Market Risk Premium: An updated assessment and the derivation of conditional and unconditional estimates

Report for the Victorian electricity distribution businesses

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1. Executive summary

Background and context

1. SFG Consulting (**SFG**) has been engaged by CitiPower, Jemena, Powercor, SP AusNet and United Energy to consider the estimate of market risk premium (**MRP**) under the National Electricity Law (**NEL**) and National Electricity Rules (the **Rules**).

2. The rule requirements that are relevant to a consideration of the MRP are best summarised by considering the statements made by the AER in its final decision for the WACC review. In section 7.2.1 of its Final Decision, the AER stated that in undertaking a review of the WACC parameters, the Rules set out several matters to which the AER must have regard. Of particular relevance to the review of the MRP are:

    a) The need for the rate of return to be a forward looking rate of return that is commensurate with prevailing conditions in the market for funds and the risk involved in providing regulated transmission or distribution services (as the case may be).

    b) The need to achieve an outcome that is consistent with the National Electricity Objective (NEO); and

    c) The need for persuasive evidence before adopting a value or method that differs from the value or method that has previously been adopted for it.

3. In its decision on the application by Energex, Ergon Energy and ETSA Utilities for a review of the value of the gamma parameter, the Australian Competition Tribunal held that "persuasive evidence" has its "ordinary meaning of able to persuade or induce a belief."[1]

4. We have been asked to set out our expert opinion in respect of the following matters:

    a) The statistical properties of the market risk premium time series and the implications of those properties for the determination of the appropriate value of the market risk premium to use in the capital asset pricing model;

    b) Having regard to the statistical properties of the market risk premium and other relevant factors how should the appropriate value for the market risk premium to use in the capital asset pricing model be determined; and

    c) Having regard to the analysis in (b) what is the appropriate value of the market risk premium to use at the present time.

5. This report has been authored by Professor Stephen Gray. I am Professor of Finance at the UQ Business School, University of Queensland and Director of SFG Consulting. I have honours degrees in Commerce and Law from the University of Queensland and a PhD in Finance from the Graduate School of Business at Stanford University. I have extensive experience in advising companies, government, and regulatory agencies on issues relating to weighted-average cost of capital.

[1] See Application by Energex Limited (No 2) [2010] ACompT 7, 13th October 2010, Paragraph 23.

Declaration

6. I have been provided with a copy of the Federal Court Guidelines for Expert Witnesses and have prepared this report in accordance with them. In preparing this report, I have made all the enquiries that I believe are desirable and appropriate and no matters of significance that I regard as relevant have, to my knowledge, been withheld from the Court.

Recent regulatory decisions

7. The Australian Energy Regulator (**AER**) has produced four recent final decisions for gas pipeline businesses and a draft decision for Aurora Energy's electricity distribution business, all of which adopt an estimate of the MRP that differs from the AER's estimate of the MRP in its Statement of Regulatory Intent (**SoRI**) from May 2009. Those decisions are:

    a) Final Decision: NT Gas: Access arrangement proposal for Amadeus Gas Pipeline, July 2011 (**Amadeus Pipeline Final Decision**);

    b) Final Decision: Envestra Ltd: Access arrangement proposal for the Qld gas network, June 2011 (**Envestra Qld Gas Final Decision**);

    c) Final Decision: APT Allgas Ltd: Access arrangement proposal for the Qld gas network, June 2011 (**Allgas Qld Gas Final Decision**);

    d) Final Decision: Envestra Ltd: Access arrangement proposal for the SA gas network, June 2011 (**SA Gas Final Decision**); and

    e) Draft Distribution Determination: Aurora Energy Pty Ltd 2012-13 to 2016-17 November 2011 (**Aurora Draft Decision**).

8. This report addresses the issues relating to MRP from the SoRI and from the recent decisions that are listed above.

9. In those recent decisions, the AER sets out its view that:

    a) Whereas the appropriate estimate of MRP was 6.5% in mid-2009, commensurate with conditions in financial markets at that time;

    b) Conditions in financial markets have since improved so that the long-run average estimate of 6% is now appropriate.

10. In addition to the recent decisions of the AER, the Australian Competition Tribunal (**the Tribunal**) has recently addressed the issue of MRP in an application by Envestra (**Envestra MRP case**).[2] This report also addresses the issues relating to MRP from that case.

Summary of conclusions

11. Our primary conclusions are:

    a) The AER's previous estimate of 6.5% should not be treated as an upper bound on MRP estimates because it was not based on any analysis;

[2] Application by Envestra Ltd (No 2) [2012] ACompT 3.

b) Indicators of conditions in financial markets establish that risk premiums remain at elevated levels (option implied volatilities, dividend yields and yield spreads in debt markets all remain well above long-run averages);

c) The AER indicates that it has placed some reliance on geometric averages of historical data. It is incorrect to do so, and correcting that error would lead to higher estimates of MRP;

d) The AER places some reliance on macroeconomic commentary. More direct evidence about the current conditions in the market for funds can be obtained from current prices in the market for funds, than from the text of various pieces of macroeconomic commentary;

e) All MRP estimates must be "grossed up" to reflect the assumed value of dividend imputation franking credits – such that internal consistency is preserved throughout the WACC estimation process. In this regard, survey estimates that make no allowance for franking credits cannot be compared with an AER estimate that *does* reflect an assumed value of franking credits; and

f) Given:

   i) An unconditional mean estimate of 6% (from recent AER decisions);

   ii) A standard error of the unconditional mean of 1.5% (from Handley, 2011a and 2011b); and

   iii) The ability of conditioning variables (such as option implied volatilities, dividend yields and yield spreads in debt markets) to explain 50% of the variation in longer-term excess returns (from the empirical finance literature),

   an appropriate range for MRP estimates is 4-8%. Since the current values of the conditioning variables are, in each case, more than one standard deviation above their long-run mean values, an estimate of at least 7% would be commensurate with the current conditions in the market for funds.

g) In my view, there is no persuasive evidence for adopting a value for MRP below the previously adopted value of 6.5%.

2. Summary of AER's current views about estimates of MRP

View on MRP expressed in the SoRI

12. The AER view is that:

    a) The best long-run average estimate of MRP is 6%; and that

    b) The MRP varies from time to time with changing conditions in financial markets, in which case the best estimate of MRP is above 6% at some points in time and below 6% at others.

13. For example, in the SoRI in May 2009 the AER concluded that:

> …prior to the onset of the global financial crisis, an estimate of 6 per cent was the best estimate of a forward looking long term MRP, and accordingly, under relatively stable market conditions—assuming no structural break has occurred in the market—this would remain the AER's view as to the best estimate of the forward looking long term MRP.[3]

14. In the SoRI the AER further concluded that:

> …while theoretically the MRP could avary [sic] over time in line with different economic conditions the view of the AER and the JIA's advisers (Professor Officer and Dr Bishop) is that, unlike for the nominal risk-free rate, there is no adequate method to automatically update the MRP at the time of each reset determination.
>
> Yet the NER requires the AER to lock in either a value or method for each parameter. Given the lack of an appropriate method that could be used to update the MRP for each reset determination effected by this WACC review, the only alternative is that a value for the MRP be adopted.
>
> In relatively stable market conditions, the adoption of a value for the MRP (which then applies for multiple reset determinations) is unlikely to be a significant issue, as the long term estimate is likely to be the best estimate of forward looking expectations prevailing at any particular point in time.
>
> However, due to the global economic and financial crisis, relatively stable market conditions do not currently exist. While it is conditions at the time of the reset, rather than at the time of the WACC review which are relevant, the AER has taken into account current conditions to the extent these conditions are expected to prevail over the time of reset determinations affected by this review. In other words, as the AER is reviewing the WACC parameters now—including 'locking-in' a value for the MRP—to the extent that current conditions (at the time of this review) are expected to be maintained until the time of the determinations effected [sic] by this review, then current conditions remain a relevant consideration in determining what value should be 'locked-in' for the MRP.[4]

AER's current view

15. The recently expressed view of the AER is that:

[3] SoRI, p. xiv.
[4] SoRI, pp. 44-45.

a) At the time of the SoRi (May 2009) financial market conditions were such that the best estimate of MRP was 6.5%; but that

b) Conditions in financial markets are now such that the best estimate of MRP is the long-run average estimate of 6%.

16. In the SoRI, the AER concluded that:

> …relatively stable market conditions do not currently exist and taking into account the uncertainty surrounding the global economic crisis…the AER considers that a MRP of 6.5 per cent is reasonable, at this time, and an estimate of a forward looking long term MRP commensurate with the conditions in the market for funds that are likely to prevail at the time of the reset determinations to which this review applies.[5]

17. In four recent final decisions, the AER has concluded that:

> The significant uncertainty that characterised markets at the time of the WACC review has substantially diminished. The prevailing conditions in the market for funds have eased.[6]

and

> The AER considers the evidence outlined above supports an MRP of 6 per cent as the best estimate of the MRP. It also indicates that the AER's approach of increasing the MRP to 6.5 per cent at the time of the WACC review is no longer appropriate.[7]

18. In its recent Aurora Draft Decision, the AER has concluded that:

> there is persuasive evidence to justify a departure from an MRP of 6.5 per cent to an MRP of 6 per cent. The AER also considers that an MRP of 6 per cent satisfies the requirements of the NER.[8]

Interpretation of AER's Global Financial Crisis (GFC) estimate of 6.5%

19. In relation to the Global Financial Crisis (**GFC**) MRP estimate of 6.5%, I note that there is widespread agreement that the AER was correct to increase its estimate of the MRP during the GFC. There is less agreement about the magnitude of this increase and about the method by which that magnitude was determined. In particular, the SoRI provides no analysis of why the appropriate adjustment to the estimate of MRP (to reflect the effect of the GFC) is precisely 50 basis points.

20. An adjustment of 50 basis points is very small relative to the confidence intervals around any estimate of MRP. For example, in his most recent report for the AER, Handley (2011a) reports that the 95% confidence interval for the point estimate of MRP based on data since 1958 (the period that is said to contain the most reliable data) is 12.5%.[9] This is 25 times the AER's 50 basis point adjustment in relation to the effects of the GFC. That is, the 50 basis point adjustment is very small, even relative to the estimation error surrounding the point estimate.

[5] SoRI, pp. xiv-xv.
[6] Amadeus Final Decision, p. 71; Allgas Qld Final Decision, p. 33; Envestra Qld Final Decision, p. 45; SA Final Decision, p. 50.
[7] Amadeus Final Decision, p. 72; Allgas Qld Final Decision, p. 34; Envestra Qld Final Decision, p. 46; SA Final Decision, p. 51.
[8] Aurora Draft Decision, p. 221.
[9] Handley (2011a) Table 1, p. 5.

21. Moreover, the 50 basis point adjustment in the SoRI is not based on any calculations or modelling or analysis. Rather, the AER selected an estimate of 6.5% on the basis that:

> …having regard to the desirability of regulatory certainty and stability, the AER does not consider that the weight of evidence suggests a MRP significantly above 6 per cent.[10]

22. It might be argued that if 6.5% was an appropriate estimate of the MRP during the height of the GFC, and if the effects of the GFC have reduced, then the current estimate of MRP should be somewhat lower than 6.5%. However, this presupposes that 6.5% *was* an appropriate estimate of the MRP during the height of the GFC. But, as set out above, the SoRI provides no analysis of why the appropriate adjustment to the estimate of MRP (to reflect the effect of the GFC) was precisely 50 basis points. The 50 basis point adjustment was not based on any calculations or modelling. Rather, the AER selected an estimate of 6.5% "having regard to the desirability of regulatory certainty and stability."[11] Moreover, the 50 basis point increase is a relatively small adjustment given that almost all financial indicators of risk were at their highest levels for decades. For these reasons, it is my view that the 6.5% estimate should not be treated as any sort of theoretical or empirical maximum upper bound for MRP estimates.

23. This issue is of particular relevance under the persuasive evidence test set out in the NER. In particular, there are two quite different questions to consider:

    a) Whether there is persuasive evidence that the forward-looking MRP is lower now than it was at the time of the SoRI in May 2009; and

    b) Whether there is persuasive evidence that the forward-looking MRP is now lower than 6.5%.

24. The NER require that before a parameter value can be changed, it must be established that there is persuasive evidence for adopting a value that differs from the previously adopted value.[12] Consequently, it would seem that the second question is the relevant one.

[10] SoRI, p. 238.
[11] SoRI, p. 238.
[12] NER 6.5.4(e)(4).

3. Current conditions in financial markets

Do risk premiums in financial markets remain at elevated levels?

25. To determine whether financial market risk premiums remain at elevated levels, the standard approach is to examine a time series of variables that have been shown in the finance literature to be related to market risk premiums. The variables that are examined include:

    a) Option implied volatilities – higher implied volatilities indicate higher levels of market risk and consequently higher risk premiums;

    b) The spread between the yields on highly-rated bonds and lower-rated bonds – a greater spread indicates that risk premiums are high in financial markets generally; and

    c) Dividend yields – a higher dividend yield indicates that prices are low relative to dividends, which is consistent with dividends being discounted back to present value using a higher discount rate, which is in turn consistent with higher risk premiums.

26. Fama and French (1988), Fama and French (1989) and Keim and Stambaugh (1986) demonstrate that dividend yields and default spreads are positively associated with future equity market returns relative to Treasury bill rates. This does not imply that equity market returns can be forecast with absolute precision or that these variables provide investors with a trading strategy which generates abnormally high returns. What the academic research shows is that the bond and equity market prices appear to be affected by similar risk considerations. This means that low equity prices (relative to trailing dividends) and low corporate bond prices (relative to promised repayments) reflect investors' expectations for risk and therefore their required return for bearing that risk, in both the equity and debt markets.

27. In the remainder of this section, I examine a time series of each of these variables in turn.

Option implied volatilities

28. In the Australian market, it is most common to estimate the implied volatility of the broad market using options on the ASX 200 index. These implied volatilities are computed by determining the volatility estimate that would have to be inserted into the Black-Scholes option pricing formula in order to reconcile the model price with actual traded market prices.[13] Prices for relatively short-term at-the-money call and put options are usually used for this purpose.

29. This series measures the market's perception of the forward-looking volatility of the ASX 200 index. It is therefore a measure of the *amount* of risk that market participants perceive. This is not a perfect measure of the Capital Asset Pricing Model (**CAPM**) MRP for two reasons:

    a) It is based on options with a relatively short (3 month) time horizon[14]; and

[13] The Black-Scholes model is the industry standard model for valuing stock options. The framework was developed by Fisher Black, Myron Scholes and Robert Merton. Scholes and Merton were awarded the Nobel Prize in Economics in relation to this work in 1997 (Black died in 1995 and the Nobel Prize is not awarded posthumously).

[14] Officer and Bishop (2009) have also examined the implied volatility of 12-month options on the S&P/ASX 200 index. However, there is less historical data available for 12-month options than for shorter-dated instruments (one month and three month options).

b) It reflects only the *amount* of risk, whereas the CAPM MRP also reflects the *price* of risk – the return that investors require for bearing each unit of risk. Both of these components, and hence the MRP, can vary over time.

30. In its recent decisions, the AER has argued that it is difficult to precisely model the relationship between option implied volatility and MRP and has stated that there is no consensus in the relevant literature about how this should be done.[15]

31. Nevertheless, it is clear and well-accepted that there is a positive relationship between implied volatilities and the forward-looking MRP. Higher implied volatilities are indicative of higher risk and consequently higher risk premiums. That is, when implied volatilities are materially above their long-run average level, risk premiums will also be above their long-run average levels.

32. Since implied volatilities provide an indication of the market's view about volatility over the life of the option, they provide a forward-looking view of stock market volatility. This is relevant to the estimation of MRP in that volatility is a measure of the *quantity* of risk that is associated with an equity investment – a greater amount of risk would logically require a greater premium as compensation for bearing it.

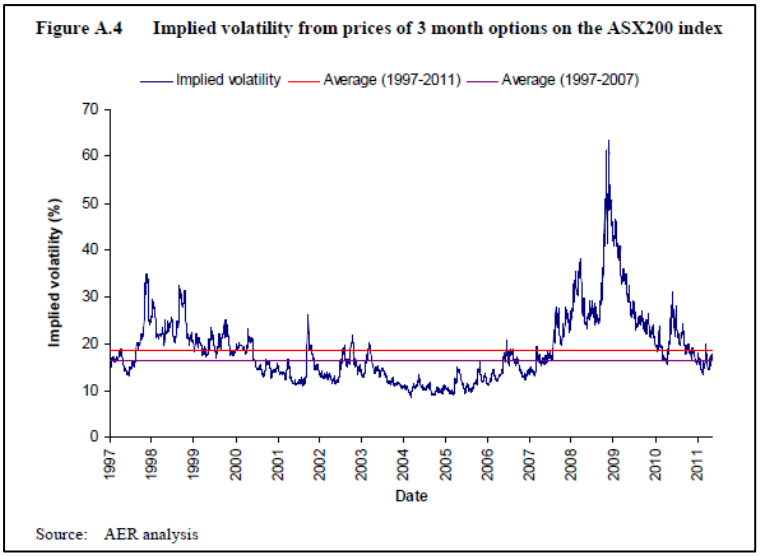
33. Although it is difficult to precisely quantify this relationship, the directional effect is well accepted. For example, in its recent final decisions, the AER accepts that there is a positive relationship between option implied volatility and MRP. The AER then further argues that implied volatilities have retreated to pre-GFC levels, in which case the MRP estimate should be reduced to its long-run average level of 6%:

> implied volatility appears to have reduced significantly since the height of the GFC and is currently consistent with levels experienced prior to the GFC, which can be seen from figure A.4.[16]

34. The basis for this conclusion is the figure that is reproduced below. This same figure appears in Appendix 1 of the AER's four recent final decisions.

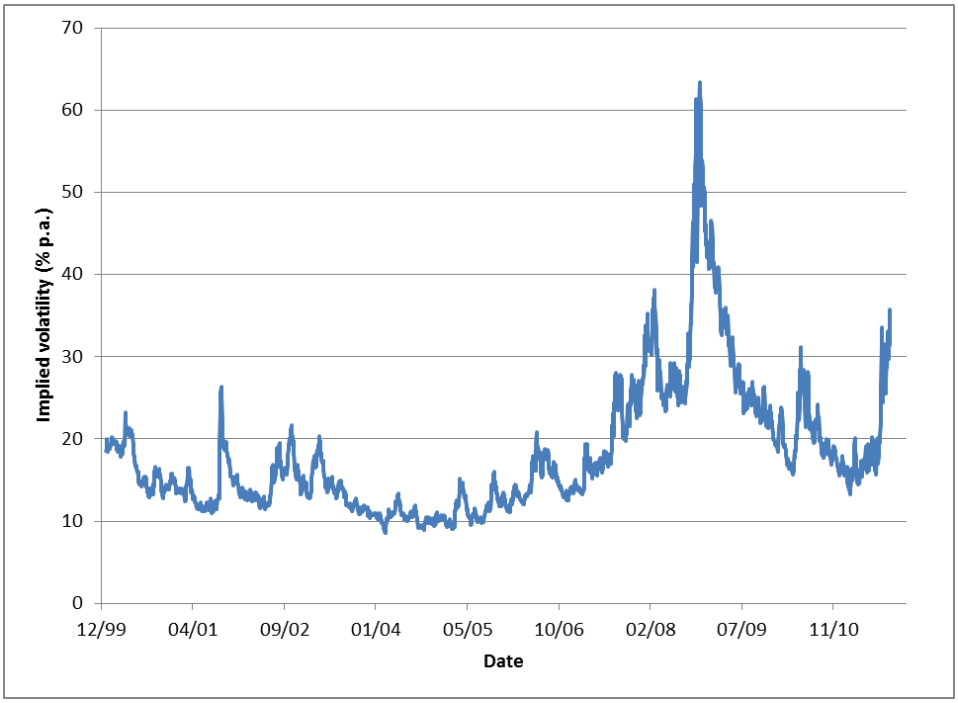
[15] Allgas Qld Final Decision, p. 133; Envestra Qld Final Decision, p. 184; SA Final Decision, p. 196; Aurora Draft Decision, p. 237.

[16] Amadeus Final Decision, p. 158; Allgas Qld Final Decision, p. 133; Envestra Qld Final Decision, p. 184; SA Final Decision, p. 196.



35. An updated version of this figure is set out in Figure 1 below. This figure contains data from the beginning of 2000 to the end of September 2011. It is clear that in recent times the implied volatility from option prices is substantially higher than its average value. This is consistent with the proposition that the effects of the GFC have not completely washed through the system, that risk premiums remain at elevated levels, and that an MRP estimate above the long-run average estimate of 6% would be appropriate in the current circumstances. In particular, the most recent observation of implied volatility is 35.7%, which is greater than 96% of the observations and more than 2.16 standard deviations above the mean since 1 January 2000.

Figure 1. Option implied volatility



Source: Citibank ASX 200 implied volatility series, Bloomberg

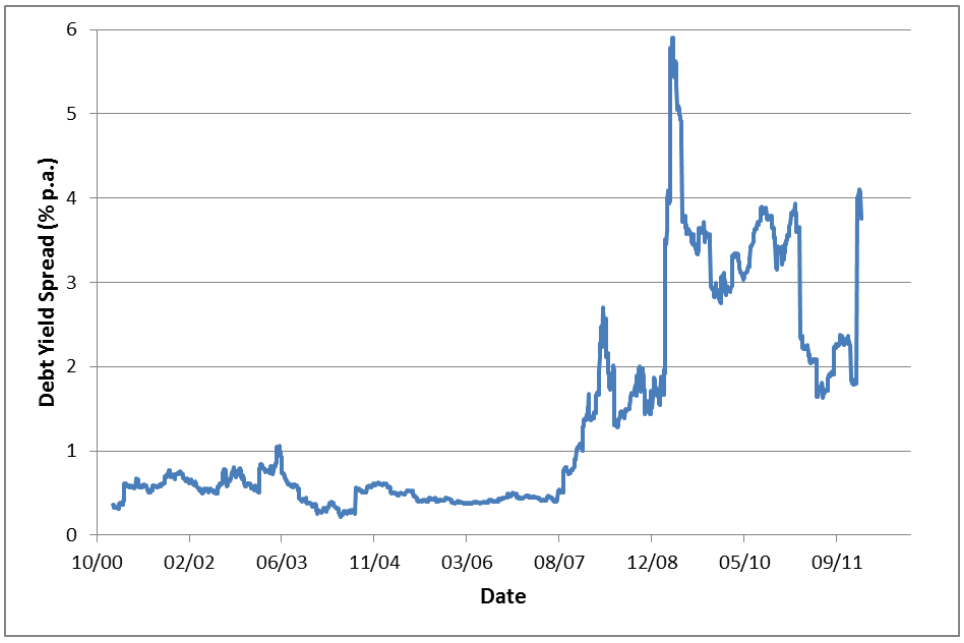
Yield spreads in debt markets

36. The *default spread* is measured as the difference between an index of the yield to maturity on BBB-rated bonds and a corresponding index of AAA-rated bonds. This spread proxies for credit or default risk. During economic expansions, the spread between the yields on higher- and lower-rated bonds tends to be low as risk premiums are also low. During recessions, however, the spread widens, commensurate with an increase in risk premiums generally.[17]

37. Figure 2 below plots the spread between the DataStream AAA and BBB yield estimates. This figure is based on redemption yields for Australian corporate bonds with approximately 3-years to maturity supplied by Merrill Lynch Bank of America. It is based on data from the beginning of 2001 to the end of January 2012. This figure shows that risk premiums in debt markets have reduced since the peak of the GFC, but remain at levels much higher than before the GFC. In particular, the most recent observation of the yield spread is 3.755%, which is greater than 95% of the observations and more than 1.94 standard deviations above the mean since 1 January 2001.

38. In my view, this is evidence supporting the proposition that risk premiums in equity markets are also likely to remain at elevated levels and not to have reduced to pre-GFC levels. In particular, it would be highly unlikely that investors would currently require materially higher than average risk premiums when investing in a firm's bonds, but not when investing in the same firms' shares.

Figure 2. Spread between AAA and BBB bonds



Source: Datastream

39. In its recent final decisions, the AER rejects the consideration of the elevated risk premiums in debt markets on two bases:

    a) That the evidence on debt premiums is unreliable in which case it cannot be concluded that risk premiums in debt markets *are* at elevated levels;

[17] See, for example, Fama and French (1988), Fama and French (1989) and Keim and Stambaugh (1986).

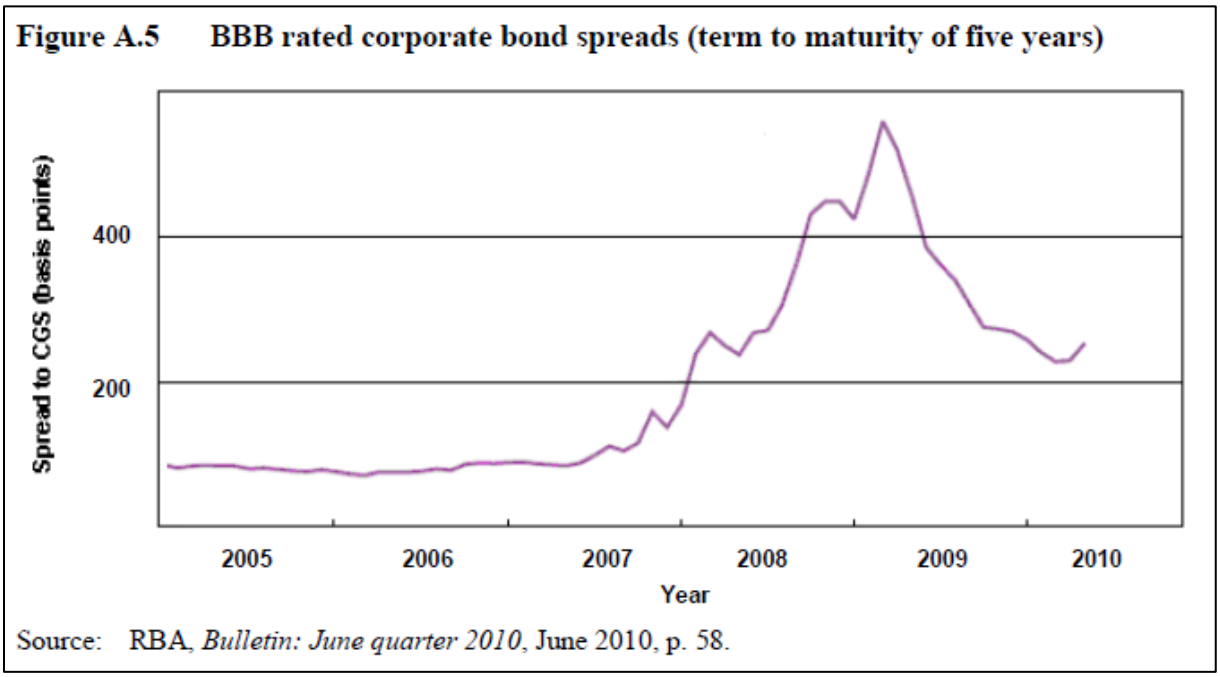
> there is a significant paucity of data on long-term bonds with credit ratings close to BBB. This is likely to reduce the accuracy of yield forecasts for long-term BBB rated corporate bonds, such as those referred to by SFG and VAA.[18]

b) In any event the evidence about risk premiums in debt markets is irrelevant because debt and equity markets are (or can be) completely disjointed.

> It is also not unreasonable for conditions in debt and equity markets to differ from each other over time.[19]

40. The AER's first argument can be addressed empirically. *Every* indicator of yield spreads in debt markets currently shows spreads remaining at elevated levels. This includes spread estimates published by the RBA and cited by the AER in its recent final decisions,[20] such as are reproduced in Figure 3 below. It also includes spread estimates based on shorter-term bonds. Indeed, the Datastream estimates in the figure above are based on 3-year corporate bond yields, not long-term bonds as the AER suggests in its recent final decisions. Moreover, the AER's *own* estimate of the BBB+ debt premium in all four of its recent final decisions is well above pre-GFC levels. In my view, the contention that debt risk premiums are not currently at elevated levels is simply unarguable.

Figure 3. RBA Spread between AAA and BBB bonds



Source: Amadeus Final Decision, p. 167.

41. In my view, the second argument set out above defies logic. It is impossible that investors would currently require substantially higher risk premiums when investing in a firm's bonds, but no more than the long-run average premium when investing in the same firm's shares. The recent final

[18] Amadeus Final Decision, p. 162; Allgas Qld Final Decision, p. 138; Envestra Qld Final Decision, p. 188; SA Final Decision, p. 201.
[19] Amadeus Final Decision, p. 163; Allgas Qld Final Decision, p. 139; Envestra Qld Final Decision, p. 189; SA Final Decision, p. 201.
[20] Amadeus Final Decision, p. 167; Allgas Qld Final Decision, p. 142; Envestra Qld Final Decision, p. 194; SA Final Decision, p. 185.

decisions simply assert that the same investors might, for some unstated reason, believe that substantially higher risk premiums are warranted when buying a firm's bonds, but not when buying the same firm's shares. This argument implies that there is no consistent relationship between risk and return and that capital markets are inefficient, and is therefore inconsistent with the basis of the regulatory framework.

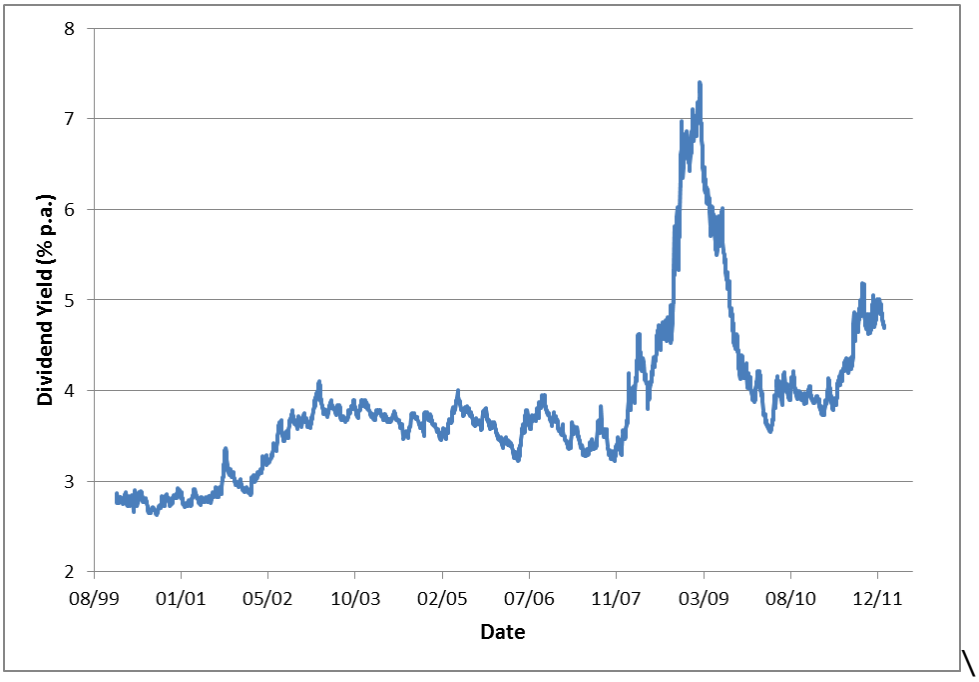
42. At the very least, there must be a prima facie case that when risk premiums are materially higher in one segment of financial markets (even according to the AER's own estimates) they are also likely to be higher in other segments of financial markets. Such a prima facie case cannot be dismissed by mere assertion.

Dividend yields

43. The dividend yield is the ratio of the cash flow to shareholders by way of dividends (including payments of a return of capital and payments in relation to loan notes) to the price of the stock. When dividend yields are high, a given set of cash flows is being discounted at a higher rate, indicative of higher equity risk premiums.[21]

44. Figure 4 shows a time series of dividend yields from the beginning of January 2000 to the end of January 2012. There was a clear and dramatic increase in dividend yields during the height of the GFC. Yields have since fallen, but remain above the pre-GFC levels. The current dividend yield is 4.69%, which is larger than 87% of the observations and more than 1.02 standard deviations above the mean since 1 January 2000.

Figure 4. Dividend yield on ASX 200 index



Source: Datastream

45. Many papers in the empirical finance literature (including Fama and French, 1988; Fama and French, 1989; and Keim and Stambaugh, 1986) demonstrate that dividend yields are strongly correlated with

[21] See, for example, Fama and French (1988), Fama and French (1989) and Keim and Stambaugh (1986).

future excess stock returns. Consequently, the fact that dividend yields are currently at historically high levels indicates that market risk premiums remain at elevated levels.

Conclusions

46. The conclusions that can be drawn from the analysis set out above are:

    a) The GFC had a pronounced effect on market risk premiums during the height of the crisis;

    b) All indicators suggest that this effect has reduced since the peak of the GFC; and

    c) These indicators remain materially above their pre-GFC levels.

47. In my view, the available financial market data supports the conclusion that the effects of the GFC have reduced, but they continue to affect risk premiums in financial markets. The available financial market data does not support the conclusion that investors view the amount of risk involved in holding a broad portfolio of equities and the price of risk (the additional return that is required in relation to each unit of risk) as now being the same as before the GFC. In my view, the turmoil in financial markets surrounding the GFC continues to have a clear effect on risk premiums in financial markets.

4. Time horizon and method of averaging

AER estimate is based, in part, on geometric averages

48. In its recent decisions, the AER sets out its view that a 10-year horizon is appropriate when estimating MRP:

> the AER considers it appropriate to calculate the MRP with the assumption of a 10 year investment horizon.[22]

49. Presumably this means that, when estimating MRP, one should think about the average annual return over a 10-year period that investors would require from an equity investment in the average firm.

50. The recent final decisions then link this 10-year horizon with the method of averaging that should be applied to historical data when estimating MRP:

> arithmetic mean estimates of realised annual excess returns are likely to overstate realised excess returns over a 10 year time horizon because they do not take account of the cumulative effect of returns over a 10 year time horizon.[23]

and

> the AER notes that the arithmetic means of historical excess returns are likely to be overstated to some degree. The best estimate of historical excess returns over a 10 year period is likely to be somewhere between the geometric mean and the arithmetic mean of annual excess returns.[24]

51. In this context, an arithmetic average is computed by adding the observations over the sample period and then dividing by the number of observations:

$$\text{Arithmetic Average} = \frac{r_1 + r_2 + \ldots + r_N}{N}$$

whereas a geometric average is computed as:

$$\text{Geometric Average} = \left[\left(1 + r_1\right) \times \left(1 + r_2\right) \times \ldots \times \left(1 + r_N\right)\right]^{1/N} - 1.$$

52. The recent final decisions do not state precisely how the AER used arithmetic and geometric averages of historical excess returns data – other than to suggest that the best estimate of MRP for a 10-year horizon is likely to be somewhere between the arithmetic and geometric averages and that:

[22] Amadeus Final Decision, p. 151; Allgas Qld Final Decision, p. 122; Envestra Qld Final Decision, p. 173; SA Final Decision, p. 185; Aurora Draft Decision, p. 229.
[23] Amadeus Final Decision, p. 153; Allgas Qld Final Decision, p. 127; Envestra Qld Final Decision, p. 178; SA Final Decision, p. 190.
[24] Amadeus Final Decision, pp. 153-154; Allgas Qld Final Decision, p. 128; Envestra Qld Final Decision, p. 179; SA Final Decision, p. 191.

> the point estimates calculated on both an arithmetic and a geometric mean basis are still relevant and should inform the best estimate of the MRP.[25]

53. In its recent Aurora Draft Decision, the AER has been more explicit about the fact that its estimate of MRP would be higher, but for some reliance on geometric means:

> The AER considers that the best estimate of historical excess returns over a 10 year period is likely to be somewhere between the geometric mean and the arithmetic mean of annual excess returns.[26]

No reliance should be placed on geometric averages

54. It is wrong to place *any* reliance on geometric averages. To the extent that reliance is (incorrectly) placed on geometric averages, the resulting estimate of MRP will be downwardly biased.

55. The issue of whether historical estimates of MRP (for use in the CAPM) should be based on arithmetic or geometric averages is dealt with in detail in the well-known Harvard Business School case relating to Marriott Corporation.[27] The instructor solutions to that case note that it is the *expected* annual return that is relevant when estimating MRP and that:

> Students focusing on the geometric average will argue that it is the appropriate growth rate of an investment…However, the arithmetic average is a better measure of the *expected* return on an investment.

56. The instructor solutions are quite clear about which approach should be used to estimate MRP:

> The arithmetic average annual return is the correct measure of the expected annual return.

57. The solutions go on to explain that:

> Suppose, for example, that a two-period investment has two equally likely outcomes: a 40% return or a -20% return. The average returns are:
>
> $$\text{Arithmetic Average} = \frac{40 + (-20)}{2} = 10\%$$
>
> $$\text{Geometic Average} = \sqrt{1.40 \times 0.80} - 1 = 5.8\%$$
>
> To see that the arithmetic average is the correct measure of expected return, compute the return associated with each possible outcome. Assume that $1,000 is invested and that the returns conform to the expected frequency distribution [i.e., half the time the return will be 40% and half the time it will be -20%].

[25] Amadeus Final Decision, p. 153; Allgas Qld Final Decision, p. 127; Envestra Qld Final Decision, p. 178; SA Final Decision, p. 190.
[26] Aurora Draft Decision, p. 229.
[27] The Harvard Business School case series is highly regarded and frequently used in top-ranking business schools and executive education programs. The Marriott Case was developed by Prof. Richard Ruback of Harvard Business School. It is widely used in graduate business programs globally. The Marriott Case uses the CAPM to estimate the required return on equity.

Year	0	1	2	Terminal value	Probability
	1000	40%	40%	1,960	0.25
	1000	40%	-20%	1,120	0.25
	1000	-20%	40%	1,120	0.25
	1000	-20%	-20%	640	0.25
Probability-weighted average				1,210	

Thus, the expected return is the arithmetic average return: $1{,}000 \times (1.10)^2 = 1{,}210$.

58. The Harvard case solutions also contain a more detailed example that considers a 10-year time horizon. It is clear about the fact that even with a 10-year time horizon, the arithmetic average must be used. Not the geometric average. Not something between the arithmetic and geometric averages.

59. Suppose the goal is to estimate an expected annual return over the next 10-years, consistent with the AER view. To see why the expected annual (compound) return is the arithmetic average, continue the previous example where there is a 50/50 chance of the return being 40% or -20% over the course of a year. In the context of historical data, suppose a sample period of 50 years was used and that in 25 of those years there was a return of 40% and in 25 of them there was a return of -20%. In this case:

    a) the arithmetic average return is 10% p.a.; and

    b) the geometric average return is 5.83%.

60. Now the question is: if stock market returns over the next 10 years occur with the same relative frequency as they did over the last 50 years, what annual compound return should we expect over the next 10 years?

61. This question can be answered by examining the outcome of every possible sequence of returns over the next 10 years and by determining the probability of each. For example, it is possible that the return will be 40% in every one of the 10 years and the value of an initial investment of $100 will accumulate to:

$$100 \times (1.40)^{10} = 2{,}892.55.$$

62. However, the probability of 10 "good" years in a row is only 0.1% (the same as the chance of tossing a coin 10 times and getting 10 heads).

63. Similarly, if the next 10 years produces nine with a 40% return and one with a -20% return, the accumulated value of a $100 investment will be:

$$100 \times (1.40)^9 \times (0.80)^1 = 1{,}652.88.$$

64. The probability of this occurring is approximately 1% (which is 10 times higher than in the previous case, since the -20% return could be in any one of 10 positions – Year 1 or Year 2, and so on). Note that this is the same as the probability of getting 9 heads out of 10 coin tosses.

65. All of the possible outcomes, and the probability of each occurring, are set out in Table 1 below.

Table 1. Probability distribution of potential investment payoffs

Number of 40% years	Number of -20% years	Probability	Accumulated value	Average compound annual return
10	0	0.0010[1]	2,892.55	40.00%
9	1	0.0098[2]	1,652.88	32.38%
8	2	0.0439[3]	944.50	25.18%
7	3	0.1172	539.72	18.36%
6	4	0.2051	308.41	11.92%
5	5	0.2461	176.23	5.83%
4	6	0.2051	100.71	0.07%
3	7	0.1172	57.55	-5.38%
2	8	0.0439	32.88	-10.53%
1	9	0.0098	18.79	-15.40%
0	10	0.0010	10.74	-20.00%
Expected payoff			259.37	

1. There is only one possible sequence of 10 "good" years, so $(0.5)^{10} = 0.0010$.

2. The one "bad" year can occur in any one of the 10 positions, so $10(0.5)^9(0.5)^1 = 0.0098$.

3. The two "bad" years can occur in any combination of the 10 years. There are 45 unique sequences that involve two bad years out of 10 – spots 1 and 2, spots 1 and 3, and so on. Therefore the probability is $45(0.5)^8(0.5)^2 = 0.0439$. The remaining probabilities are determined accordingly.

66. The *expected* accumulated value (at the end of 10 years) is $259.37. Note that this implies an annual return of 10% (which is precisely the arithmetic average):

$$100 \times (1.10)^{10} = 259.37.$$

67. Hence, if the relevant question is:

> if stock market returns over the next 10 years occur with the same frequency as they did over the last 50 years, what annual compound return should we expect over the next 10 years?

which it is, the answer is the arithmetic average return – which in this case is 10%.

68. The mistake that is made by using the geometric average is to confuse the *expected* return with the return from the *median* scenario. Note that the annual return from the median (middle-ranked) scenario is 5.83% – the geometric mean. The MRP in the CAPM is an *expected* return, not a *median* return. Consequently, the arithmetic mean, and not the geometric mean *must* be used.

Conclusion

69. To the extent that the AER has relied on geometric mean estimates in its recent decisions, it is in error and its estimates must be corrected upwards to what they would have been had there been no reliance on geometric means.

Recent comments by Australian Competition Tribunal

Context

70. In the recent Envestra MRP Case, the Tribunal noted that it did not need to decide the arithmetic vs. geometric mean issue, but indicated that it would make "some comments."[28] The Tribunal then made no formal conclusion on the issue, stating that:

> The material before the Tribunal in this matter does not allow it to decide this issue. Rather, it is a matter that the AER should consider in consultation with service providers and other interested parties.[29]

Geometric mean is less than arithmetic mean

71. In its consideration of arithmetic and geometric means, the Tribunal begins by noting that:

> It is the AER's view, with which the Tribunal agrees, that the cumulative return across a period greater than one year will be less that the average of yearly returns.[30]

72. This statement is obviously incorrect, and can be shown to be so via a simple example. Consider a portfolio worth 100 that increases to 200 over the first year and then deceases to 180 over the second year. This portfolio has returns of 100% and -10% in each of the two years. The average return is 45%[31] and the cumulative return across the period is 80%, which is obviously *higher* than the average of the yearly returns.

73. What the Tribunal apparently meant to say was that the geometric mean return across a period of greater than one year will be less than the arithmetic mean of the yearly returns across the same period. This is well known to be true in all cases but for the special case where all of the yearly returns are equal. Moreover, it is also well known that the difference between the arithmetic and geometric means increases with the volatility of the annual returns.

Use of 10-year time horizon

74. In the recent Envestra MRP case, the Tribunal stated that the AER itself has:

> noted that the arithmetic mean of 10-year historical excess returns would likely be an unbiased estimator of a forward-looking 10-year return, the appropriate benchmark.[32]

75. That is, the AER is of the view that if it had available sufficient non-overlapping 10-year historical periods it would take the arithmetic average of those 10-year periods as an estimate of the expected return over the next 10-year period. I agree that this would be entirely appropriate.

76. Of course, having obtained the arithmetic average of many non-overlapping 10-year periods (if there were a sufficient number of such periods), the AER would have to convert this back to an equivalent one-year return because an annualised WACC is ultimately required. For example, suppose the

[28] Application by Envestra Ltd (No 2), ACompT 3, Paragraph 147.
[29] Application by Envestra Ltd (No 2), ACompT 3, Paragraph 155.
[30] Application by Envestra Ltd (No 2), ACompT 3, Paragraph 150.
[31] (100% + -10%)/2.
[32] Application by Envestra Ltd (No 2), ACompT 3, Paragraph 150.

arithmetic average of a large number of 10-year periods turned out to be 79%. The AER would need to estimate the annual value that would compound up to 79% over 10 years as:

$$MRP_{annual} = \left(1 + MRP_{10-years}\right)^{1/10} - 1$$
$$= \left(1.79\right)^{1/10} - 1 = 6\%.$$

77. In my view, the matters set out in this sub-section are not the subject of any debate.

Tribunal example

78. The Tribunal has recently made some comments about the use of geometric and arithmetic means in the process of estimating market risk premium. In particular, the Tribunal notes that for any particular historical period, the geometric mean will be less than the arithmetic mean, except for the case where the return is constant over the period, in which case the two means will be equal.

79. The Tribunal then presents a simple example of a case where the geometric mean is less than the arithmetic mean:

> imagine a portfolio that is worth 100 at the beginning of year one. Suppose that in year one the portfolio falls to 80, a -20% return, before returning to 100 in year two. The cumulative two year return is zero, whereas the average annual return is (-0.2+0.25)/2=2.5%.[33]

80. An individual who invested $100 in this portfolio at the beginning of the two-year period has clearly earned a zero return over the two years. There is obviously no dispute about this. The backward-looking historical compound annual growth rate (**CAGR**) is computed as the geometric mean of a particular series of historical annual returns. But that is not the relevant question in terms of estimating the MRP to apply to a forward-looking period.

81. To see this, consider the following example which is based on the Tribunal's illustration above. Suppose that there is a portfolio whose return is either -20% or +25% every year – these are the only two possible returns. Also suppose that we want to estimate the expected return over the next two years. The AER has stated, and I agree, that an appropriate way to estimate the forward-looking two-year return would be to take the arithmetic average of a sample of historical two-year returns.

82. For this portfolio, there are four possible combinations of two-year returns as set out in Table 2 below.

Table 2. Possible sequences of two-year returns in Tribunal example

Year	1	2
	25%	25%
	25%	-20%
	-20%	25%
	-20%	-20%

[33] Application by Envestra Ltd (No 2), ACompT 3, Paragraph 150.

83. If the returns are serially independent, then these four possible outcomes are equally likely to occur. If we had eight years of historical data, for example, we would, on average, obtain one of each of the four outcomes above, as shown in Table 3 below.

Table 3. Historical sequences of two-year returns in Tribunal example

Year	1-year return	2-year return
1	25	
2	25	56.25
3	25	
4	-20	0
5	-20	
6	25	0
7	-20	
8	-20	-36
Arithmetic mean	2.5	5.0625

84. In this case, we have eight observations of historical 1-year returns. The AER view, with which I agree, is that it would agree that if we were seeking to obtain an estimate of the 1-year forward-looking return it would be appropriate to use the 1-year arithmetic mean of 2.5%.

85. Similarly, we have four observations of historical 2-year returns. Again, it would be appropriate to use the arithmetic mean of those two-year returns as an estimate forward-looking 2-year return. This would be 5.0625% per two-years. Expressing this return in an annualised manner yields 2.5% p.a. since:

$$(1.025)^2 - 1 = 5.0625\%.$$

86. That is, whether we have a time horizon of one or two years, the expected return is the same – 2.5% p.a.

87. Of course, the same would apply again if we had a 3-year time horizon. In this case there would be eight possible sequences of returns, all of which would be equally likely to occur, as set out in Table 4 below.

Table 4. Historical sequences of three-year returns in Tribunal example

Year	1-year return	3-year return
1	25	
2	25	
3	25	95.3125
4	25	
5	25	
6	-20	25
7	25	
8	-20	
9	25	25
10	25	
11	-20	
12	-20	-20
13	-20	
14	25	
15	25	25
16	-20	
17	25	
18	-20	-20
19	-20	
20	-20	
21	25	-20
22	-20	
23	-20	
24	-20	-48.8
Arithmetic Mean	**2.5**	**7.69**

88. In this case, the average 3-year historical return is 7.69% per 3-years, which is equivalent (again) to 2.5% p.a.:

$$(1.025)^3 - 1 = 7.69\%.$$

89. In summary, the annualised forward-looking expected return is independent of the time horizon that is being examined. Whether the forward-looking horizon is one, two, three or ten years, the expected return is 2.5% p.a. There is no such thing as a different expected return depending upon the time horizon.

90. Nowhere in the literature or in practice does anyone report a term structure of MRP estimates, with different estimates depending upon the time horizon of investors. It is only the AER that claims that there is a link between the time horizon and the estimate of MRP, and that this occurs in a way that somehow makes the geometric mean relevant.

5. Grossing up for the assumed value of imputation credits

91. In the recent decisions[34] the estimates of MRP from historical stock return data have been "grossed up" to reflect the assumed value of theta of 0.35. It is correct to gross up estimates of MRP to reflect the assumed value of imputation credits to ensure internal consistency between the estimate of MRP and the estimate of gamma.

92. The total return on equity consists of three components – dividends, capital gains and dividend imputation franking credits. The stock index data that forms the basis of the historical data used to estimate MRP reflects only dividends and capital gains. Consequently, the assumed value of franking credits must be added to the historical MRP estimate via a procedure known as "grossing up."

93. The grossing up calculations were performed for the AER by Associate Professor Handley. I have no reason to doubt those calculations, but note that the details of those calculations have not been made public.

[34] Amadeus Final Decision, p. 154; Allgas Qld Final Decision, p. 128; Envestra Qld Final Decision, p. 179; SA Final Decision, p. 191-192; Aurora Draft Decision, p. 227.

6. Qualitative information relied upon in recent AER decisions

Overview

94. In its recent decisions and the Aurora draft decision, the AER has made use of two types of qualitative information in its considerations of MRP:

    a) Survey responses and market practice; and

    b) Macroeconomic commentary.

95. In this section, I set out my views about how this qualitative information should be interpreted and about how much weight should be afforded to it.

Survey responses

96. In its recent decisions, the AER concludes that:

> survey based estimates of the MRP are relevant for consideration along with the range of other evidence on the MRP.[35]

97. Surveys can be useful when asking questions about what people actually do (e.g., whether or not their company regularly uses the CAPM to estimate the required return on equity). However, questions about what people think might happen in the future (e.g., how much the stock market might go up over some future period) are of very limited use.

98. Moreover, the AER's recent decisions do not state *how* the AER used the survey evidence in reaching its conclusion about MRP, nor do they even set out *what* estimate the AER thinks is supported by the survey evidence.

99. The recent decisions are also unclear about whether the AER has made any adjustment to survey estimates of MRP to reflect the assumed value of franking credits. The survey estimates of MRP reflect no value for franking credits, whereas the AER has adopted a value of theta of 0.35. To create a like-with like comparison, estimates of MRP that are ex-franking credits must be adjusted for the AER's assumed value of franking credits. In this regard, the decisions state the AER's view that:

> the estimation of MRP is imprecise and it may not be appropriate to explicitly adjust survey based estimates of the MRP for an assumed theta value that is as low as 0.35.[36]

100. It is not clear whether the AER made any adjustment for the assumed value of franking credits (as they should have), what value of MRP they believe the survey evidence supports, or how they used that information in determining their final estimate of MRP.

Observed market prices vs. macroeconomic commentary

101. The recent decisions note that the AER has placed some reliance on various pieces of macroeconomic commentary:

[35] Amadeus Final Decision, p. 161; Allgas Qld Final Decision, p. 137; Envestra Qld Final Decision, p. 188; SA Final Decision, p. 200; Aurora Draft Decision, p.230.
[36] Amadeus Final Decision, p. 161; Allgas Qld Final Decision, p. 137; Envestra Qld Final Decision, p. 188; SA Final Decision, p. 200.

> The economic and financial markets outlook for Australia is robust as noted in statements by the Reserve Bank of Australia (RBA), the International Monetary Fund (IMF) and the Organisation for Economic Co-operation and Development (OECD). This is likely to be factored into investors' expectations of future equity market returns and therefore the MRP required by investors.[37]

102. However, the recent decisions are unclear about how much weight the AER has applied to this macroeconomic commentary or what estimate of MRP it believes the commentary supports.

103. This commentary is indirect evidence at best and should be afforded little weight in comparison to observed market data. No other WACC parameters are estimated with reference to commentary. Presumably this commentary also touches on the issue of interest rates, but the risk free rate is estimated from market prices without reference to any commentary.

104. Moreover, there is a distinction between forecasts of macroeconomic conditions and the prevailing conditions in the market for funds. More direct evidence about the current conditions in the market for funds can be obtained from current prices in the market for funds, than from the text of various pieces of macroeconomic commentary.

Recent comments from Tribunal

105. The Tribunal has recently had regard to the use of qualitative evidence such as survey responses and general macroeconomic commentary. In relation to surveys, the Tribunal noted that survey evidence on which the AER has sought to rely has been criticised for not providing a sufficient real world context to give the survey results any real meaning and concluded that:

> Surveys must be treated with great caution when being used in this context. Consideration must be given at least to the types of questions asked, the wording of those questions, the sample of respondents, the number of respondents, the number of non-respondents and the timing of the survey. Problems in any of these can lead to the survey results being largely valueless or potentially inaccurate.
>
> When presented with survey evidence that contains a high number of non-respondents as well as a small number of respondents in the desired categories of expertise, it is dangerous for the AER to place any determinative weight on the results.[38]

106. In relation to general macroeconomic commentary, the Tribunal has drawn a clear distinction between general economic forecasts and estimation of market risk premium noting that no case has been made for quantitatively linking the two. The Tribunal has concluded that:

> It is not appropriate for the AER to infer from generally positive economic forecasts conclusions as to the likely MRP. These reports are not intended to provide forecasts of equity returns. Further, the reports do not endeavour to address the extent of correlation between economic performance and equity risk. This correlation would need to be explicitly dealt with, either by the forecasting bodies, the AER or expert evidence, before these reports could be usefully or validly employed to assist in forecasting the MRP.[39]

[37] Envestra Qld Final Decision, p. 47; SA Final Decision, p. 52. See also Aurora Draft Decision, pp.230-234.
[38] Application by Envestra Ltd (No 2), ACompT 3, Paragraphs 162-163.
[39] Application by Envestra Ltd (No 2), ACompT 3, Paragraph 158.

Conclusions in relation to qualitative information

107. In my view, the best information about the prevailing conditions in the market for funds comes from traded prices drawn from the market for funds, rather than from survey responses or macroeconomic commentary. Consequently, I give no material weight to this qualitative information. I note that this view is consistent with the recent comments of the Tribunal.

7. Appropriate empirical estimate of MRP

Unconditional MRP estimate

108. In its recent decisions, the AER has reaffirmed its conclusion in the SoRI that the appropriate *long-run average* estimate of MRP is 6%.[40] The four recent final decisions refer to historical MRP estimates prepared by Handley (2011a) and the Aurora Draft Decision uses the corresponding information from Handley (2011b). That report notes that the standard error of the mean historical MRP estimate is 1.5% if the longest available sample period is used. This is the most precise estimate of mean historical excess returns that is available. I also note that this standard error is insensitive to the assumed value of franking credits since, once an assumed value has been selected, the grossing-up for franking credits is stable over time.

109. In summary, the AER's recent decisions adopt an historical long-run average MRP estimate of 6% with standard error of 1.5%. Statistically, this is an estimate of the unconditional mean of a random variable. I represent this using the following notation:

$$\bar{r}_{t,T} \sim N(6\%, 1.5\%)$$

where $\bar{r}_{t,T}$ represents the average annual excess return between time t and time T, where that time period is considered to be a long-run period.[41]

110. In the regulatory setting, the task is to estimate $\bar{r}_{t,T}$ in a manner that is consistent with the prevailing conditions in the market from time to time, and in the case of electricity distribution, to determine whether there is persuasive evidence to adopt a value that differs from the previously adopted value. The way to interpret the distribution above is as follows: At the time of the regulatory re-set, nature draws a value of $\bar{r}_{t,T}$ from the above distribution and the role of the regulator is to compute an estimate of what value of $\bar{r}_{t,T}$ has been drawn from the distribution on this occasion. The best *unconditional estimate* of $\bar{r}_{t,T}$ is 6%, but it must be recognised that the true value of $\bar{r}_{t,T}$ might be as low as 3% or as high as 9% on some occasions (this being the 95% confidence interval). Ideally, the regulator would have information about when an estimate as low as 3% would be appropriate and when an estimate as high as 9% would be appropriate. In the absence of any such information, the unconditional estimate of 6% should be used. However, I demonstrate below that there is presently substantial information to suggest that an MRP estimate above the long-run mean estimate of 6% is appropriate in the current market circumstances.

Conditional MRP estimate

111. As set out in Section 2 of this report, the empirical finance literature notes that a number of variables are strongly predictive of future excess returns. Consequently, the best estimate of future excess returns is one that is conditional on these predictive variables. That is, we may be able to use these variables to determine the circumstances in which it would be appropriate to adopt an estimate of MRP above (or below) the unconditional estimate of 6%.

[40] In the SoRI, the AER concluded that the appropriate long-run average estimate of the MRP was 6%, but that an appropriate estimate in the circumstances (of a global financial crisis) was 6.5%. The key figure here is the 6% long-run average estimate (the "unconditional mean") not the 6.5% "conditional mean" estimate.

[41] The most recent report on historical excess returns commissioned by the AER is Handley (2011b). That report concludes that, over the longest available data period, the unconditional mean excess return is 6.2% with a standard error of 1.5%. The AER has concluded that, after considering all relevant factors and information, the appropriate estimate of the unconditional mean is 6%. We use the AER's 6% unconditional mean estimate for illustrative purposes in this section.

112. The use of CAPM parameter estimates that are conditional on the relevant information that is available at the time is consistent with the framework adopted by the AER. In a recent report for the AER, Davis (2011) concludes that:

> The AER approach could, I suggest, be viewed as an "implicit conditional CAPM" approach in which there is regular review of beta, the risk free rate and the MRP.[42]

and

> there is some support for a "conditional" CAPM in which forward looking expected returns depend on some stochastic factor(s) additional to the expected Market Risk Premium (which itself may be variable).[43]

113. The AER accepts this interpretation of the framework it uses to estimate the required return on equity:

> As noted by Professor Davis, the AER is using an 'implicit conditional CAPM' approach.[44]

114. Within this framework, there is a long-run unconditional mean estimate of MRP (which the AER has determined to be 6%) and a conditional mean estimate that varies above and below the long-run mean unconditional mean over time. The conditional estimate is based on (statistically speaking, it is "conditional" on) all relevant information that is available at the time.

115. To date, the AER has adopted an *implicit* conditional CAPM approach. To see how this might be made more explicit and transparent, I first denote the conditional mean excess return as $E(\bar{r}_{t,T} \mid I_t)$, where I_t represents all of the relevant conditioning variables, observed as at the date of the prediction.[45]

116. This allows us to write:

$$\bar{r}_{t,T} = E(\bar{r}_{t,T} \mid I_t) + \varepsilon_t$$

where ε_t is mean zero noise, conditional on I_t.

117. Fama and French (1988, 1989) and Keim and Stambaugh (1986) show that for long time horizons the conditioning variables can explain half of the variance of $\bar{r}_{t,T}$. That is, the R^2 statistic in the regression equation in the previous paragraph is in the order of 50%. To see the effect of this, note that:

$$Var[\bar{r}_{t,T}] = Var[E(\bar{r}_{t,T} \mid I_t)] + Var[\varepsilon_t]$$

118. An R^2 statistic of 50% implies that:

[42] Davis (2011, p. 9).
[43] Davis (2011, p. 11).
[44] Envestra Final Decision, p. 41.
[45] That is, I_t represents the "information set" at the time of making the prediction.

$$Var\left[E\left(\bar{r}_{t,T} \mid I_t\right)\right] = Var\left[\varepsilon_t\right] = \frac{Var\left[\bar{r}_{t,T}\right]}{2}.$$

119. In this case we have:

$$Var\left[E\left(\bar{r}_{t,T} \mid I_t\right)\right] = \frac{Var\left[\bar{r}_{t,T}\right]}{2} = \frac{0.015^2}{2} = 0.000113,$$

which implies that the standard deviation of $E\left(\bar{r}_{t,T} \mid I_t\right)$ is approximately 1% p.a.

120. By the law of iterated expectations, $E\left[E\left(\bar{r}_{t,T} \mid I_t\right)\right] = E\left[\bar{r}_{t,T}\right]$, which is 6% in this case. Consequently,

$$E\left(\bar{r}_{t,T} \mid I_t\right) \sim N(6\%, 1\%).$$

121. This all implies that when conditioning on variables that have been shown to be related to market risk premiums, the 95% confidence interval for the conditional expectation of the average excess return is 4% to 8% – two standard deviations around the mean estimate. When the conditioning variables are all well above their long-run mean values, risk premiums are likely to be high and an estimate toward the upper end of the range would be appropriate. Conversely, when the conditioning variables are all well below their long-run mean values, risk premiums are likely to be low and an estimate toward the lower end of the range would be appropriate. I demonstrate below that all of the conditioning variables are substantially above their long-run mean values, which suggests that an MRP estimate above the long-run mean estimate of 6% is appropriate in the current market circumstances.

Implications for estimates of MRP

122. The AER's recent decisions together with the results from Handley (2011) suggest that the long-run annual MRP is a random variable with mean of 6% and standard deviation of 1.5%. This equates to a 95% confidence interval of 3% to 9%. The task of the regulator is to determine an estimate that is commensurate with the prevailing conditions in the market. The appropriate point estimate at a particular point in time depends upon the usefulness of conditioning variables:

a) If the conditioning variables provide *no information* at all about the current market risk premium, one would always adopt a point estimate of 6%. It would be recognised that true value of MRP at the relevant point of time (i.e., the draw from $N(6\%, 1.5\%)$) could be as low as 3% or as high as 9%, but since there is no information that can be used to determine whether the appropriate estimate at the particular point in time is 3% or 9% or something in between, the unconditional estimate of 6% would always be used;

b) If the conditioning variables provide *perfect information* about market risk premiums, those variables could precisely forecast when an estimate of 3% would be appropriate, when an estimate of 9% would be appropriate, and so on. In this case, if all of the conditioning variables were currently two standard deviations below their mean, the MRP would be two standard deviations below its mean and an estimate of 3% would be used. If all of the conditioning variables were currently two standard deviations above their mean, the MRP would be two standard deviations above its mean and an estimate of 9% would be used. In all cases, the conditioning variables would provide perfect information about the MRP that is commensurate with prevailing conditions in the market; and

c) If the conditioning variables provide *imperfect information* about market risk premiums, the range of predictions will be somewhere between the single point estimate in (a) above (6%) and the full range set out in (b) above (95% confidence interval of 3-9%). The range of conditional MRP estimates will depend on how much of the variability of future excess returns can be explained by the conditioning variables. If a small proportion of this variability can be explained (i.e., the conditioning variables provide a poor signal, such as would be the case when some are above and some are below their long run means so there are conflicting signals) the appropriate range of estimates would be a small region around 6%. If the conditioning variables provide a strong and consistent signal, the appropriate range would be closer to the full range of 3-9%. In the case at hand, the literature suggests that the conditioning variables can explain approximately 50% of the variation in long-term excess returns, in which case a range of 4-8% would be appropriate. That is, if the prevailing conditions are such that the conditioning variables are well above their long-run mean values, one would have strong, but not full, confidence that an estimate of MRP above its long-run mean would be appropriate in the circumstances. This would lead to an estimate toward the upper end of the range of 4-8%. Even though it is possible that the current draw of MRP is 9% (the upper bound of the 95% confidence interval), we would not be led to select an estimate that high because the conditioning variables do not provide a perfect signal.

Application to current conditions in the market for funds

123. Table 5 below shows the current values of the three conditioning variables, relative to their long-run means. All three variables are well above their long-run means and take current values that are higher than 96, 80 and 93% respectively of all post-2000 observations. This is clear evidence that risk premiums in financial markets are currently at elevated levels.

Table 5. Current and relative value of MRP conditioning variables

Conditioning variable	Mean since 2000	Current observation	Percentile rank of current observation	Number of standard deviations above mean
Option implied volatility	18.09%	35.74%	96%	2.17
Debt yield spread	1.35%	3.76%	95%	1.95
Dividend yield	3.82%	4.69%	88%	1.02

Source: Datastream, Bloomberg, SFG calculations.
Implied volatility figures are from the beginning of January 2000 to the end of September 2011.
Debt yield spread figures are from the beginning of January 2001 to the end of January 2012.
Dividend yield figures are from the beginning of January 2000 to the end of January 2012.

124. Next, I note that the current values of the three conditioning variables are 2.17, 1.95 and 1.02 standard deviations above their means, respectively. This indicates that the conditioning variables are all more than one standard deviation above their means. Applying this to the range of conditional estimates of MRP, and recalling that $E(\bar{r}_{t,T} \mid I_t) \sim N(6\%, 1\%)$, yields a current point estimate in excess of 7%.

Final conclusions

125. My main conclusions are:

a) Indicators of conditions in financial markets establish that risk premiums clearly remain at elevated levels (option implied volatilities, dividend yields and yield spreads in debt markets all remain well above long-run averages);

b) Risk premiums in financial markets have not eased to pre-GFC levels and the AER has erred in concluding that they have. There is no basis for reducing the MRP estimate below the SoRI estimate of 6.5%; and

c) For the reasons set out above, an appropriate estimate of MRP, conditional on current values of option implied volatilities, debt yield spreads and dividend yields, is in excess of 7%.

126. In my view, there is no persuasive evidence for adopting a value for MRP below the previously adopted value of 6.5%.

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