the business would be pricing above the QCA threshold (based on 4.0% risk free rates). The QCA would then impose formal price regulation at which time it would use five year risk free rates (to match the five year regulatory period). This would result in higher prices than the business was charging. This is clearly an inappropriate outcome.

14. The problem would be even worse if a one year risk free rate was used, as advised by Lally. The above example demonstrates why it is illogical to attempt to apply Lally's logic to a price monitoring regime. Even if Lally's logic was sound when applied to a formal ongoing price regulation regime, its application would require the risk free rate

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[4] Grundy, B.D, *Determination of the WACC in the Setting of a 5 year Regulatory Cycle*, 17 February 2011

to be based on the term of the regulatory regime that would replace price monitoring – not the term of the price monitoring.

2.3. Market risk premium

15. In my view the forward looking MRP is above 6.0%. An important source of information supporting this is dividend growth estimates for regulated utilities. These indicate a MRP of at least 6.50%.

16. To illustrate this I have performed DGM for the six listed regulated energy providers in Australia. I considered what MRP would be consistent with the QCA's equity beta estimate of 0.66 at different dividend growth rates. The results are presented in Table 3.

Table 3: Market risk premium implied by the QCA beta estimate

Dividend growth rate (%)	ERP (%)	QCA beta estimate	Implied MRP (%)
-4.10	4.0	0.66	6.0
0.00	7.0	0.66	10.6
2.50	8.8	0.66	13.3
5.50	11.1	0.66	16.8

Source: Bloomberg dividend forecasts, CEG analysis

17. In order for the utilities' average DGM discount rate to be equal to the QCA's estimated discount rate[5] then one would have to assume that the market expected these utilities' dividends to fall by 4.10% p.a. in nominal terms (around 6.60% in real terms) beyond the dividend forecast period provided by Bloomberg. I do not consider that this is a credible forecast.

18. A more realistic forecast is that dividends will grow at least at CPI (2.50%), in which case the implied DGM equity risk premium for the utilities is 8.8%. This is consistent with a beta of 1.0 and an MRP of 8.8%. While these are electricity and gas network businesses, not water businesses, I note Lally's advice that electricity businesses are a reasonable comparable to water businesses.[6] I also note that I have conservatively only adopted a 6.50% estimate of the MRP, whereas this data would support a figure in excess of 8.0% even when beta is set at 1.0.

2.4. Cost of debt

19. I consider that the cost of ten year debt has been appropriately estimated by the QCA. However, I disagree with the QCA that the cost of debt should be estimated to include a cost reduction associated with hedging risk free rates to the three year CGS rate. I

5 Based on a beta of 0.66 and MRP of 6.0%, a gamma of 0.5 and a three year risk free rate, as proposed by the QCA.

6 Lally, M., *The Estimated WACC for the Interim SEQ Price Monitoring*, 5 January 2011

do not consider that the hypothetical hedging contract used by the QCA actually does this. Moreover, I consider that adopting this strategy would increase the risk faced by the businesses, and hence their cost of equity, by more than the saving estimated by the QCA. For these reasons I recommend that the QCA not assume any hedging strategy when estimating the cost of debt.

2.5. Cross check – comparison of the cost of debt and equity

20. As explained in a report to be provided by Professor Grundy, standard finance theory suggests that the equity risk premium (ERP)[7] for a 60% geared business will be *at least* 2.67 times the debt risk premium (DRP).

21. With market observed debt risk premiums in the order of 4.0% for firms with gearing levels of around 60%, the implied ERP for these firms is 10.7% (2.67*4.0%). This is more than double the QCA's 4.0% (equity beta*MRP=0.66*6%) point estimate for the ERP relative to the Government bond rate. I note that this figure is broadly consistent with the ERP for Australian electricity and gas utility firms derived from the DGM analysis described above.

22. While there are factors that might be used to explain some of this difference (eg, liquidity adjustments to the cost of debt etc), it is inconceivable that these can explain all of the difference. The difference must be explained at least in part by error in the estimation of the cost of equity. I consider that this provides powerful support for the appropriateness of the above proposed changes to the QCA's estimate of the cost of equity.

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

3. Term of the risk free rate to be used in the CAPM

23. In my view there is no conceptually correct approach for estimating the term of the risk free rate to be used in the CAPM. This is because the CAPM is a "one period model". That is, the theoretical basis for the CAPM equation is derived in a hypothetical world where all investors:

i) come into existence, imbued with wealth for investing, at a point in time;

ii) invest that wealth in assets with that investment 'locked in' for a single period (i.e. no adjustment of their portfolio is possible); and

iii) withdraw that wealth and consume it in its entirety (i.e. no re-investment or re-allocation of the portfolio occurs at the end of the period).

24. This is one of the many highly restrictive assumptions on which the CAPM formula used by the QCA is based. The assumption was relaxed by the Nobel Prize winner Robert Merton (1973) who demonstrated that, when one allowed for the possibility of reinvestment by investors, the CAPM formula was no longer valid because investors will care about factors other than beta.[8]

25. Two points follow from this:

i. It is impossible to theorise about what the correct term of the risk free rate is in the Sharpe CAPM formula because the Sharpe CAPM formula is derived from a theoretical model that simply does not allow for the possibility of there being more than one discrete and undefined period. This model provides no guidance for how that period should be defined in the real world where it is possible to measure time and investment periods in hours, days weeks, years and decades.

ii. There are very good reasons to believe that this simplifying, but highly restrictive, assumption underlying the CAPM formula explains why the CAPM performs so poorly in empirical tests (including why it tends to underestimate returns for low beta stock). This issue is described in Professor Grundy's companion report.

26. Given that one cannot reason as to the correct term of the risk free rate within the logic of the CAPM, one must decide between a short term and a longer term on other grounds. In my view, all of the below stated reasons tend to point towards choosing a longer term estimate:

i. consistency with how the MRP has been estimated;

ii. consistency with the objective of limiting volatility in the cost of capital allowance;

iii. consistency with the objective of not underestimating the cost of equity;

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8 Merton, R.C., "An Intertemporal Capital Asset Pricing Model", *Econometrica*, Vol. 41, No. 5. (Sep. 1973), pp. 867-887.

iv. consistency with the intuitive assumption that utility investors take a long term perspective (consistent with the life of the assets they own); and

v. consistency with the term of the cost of debt.

3.1. Consistency with the MRP estimate

27. The MRP proposed by the QCA is based on historical average differences between market returns and the return on the ten year government bond rate. It would be internally inconsistent to use a MRP estimated in conjunction with a three year risk free rate.

28. The cost of equity is determined by the QCA using the capital asset pricing model (CAPM) formula developed in Sharpe (1964), which sets the required return on equity using the following formula:

$$RoE = r_f + \beta \times (market\ return - r_f)\ ;\ \text{where} \qquad (1)$$

$$RoE = required\ return\ on\ return\ on\ equity$$

$$(market\ return - r_f) = market\ risk\ premium\ (MRP)$$

$$r_f = risk\ free\ rate$$

$$\beta = asset\ specific\ equity\ beta$$

29. The Sharpe CAPM formula is based on a number of assumptions about investors and capital markets. In particular, the derivation of this formula relies on the assumption that investors invest once, hold that portfolio unchanged for a given period, and then consume their entire wealth at the end of that period. In the terminology of finance theory the Sharpe CAPM is a 'single period' model.

30. Sharpe (1964) himself states in relation to his assumptions:

> *Needless to say, these are highly restrictive and undoubtedly unrealistic assumptions.*

31. The assumption of a 'single period' in the CAPM simplifies the mathematics and allows one to arrive at the above simple formula. However, a cost of this simplicity is that finance theory can tell us nothing about the appropriate term of the risk free rate to use in the CAPM formula. In the CAPM there is only one risk free rate because the simplifying assumptions of the model assume that there is only period. The real world is made of multiple consecutive periods and thus, multiple possible risk free rates – eg, from one month to 30 years.

32. There is no financial theory that can be used to conclude that the CAPM, when applied to regulated businesses with five yearly resets, must be implemented with a five year risk free rate. The correct term of the risk free rate to be used in the CAPM is an imponderable question because the model is incapable of even considering more than one possible risk free rate.

33. In this context by far the most important consideration for choosing the term of the risk free rate is to choose one that is internally consistent with the definition of the MRP $(market\ return - r_f)$. If the MRP has been estimated using a ten year risk free rate then the risk free rate used in the CAPM equation (equation 1) must also be set using the same assumption. If a ten year risk free rate is used in the estimation of the MRP but the MRP is added to a three year risk free rate then the equation actually implemented is:

$$RoE = r_{f\ (three\ years)} + \beta \times (market\ return - r_{f\ (ten\ years)})\ ; \qquad (2)$$

34. Obviously, if the three year risk free rate is materially lower than the ten year risk free rate, then this inconsistent use of risk free rates will downward bias the estimated RoE relative to a consistent use of risk free rates (consistent use of either three or ten year risk free rates).

35. This is incorrect as a matter of finance theory and is also the basis of the Australian Competition Tribunal's finding in GasNet that the ACCC made an error in the use of a five year risk free rate in the CAPM formula when the MRP had been estimated using a ten year risk free rate.[9]

> *In truth and reality, the use of different values for a risk free rate in the working out of a Rate of Return by the CAPM formula is neither true to the formula nor a conventional use of the CAPM. […] The CAPM is not a model, which is intended to operate in this way. The timescales are dictated by the relevant underlying facts in each case and for present purposes those include the life of the assets and the term of the investment.*

36. The Draft Report acknowledges this inconsistency also exists in its decision but determines that it will nonetheless proceed with the adoption of a five year risk free rate on the grounds that:[10]

> *Historical averaging methods (using a 10-year risk-free rate) produce MRP estimates ranging between 5.27% and 6.99% while forward looking measures and surveys range between 3.66% and 6%. The median of the estimates was 5.84% and the average was 5.63%.*

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9 Australian Competition Tribunal, *Application by GasNet Australia (Operations) Pty Ltd* [2003] ACompT 6, para. 47.

10 QCA, *Draft Report: SEQ Interim Price Monitoring for 2010/11: Part B*, February 2011, p. 206.

In response to QUU's comment that a 6% MRP is based on the use of 10-year bonds to estimate the risk-free rate, the Authority notes that it has also estimated the MRP using 5-year bonds. The effect is to increase the Authority's median estimate of the MRP from 5.84% to 5.94%. Adopting a 5-year risk free rate would not change the Authority's estimate from 6%.

Given the three year term of the interim price monitoring period, the Authority has now also compared its previous estimates with those resulting from the use of 3-year bonds. The effect is to increase the Authority's average estimate from 5.63% (using 10-year bonds) to 6.00% (using 3-year bonds) and the median from 5.84% to 6.33%. Given the upward bias of the estimation techniques (e.g. Ibbotsen historical averaging), and the standard error of the estimates, the Authority considers that adopting a three-year rate would not change the estimate from 6%.

37. This is very similar to the rationale provided by the QCA in the QR Draft Decision for adopting a 6% MRP in conjunction with a five year risk free rate. In that context the QCA stated that the magnitude of the inconsistency is 'well within the standard error of the estimates' for the MRP.[11]

The Authority also took into consideration the potential inconsistency of estimating the mrp relative to the 10-year Commonwealth government bonds but using the 5-year Commonwealth government bond in other aspects of this draft WACC decision.

In this regard, in terms of the historical averaging, available data indicate that the average difference between the five-year and 10-year Commonwealth government bonds is around 20 basis points (ie, 0.20%). Such a difference is well within the standard error of the estimates and the head room the Authority provided between the proposes 6% allowance and the mean/mode estimates relying on a range of methodologies.

38. There are a number of critiques of these statements that can be made.

39. First, there are apparent numerical inconsistencies. In the context of the QR Draft Decision the QCA states that the appropriate adjustment when moving from a ten to a five year risk free rate proxy is 20bp. However, in the current water decision the QCA claims that the effect is only 10bp (the difference between 5.84% and 5.94%). Also, when describing the effect of moving from a ten year to a three year risk free rate the QCA appears to suggest that the impact on its mean estimate (37bp = 6.00% less 5.63%) is materially lower than the impact on its median estimate (49bp = 6.33% less 5.84%).[12]

11 QCA, *Draft Decision: QR Network 2009 Draft Access Undertaking*, December 2009, p. 15.

12 QCA, *Draft Report: SEQ Interim Price Monitoring for 2010/11: Part B*, February 2011, p. 206.

40. In neither case does the QCA provide a basis for these calculations so it is difficult to ascertain the cause of the apparent anomalies. However, it is conceivable that the differences derive as a result of the QCA using historical average differences in three and ten year CGS yields to update historical average MRP estimates and used prevailing (forward looking) differences in CGS yields to update forward looking MRP estimates. Of course, to update forward looking estimates one would also have to update the actual forward looking cost of equity – there is no evidence that the QCA has done this. However, as described elsewhere in this document, I consider that doing so would result in a materially higher cost of equity. In any case, I estimate the required change to be in excess of 50bp (50bp for historical average CGS yield differences and 63bp for forward looking CGS yield differences in the averaging period).[13] In my view, the minimum required adjustment just for the adoption of a three year risk free rate proxy is 50bp (and up to 63bp).

41. Second, failure to increase the MRP by 50bp, as described above, to 6.5% amounts to a highly material reduction in the cost of equity solely consequent on a bureaucratic decision to alter the assumed risk free rate proxy. There is no basis for the QCA concluding that a different risk free rate proxy actually lowers businesses cost of equity (in fact the opposite is true for the reasons described below). Even the QCA's own estimates of 6.0% and 6.3%, the derivation of which has not been explained, support an MRP above 6.0%.

42. Thirdly, the Draft Report's rationale for using a three year risk free rate (and three year cost of debt) is predicated on the assumption that using an up-to-date three year risk free rate at the beginning of a three year regulatory period will best proxy investors' required return at the beginning of the regulatory period. However, the same logic suggests that one must also use an up-to-date estimate of the MRP. No attempt has been made to do this. As described above and elsewhere in this report, the MRP relative to the current three year risk free rate would be materially greater than 6%.

43. Fourthly, the current decision relates to price monitoring, and not price setting. In this context arguments that rely on revenues being set equal to the risk free rate at the beginning of each regulatory period are simply not relevant.

44. Finally, I note that to the extent the QCA is correct and the change in risk free rate proxy is not material enough to justify a consequential change in the MRP then it must be the case that the term structure of interest rates is not generally upward sloping (ie, the ten year risk free rate is, on average, equal to the three year risk free rate). In which case there is no basis for concluding that use of the ten year risk free rate will over-compensate businesses on average.

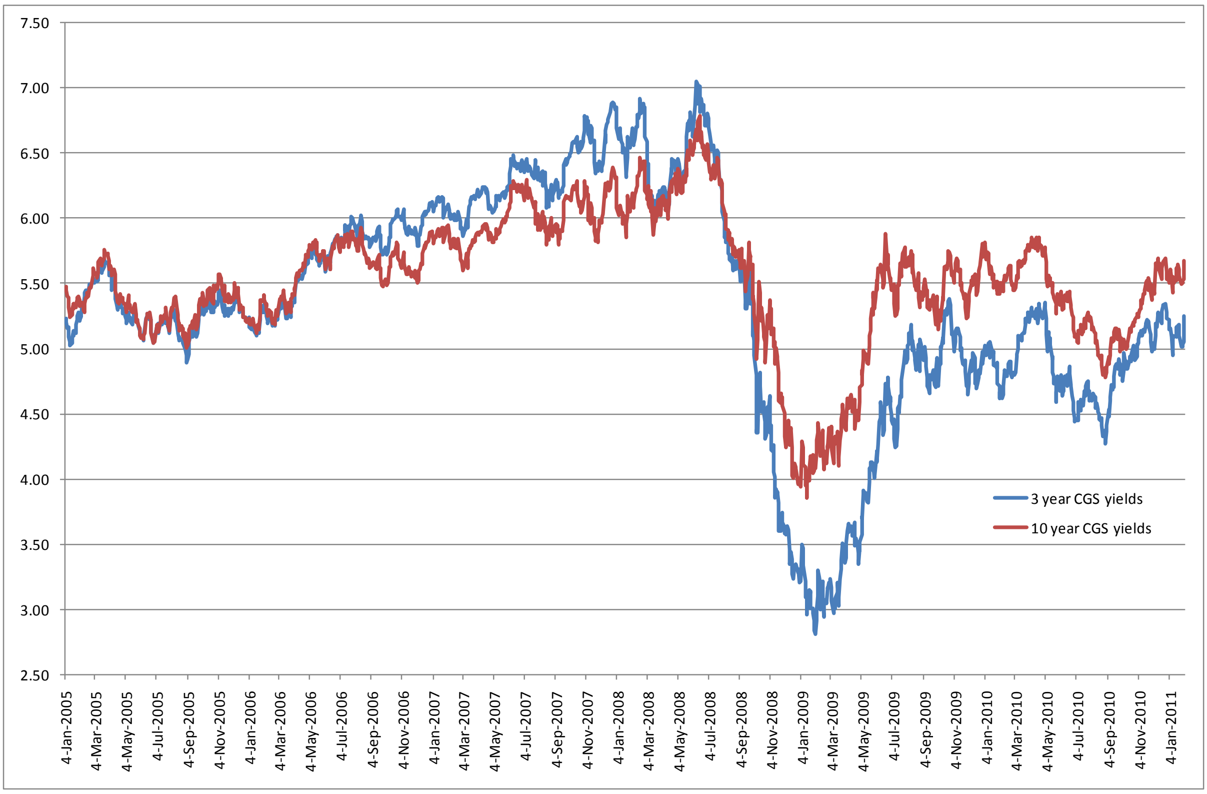
[13] From 1992 to 2010 (the longest time series available from the RBA website) the average difference in 10 and 3 year CGS yields published is 50bp. To derive this I have interpolated between actual CGS bond yields with matuiryt on either side of 3 and 10 years. The average difference prevailing during the averaging period was 63bp.

45. Certainly, if the QCA is right that the three and ten year MRPs are not materially different then there are powerful reasons for using the ten year risk free rate in conjunction with the (unique) MRP estimate. These reasons are discussed in the following sections.

3.2. Consistency with providing a less volatile cost of equity allowance

46. The ten year bond rate is materially more stable than the three year bond rate. The below figure illustrates the yields of ten and three year Commonwealth Government Securities (CGS) since 2005.

Figure 1: Commonwealth Government Security yields



Source: RBA, CEG analysis

47. A visual inspection of this curve demonstrates that there is higher volatility of bond rates at the short maturity end. The average ten year bond rate is generally higher than the average three year rate. However, it is materially less volatile. When the economy is weak or in crisis the short term bond rates drop significantly more than the long term bond rates. Similarly, when the economy is relatively strong the short term bond rates rise materially more than the long term bond rates.

48. This effect is captured in statistical measures of volatility. The variance of the three year bond rates in Figure 1 above is 0.77. The variance of the ten year bond rate was

0.25 (less than one third than the three year bond rate variance). This greater volatility of short term debt is exemplified during the recent global financial crisis, where short term bond rates fell much faster and further than long term bond rates.

49. As a result of this property of Government bond rates, adopting a short term bond rate will increase the volatility of the estimated cost of equity. This is because the QCA's methodology is to add a fixed premium (beta multiplied by MRP) to the Government bond rate.

50. Other things equal, volatility in allowed equity returns is undesirable and, on this basis alone, it would be reasonable to believe that long term estimates of the risk free rate are preferred to short term estimates. This is the approach of many regulators who do not reflect short term movements in bond rates in the allowance for the cost of equity (as discussed in Appendix A).

51. However, it may be the case that other things are not equal. If adopting the more volatile proxy for the risk free rate in the CAPM formula resulted in more accurate estimates of the cost of equity, then this volatility could potentially be justified. That is, if the volatility in the short term risk free rates was reflected in the volatility of the cost of equity (in terms of both magnitude and direction) then the volatility in short term risk free rates might be a desirable property in a proxy for the risk free rate in the CAPM formula.

52. In reality, the opposite is true. Short term risk free rates tend to fall when the cost of equity is rising and rise when the cost of equity is falling. This inverse relationship between the government bond ('safe') rate and the equity premium has been clearly documented in the financial literature even outside periods of financial crisis.[14] On the basis of this empirical regularity Smithers and Co, advisers to the UK economic regulators, have recommended that the cost of equity not be varied based on variations in the risk free rate. Smithers and Co state:

> *"A commonly used estimate of the equilibrium short-term rate (based on a sample of data from around 1980) is of the order of 2 1/2%. Using this figure, the implied equity risk premium is of the order of 3 percentage points (geometric) and 4-5 percentage points (arithmetic). Given our preferred strategy of fixing on an estimate of the equity return,* ***any higher (or lower) desired figure for the safe rate would***

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[14] For example, Lettau and Ludvigson 2001 find that the market risk premium tends to move in the opposite direction to the government bond rate – such that the cost of equity remains constant when the government bond rate changes (Lettau, Martin and Sydney Ludvigson, 2001, "Consumption, Aggregate Wealth and Expected Stock Returns," *Journal of Finance* 56 (3), pp. 815—849).

Amongst other findings, they found a strongly statistically significant inverse relationship between the change in US Treasury yields and the change in the observed MRP relative to Treasury yields. Such an inverse relationship held true without controlling for other potential variables that might affect the MRP (i.e. a simple correlation suggested that the MRP rose 0.3% for every 1% reduction in the risk free rate). However, when Lettau and Ludvigson included controls for other variables the inverse relationship between the risk free rate and the MRP strengthened. In fact, Lettau and Ludvigson found that when the risk free rate fell the MRP tended to rise by the same amount as the fall in the risk free rate and vice versa. That is, a 1% reduction/increase in the risk free rate tended to be associated with a 1% increase/reduction in the MRP (measured relative to Treasury yields).

be precisely offset by a lower (or higher) equity premium, thus leaving the central estimate of the cost of equity capital unaffected*.”*[15] [Emphasis added.]

53. Ofgem (the UK energy regulator) adopted Smithers and Co's recommendation in its 2004 Electricity Distribution Price Control Review.[16] This recommendation has also been effectively adopted by other UK economic regulators who have decided not to mechanistically pass on variations in the government bond rate into the regulatory cost of capital (discussed at Appendix A on regulatory precedent).

54. This evidence is presented on the basis of a well accepted view that volatility in the risk free rate is not matched by volatility in the cost of equity (at least not in the same direction). One solution to this problem is to simply adopt a risk free rate based on historical averages rather than the volatile spot rate – this is the solution of UK regulators. An alternative solution is to adopt a proxy for the risk free rate that is less volatile, specifically, a long term Government bond rate.

55. An example of this is provided in the context of the recent global financial crisis. As can be seen from the above figure, in late 2008 and early 2009 Government bond yields plunged. This reflected a flight to safety and liquidity by investors as they shunned alternative riskier assets. While all risk free rates fell during this period, short term risk free rates fell the most.

56. If one sets a fixed MRP, primarily based on long run historical averages, then, during an event such as the crisis, the estimated cost of equity will fall in line with the fall in the relevant proxy for the risk free rate. If that proxy is the three year Government bond rate then the estimated cost of equity will fall by more than if the proxy is the ten year risk free rate.

57. It is well accepted that the actual cost of equity generally tends to rise during a crisis.[17] This is because, even though risk free rates fall the equity risk premium (proxied by the MRP) tends to rise by more than the fall in the risk free rate. This is intuitively obvious once one recognises that the reason for the fall in the risk free rate is a flight *from* risky assets *to* almost riskless assets. In my view, any reasonable estimate of the cost of equity during the period of the crisis would have put such an estimate at an all time high.[18]

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15 Smithers and Co, *A Study into Certain Aspects of the Cost of Capital for Regulated Utilities in the U.K., A report commissioned by the U.K. economic regulators and the Office of Fair Trading,* 2003, p. 49.

16 See Ofgem, *Electricity Distribution Price Control Review: Final Proposals*, November 2004, paras. 8.43-44

17 The mirror image of the 'flight to safety' in a financial crisis is a 'flight from risk'. That the cost of equity increases during financial crises is well understood in the economic literature. Financial crises increase the uncertainty associated with the value of corporate assets and, as a consequence, increase the volatility of equity and corporate debt investments – both individually and as an asset class. Standard asset pricing theory predicts that investors dislike higher levels of volatility and demand a higher risk premium to provide capital in such circumstance. Indeed, Ghysels, Santa-Clara, and Valkanov (2005) describe this as "the first fundamental law of finance".

18 CEG, *Forward looking estimates of the equity premium For regulated businesses and the market as a whole: A report for the JIA*, January 2009.

58. However, to the extent that regulatory practice is, as reflected in the QCA's draft decision, to set a fixed premium above the risk free rate based on long run historical averages, then one would wrongly estimate that the cost of equity during the crisis was at an all time low. While this error would exist if the ten year bond rate was used as the proxy for the risk free rate, it would be exacerbated by the use of the more volatile three year bond rate.

59. Put simply, even if all of the theoretical arguments for a three year risk free rate were correct, they are based on the assumption that the MRP is also reset at the time that the risk free rate is reset.[19] In reality the MRP is fixed at an estimate of the long-term MRP – invalidating any assumption that the CAPM has been fully applied to market circumstances at the beginning of the regulatory period.

60. Moreover, given that the true prevailing MRP tends to move in the opposite direction to the risk free rate, adopting a fixed MRP along with the more volatile prevailing three year rate will result in a worse estimate of the prevailing CAPM required return than using the more stable ten year rate. This is true even if, in theory, using the prevailing three year risk free rate in conjunction with the prevailing MRP would be most accurate.

61. Consider the following example where it is assumed that the theoretically correct approach is to adopt a prevailing three year risk free rate and a prevailing MRP measured relative to the prevailing three year risk free rate. Assume that:

    i) the correct actual beta is equal to 1.0 and this is the beta value set by the regulator (a value of 1.0 is chosen to simply make the calculations in this example easy to follow);

    ii) the prevailing three year risk free rate is at a low level of 2% (reflecting high demand for safe assets in a period of high perceived risk);

    iii) the prevailing MRP measured relative to the three year risk free rate is 10% (reflecting high the high perceived risk levels that have caused risk free rates to be low);

    iv) the resulting correct cost of equity is 12% (2% + 1*10%) ; and

    v) The prevailing post tax ten year risk free rate is also at a low level of 3% (but still higher than the prevailing three year risk free rate reflecting a lower volatility of the ten year rate).

62. Assume that the long run MRP to be adopted is 6%. Using the three year risk free rate of 2% in conjunction with the long run MRP of 6% will result in a cost of equity that is 4% too low (4% = 12% - (2% + 1*6%)). Using the long run MRP of 6% in conjunction with the 10 year risk free rate will also result in a cost of equity that is too low, however, it will only be 3% too low (3% = 12% - (3% + 1*6%)).

[19] Or, at least that the fixed MRP is the best estimate of the MRP to be applied in conjunction with the prevailing three year risk free rate.

63. This is true even though it has been assumed that the three year risk free rate is the theoretically correct risk free rate to use in the CAPM. The reason is that the higher volatility of the three year risk free rate is not offset by using a prevailing MRP measured relative to that prevailing three year risk free rate. In practice, the more stable ten year risk free rate provides a better estimate of the cost of equity when used in conjunction with a fixed 'long run' MRP.

64. It is relevant to note that the issues described above were considered in some detail in regulatory proceedings before the AER and, subsequently, appealed to the Australian Competition Tribunal (ACT). The issue of contention was whether the historically low risk free rates during the crisis should be mechanistically passed through in equally low equity allowances.

65. In the context of those proceedings I provided expert evidence very much along the lines described above.[20] The ACT agreed that using such rates to set the cost of equity without increasing the market risk premium was likely to underestimate the cost of equity. The ACT stated:[21]

> *The Applicants submitted that these facts demonstrated that basing a risk free rate on the AER's specified averaging periods would not achieve the objective of an unbiased rate of return consistent with market conditions at the date of the final decision. They appealed to expert opinion that the market risk premium was far higher than its deemed value while the risk free rate was abnormally low, so that the return required by investors was much higher than the AER's specified averaging period would generate.*
>
> …
>
> *The Tribunal considers that an averaging period during which interest rates were at historically low levels is unlikely to produce a rate of return appropriate for the regulatory period.*

66. While the Tribunal drew this conclusion regarding the use of a ten year risk free rate the conclusion would only have been stronger in relation to three year risk free rates (which were 89bp or 23% below ten year rates when ten year rates reached their minimum of 3.85% on 15 January 2009).

3.3. Consistency with not underestimating the cost of equity

67. If one accepts that it is better to overestimate the cost of equity than underestimate the cost of equity then, absent any other considerations, it follows that one should select the risk free proxy that is least likely to underestimate the cost of equity (in frequency

20 CEG, *Rate of return and the averaging period under the National Electricity Rules and Law*, January 2009.

21 *Application by EnergyAustralia and Others (includes corrigendum dated 1 December 2009)* [2009] ACompT 8 (12 November 2009), paras. 112-114

and materiality). Given the higher volatility in the three year risk free rate, and also the fact that it is generally lower than the ten year risk free rate, this objective would be best served by adopting the ten year risk free rate.

3.4. Consistency with long term perspective

68. It is a natural assumption that, because the payback period for the assets in question is long, the term of the risk free rate should also be long. This is consistent with the ACT description of standard practice by economists and regulators.

69. The value of equity in a regulated business will, like the value of a long term bond, be determined by expectations of economic conditions in the long term. While an investor can sell equity in the short term the same is true of investors in long term government bonds (in fact, the higher liquidity of Government bonds makes it relatively easier for investors to dispose of long term government bonds).

70. Whatever the factors are that make investors demand a premium for long term government bonds are equally likely to be present in relation to equity investors in long lived assets.

3.5. Consistency with the term of the risk free rate used in the cost of debt calculation

71. I have previously addressed why it is the case that the cost of debt, and therefore the risk free rate used to estimate the cost of debt, must be at least ten years. Professor Grundy has, in a separate report, demonstrated that the counter arguments presented by Lally [22] are not robust.

72. If one accepts that the risk free rate used to estimate the cost of debt must have a term of at least ten years, it is natural to adopt the same term for the risk free rate used to estimate the cost of equity.

3.6. Fallacy of "NPV=0" arguments for a five year risk free rate

73. The QCA, and its adviser, Professor Lally, have argued that a risk free rate equal to the length of the regulatory period is required on the grounds of satisfying an NPV=0 rule. Most comprehensively, Lally sets out this view in his 2010 paper for the QCA.[23]

74. I consider that the logic underlying Lally's analysis can be illustrated with a simple example. Imagine that, instead of regulating the return on a company using debt and equity to provide water services, the QCA was regulating the interest rate on a perpetually lived Government bond with a face value of $100. Specifically, imagine

[22] Lally, M., *The appropriate term for the risk free rate and the debt margin*, 27 April 2010.

[23] Ibid. The paper assesses and advises on policy in the context of the QCA regulatory decision relating to QR. However, it does not directly state that the QCA engaged Lally for the report.

that it was the QCA's job to reset the interest rate on that bond every three years with the objective of ensuring that the market value of the bond was equal to the face value of the bond at the time that interest rates are reset.

75. A question of interest then becomes: on what basis would the interest rate need to be reset to achieve this objective? Lally concludes that the interest rate should be reset every three years at the prevailing three year interest rate. I agree with this conclusion, but with a number of important caveats. This conclusion relies on an implicit assumption that capital markets are perfectly efficient and liquid, and that the Commonwealth Government is expected to be a perpetually risk free debt provider.

76. However, I disagree with the policy implication Lally draws from this type of theoretical exercise. Lally's conclusion is that if a regulator resets the cost of equity (and debt) every three years, then it must also be true that the risk free rate used in the CAPM to reset the cost of equity is the three year Government bond rate. This is to ensure that investors are not under or over compensated relative to the 'face value' of their asset (namely, the regulatory asset value to which the rate of return is applied). My reasons for this disagreement include the following:

    i) the caveat described above is important, and it is violated both in the market for long term Government bonds and, in particular, in the market for equity;

    ii) equity returns are risky and this fundamentally alters the relevance of the hypothetical example undertaken with a risk free Government bond. Importantly, one must *assume* that equity investors use the three year risk free rate to arrive at their CAPM cost of equity;

    iii) The Lally conclusion ignores the complexity of the regulatory objectives and regime;

    iv) In my view, these considerations combine to demonstrate that the Lally proposition can be rejected on the basis of a *reductio ad absurdum* test. That is, the proposition underlying the Lally conclusion can be rejected on the basis that it leads to absurd outcomes.

3.6.1. Long term equity shares risk with long term bonds – even if returns are reset periodically

77. The hypothetical example described above involved a perpetual bond having its interest rate reset to the prevailing three year Government bond rate one that date every three years. Such a bond should always trade at face value on each interest rate reset date, provided that capital markets are currently perfectly efficient and liquid and are known with certainty to remain so over the life of the (perpetual) life of the bond and that 'regime risk'[24] in Australia is known with certainty to be zero beyond three years.

[24] Regime risk is the risk that future actions by the State may reduce the value of the investment. For example, in the case of a perpetual bond risks include the risk of imposition of exchange rate controls on foreign investors, outright default etc). In

78. Ownership of long term bonds and ownership of equity in a utility exposes investors to liquidity risk and regime risk beyond three years. However, the CAPM is a single period model (all investments have one, and only one life and there is no reinvestment at the end of that life) which assumes away transaction costs associated with trading (assumes away liquidity risk). This means the CAPM pricing formula provides no way of distinguishing between assets with different length life and no way of distinguishing between assets with different levels of liquidity risk.

79. Only if these implicit assumptions are actually true in reality will an investor willing to buy a three year bond with a given promised interest rate, also be willing to buy the perpetual bond at the same promised interest rate.

80. This is because an investor with a three year bond today knows that they will be paid in cash the face value of the bond in three years time. This promised cash payment in three years time limits the risk horizon for the investor in that bond to a maximum of three years. By contrast, the buyer of the perpetual bond has no promise of cash in three years time. The buyer of the perpetual bond must rely on their ability to find another buyer for that bond in order to be able to convert it into cash. Similarly, any such future buyer of the bond must rely on their ability to sell the bond to convert it into cash (and so on and so on).

81. A consequence of this fact is that, in the real world, a three year bond differs materially from a perpetual bond which has its interest rate reset every three years. The price of the latter today will depend on market perceptions about the ability to sell the asset in the future – not just within the next three years, but in perpetuity. This means that any investor in such a bond must worry about very long term risks. These risks relate to the future efficiency and liquidity of capital markets and also the very long run credit worthiness of the issuer of the bond (in this example the Australian Government).

82. The perpetual bond in our hypothetical example will be worth less than the three year bond, unless one takes the view that investors believe with certainty that:

   i) capital markets are, and will remain, perfectly efficient and liquid in the future (a proposition difficult to sustain following the break down in capital markets during the GFC); and

   ii) there is zero 'regime risk' from the Australian Government beyond three years (a proposition difficult to sustain following the current high levels of sovereign debt concerns over advanced economy Government debt – including to some extent concern about the US and UK government debt).

83. This is because the perpetual bond with its interest rate reset every three years will be perceived as higher liquidity and 'regime risk' than the three year bond. As a result,

the case of a perpetual equity in a regulated utility, the risk of exchange rate controls on foreign investors and changes to the regulatory regime.

investors will require a higher interest rate to invest in that bond. Indeed, they may, on average, require an interest rate more akin to the ten year bond rate than the three year bond rate.

84. This caveat is important because equity investment in a Queensland water business has the same long run horizon as investment in long term Australian Government bonds. In fact, the long lived nature of the individual assets, their integrated use with assets of different vintages and their need for continual rolling replacement, gives equity investment in water utilities a characteristic that is, in fact, perpetual.[25] Investors are exposed to future liquidity risk as well as regulatory regime change risk. For these reasons, adopting a ten year risk free rate can be viewed as a conservative reflection of the closer to perpetual nature of the time horizon that equity investors are exposed to risks for.

85. One might be tempted to object to the above conclusion on the grounds that the reason the ten year bond rate has a higher yield than the three year bond rate is that it is higher risk than the three year bond rate. Such an objection might take the following form:

> *The objective at hand is to determine a risk free rate for use in the CAPM. If long term bonds are higher risk than short term bonds then that makes them less, not more, attractive as a potential proxy for the risk free rate.*

86. The fundamental problem with this proposition is that it is based on a semantic rather than theoretical basis. This can be understood by noting that in the derivation of the CAPM all risks except "beta risk" are removed by assumption. Thus, the only risk in CAPM world (a world consistent with the restrictive assumptions used to derive the CAPM) is beta risk. In this context, the term CAPM risk free rate is most accurately described as the 'zero beta rate' rather than the risk free rate.

87. In the foregoing I have referred to "liquidity risk", which is the common usage of the term. However, this not "risk" in the sense that the CAPM models risk. Rather, the implied meaning is "transaction costs associated with trading". That is, while the standard terminology talks about "liquidity risk" this is, in reality, just a higher expected level of transaction costs associated with investing in relatively less liquid assets long term assets. The derivation of the CAPM abstracts from transaction costs of this type and, consequently, has nothing to say about how they would affect the return required by investors. It would be an error to infer that this means that such costs/risks must be ignored by the QCA.

88. In addition to assuming zero transaction costs (perfectly efficient and liquid markets) the derivation of the CAPM assumes, as described above, a single time horizon for all investors in all assets. The real world has both:

[25] That is, there is no single date at which equity investors expect to receive their capital back from customers in the form of cash. Unlike, say, a property development company which buys land to develops then sell in a period of years, utility investors have no such limited time horizon for their investments.

i) assets with different lives; and

ii) assets with different liquidity and other risks assumed away in the CAPM.

89. If one believes that long lived assets are exposed to a particular class of risks abstracted from by the CAPM then, when implementing the CAPM, it is prudent to apply a long term risk free rate when attempting to price the returns on long lived assets.

90. Put another way, in the real world there might be two assets both of which have a zero beta risk (i.e. are riskless in the sense that the CAPM measures risk), but which have different levels of other risks abstracted from by the CAPM. Both could be used as the risk free rate in the CAPM. However, in selecting one or the other it would be appropriate to match the choice of risk free rate to the life of the asset being priced.

91. To give a concrete example, let us assume that both long and short term government bonds have zero beta (zero CAPM) risk. However, let us accept that long term assets are exposed to greater levels of non-CAPM risk. If we are attempting to estimate the required return on assets with long lives, it will be appropriate to use the long term bond rate in the application of the CAPM. By doing so we pick up some of the impact of non-CAPM risks in the choice of the risk free rate.

92. In my view this example is likely to be a reasonable description of the conditions that the QCA finds itself in. The long term bond rate should be used by the QCA unless there is good reason to believe the (on average) higher return required on long term bonds is not reflective of risks also associated with long term equity.

3.6.2. Equity returns are not risk free returns

93. Logic that applies to risk free assets need not apply to risky assets. For risky equity one must use a model of how risk is compensated. For the reasons described in paragraphs 23 to 25 when estimating the cost of equity using the CAPM one simply cannot reason to a correct term of the risk free rate based on CAPM theory. One can only reason to a particular answer using arguments and theory from outside the CAPM.

94. Lally recognises this by running through a number of scenarios where it is assumed that the correct risk free rate is, respectively, less than five years, five years and ten years. However, these are nothing more than assumptions.[26] Lally concludes that:[27]

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26 Lally motivates these assumptions by virtue of different "across-investor average period between successive portfolio reassessments". I do not believe that this is a sens ble or meaningful approach because the CAPM is not derived on the basis of an "average period between successive portfolio reassessments" (page 10). The CAPM is fundamentally silent on the issue of the length of the relevant period because it is a one period model. If one introduces multiple periods then the CAPM formula no longer holds (irrespective of the "average period between successive portfolio reassessments ") as demonstrated by Merton (1973) and descr bed above.

27 Lally, M., *The appropriate term for the risk free rate and the debt margin*, 27 April 2010, p. 6.

Finally, if the across-investor average period between successive portfolio reassessments is believed to be as much as ten years, then the CAPM would require use of the ten year risk free rate within both the first term of the model and the market risk premium, whilst the NPV = 0 requirement would still mandate use of the five year risk free rate within the first term of the CAPM. As before, this apparent conflict arises from the fact that the two models are concerned with different periods, but it cannot now be resolved in the same way. Thus, we face a choice between abandoning the CAPM and adapting it to the scenario in question, and the lack of a credible alternative to the CAPM demands that it be adapted. Following the principle that one should minimize the modifications that are required to any model to adapt it to a particular scenario, the first term within the CAPM should be the five year risk free rate whilst the market risk premium should continue to be defined and therefore estimated relative to the ten year risk free rate. Since the QCA's estimate of the market risk premium reflects the use of this ten year risk free rate, then no alteration to the QCA's estimate of the market risk premium would be required.

95. I reproduce this quote in full because I believe that it is symbolic of the flawed reasoning applied by Lally in this and other papers, where he argues that the risk free rate should be aligned to the length of the regulatory period. In this quote Lally takes the following positions:

    i) the most accurate estimate of the cost of equity may require the use of the ten year risk free rate in the CAPM;

    ii) allowing regulatory compensation consistent with the most accurate cost of equity will violate the NPV=0 principle; therefore

    iii) an estimate of the cost of equity that is not the most accurate should be adopted (where the five year risk free rate is used instead of the correct ten year risk free rate). This is because satisfying the "NPV=0" principle is more important than adopting the most accurate estimate of the cost of equity.

96. In my view these positions are untenable. Any standard meaning applied to the NPV=0 principle is that cash-flows must provide a return that is consistent with the correct discount rate. If the most accurate estimate of the correct discount rate is the cost of equity derived using a ten year risk free rate in the CAPM then this is the only rate of return that can be used to satisfy the NPV=0 principle. Providing a regulated return that differs from the most accurate estimate of the cost of equity is, rather than being a way to implement the NPV=0 principle, a way to ensure that it is violated.

3.6.3. Other complexity ignored by Lally

97. Lally argues that, in order to satisfy the NPV=0 principle, the term of the risk free rate must be:

    i. set equal to the term of the regulatory period; and

    ii. established at the beginning of each regulatory period.

98. However, in coming to this conclusion he assumes that this is the objective of economic regulation and that all other CAPM parameters have been set to reflect market conditions at the beginning of each regulatory period.

99. In reality, this is demonstrably not how the QCA approaches the estimation of the other CAPM parameters. Most notably, the MRP is based primarily on long run historical average levels of the MRP. This is consistent with the approach of regulators around the world who do not attempt to estimate the prevailing level of market risk – but who nonetheless recognise that market risk premiums vary materially over time.

100. This is the approach of most regulators around the world who use the CAPM. Notably, UK regulators have determined not only to use a long-term MRP, but to also use a long-term risk free rate in conjunction with that estimate. This is consistent with the advice of Smithers and Co to UK regulators that variation in the risk free rate is likely to be offset by variation in the MRP in the opposite direction (see para 52 above and Appendix A below).

101. In order for Lally's objective to be met, the MRP must also be estimated at the beginning of each regulatory period to reflect the perceived MRP over the regulatory period. In order to do this the QCA would need to obtain the best forward looking estimate of the cost of equity and deduct the then prevailing 'correct' risk free rate.

102. In reality, the risk free rate estimate is combined with a long-term MRP. In this context, even if there was a theoretical justification, it does not make sense to argue that the risk free rate must be set with regard to achieving an NPV=0 principle over the regulatory period. This would be somewhat analogous to arguing that one component of a watch must be built to a particular standard because it had the potential of delivering some desirable property but ignoring the fact that the rest of the watch was built to a different standard that meant that the relevant property would not be delivered.

103. Similarly, the purely financial asset that is the basis of Lally's framework differs from the real world business that is being regulated. An important goal of that regulation is to ensure that, over the life of the regulatory asset, the business has an incentive to invest. That is, the business should ideally have the right incentives to invest in each year of the regulatory period, not just at the beginning of the regulatory period.

104. The ACT considered these issues in the case discussed above.[28] The ACT also considered the relevance of what Lally describes as the 'NPV=0 rule' (also discussed in section 3.6 below). The AER had relied on a report from Lally arguing that the cost of capital must be reset at the beginning of each regulatory period in order to satisfy this rule. The ACT did not find this evidence compelling. Rather, it took the view that the purpose of the WACC estimate was not so much to provide an accurate estimate of the cost of capital at the beginning of the regulatory period but rather to provide a

[28] *Application by EnergyAustralia and Others (includes corrigendum dated 1 December 2009)* [2009] ACompT 8 (12 November 2009).

reasonable estimate of the rate of return likely to apply in each year of the regulatory period.[29]

The WACC formula has five inputs, viz. the equity beta, the market risk premium, the debt to equity ratio, the risk free rate, and the debt risk premium. The first three of these are given deemed values in cl 6.5.2(b). The choice of those values implies that the equity of NSPs is deemed to have the risk characteristics of the market as a whole. The risk free rate is defined in cl 6.5.2(c) but is to be averaged over a period, as described above. …

On the face of it, this set of inputs and formula generates a rather strange rate of return estimate. The risk free rate, whether agreed or specified, is, it seems to be agreed by all parties, that which prevails at some time (the averaging period) prior to the start of the regulatory control period; similarly with the benchmark corporate bond rate. Those inputs might generate a rate of return value reasonably close to that actually required by investors at the start of the regulatory control period, and applied to the first year's starting regulatory base. But with changes in market conditions over the regulatory control period, it is hard to see why the rate of return value would represent the return required by investors at, say, the start of the final year of the regulatory control period.

In the meantime, the risk free rate and corporate bond rates would almost certainly have varied from their initial values. Consequently, there appears to be no virtue in setting those rates at values that prevailed close to the start of the regulatory control period, or to the publication of a final determination.

105. The ACT goes on to state:[30]

The Tribunal has already explained above that it sees no special virtue in an averaging period close to the date of the AER's final decision.

106. I agree with the findings of the Tribunal. The regulated cost of capital estimate is a compromise between short and long term parameter estimates. Even if we put aside the theoretical flaws in Lally's position (as described above and as described in Professor Grundy's report), it assumes an objective that is narrower than the actual set of regulatory objectives, to wit: To set a stable allowance for the cost of capital that ensures that investment incentives are maintained in each year of the regulatory period (not simply the first day of the regulatory period).

3.6.4. Reductio ad absurdum

107. Imagine that the QCA decided to set the length of the regulatory period, at least in so far as capital financing costs are concerned, equal to 24 hours. This could be

[29] Ibid, paras. 88-90.

[30] Ibid, para. 111.

achieved relatively simply in administrative terms.[31] According to Lally's stated position, the QCA could and should set the risk-free rate equal to the overnight cash rate without compromising the business's ability to raise funds.

108. This is an intuitively absurd result. The risk profile for a regulated utility that had its equity returns tied to the overnight cash rate would be very different to the risk profile for a regulated utility that had its equity returns tied to long term bonds. The volatility of equity returns would be dramatically increased and, in my view, the estimated cost of equity would commonly be significantly different from the true cost of equity.

109. Nothing in Lally's logic limits the application of his conclusion to exclude very short regulatory periods such as that described above. In my view, this further demonstrates the general problems with Lally's conclusions.

3.7. Non applicability to a price monitoring regime

110. I also note that in the specific context of the price monitoring regime these flaws are compounded. Specifically, the logic for Lally's position is that there is a stable regulatory cycle with revenues reset every three years based on prevailing three year interest rates. This is not the case.

111. The problems inherent in this approach can be illustrated by an example. Imagine that if businesses are found to have priced above the levels consistent with the QCA cost of capital a five year regulatory regime is imposed. Imagine that five year risk free rates are 5.0% and three year risk free rates are 4.0%, and that a business was pricing at a level consistent with risk free rates of 4.5%.

112. If this was the case, then the business would be pricing above the QCA threshold (based on 4.0% risk free rates). The QCA would then impose formal price regulation at which time it would use five year risk free rates (to match the five year regulatory period). This would result in higher prices than the business was charging. This is clearly an inappropriate outcome.

113. The problem would be even worse if a one year risk free rate was used, as advised by Lally. The above example demonstrates why it is illogical to attempt to apply Lally's logic to a price monitoring regime. Even if Lally's logic was sound when applied to a formal ongoing price regulation regime, its application would require the risk free rate to be based on the term of the regulatory regime that would replace price monitoring – not the term of the price monitoring.

[31] This could be done simply by promising to ensure that a business earned the overnight cash rate on its assets in the long run (with necessary adjustments to prices being made every few years).

4. Term of the cost of debt

4.1. Hedging the cost of debt to the regulatory period

114. On the advice of Lally[32] [33], the QCA has determined that the cost of debt will be based on three year CGS yields plus a debt margin estimated as:

   (a) *the 3-year debt margin, estimated by Bloomberg as 2.74% for the 20 trading days ending 3 June 2010 (2.80% to 30 June 2010);*

   (b) *compensation for the cost of credit default swap contracts which are not able to be directly priced. A proxy premium of 1.74% is allowed (the difference between the 10-year debt margin and the 3-year debt margin as at 3 June. The difference is 1.73% as at 30 June 2010);*

   (c) *an allowance of 0.174% for interest rate swap costs; and*

   (d) *an allowance of 0.125% for annual debt refinancing.*

115. The theoretical basis for this calculation is the assumption that a business will efficiently issue ten year debt but then engage in derivative contract with a counterparty where:

   - that counterparty promises to pay the ten year risk free rate to the business for the next ten years (from $T = 0$ to $T = 10$); and
   - in exchange the business promises to pay the counterparty:
     - the three year risk free rate for the first three years ($T = 0$ to $T = 3$);
     - the prevailing three year interest rate at $T = 3$ over the following three years ($T = 3$ to $T = 6$); and
     - the prevailing three year interest rate at $T = 6$ over the following three years ($T = 6$ to $T = 9$).[34]

116. Based on this assumption the total cost to the business in the first three years will be:

   - the debt risk premium measured at ten years (being the interest rate on the ten year corporate debt issued less the ten year risk free rate);[35] plus

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[32] Lally, M., *The appropriate term for the risk free rate and the debt margin*, 27 April 2010. The paper assesses and advises on policy in the context of the QCA regulatory decision relating to QR. However, it does not directly state that the QCA commissioned the report.

[33] Lally, M., *The Appropriate Term For WACC Parameters For The SEQ Interim Price Monitoring*, 6 September 2010

[34] It is actually unclear what is assumed to happen after 9 years given that the debt only has 1 year left to run but the regulatory period is assumed to be 3 years. Possibly it is assumed that the business buys back the debt at the end of the 9th year.

- the three year risk free rate at time $T = 0$;[36] plus
- any amortised costs of entering into the derivative contract; plus
- the amortised cost of issuing the corporate debt.

117. The first dot point above corresponds to a) plus b) from the QCA quote above. The third and fourth dot points correspond to c) and d) from the QCA quote. Thus, to the extent that the QCA has accurately estimated the relevant values, the QCA methodology will provide full compensation for such a strategy.

118. However, by the time that the beginning of the second three year period this is no longer necessarily true. At the beginning of the second three year period ($T = 3$), the cost to the business of this debt/derivative combination will be the same with the exception that it will be paying the prevailing three year risk free rate on its derivative contract.

119. The QCA's methodology will also change such that compensation for the cost of debt will be updated to reflect the prevailing three year risk free rate. However, the QCA's methodology will also update so as to reflect the prevailing ten year debt risk premium. As a consequence, a business that undertakes this strategy will be exposed to the risk that the debt premium it locks in at time $T = 0$ will not be compensated for from $T = 3$ onwards.

120. This is relevant because it would be a mistake to believe that the QCA is proposing a regime under which, if businesses adopt the QCA assumed debt issuance strategy, they can effectively hedge their cost of debt. This is not the case.

4.2. Standard Australian regulatory practice

121. Relative to standard Australian regulatory practice of simply allowing the cost of ten year corporate debt, the QCA's compensation for the cost of debt will, other things equal, be:

- lower by the difference between the ten year and three year risk free rates. In the current context this is around 63bp – being the difference between the ten year and three year CGS yields over the averaging period; and
- higher by the allowance for the derivative contract (interest rate swap allowance). In the current context this is estimated by the QCA at 17.4bp.

122. It follows that, as implemented by the QCA, the cost of debt is lowered by 45.6bp relative to standard practice.

[35] Note that this is the cost of that debt net of the businesses' receipt from the counterparty of the 10 year CGS yield.

[36] This is what is paid to the counterparty under the derivative contract.

4.3. Cost of the derivative contract (interest rate swap)

123. The QCA's estimate of the cost of entering into the derivative contract is not based on the actual derivative contract that I describe above – where the business finds a counterparty willing to pay the ten year CGS rate for the next ten years in exchange for a three year interest rate updated every three years.

124. This type of derivative contract would be non-standard and not a common contract entered into. As a result, fees for entering into the type of contract would likely be costly – much more costly than the costs allowed by the QCA.

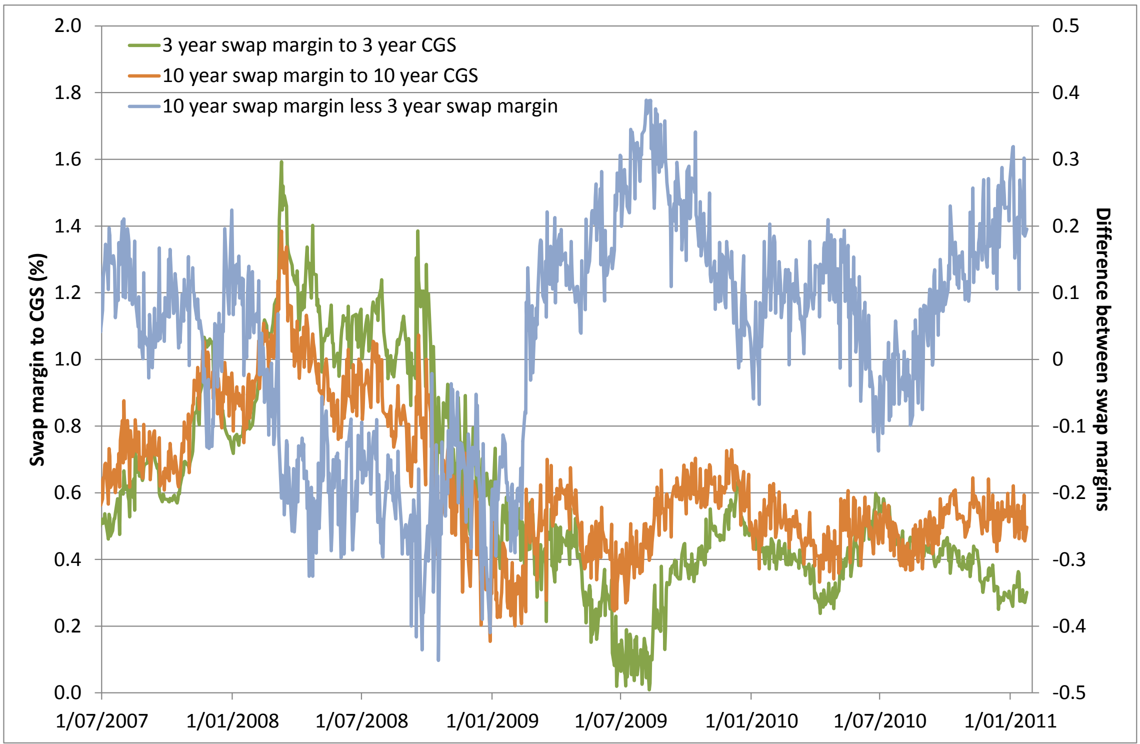
125. The QCA has instead allowed a lower cost of hedging associated with a substitute hedging strategy – but one that increases risks to the business. Specifically, Evans and Peck have estimated the cost of:

- entering into a contract to receive a fixed ten year rate in exchange for paying a quarterly floating rate based on BBSW;
- entering into a series of other contracts to pay three year fixed rates (prevailing at the beginning of each three year regulatory period) in exchange for receiving the quarterly floating rate based on BBSW over those three years.

126. This is an approximation to the actual contract the QCA assumes a business enters into – which is implicitly an interest rate swap based on paying and receiving CGS yields not rates in the swap market. A business entering such a set of contracts will be exposed to greater risk and will their actual costs will in general be different to those modelled by the QCA. This will be the case whenever the spread between the ten year swap rate and ten year CGS is different to the spread between the three year swap rate and three year CGS. For example, if the ten year spread is higher the business will have costs that are lower than that modelled by the QCA (because the business receives the ten year swap rate but pays the three year swap rate). However, the opposite is true if the three year spread is higher.

127. As the figure below shows, the swap spread to CGS is volatile and does not always move uniformly across the yield curve. In particular, any business pursuing this policy would have been materially undercompensated (in the order to 20bp to 30bp) during the GFC when three year spreads were higher than ten year spreads.

Figure 2: Three and ten year spreads between swap rates and CGS yields



Source: RBA, Bloomberg, CEG analysis

128. This demonstrates that the hedging strategy compensated for by the QCA has the potential to actually increase rather than reduce risk. It also demonstrates how difficult it can be for regulators to attempt to second guess efficient hedging strategies by regulated businesses

129. In my opinion if the QCA wishes to compensate businesses only for the cost of hedging movements in the swap rate (rather than CGS yields) then the QCA should for consistency adopt the swap rate as the risk free rate proxy.

4.4. Why assuming businesses adopt this debt hedging strategy is problematic

130. First, as described above, even if a business undertook precisely the long term debt issuance and hedging strategy that the QCA is saying it would compensate them for, the firm will nonetheless not necessarily be fully compensated.

131. Second, the price monitoring regime is not a well established regulatory regime that is expected to continue indefinitely on three year cycles. Yet the QCA's assumed debt issuance compensation is based on businesses re-ordering their entire debt portfolio as if they believed this to be the case.

132. Third, there is little or no evidence that this is what businesses actually do even when they are operating in well established regulatory regimes. This fact suggests that the

actual costs and risks of entering into these arrangements are likely higher than is estimated by the QCA and that these arrangements are higher in cost than not entering into such hedges.

133. Fourth, such a strategy exposes the business to the volatility of short term interest rates. This is inconsistent with what is generally regarded as prudent debt management policy. One might be tempted to respond that the proposed regulatory regime provides an offsetting hedge for this with revenues linked to volatile interest rates. However, this response is problematic for a number of reasons not least:

- it is unlikely to be desirable to expose consumers/businesses to more volatile prices for essential services; and
- ultimately, there is a risk that future regulators will not do so. The QCA is implicitly asking businesses to 'trust' its future self to allow them to pass on very high short term interest rates at some future date. As noted by Professor Myers in the cost of capital expert panel commissioned by the New Zealand Competition Commission, there is a tendency amongst regulators to pass on very high interest rates which introduces a 'stickiness' to the actual returns customers receive. This makes regulated assets share the same interest rate risk profile as long term government bonds.[37]

134. Finally, to the extent that equity betas are estimated from firms that in general do not enter into such debt derivates then it is inconsistent with the Modigliani-Miller theorem to assume a debt management policy that is radically different to the debt management policy of the firms used to estimate the equity beta.

4.5. Lally and the Modigliani Miller theorem

135. Professor Lally[38] has recently advised the QCA to adopt a practice that has similarities to that which it has proposed. I consider conclusions from this report in relation to setting the risk free rate in the CAPM later in this report. I note that Professor Grundy has provided a separate report dealing with Lally's claims regarding to setting the term of the cost of debt.

136. I concur with Professor Grundy's conclusion that Lally fails to adequately understand the Modigliani Miller theorem (which is at the bedrock of modern capital structure analysis). I also concur with Professor Grundy's conclusion that:

[37] Professor Myers states that:
Long-lived assets are exposed to interest rate risk in much the same way as long-duration bonds and this risk can be partly market risk. Allowed rates of return and profits on utilities are traditionally 'sticky', which exposes investors in such assets to significant interest rate risk. (Para 103)

[38] Lally, M., *The appropriate term for the risk free rate and the debt margin*, 27 April 2010. The paper assesses and advises on policy in the context of the QCA regulatory decision relating to QR. However, it does not directly state that the QCA commissioned the report.

If comparable unregulated entities finance with T-year debt, the appropriate term for the risk-free rate, the debt margin and equity risk premium when determining the WACC of a regulated firm is T years irrespective of the length of the regulatory cycle.

137. Professor Grundy, like myself, identifies a fundamental inconsistency between estimating the equity premium for firms that issue long term debt (eg, estimating the value of beta based on firms that issue long term debt) and then assuming that this equity premium can be applied to a notional firm that issues short term debt (or that hedges that debt to be short term debt).[39] In short:

i. if firms issue long term debt at a higher interest rate than short term debt then this must be because this lowers the cost of equity (Modigliani Miller);

ii. the QCA has estimated the cost of equity (beta) using a sample of firms that issue, on average, very long term debt[40] and there is little or no evidence that they hedge this debt back to shorter maturities;

iii. as a result of ii, the QCA has captured the benefits associated with issuing (higher cost) long term debt;

iv. however, the QCA sets the term of the cost of debt equal to three years (at least for the risk free rate component); and

v. as a result the QCA is acting inconsistently in respect of iii and iv. It is assuming a lower cost of equity without allowing the higher cost of debt that makes this possible.

138. Similarly, using an MRP derived using a ten year risk free rate gives rise to the same sort of inconsistency. Professor Grundy also identifies technical errors in Lally's mathematical justification for his propositions.

39 Grundy, B.D, *Determination of the WACC in the Setting of a 5 year Regulatory Cycle*, 17 February 2011

40 See in particular Appendix D.1 which shows the average maturity of debt issued by US electricity and gas network firms, including those relied upon by Lally.

5. Cost of debt

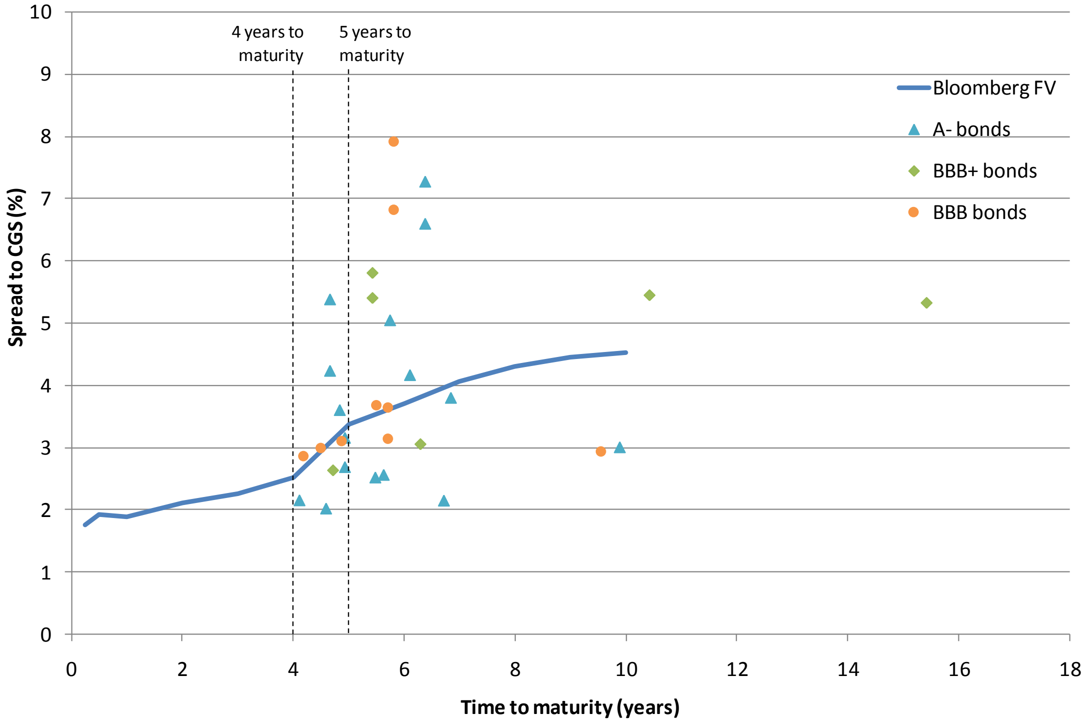
139. The QCA's Draft Report effectively determines the cost of debt by reference to the Bloomberg ten year BBB fair value curve (where that fair value curve has been extended from seven to ten years using the shape of the Bloomberg AAA fair value curve). This is consistent with the QCA's analysis that suggests that the appropriate credit rating for a 60% geared water business is BBB (rather than BBB+ as assumed by the AER for regulated energy businesses). This is also consistent with the New Zealand Commerce Commission's recent estimate that a 40% geared energy business would have a BBB credit rating.

140. I consider that the Bloomberg fair value curve provides a good approximation for the yields on BBB rated debt. In fact, the Bloomberg BBB fair value curve is a reasonable fit to debt rated from BBB to A- - suggesting that it is a somewhat conservative estimate for BBB rated debt (given that BBB rated debt can expect to have a higher yield). .

141. Figure 3 below shows the Bloomberg[41] BBB fair value curve against the median estimated yield from UBS, Bloomberg and CBASpectrum for all bonds rated BBB to A- with maturity greater than 4 years. Only bonds with maturities greater than 4 years are shown given that we are interested in the yield on ten year debt and the period examined is the 4th of January to the 24th of January.

[41] Extended from 7 to 10 years using the Bloomberg AAA fair value curve.

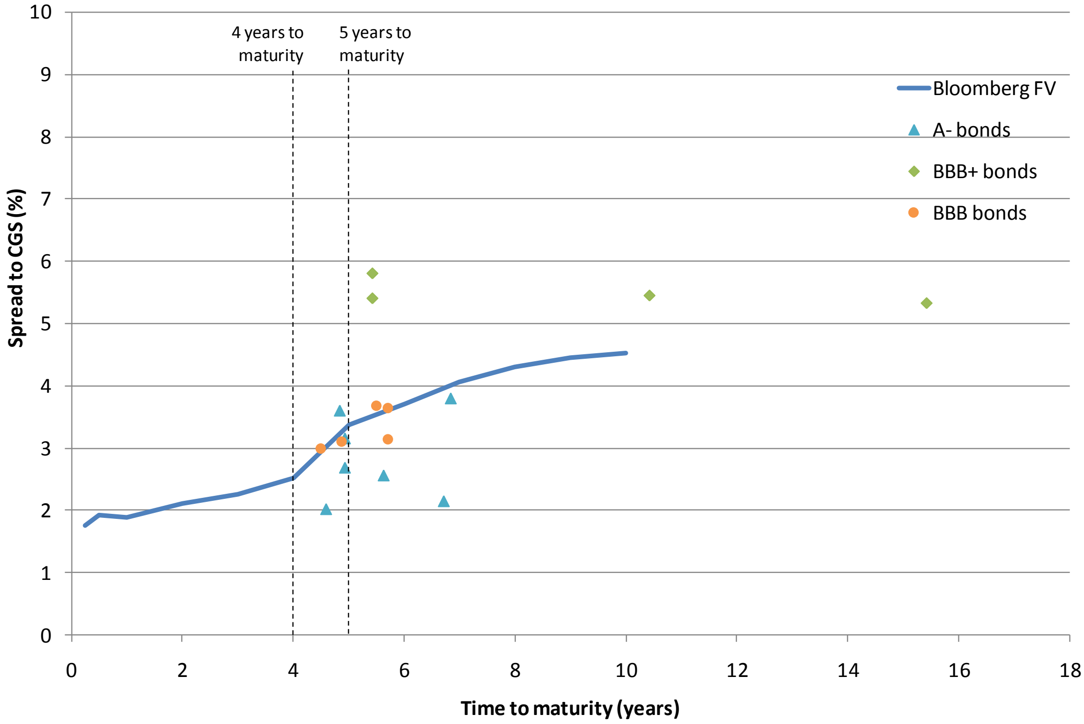
Figure 3: Median reported spread to CGS on all bonds rated BBB to A- with greater than four years to maturity



Source: UBS, Bloomberg, CBASpectrum, RBA, CEG analysis.

142. The above figures do not distinguish between the type of issuer. A potentially relevant question is whether a particular fair value curve is a better fit to the yields on bonds issued by natural monopoly regulated infrastructure operators with ratings similar to BBB. Figure 4 below examines this issue.

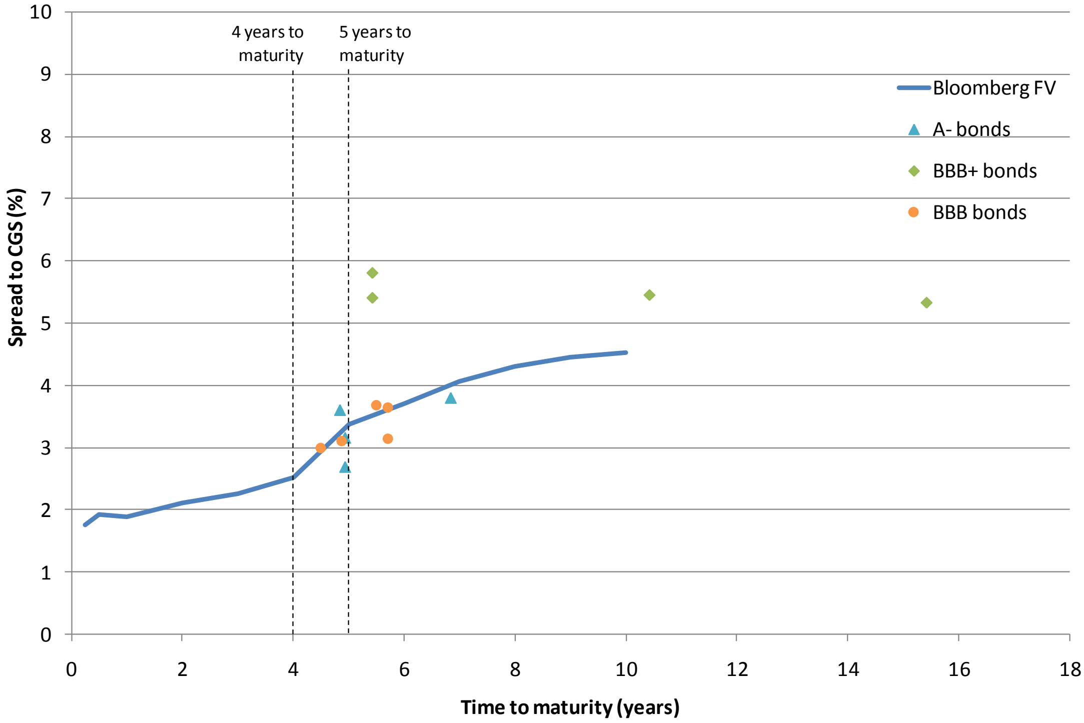
Figure 4: Median reported spread to CGS on bonds issued by monopoly regulated infrastructure providers rated BBB to A- with more than four years to maturity



Source: UBS, Bloomberg, CBASpectrum, RBA, CEG analysis.

143. It should be noted that the Bloomberg fair value curve is a good approximation for BBB and BBB+ bond issues – with only A- rated issues falling materially below the curve. A further amendment to the sample can be made by excluding bonds with option value – such as callable bonds (except those with make good call options) and bonds whose coupon depends on maintaining a given credit rating.

Figure 5: Natural monopoly issuers excluding all non-standard bonds except for 'make good' callable bonds



Source: UBS, Bloomberg, CBASpectrum, RBA, CEG analysis.

144. It can be seen that for these standard bonds the Bloomberg fair value curve is a good fit to the available data.

145. On the basis of the above I consider that the QCA has acted reasonably in basing its estimate of the cost of debt on the Bloomberg fair value curve.

6. Equity beta

146. The QCA adopts an asset beta of 0.35 and an equity beta of 0.66 (corresponding to a 60% gearing). These estimates rely upon advice provided to the QCA by Lally, recommending an asset beta of 0.35.[42] In my view, the best estimate of the equity beta based on market data is 1.0. Changing this parameter alone will increase the cost of equity by 2.0%.

147. The key reason that the equity beta that I derive is higher than Lally's estimate is that I use more up-to-date data. However, there are other differences also. Four reasons as to why my recommendation differs from Lally's, which was adopted by the QCA in its Draft Report, are:

- Lally relies upon beta estimates conducted by PwC and Henry in recommending an asset beta of 0.35 and equity beta of 0.66. These beta estimates are based on data that is up to three years out of date. The current beta estimates that I have sourced from data providers are significantly higher than these, supported by time series data which indicates that betas have been rising over the past three years. I have also examined a wider sample of firms – both the Lally and the wider sample of firms support a beta of 1.0 using up-to-date numbers;
- Lally adopts a debt beta of 0.11 in order to de-lever and re-lever the raw equity betas using the Conine transformation. The debt beta of 0.11 that Lally was instructed to use by the QCA is not based on empirical estimates, but on an 'upper bound' technique would yield nonsensical results if updated with current data. Lally himself states that he prefers a debt beta of 0 to this assumption. I agree and consider that the equity beta used by the QCA would increase by at least 0.02 if Lally's recommendation were taken into account;
- Lally appears to make an error in de-levering and re-levering the equity betas estimated for US electricity and gas firms by Henry. He incorrectly attributes these asset betas of 0.30 and 0.37 (at debt betas of 0 and 0.11 respectively) when the correct numbers are in fact 0.36 and 0.41. Such is Lally's reliance on these data that his recommended asset beta would likely increase by at least 0.02 on this change, causing the resulting re-levered equity beta to increase by at least 0.04; and
- Lally's recommendation to the QCA is made and accepted without consideration of the consequences of using empirical beta estimates. The academic literature clearly indicates that empirically estimated equity betas underestimate the cost of equity for beta of less than one, and overestimate it for betas of more than one. By adopting an empirically estimated beta so far below one without adjustment for this effect, the QCA has estimated a downward biased cost of equity for the South-East Queensland Water Businesses.

[42] Lally, M., *The Estimated WACC for the Interim SEQ Price Monitoring*, 5 January 2011, p. 4.

148. In addition to the issues raised above, I have also considered a dividend growth model (DGM) of six listed Australian electricity and gas utilities firm. This model indicates that the forecast path of future dividends implies an equity risk premium (ERP) significantly higher than the 4.0% allowed by the QCA under any reasonable assumptions. The results of this analysis support the results of my updated survey of beta estimates and suggest that an equity beta of 1.0 is appropriate for regulated utilities.

6.1. Lally's reliance upon beta analysis conducted by PwC and Henry

149. The QCA has relied on advice from Lally when setting the asset and equity beta. Lally, in turn, has relied on asset and equity betas in a report commissioned from PwC[43] and a paper commissioned from Henry.[44]

150. PwC examined three water businesses in the United Kingdom and nine water businesses in the United States between 2004 and 2009, and estimated their average asset betas at 0.29 and 0.55 respectively. PwC de-levers the raw equity betas using the firm's leverage and the Conine gearing model, and assume a leverage of 50 percent and a debt beta of 0.11. Lally comments that the PwC data is "presumably" based upon five years of monthly data and the OLS method, although the report contains no information to support either assumption.

151. Henry examined nine Australian electricity and gas network businesses over the period 2002-2008 and eleven US rate-of-return regulated electric utilities over the period 1990-1998 and 2002-2008. Henry de-levered the raw equity betas using the firm's leverage and simple re-levering. Henry calculated an average monthly re-levered equity beta of 0.58 for the first comparator set and an average monthly re-levered equity beta of 0.71 for the second comparator set.

152. Lally has taken the four comparator samples in the PwC and Henry reports and calculated average asset betas by de-levering raw asset betas with a Conine transformation. In the case of Henry's report, Lally has deduced raw equity betas from the re-levered betas and the leverage data for each firm. Lally's estimated asset betas for the four samples are presented in Table 4 below.[45]

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[43] PwC, *Gladstone Area Water Board: Update of Cost of Capital Parameters*, 2009.

[44] Henry, O., *Estimating beta*, 23 April 2009.

[45] Lally, M., *The Estimated WACC for the Interim SEQ Price Monitoring*, 5 January 2011, p. 26.

Table 4: Lally's estimated asset betas

	No. Coys	Data period	$\beta_d = 0$	$\beta_d = 0.11$
UK water sample	3	2004-2009	0.18	0.22
US water sample	9	2004-2009	0.36	0.38
Australian energy network sample	9	2002-2008	0.24	0.30
US electric utilities	11	1990-2008	0.31	0.37
Mean			*0.27*	*0.32*
Mean excluding UK water sample			*0.30*	*0.35*

153. Lally notes advantages and disadvantages with the respective estimates in Table 4. Lally comments on that all foreign estimates are more difficult to compare with Australian results as they are measured relative to a foreign market index which can affect the beta values. This favours the use of Australian companies. Further, Lally states that estimates for longer periods are more reliable, which favours Henry's US estimates. Also, estimates for firms subject to similar regulation of the SEQ entities are preferred, which favours the UK firms. Lally argues that the least weight should be given to the UK water companies, and if excluded this results in a mean asset beta of 0.30 with a debt beta of zero and a mean asset beta of 0.35 with a debt beta of 0.11.[46] These estimates are consistent, under the Conine transformation, with equity betas of 0.68 and 0.66 respectively. The QCA has adopted an equity beta of 0.66.

6.2. Dataset relied upon by Lally is outdated

154. The data used in the estimates relied upon by Lally is up to three years out of date (in the case of the Henry estimates), and includes a number of companies that have long since been delisted, such as GasNet and Alinta.

155. Furthermore, the dataset that Lally relies upon to recommend an asset beta of 0.35 is small, consisting of 12 water businesses and 20 other electric and gas network businesses. Neither PwC nor Henry make clear in their reports why they have only been able to identify such a small number of listed firms engaged in these activities, or the basis upon which they did not include other such firms.

156. In my opinion, it is important to rely upon as large a sample as possible in beta estimation because of the very significant variability in estimates. Within the 32 firms relied upon by Lally, re-levered betas vary between 0.19 and 1.48. Increasing the number of comparators in the sample will increase the reliability of the estimates, reducing the likelihood that a conclusion is based upon a small set of unusual observations.

[46] Ibid, p. 26.

157. SNL Financial is a US firm that specialises in collating financial data on US firms across several industries, including energy. Using SNL's comprehensive database, I have identified an additional 72 listed US firms engaged in electricity or gas distribution.[47] SNL also provides recent gearing and equity beta data for all these firms. Relying on a larger and thus more reliable sample of firms in this case results in slightly higher beta estimates, as illustrated in Table 5. Appendix D.2 below presents the estimates in Table 5 for each business in the CEG sample.

Table 5: Average beta estimates – Lally's sample vs. CEG sample from SNL

	Sample size	Raw beta	Gearing	Asset beta	Re-levered beta
			Three year average		
Lally's sample	11	0.66	0.58	0.52	1.04
CEG sample	83	0.76	0.54	0.60	1.22

Source: SNL Financial, CEG analysis

158. I have not been able to locate a similarly comprehensive database of firms engaged in water distribution and supply. However, I have identified additional firms above those relied upon by Lally that provide these services. I have sourced betas for these firms from Bloomberg.[48]

6.3. Estimation procedure

159. As noted above, I have sourced equity beta estimates for US electricity and gas distribution businesses from SNL Financial. SNL provides one-year and three-year beta estimates, calculated based on daily betas over a 250 trading day holding period for the one-year beta and 750 trading day holding period for the three-year beta.

160. I have also sourced equity beta estimates for water utilities from Bloomberg. In doing this, I have specified five-year weekly betas.

161. One important empirical issue with estimate equity betas is the variability in the results. This is particularly the case in estimating monthly betas, where the betas estimated can swing wildly for the same stock depending upon what time of the month estimation is commenced. I note that Lally is not able to identify the precise sampling intervals used in the estimate of the equity betas by PwC and Henry upon which he relies.

162. For this reason, I prefer to rely upon the use of weekly betas (for the week ending Friday), which are in general less prone to these variations. I also note that Henry

47 Whereas Lally only uses a sample of electricity distr bution firms provided by PwC for comparison, I assume that gas distribution firms are equally comparable.

48 Additional firms for which betas were found were: New Dee Valley (UK-listed), United Utilities (UK) and the Consolidated Water Company (US).

recommends the use of weekly betas.[49] Since it is not clear exactly how the betas relied upon by Lally were estimated, it is not possible to infer whether the use of weekly equity betas increases or decreases estimates on aggregate. I note that the beta estimates for the week ending Friday are not significantly different from those for weeks ending on other days.

Table 6: Update to Lally's estimated asset betas

	No. Coys	Data period	$\beta_d = 0$	$\beta_d = 0.11$
Lally's firms				
UK water sample	2	2006-2011	0.41	0.46
US water sample	8	2006-2011	0.50	0.53
US electric utilities	9	2008-2011	0.51	0.54
All firms				
UK water sample	4	2006-2011	0.32	0.36
US water sample	10	2006-2011	0.58	0.60
US electric and gas utilities	83	2008-2011	0.57	0.60

Source: Bloomberg, SNL Financial, CEG analysis

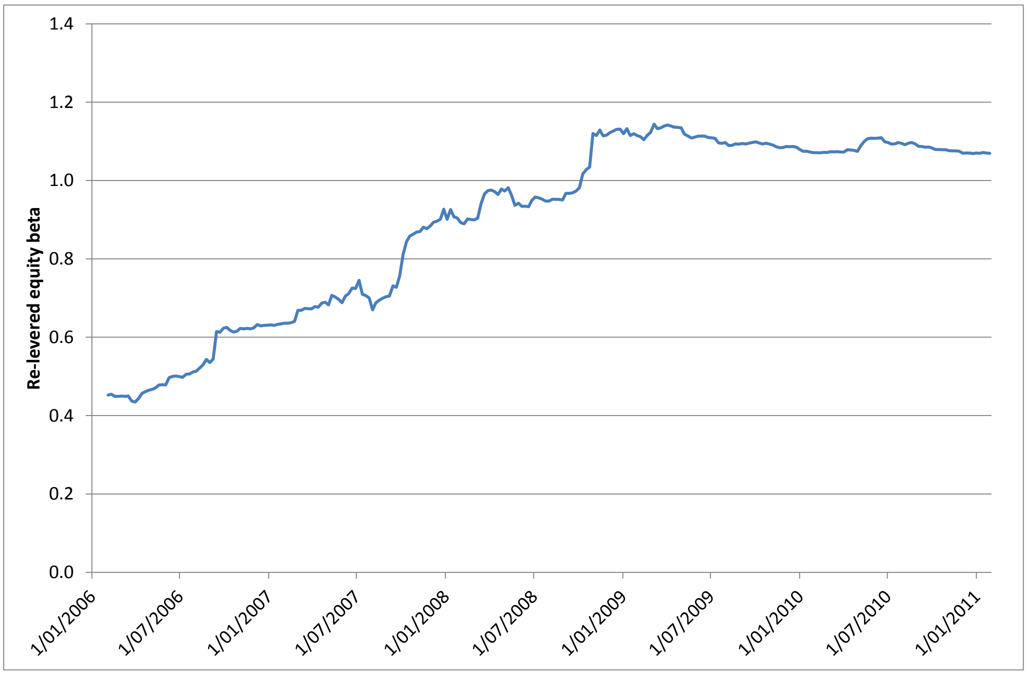
163. On the basis of the table above, it would be reasonable to conclude that an asset beta of 0.55 is representative of the sample, taking into account the fact that the small number of UK water firms appear to have asset betas considerably lower than the average of other firms. Given a debt beta of 0.11, this asset beta is consistent with an equity beta of 1.11.

164. It can be seen that all of these estimates are substantially higher than the QCA's estimate of asset beta of 0.35, and this is especially true for the most recent estimates. Using a lower assumed debt beta, as I believe is appropriate and as is consistent with the AER methodology, would result in higher still estimates of the equity beta.

165. Figures 6 to 8 below illustrate a time-series of average equity betas from February 2006 to January 2011 for the Bloomberg beta estimates in Table 6 above. Similar time series data was not available from SNL Financial. Figure 6 illustrates that the average equity beta for all water businesses ranges from as low as 0.44 to 1.14, with a peak in early to mid 2009. This highlights the importance of using up to date beta estimates – something the QCA has not done. A similar trend can also be seen in Figure 7 and Figure 8, which limit the sample to US and UK water distribution businesses respectively.

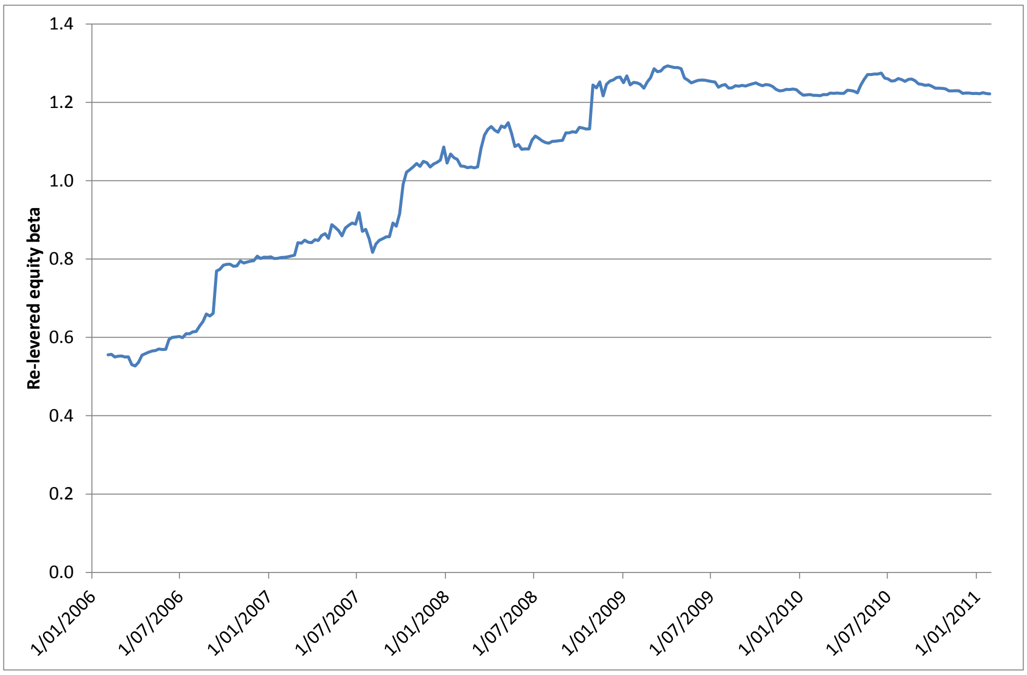
[49] Henry, O., *Econometric advice and beta estimation*, November 28 2008, p. 5.

Figure 6: All water businesses



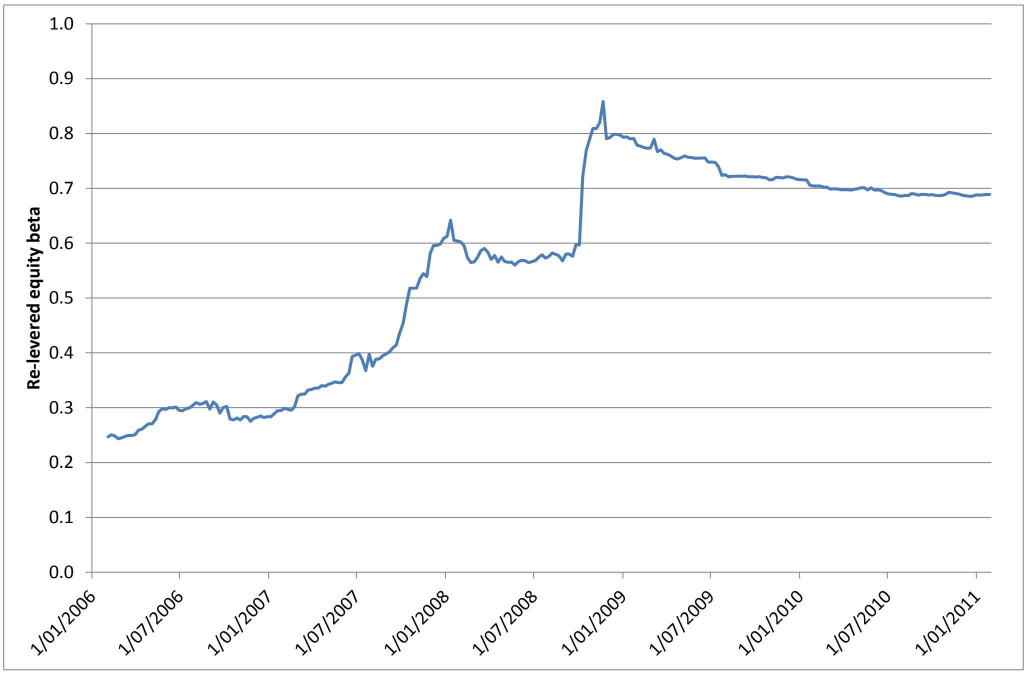
Source: Bloomberg, CEG analysis

Figure 7: All US water businesses



Source: Bloomberg, CEG analysis

Figure 8: All UK water businesses



Source: Bloomberg, CEG analysis

6.4. Use of debt beta of 0.11

166. The QCA proposes to use a debt beta of 0.11 in the de-levering and re-levering of raw equity beta estimates. It instructed Lally to use this debt beta in his recommendations, despite Lally's stated preference for a debt beta of 0.[50]

167. The debt beta describes the covariance between the return on debt and the return on the market. Using a positive debt beta reduces the re-levered equity beta under the Conine transformation relative to an assumed debt beta of zero, because some of the firm's non-diversifiable risk is assumed to be compensated for in the cost of debt.

168. Adopting a positive debt beta will not affect the results of the estimates materially so long as the average level of gearing in the sample is the same as the benchmark gearing. However, if a higher level of benchmark gearing is used then this is no longer true. In my opinion a zero debt beta should be adopted unless the benchmark gearing is the same as the average in the sample of comparators.

169. In this regard, I note that the QCA's current estimate of 0.11 for the debt beta is based on a report it issued in 2004.[51] In that report, the QCA opted not to review the empirical literature on debt beta, but instead to choose a value halfway between zero

[50] Lally, M., *The Estimated WACC for the Interim SEQ Price Monitoring*, 5 January 2011, p. 4.

[51] QCA, *Gladstone Area Water Board: Investigation of Pricing Practices*, December 2004.

and what it regarded as an upper bound for the debt beta, the ratio of the debt risk premium to the market risk premium.[52] At the time, the QCA estimated the debt risk premium at 1.36%.[53]

170. The problems associated with this estimation methodology can be shown based on current debt risk premium data, where the QCA would estimate a debt beta of 0.37 if it updated its methodology based on its proposed parameters in this determination. That is, higher than the QCA's proposed asset beta.

171. In the QCA's case the benchmark gearing is higher and, therefore, the use of a positive debt beta has the effect of lowering the re-levered equity beta – an outcome that I consider inappropriate given the problems associated with the debt beta estimation. In my opinion, the correct approach to take when faced with this level of uncertainty is to be conservative and adopt a debt beta of zero. I note that this is the approach recommended by Lally and adopted by the AER in its estimation and use of equity betas.

6.5. Error in calculation of US electric utility betas

172. Notwithstanding the additions and updates that I have made to the betas estimates and comparators used by Lally, it is worthwhile noting an error in the composition of the table that Lally relies upon in recommending an asset beta of 0.35. In Table 1 of his report, Lally incorrectly identifies the US electric utility firms as having average asset betas of 0.30 and 0.37, at debt betas of 0 and 0.11 respectively.

173. In fact, using the approach set out by Lally in that report and which he correctly applied to the other firms in his table, the correct asset betas for the US electric utilities would be 0.36 and 0.41 respectively.[54]

Table 7: Lally's estimated asset betas, amended for error

	No. Coys	Data period	$\beta_d = 0$	$\beta_d = 0.11$
UK water sample	3	2004-2009	0.18	0.22
US water sample	9	2004-2009	0.36	0.38
Australian energy network sample	9	2002-2008	0.24	0.30
US electric utilities	11	1990-2008	0.36	0.41
Mean			*0.31*	*0.35*
Mean excluding UK water sample			*0.32*	*0.37*

52 Ibid, pp. 87-89

53 Ibid, p. 102

54 See Henry, O., *Estimating beta*, 23 April 2009, Table 6.5, p. 45, and Lally's description of his calculations at Lally, M., *The Estimated WACC for the Interim SEQ Price Monitoring*, 5 January 2011, pp. 24-25. Based on Henry's betas, converted back to raw equity betas using Henry's formulation and then de-levered to asset betas assuming gamma of 0, tax of 39% and debt beta of 0.11 as described by Lally , I calculate a higher average than reported by Lally.

174. I note that Lally gives significant weight to the results of the US electric utilities and less to the UK water businesses. Given these weightings, correction of Lally's error increases his point estimate of the asset beta from 0.35 to 0.37, and the corresponding estimate of the equity beta from 0.66 to 0.70. Combined with a debt beta of zero, as recommended by Lally, the equity beta would increase further to 0.74.

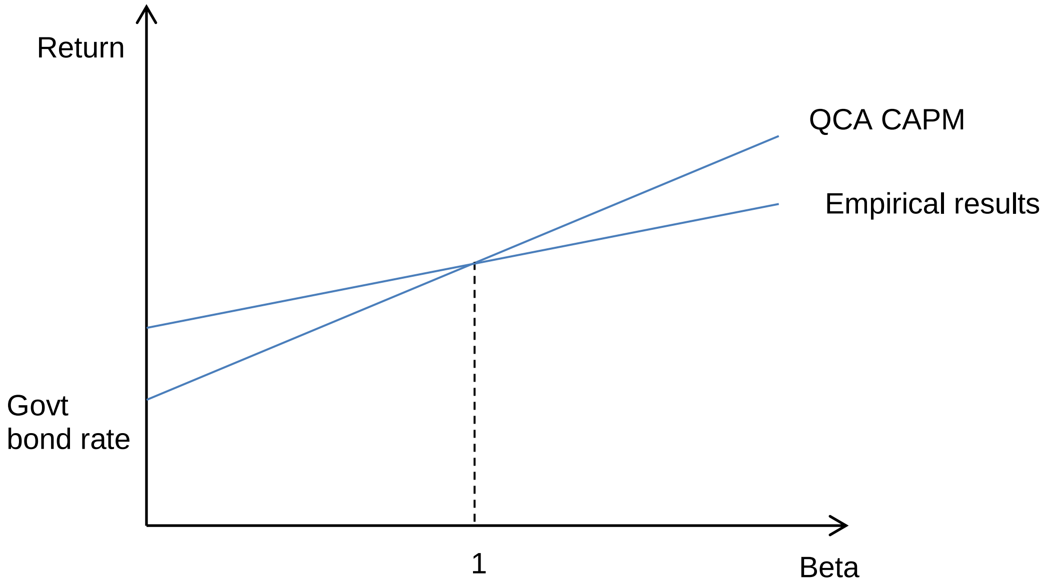
6.6. Use of empirically estimated betas

175. Even if the QCA's equity beta estimate of 0.66 was correct two sources of bias would mean its application in the QCA's CAPM model will result in the cost of equity being underestimated by at least 1.5%.

6.6.1. Empirically established bias (data supports Black CAPM)

176. It is well established in the empirical literature that the actual cost of equity for firms of zero beta is higher than the government bond rate commonly used by regulators as an estimate of the risk-free rate. This results in the CAPM formula used by the QCA underestimating the cost of equity for firms with an equity beta of less than 1.0, as shown in Figure 9 below.

Figure 9: Empirically estimated return on equity as a function of beta



177. This effect has been shown internationally in seminal number of papers (see Fama and French[55] for a summary) and recently for Australian data by CEG and Professor Grundy.[56] It is well accepted in the finance literature.

178. While these results suggest that the form of the CAPM used by the QCA is not a particularly good fit for the data on the cost of equity, they do not necessarily invalidate the use of the CAPM to accurately estimate the cost of equity provided care is taken, when using empirically estimated equity betas, to adjust these towards one to account for their bias in estimating the correct cost of equity when used in the CAPM formula unadjusted. The common use of the Blume adjustment by equity analysts is consistent with practical implementation of the results from the empirical literature. It is also consistent with the theoretical version of the CAPM that recognises investors can't borrow at the Government bond rate – the Black CAPM.

179. Thus, even if the QCA had accurately estimated the beta at 0.66, its use in the CAPM formula will tend to underestimate the cost of equity. Professor Grundy, who has surveyed the relevant empirical literature, advises on how to correctly estimate the extent of this underestimation.[57] Appendix B implements this methodology to show that the QCA's use of an equity beta of 0.66 will underestimate the cost of equity by approximately 1.5%.

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[55] Fama, E.F., and French, K.R., 2004, "The capital asset pricing model: Theory and evidence," *Journal of Economic Perspectives* 18, pp. 25-46.

[56] CEG, *Estimation of, and correction for, biases inherent in the Sharpe CAPM formula,* 15 September 2008

[57] Grundy, B.D., A Calculation of the Cost of Capital: A Report for South East Queensland Water Businesses, 17 February 2011, pp. 16-17.

6.6.2. Heightened market gearing over the past 5 years

180. When estimating beta from stock market data one is estimating the risk of a stock relative to the risk of the market. Other things equal, a firm that has a constant level of risk will tend to have a low measured beta in periods when the market has heightened risk. That is, an increase in market risk relative to the firms risk will push down the measured beta. This does not mean that the firm is less risky in absolute terms – only that it is relatively less risky.

181. Over the last five years the average level of gearing for the market has been high relative to historical averages and, consistent with the experience in the global financial crisis, this has been associated with heightened market risk. Thus, in this period we would expect the estimated beta for regulated utilities, measured at a constant notional gearing, to be depressed. This means that these beta estimates are likely to be an underestimate of the beta looking forward as market gearing returns to more normal levels.

182. The Governor of the Reserve Bank of Australia has explained the underlying factors driving market gearing as follows:[58]

> *In the boom years that precede a crisis, credit expands very strongly as businesses or households (or both) gear up, either to fund spending or asset acquisition. Some of the decisions that people make during those periods are based on unrealistic expectations about future economic conditions or asset prices. As such, they turn out not to be financially viable.*
>
> *A process of de-leveraging therefore follows. Businesses and households become more cautious, increasing saving, selling assets and reducing debt. Lenders also become more cautious, both because they see the weaker economic circumstances as increasing the risk on loans, particularly as collateral values decline, and because they typically begin to experience a noticeable increase in bad loans. The result is that both the demand for, and the supply of, credit tend to decline.*

183. This suggests that the beta estimates contained in this report should be treated as a lower bound to the extent that one believes that market gearing and risk in the future will return to long run historical averages (an assumption implicit in the QCA's adoption of a MRP of 6%). Further discussion of this issue is provided in Appendix C below.

6.7. DGM analysis of the cost of equity for Australian utilities

184. The QCA assumes a market risk premium of 6%. Coupled with the QCA's equity beta of 0.66, this implies an equity risk premium of 4% for the South-East Queensland Water Businesses.

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[58] http://www.rba.gov.au/speeches/2010/sp-dg-081010.html

185. To further examine whether the QCA'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.

186. 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.[59] 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 subjective, I have shown a range of assumptions, including those that would be necessary to support the QCA's estimated 4 percent equity risk premium.

187. The results of the DGM analysis show that, to arrive at an average equity risk premium of 4%, the assumed growth rate for dividends in the future has to be negative 4.10%. Even at an assumed growth rate for dividends of zero, the average equity risk premium is estimated at 7.0%, 3% higher than implied by the QCA assumptions. The results of the DGM analysis at varying growth rates is summarised in Table 8 below.

59 Consistent with the QCA's assumption regarding the value of imputation credits, forecast dividends 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)

Table 8: DGM analysis - ROE and ERP with dividend growth rates assumptions

Growth rate		APA	DUET	ENV	HDF	SPN	SKI	Average
	ROE	8.3	11.1	9.1	6.9	9.7	7.9	8.8
-4.10%	**ERP (3 yr)**	**3.5**	**6.3**	**4.3**	**2.1**	**4.9**	**3.1**	**4.0**
	ERP (10 yr)	2.8	5.6	3.7	1.5	4.2	2.5	3.4
	ROE	10.4	13.1	11.1	9.1	11.3	10.0	10.8
-1.30%	**ERP (3 yr)**	**5.6**	**8.3**	**6.3**	**4.3**	**6.5**	**5.2**	**6.0**
	ERP (10 yr)	5.0	7.6	5.7	3.6	5.9	4.6	5.4
	ROE	11.4	14	12.1	10.1	12.1	11	11.8
0%	**ERP (3 yr)**	6.6	9.2	7.3	5.3	7.3	6.2	7.0
	ERP (10 yr)	6	8.6	6.6	4.7	6.6	5.6	6.4
	ROE	13.4	15.8	13.9	12.1	13.6	12.9	13.6
2.50%	**ERP (3 yr)**	8.6	11	9.1	7.3	8.8	8.1	8.8
	ERP (10 yr)	7.9	10.4	8.5	6.7	8.1	7.5	8.2
	ROE	15.8	18	16.2	14.5	15.4	15.3	15.9
5.50%	**ERP (3 yr)**	11	13.2	11.4	9.7	10.6	10.5	11.1
	ERP (10 yr)	10.3	12.6	10.7	9.1	9.9	9.9	10.4

Source: Bloomberg, RBA, CEG analysis

188. The table below 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 1.17 would be required, at an MRP of 6%, if one assumed that dividends were not to fall over time.

Table 9: Beta implied by QCA market risk premium

Dividend growth rate (%)	ERP (%)	Implied beta estimate	QCA MRP (%)
-4.10	4.0	0.67	6.0
-1.30	6.0	1.00	6.0
0.00	7.0	1.17	6.0
2.50	8.8	1.47	6.0
5.50	11.1	1.85	6.0

Source: Bloomberg, RBA, CEG analysis

189. Put another way, the QCA's equity beta estimate of 0.66 together with the equity risk premiums estimated in the DGM model, results in a significantly higher market risk premium than the 6% assumed by QCA. This is illustrated in Table 10 below.

Table 10: Market risk premium implied by the QCA beta estimate

Dividend growth rate (%)	ERP (%)	QCA beta estimate	Implied MRP (%)
-4.10	4.0	0.66	6.0
-1.30	6.0	0.66	9.1
0.00	7.0	0.66	10.6
2.50	8.8	0.66	13.3
5.50	11.1	0.66	16.8

Source: Bloomberg, RBA, CEG analysis

6.8. Inconsistency in setting the cost of equity below the cost of debt

190. As explained by Professor Grundy,[60] standard finance theory suggests that the ERP[61] for a 60% geared business will be at 2.67 times the debt risk premium (DRP). The general formula for the relationship between the equity and debt risk premia is given by:

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

L = the proportion of debt in the finance structure, ie, gearing; and

E = the proportion of equity = 1-L

191. This follows mathematically from two well accepted propositions. The first is the application of the Modigliani-Miller result that the WACC (total firm level risk adjusted return) is unaffected by financial structure (ie, WACC is invariant to the level of gearing). The second is that the debt risk premium is convex in the level of gearing. That is, the debt risk premium increases slowly initially but then increases more rapidly as more and more debt is issued (increasing the probability of default on debt).[62]

192. With market observed debt risk premiums in the order of 4.0% for firms with gearing levels of around 60%, the implied ERP for these firms is 10.7% (2.67*4.0%). This is more than double the QCA 4.0% point estimate for the ERP relative to the Government bond rate.

60 Grundy, B.D., A Calculation of the Cost of Capital: A Report for South East Queensland Water Businesses, 17 February 2011, pp. 17-18.

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

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

193. Notwithstanding the above conclusion, I consider that the ERP for such businesses will be less than 10.7%. This is because the true risk free rate used in the market is, consistent with the empirical literature in support of the Black CAPM, something more than the Government bond rate.

194. If so, the correct measure of the DRP is lower because the relevant risk free benchmark is higher than the Government bond rate. Consequently, the lower bound on ERP will also be lower because it is multiple of the true DRP. For example, if the true unobservable risk free rate was 3% above the government bond rate then the true DRP, measured relative to the higher risk free rate, would only be of the order of 1.0% (4.0% less 3.0%). In which case a lower bound for ERP would be 2.67*1.0% = 2.67%. In this case the cost of equity would be estimated as

ROE = Government bond rate + 3% + 2.67%.

195. Using the QCA Government bond rate of 4.91% gives and ROE of 10.58%. Thus, even if we accept that 3% of the difference between Government bond rates and corporate debt yields is due to other factors[63] the minimum estimated cost of equity that is consistent with a 4.0% debt risk premium is still 10.58% (1.73% above the QCA's estimate of 8.85%).

196. Of course, assuming that the risk free rate was higher than the Government bond rate would lower the MRP measured relative to the higher risk free rate. The net effect of both changes would be to leave the cost of equity unchanged for firms with an equity beta equal to 1.0 but to raise the estimated cost of equity for firms with an equity beta of less than 1.0 – consistent with the reasoning in relation to the Black CAPM set out above.

6.9. Conclusion

197. The QCA adopts an asset beta of 0.35 and an equity beta of 0.66 (corresponding to a 60% gearing). These estimates rely upon advice provided to the QCA by Lally, recommending an asset beta of 0.35. In my view and based on the reasoning presented above, the best estimate of the equity beta based on market data is 1.0. Changing this parameter alone will increase the cost of equity by 2.0%.

198. I have updated Lally's empirical analysis using weekly beta estimates as recommended by Henry and by extending the US sample to include all relevant electricity and gas distribution businesses, not just a limited selection. My analysis indicates an asset beta of 0.60 and an equity beta of 1.11, when assuming a debt beta of 0.11. This result is also in line with average asset and equity betas derived using an

[63] Commonly described as a "convenience yield" attached to Government bonds that makes these bonds yields lower than equivalent CAPM risk corporate assets. For a discussion of this see previous reports by myself including *Establishing a proxy for the risk free rate* A report for the APIA, ENA and Grid Australia, September 2008 (submitted to the AER WACC review).

alternative data source, SNL Financial, for the US electricity and gas distribution businesses. It is also worth noting that, even if QCA has regard only to estimates provided by Lally, simply correcting for the errors in de-levering and re-levering asset betas for the US businesses and using a debt beta of zero rather than 0.11, the equity beta should be 0.74 rather than 0.66.

199. Even if the QCA's equity beta estimate of 0.66 was correct, biases in the QCA's CAPM model will result in the cost of equity being underestimated by around 1.5%. The empirical evidence is well understood that the actual cost of equity for firms of zero beta is higher than the government bond rate commonly used by regulators as an estimate of the risk-free rate. This results in the CAPM formula used by the QCA underestimating the cost of equity for firms with an equity beta of less than 1.0.

200. In addition to the issues raised above, I have also considered a dividend growth model (DGM) of six listed Australian electricity and gas utilities firm. This model indicates that the forecast path of future dividends implies an equity risk premium (ERP) significantly higher than the 4.0% allowed by the QCA under any reasonable assumptions. The results of this analysis support the results of my updated survey of beta estimates and suggest that an equity beta of 1.0 is appropriate for regulated utilities.

201. My empirical equity beta estimate, together with the CAPM formula underestimating cost of equity for firms with an equity beta of less than 1.0 and the results derived in the DGM model, strongly favours an equity beta of at a minimum 1.0. In light of the potential difficulties of empirically estimating betas, I believe a conservative estimate of 1.0 is the best estimate of equity beta.

7. Gamma

202. While not an input into the nominal post tax WACC, gamma is an input into the final pre tax WACC. The Australian Competition Tribunal (ACT) is currently considering the appropriate estimate of gamma. Gamma is the value of each dollar of imputation credits to shareholders as those imputation credits are created (ie, at the time of paying corporations tax). The value of gamma can be expressed as the product of the distribution rate[64] and the utilisation rate[65].

203. The ACT has determined that the distribution rate should be set at 0.7[66] and has ordered that further work should be performed in order to inform an estimate of the value of theta.[67] The AER has previously set the utilisation rate at 0.65.[68] Applying

64 The proportion of imputation credits actually distr buted to shareholders.

65 The value of imputation credits to shareholders once distributed.

66 *Application by Energex Limited (Distribution Ratio (Gamma)) (No 3)* [2010] ACompT 9

67 *Application by Energex Limited (No 2)* [2010] ACompT 7

68 The average of 0.57 from Beggs and Skeels and 0.74 from Handley and Maheswaran based on tax statistics.

this to a 0.7 distribution rate gives a value of gamma of 0.46. This is less than the QCA's estimate of 0.5.

204. In my opinion, the tax statistics are an unreliable estimate of the utilisation rate as they fail to provide information on the role of individual investors in forming market valuations. This means that although 74% of imputation credits may actually be used by investors these need not be the marginal investors that companies rely on to raise capital (and which set market prices). I therefore favour estimates of the utilisation rate based on dividend drop off studies. Adopting the AER's 0.57 estimate from Beggs and Skeels and a 0.7 distribution rate gives a gamma of 0.4. I consider that this is a superior estimate of gamma than the 0.5 proposed by the QCA.

205. In my opinion, the QCA should defer to the outcome in the Tribunal should this be available at the time that it makes its final decision. It appears to me almost certain that a value of gamma less than 0.46, reflecting updated dividend drop off estimates, will emerge from this decision.

Appendix A. Regulatory precedent in rejecting volatile risk free rate proxies

206. There is considerable regulatory precedent for not adopting volatile risk free rate proxies.

A.1. Australian precedent

207. Almost all Australian regulators have, historically, adopted a ten year government bond rate.

208. In South Australia the Electricity Pricing Order (EPO) that described how the cost of equity for ETSA would be determined (in the two regulatory determinations between 2000 and 2010) required that the risk free rate be based on a five year historical average of the yield on ten year CGS. Specifically, Schedule 10 of the EPO stated:

> *"Except for exceptional circumstances the term for the benchmark risk free security shall be the ten-year government bond. Furthermore the benchmark for the risk free rate should reflect the average yield over the last five years on a rolling average basis.*
>
> *In all other respects the estimation of parameters shall reflect prevailing conditions in the market for investments having a similar nature and degree of business risks as those faced by ETSA Utilities."*

A.2. UK precedent

209. UK economic regulators have accepted the fact that applying the most recent estimates of the risk free rate may not be appropriate – especially when those estimates are at historically low levels. Instead, they have instead had regard to average observed values over a long time period.

210. For example, Ofcom, the UK telecommunications regulator, has stated:

> *"the nominal rate for 5-year gilts has fallen over the last year and mechanistically applying a 3 month average of the most recent data would lead to a risk free rate of 4.5% or less. Such an estimate would, however, be low by historic standards, and Ofcom believes that some weight should be given to a longer-term perspective, suggesting that the use of a slightly higher risk free rate would be more appropriate."…*
>
> *"Taking account of both current and recent historical evidence, Ofcom's view is that it is appropriate to use a value of 4.6% for the nominal risk free rate. This is somewhat higher than the current rate of about 4.2% to 4.3% (which are lower than*

historic averages), but consistent with a longer term averages and a real risk free rate of 2.0% and a rate of inflation of 2.5%."[69]

211. Ofwat, the UK water regulator, has also adopted an estimate that is based on long run averages rather than volatile spot rates.

"*Our estimate for the risk-free rate is in the range 2.5% to 3%. It is based on the longer run level of yields on medium term index-linked gilts rather than the current rate which the evidence suggests is historically low*."[70]

212. In the same decision Ofwat state:

"The proposed range is consistent with regulatory precedent. Recent regulatory determinations have placed little weight on low gilt rates [Government bond rates]. The Competition Authority, e.g. BAA plc (2002), has also noted that current yields should be used with caution when estimating the risk free rate because of market volatility. The Smithers & Co study (February 2003) undertaken on behalf of the regulators concludes that a reasonable assumption for the risk-free rate is 2.5%."

213. I have already discussed Ofgem's (the UK energy regulator) adoption of the Smithers and Co advice in its 2004 electricity distribution decision. In its 4 December 2006 Final Proposals electricity and gas transmission decision it has similarly decided not to reflect historically low risk free rates in historically low cost of capital. It adopted an estimate of the real risk free rate of 2.5% on the basis that:

"*The Smithers report concluded that the best long term estimate of the risk-free rate is 2.5 per cent, which is broadly consistent with the range of previous decisions taken by ourselves, other regulators, and the Competition Authority."* (Page 53 para 8.10)

214. In its 26 June 2006 Initial Proposals Ofgem similarly stated:

"In DPCR4, as described above, we observed that the CAPM model gave a wide range of estimates for the cost of equity, reflecting a significant variation between long term average values for the cost of equity and observed market data at a given point in time. We concluded that we could not rely on observed market data due to exceptional factors pushing down interest rates and the instability of the equity beta." (Page 30)

A.3. US precedent

215. In the US standard regulatory precedent is for:

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69 Ofcom, *Ofcom's approach to risk in the assessment of the cost of capital*, 23 June 2005, p. 15.

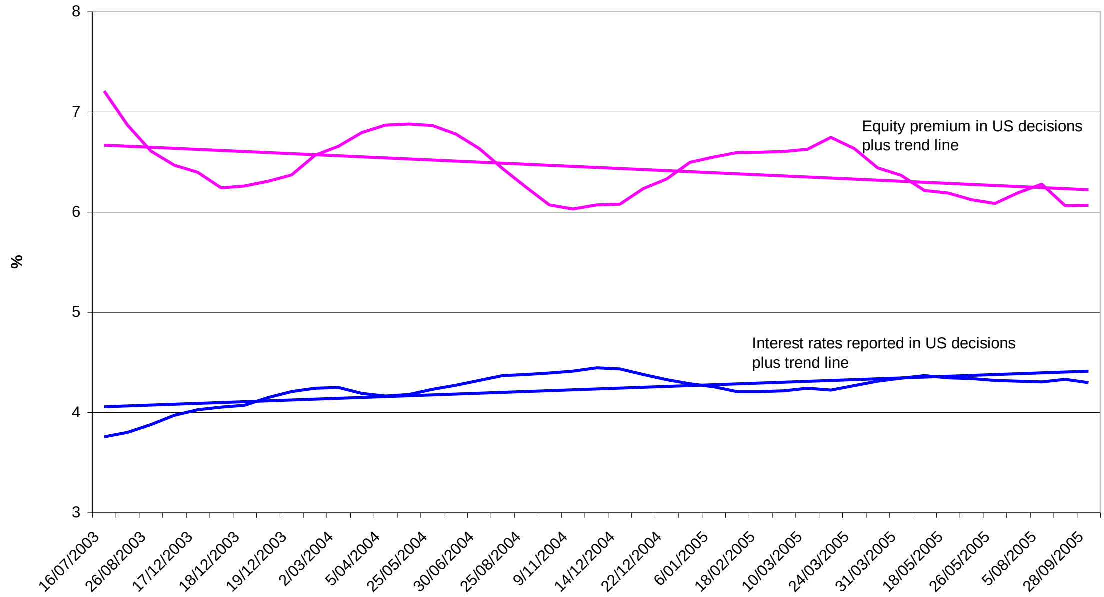
70 Ofwat, *Future water and sewerage charges 2005-10: Final determinations*, Appendix 5, Cost of Capital., 2004.

216. In a discounted cash flow analysis the cost of equity does not vary with short term changes in the risk free rate. Rather, the cost of equity is derived as the discount rate that is consistent with current equity prices for benchmark regulated firms and current forecasts of future dividends to be paid by those benchmark firms.

- the cost of debt to reflect the actual debt payments made by regulated businesses on their debt issues;
- the cost of equity to be determined by reference to a discounted cash flow analysis.

217. The following graphic demonstrates that US energy regulatory decisions have tended to move less than one-for-one with changes in government bond rates. This can be seen by the fact that from 2003 to 2005 the premium above the government bond rate allowed by US regulators falls as the government rate increases. In this case, the trend increase in US interest rates is largely offset by an associated reduction in allowed equity premium - leaving the total return on equity largely invariant to the rise in interest rates from mid 2003 to 2005.

Figure 10: Relationship between equity premium and interest rates in US energy decisions (2003 to 2005



Source: Regulatory Research Associates, Inc. 14 January 2005, Major Rate Case Decisions – January 2003 – December 2004 Supplemental Study and 4 October 2005, Major Rate Decisions – January – September 2005. The Federal Reserve Board, Statistics: Releases and Historical Data h15 Daily yields on ten year Treasury securities.

218. This reflects an explicit and deliberate decision by US regulators not to mechanistically reflect 100 percent of all variations in interest rates in the allowed return on equity. In the words of the Californian regulator, which is responsible for regulated assets in excess of the value of Australian regulated assets:

"*We consistently consider the current estimate and anomalous behavior of interest rates when making a final decision on authorizing a fair ROE. In PG&E's 1997 cost of capital proceeding we stated "Our consistent practice has been to moderate changes in ROE relative to changes in interest rates in order to increase the stability of ROE over time". That consistent practice has also resulted in the practice of only adjusting rate or return by one half to two-thirds of the change in the benchmark interest rate."*[71]

[71] Californian PUC, Decision 00-12-062, December 21, 2000, ROE for Sierra pacific Power Company.

Appendix B. The Black CAPM

219. The Black CAPM is a more realistic theoretical model than the original CAPM developed by Sharpe and Lintner and used by the QCA in that it does not assume that investors can borrow at the risk free rate (government bond rate). This gives rise to a CAPM formula where the return on a zero beta investment is higher than the risk free rate and, consequently, the sensitivity of required returns to beta is lower. This more realistic theoretical model is, unsurprisingly, much better supported by the data from equity markets.

220. At the turn of the millennium, John Campbell was asked by the Journal of Finance to survey the state of play in modern asset pricing theory in an article entitled *Asset Pricing at the Millennium*.[72] In that article he states:

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

221. I estimate the Black CAPM using Australian data. I estimate[73] that, based on the returns for the 200 largest equities listed on the Australian Stock Exchange over the period from 1964 to 2007, the intercept of the Black CAPM is below the average market return by 14.6% of the market risk premium measured relative to the Government bond rate. In the nomenclature used by Professor Grundy this associated with a value for $\frac{Rm - R0}{Rm - Rf}$ = "α" of 0.146.

222. There is no difference between the result of the outcomes of the Black and Sharpe-Lintner CAPM at a beta of 1.0, as I recommend at section 6 above. However, at the QCA's estimated equity beta of 0.66, the effect of using the more accurate model is considerable.

223. Following the logic set out in Professor Grundy's report, if the MRP (measured relative to the Government bond rate) is 6.0% as assumed by the QCA then the Black CAPM risk premium for an asset with a 0.66 equity beta will be 5.7%. With a Government bond rate of 4.9% as assumed by the QCA then the Black CAPM cost of equity will be 10.6%, 1.7% higher than estimated by the QCA.

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

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

224. Professor Grundy also examines international studies of the value of "α" over different time periods. The most recent estimate and the one that covers the largest time period, that by Da, Guo and Jagannathan (2009). This study uses data on US stocks over the period 1932 to 2007 and its results are relied on by the AER in rejecting the FFM as a well accepted model. The study concludes that the average value of "α" is 0.232. Using this value with a static beta of 0.66, risk free rate of 4.9% and an MRP of 6% gives rise to a cost of equity of 10.4% - which is 1.6% higher than the estimate derived from the static application of the Sharpe CAPM.

225. The highest estimate of α is 0.761 from Black Jensen and Scholes (1972). If this estimate is used then the cost of equity is estimated to be 9.3% (again with an equity beta of 0.66, MRP of 6.0% and a Government bond rate of 4.9%).

Appendix C. Long-term average MRP and current high levels of market gearing

226. The QCA's methodology for estimating beta, following Lally, is to estimate:

i. a sample of utilities' levered betas;

ii. estimate an average "asset beta" by removing the impact on gearing for each of the utilities - having regard to only the absolute leverage of the utilities in question;

iii. apply this average "asset beta" to an MRP that reflects a long-term average.

C.1. Use of long-term average MRP

227. The adoption of a long-term average MRP in step iii) is reasonable to the extent that the QCA reasonably believes that MRP has fallen materially post GFC back to long-term average levels. However, there is a potential inconsistency between this step and step ii).

228. In step ii) it is assumed that one must only adjust the levered beta estimated in step i) for the gearing of the firm in question. This is correct so long as one is going to apply the asset beta so estimated to an MRP that reflects the market wide gearing at the time the equity beta was estimated. However, if one is going to apply an MRP based on a different level of market gearing then one must also adjust the asset beta to be consistent with the assumed MRP/market gearing.

229. To see why this is so note that beta is a measure of *relative* risk. That is, beta measures the absolute risk of a firm's equity relative to the absolute risk of the market portfolio. This can be shown mathematically using the CAPM formula:

$Re = Rf + ERP_{Utility}$ where: (1)

Re = a utility's cost of equity

Rf = the risk free rate

$ERP_{Utility}$ = a utility's equity risk premium.

230. Utilities' equity risk premium can itself be expressed, using the capital asset pricing model formula, as:

$ERP_{Utility} = \beta \times MRP$ where: (2)

β = utility's beta;

MRP = Average market cost of equity – Rf

= average risk premia across all firms in the market.

231. Formula (2) can be rearranged to be expressed in terms of beta:

$$\beta = \frac{ERP_{Utility}}{MRP} \quad (3)$$

232. This demonstrates mathematically that beta for a utility is simply equal to the absolute risk associated with that utility divided by the absolute risk associated with the market as a whole.

233. Suppose that $ERP_{Utility}$ was constant through time (e.g. because utilities maintained a constant level of risk). However, imagine that the absolute risk associated with the market as a whole varied through time (e.g. because the average market level of gearing fluctuated). In periods of high market risk the value of $ERP_{Utility}$ would be constant but the value of beta would be depressed.

234. If one were then to take that depressed value of beta and multiply it by the heightened value of the MRP, then there would be no error in correctly estimating the required equity risk premium for utilities. However, if one took the beta estimated in a period of high market risk and applied it to an MRP that reflected an assumed lower level of risk (e.g. a return to 'normal' conditions) then one would underestimate the true $ERP_{Utility}$. This is because the lowering of the MRP would also be associated with an offsetting increase in the beta.

235. This demonstrates why betas estimated from a period of high market leverage (market risk) must be adjusted upwards if they are to be combined with MRP estimates based on lower assumed market leverage.

236. This is where I consider that an important inconsistency in the QCA's methodology exists. Put simply, the QCA estimates an asset beta relative to the market in the recent past and applies this unadjusted to the MRP that it has estimated as a long-term MRP.

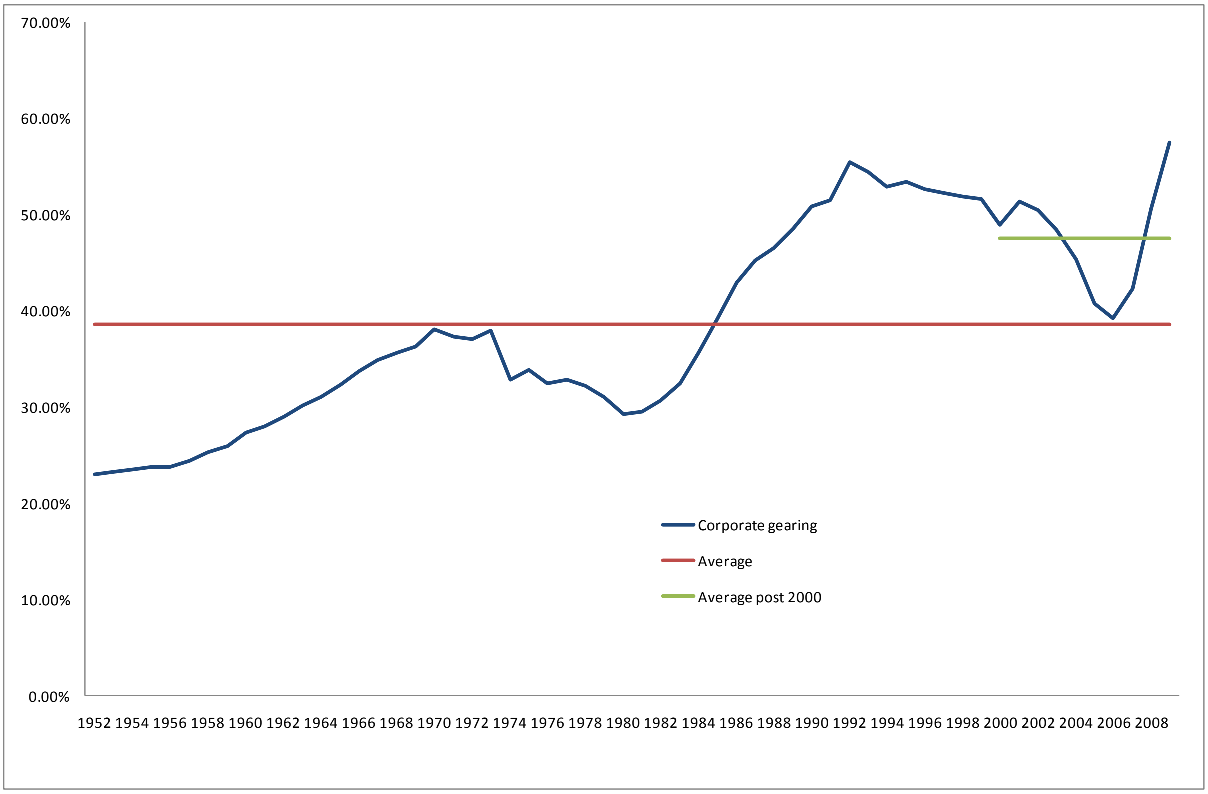
237. This is only reasonable if market leverage over the period of beta estimation was consistent with the implied level of market gearing underpinning the 'long-term' MRP (i.e. a long term average level of gearing). As a purely factual matter this is not the case and market gearing over the relevant period was higher than historical average levels.

C.2. Historical market levels of gearing

238. The following charts describe the movement in market wide gearing measures in the US and the UK – noting that all of the comparable water businesses in the Lally/QCA sample are from the US or UK.

239. Figure 10 below describes the time series for corporate gearing as reported in US Federal Reserve Flow of Funds statistics. This describes the ratio of debt to net worth (measured at market value) for Nonfarm Nonfinancial Corporate Businesses.

Figure 11: US corporate gearing

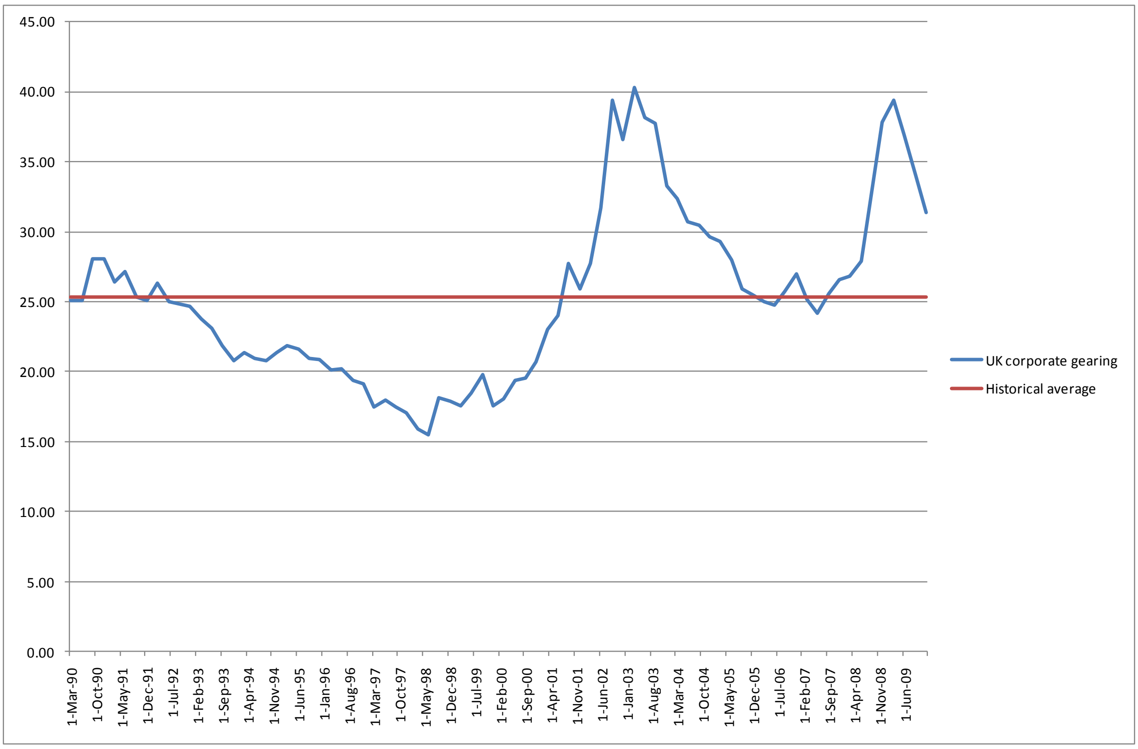


Source: Balance Sheet of Nonfarm Nonfinancial Corporate Business (B.102) for different time periods. http://www.federalreserve.gov/releases/z1/Current/data.htm

240. This figure demonstrates a significantly higher level of corporate gearing in the US since 1990 than any time from 1952 backwards. The average level of gearing over the entire period is 39% relative to a 48% gearing post 2000.

241. Figure 12 below is based on Bank of England data which excludes financial institutions.

Figure 12: UK corporate gearing



Source: Bank of England data on average gearing of private non-financial corporate sector (FSR10 June)

242. It should be noted that this chart understates the average rise of gearing in the general economy because the data excludes financial companies (whose gearing increased materially in the lead up to the crisis and during the crisis proper). Given the importance of financial companies to the FTSE in generally (and particularly to the risk of the FTSE over the crisis), it is important for understanding the movement in overall market risk that these companies are included.

243. Data that includes financial companies shows an even more dramatic trend in the average gearing of FTSE-100 companies over the past 20 years. Figure 13 shows the weighted average gearing of the 50 current FTSE-100 companies that have gearing figures available from Datastream continuously over the last 20 years. As can be seen, the level of gearing nearly tripled. A similar trend is observed on the larger sets of companies that have been covered by Datastream over the last five years (82 firms) and ten years (70 firms) respectively.

Figure 13: Gearing of FTSE-100 firms

Source: Datastream, CEG analysis.

244. I note that following the crisis there has been a move by companies to significantly reduce their gearing back towards historical average levels. A recent article noted:

> *The amount of debt that UK companies are holding on their balance sheets has fallen dramatically since 2007. If leverage was the name of the game in the boom years following the Millennium, then the past three have been all about deleveraging. Analysis from KPMG shows that two-thirds of the FTSE 100 companies that have filed their accounts for 2010 have reduced their debt levels since 2007.*[74]

245. The Governor of the Reserve Bank of Australia has explained the underlying factors driving gearing as follows:[75]

> *In the boom years that precede a crisis, credit expands very strongly as businesses or households (or both) gear up, either to fund spending or asset acquisition. Some of the decisions that people make during those periods are based on unrealistic expectations about future economic conditions or asset prices. As such, they turn out not to be financially viable.*

74 The Telegraph, Rebuilding confidence: it's time to climb off the tightrope and start investing, 25 October 2010.

75 http://www.rba.gov.au/speeches/2010/sp-dg-081010.html

A process of de-leveraging therefore follows. Businesses and households become more cautious, increasing saving, selling assets and reducing debt. Lenders also become more cautious, both because they see the weaker economic circumstances as increasing the risk on loans, particularly as collateral values decline, and because they typically begin to experience a noticeable increase in bad loans. The result is that both the demand for, and the supply of, credit tend to decline.

246. Market gearing was well above historical averages in both the lead up to the crisis and was at extreme levels during the worst of the crisis – when high levels of debt combined with collapsing market wide equity prices. That is, in the lead up to the GFC the numerator of the market wide gearing ratio (debt) increased dramatically and during the GFC the denominator went in the opposite direction (due to falling equity prices).

C.3. Conclusion

247. The QCA's MRP estimate is associated with an assumed level of market gearing and risk that has returned to 'normal'. However, the beta estimates are derived from a period of high market risk and high levels of market gearing. These beta estimates need to be adjusted upwards to the extent that it is intended to use them with an MRP estimate associated with a lower level of market gearing and market risk.

248. The nature of this adjustment is consistent with the nature of the gearing adjustment the QCA already makes in relation to an individual firms' gearing. Specifically, the QCA multiplies the individual firm's beta by one minus the individual firms gearing. This gives an asset beta which is a measure of firm specific risk *relative to* the market risk associated with the market gearing during the period of the beta estimation (call this period 1). Let the gearing of the market during that period be called "G^1_{Market}". If we let the gearing associated with the proposed long-term MRP be called "G^2_{Market}", then the following equation describes how the asset beta estimated in period 1 needs to be adjusted to make it comparable to the MRP estimated for period 2.

$$\beta^2_{Asset} = \beta^1_{Asset} \times \frac{1-G^2_{Market}}{1-G^1_{Market}} \qquad (4)$$

249. Using the average US Federal Reserve Flow of Funds gearing from 1952 to 2009 as the proxy for G^2_{Market} and the average from 2000 to 2010 as the proxy for G^1_{Market} then the asset betas estimated during the period 2000 to 2010 would need to be scaled up by a factor of 17% ((1-.39)/(1-.48)).

250. I have not performed these scale ups and, consequently, my equity beta estimates are conservative.

Appendix D. SNL Financial data

D.1. Debt maturity

251. The following data relates to listed electric and gas utilities in the United States. The data has been compiled from SNL Financial. SNL Financial directly reports the tenor of all debt issued by the below listed companies (Table 11). I have calculated an average tenor by weighting by total issued debt.

Table 11: United States electric and gas utilities debt maturity

Ticker	Issuers ($000)	Weighted average tenor
AEP	15,246,040	17.51
AES	7,037,130	9.66
AGL	1,970,600	14.64
AYE	4,413,166	13.94
ALE	672,995	16.26
LNT	3,323,449	15.78
AEE	7,802,565	14.25
ATO	2,195,003	13.29
AVA	1,152,100	17.72
BKH	1,356,105	13.76
CPN	7,346,000	8.73
CNP	10,171,033	14.59
CV	193,733	18.10
CHG	538,977	18.96
CPK	105,978	17.76
CNL	1,209,540	20.47
CMS	6,186,149	12.19
ED	11,838,583	18.95
CEG	4,393,074	21.81
CNIG	3,280	20.00
CVA	883,750	11.47
DGAS	3,408,045	16.65
D	16,208,665	20.26
DPL	1,347,222	17.81
DTE	7,054,442	18.72
DUK	16,807,786	16.70
DYN	3,901,000	11.72
EIX	12,384,990	17.38
EE	865,961	26.93
EDE	700,504	18.50
EGN	571,522	18.31
ETR	9,922,898	12.58
EPGRQ	46,445	23.45
EQT	1,969,200	12.44
EXC	12,596,577	15.47
FE	14,845,709	12.29

Ticker	Issuers ($000)	Weighted average tenor
EGAS	13,000	10.00
GXP	3,694,028	13.94
HE	1,400,193	21.16
IDA	1,397,460	19.06
TEG	2,493,088	20.38
ITC	2,463,800	14.85
LG	466,200	23.08
MDU	183,600	23.60
MAM	24,000	23.43
MGEE	385,000	20.41
MIR	3,553,000	12.64
NFG	1,124,000	11.56
NU	4,678,934	17.35
NEE	17,991,775	20.36
GAS	501,401	22.32
NI	7,199,640	11.09
NJR	329,845	19.34
NWE	905,205	10.42
NRG	6,558,500	9.87
NST	2,642,870	12.74
NVE	5,617,951	14.79
NWN	636,700	18.71
OGE	2,711,450	17.37
OKE	1,478,561	18.57
ORA	244,600	16.11
OTTR	452,159	13.23
POM	4,365,828	17.77
PCG	12,255,995	17.84
PNY	732,013	25.38
PNM	2,450,044	16.17
POR	1,809,000	19.26
PNW	3,575,855	16.18
PPL	7,541,702	16.80
PGN	12,815,421	18.75
PEG	8,310,300	15.03
STR	830,100	13.58
RGCO	8,000	22.00
RRI	2,328,000	6.04
SJI	453,081	18.25
SCG	4,921,175	20.18
SRE	8,345,810	16.74
SO	21,112,613	18.73
SUG	2,673,695	27.05
SWX	1,078,555	23.24
TE	3,355,950	12.64
UGI	1,474,916	11.51
UIL	637,032	14.56

Ticker	Issuers ($000)	Weighted average tenor
UNS	37,445,780	24.49
UTL	315,625	16.22
VVC	1,944,365	15.87
WR	2,736,048	19.64
WGL	639,173	18.01
WEC	4,760,750	24.38
XEL	9,392,780	19.77

D.2. Asset and equity beta estimates

252. I have calculated asset betas using raw equity betas and gearing levels sourced from SNL Financial. The sample includes all businesses currently classified by SNL 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 12: 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

	Raw beta	Gearing	Asset beta	Re-levered beta	Raw beta	Gearing	Asset beta	Re-levered beta
	One year betas				Three year betas			
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
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

	Raw beta	Gearing	Asset beta	Re-levered beta	Raw beta	Gearing	Asset beta	Re-levered beta
	One year betas				Three year betas			
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
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