The required return on equity: Initial review of the AER draft decisions

Report for Energex

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SFG CONSULTING
Level 1, South Bank House
Cnr. Ernest and Little Stanley St
South Bank, QLD 4101

PO Box 29
South Bank, QLD 4101

Email: s.gray@sfgconsulting.com.au
Office: +61 7 3844 0684
Phone: +61 419 752 260

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1. Executive summary

Context

1. SFG Consulting has been retained by ENERGEX Ltd to:

   a) Comment on a range of issues relating to the cost of equity raised in recent draft decisions published by the Australian Energy Regulator (**AER**), which the AER refers to in its *Issues paper: Qld electricity distribution regulatory proposals 2015-16 to 2019-20*;

   b) Update our estimate of the required return on equity for the benchmark efficient entity to account for the changes in government bond yields that have occurred over recent months; and

   c) Provide our views as to the best estimate of the required return on equity having regard to the NER and NEL without the constraint of the Sharpe-Lintner CAPM as the foundation model.

Preparation of this report

2. This report has been authored by Professor Stephen Gray, Professor of Finance at the UQ Business School, University of Queensland and Director of Frontier Economics, a specialist economics and corporate finance consultancy. I have Honours degrees in Commerce and Law from the University of Queensland and a PhD in financial economics from Stanford University. I teach graduate level courses with a focus on cost of capital issues, I have published widely in high-level academic journals, and I have more than 15 years' experience advising regulators, government agencies and regulated businesses on cost of capital issues. I have previously served as board risk management advisor to a company in the energy sector and I was the principal advisor to the Australian Energy Markets Commission (AEMC) on cost of capital issues (including the allowed return on debt) during its 2012 rule change process.

3. My opinions set out in this report are based on the specialist knowledge acquired from my training and experience set out above.

4. I have read, understood and complied with the Federal Court of Australia Practice Note CM7 *Expert Witnesses in Proceedings in the Federal Court of Australia*.

5. A copy of my curriculum vitae is attached as an appendix to this report.

Structure of report

6. The next section of this report considers the requirement under the new Rules for the regulator to have regard to all relevant evidence. In particular, I consider the approaches to considering relevant evidence that the AER has taken under the previous Rules and under the new Rules. I then consider the AER's reasons for its "continued use of the SLCAPM"[1] and for its continued use of the same estimation methods and data sources as its primary evidence. In Section 3, I consider the AER's reasons for rejecting all financial models other than the Sharpe-Lintner Capital Asset Pricing Model (**CAPM**) for the purpose of estimating the required return on equity for the benchmark efficient entity. In Section 4, I consider the AER's approach of allocating relevant evidence to "primary" and

[1] See, for example, Ausgrid Draft Decision, Attachment 3, p. 50.

other categories and I provide some examples of how non-primary evidence has no realistic opportunity of having any material effect. In Section 5, I provide updated estimates of the market risk premium that reflect the recent declines in the risk-free rate.[2] In Section 6 I provide what I consider to be the best estimate of the return on equity, having regard to the NER and NEL without the constraint of the Sharpe-Lintner CAPM as the foundation model.

[2] These estimates are based on estimates that were included in SFG (2014 ENERGEX) and have been updated only for subsequent changes in government bond yields. In parallel work I am currently updating the estimates of other parameters, but that work is not complete as at the date of this report.

Primary conclusions

Consideration of relevant models

7. Under the previous Rules, the AER's approach was to determine the allowed return on equity by inserting three parameter estimates into the Sharpe-Lintner CAPM formula and adopting the output. Under the new Rules, the AER has again inserted three parameter estimates into the Sharpe-Lintner CAPM formula and has adopted the output as the allowed return on equity. Under the new Rules, the AER has recognised that the Black CAPM, Fama-French, and dividend growth models are all "relevant models," but it does not even proceed to the stage of estimating any model other than the Sharpe-Lintner CAPM.

8. For the reasons set out in this report, I consider that estimates of the required return on equity from other models would provide relevant evidence and should have been considered.

9. I also consider that the primary reasons that the AER has provided for rejecting models (in the sense that it determines the allowed return on equity by inserting three parameter estimates into the Sharpe-Lintner CAPM formula) do not support the conclusion that the Sharpe-Lintner CAPM should be estimated to the exclusion of all other models. In this report, I respond to each of the reasons set out in the AER's cost of capital Attachment 3.

Consideration of relevant evidence

10. In its recent draft decisions the AER does not estimate any model other than the Sharpe-Lintner CAPM for the purpose of estimating the required return on equity for the benchmark efficient entity. Under this approach, the only task required of the AER is to produce estimates of each of the three Sharpe-Lintner CAPM parameters. To do this, the AER invents the notion of "primary" and "secondary" evidence. The Rules now specify that the regulator must have regard to all of the relevant evidence, but they do not specify *how* the regulator must have regard to that relevant evidence. The AER's approach is to define some of the relevant evidence as being primary evidence and to relegate other relevant evidence to the secondary category.

11. The evidence that the AER now adopts as its "primary evidence" is the same evidence that the AER used under the previous Rules, as summarised in Table 1 below.

Table 1
AER Sharpe-Lintner CAPM parameter estimation methods

Parameter	2009 WACC Review	2013 Guideline
Risk-free rate	Contemporaneous yield on 10-year government bonds.	Contemporaneous yield on 10-year government bonds.
Equity beta	Regression analysis applied to domestic comparators leads to a **range of 0.4 to 0.7**. The final beta estimate is 0.8.	Regression analysis applied to domestic comparators leads to a **range of 0.4 to 0.7**. The final beta estimate is 0.7.
Market risk premium	Primary evidence is the mean of historical excess returns.	Primary evidence is the mean of historical excess returns from which the AER derives a range of 5.1% to 6.5%. This is the AER's estimate of a plausible range in normal market conditions.
	The AER states that some weight is given to dividend discount model analysis and survey evidence.	The AER states that some weight is given to dividend discount model analysis and survey evidence to derive a range for the market risk premium of 5.1% to 7.8%. This is a hybrid of the range we would observe in normal market conditions and a range appropriate for current market conditions.
	The final MRP estimate is **6.5%**.	The final MRP estimate is **6.5% which is the upper bound of the range for MRP we would expect in normal market conditions.**

Source: AER 2009 WACC Review Final Decision; AER 2013 Rate of Return Guideline.

12. The AER then comes to the secondary class of relevant evidence that it must have regard to under the new Rules. However, the AER "has regard to" the secondary evidence in such a way that it has no material effect on the primary parameter estimates. That is, the primary estimates (that are based on the same subset of relevant evidence that would have been used under the previous Rules) are preserved intact after having regard to the secondary evidence.

13. The way the AER has regard to the secondary evidence effectively guarantees that it will have no effect. That is, the estimation process neuters all but the AER's favoured subset of "primary" evidence – effectively producing the same outcome that would have been obtained under the previous Rules.

14. In this report I provide three examples to illustrate how the AER's estimation approach serves to neuter relevant evidence that is not allocated to the "primary" category.

Alternative calculations of the required return on equity

15. I have estimated the required return on equity having regard to the NER and NEL without the constraint of the Sharpe-Lintner CAPM as the foundation model. My best estimate of the required return on equity using this approach is 10.26%. I have also estimated the required return on equity using the Sharpe-Lintner CAPM as a foundation model, but parameterising it in a way that has due regard to, amongst other things, the other relevant financial models. This approach produces an identical estimate of the required return on equity of 10.26%.

2. Having regard to relevant evidence

The role of the allowed return on equity

Relevant legislation

16. Under the Australian regulatory framework, allowed revenues are set using a building block approach, which is designed to calculate the required regulated revenues over the relevant regulatory period. Specifically, revenues are set at a level to provide an allowance for:

    a) Efficient operating costs;

    b) Taxes;

    c) Efficient depreciation (return of capital);

    d) Interest (return on debt capital);

    e) A return on equity capital; and

    f) Incentive mechanisms (e.g., efficiency sharing mechanisms such as the EBSS).

17. The Rules provide that the allowed return on equity is designed to provide a fair return to the providers of equity capital, commensurate with the risk of owning shares in a benchmark efficient firm with a similar degree of risk at that which applies to the relevant service provider for which regulatory revenue requirements are being determined. Combined with the return on debt, it should provide for a rate of return that is commensurate with the efficient financing costs that the benchmark efficient entity would incur over the relevant regulatory period.

18. Some guidance on how the allowed return on equity should be determined is provided in the National Electricity Objective (**NEO**) and the Revenue and Pricing Principles (**RPP**). For example, a key part of the NEO is to:

> promote efficient investment in…electricity services…for the long term interests of consumers."[3]

19. An allowed return on equity that is materially above (below) the efficient financing costs of the benchmark efficient entity will create incentives for over (under) investment, neither of which are in the long-term interests of consumers.

20. Similarly, the RPP require that:

> A regulated network service provider should be provided with a reasonable opportunity to recover at least the efficient costs the operator incurs in providing direct control network services and complying with a regulatory obligation or requirement or making a regulatory payment[4]

and that:

[3] National Electricity Law, s. 7.
[4] National Electricity Law, s. 7A(2)

> regard should be had to the economic costs and risks of the potential for under and over investment, [5]

and:

> A price or charge for the provision of a direct control network service should allow for a return commensurate with the regulatory and commercial risks involved in providing the direct control network service to which that price or charge relates.[6]

21. It is difficult to see how these principles can be complied with if the allowed return does not properly reflect the efficient financing costs of the benchmark efficient entity.

Recent AEMC Rule changes

22. Under the previous Rules, the Australian Competition Tribunal held that if a regulator or regulated business (a) was using a well-accepted financial model such as the CAPM, and (b) had a reasonable basis for each of its parameter estimates, then it must automatically be the case that the resulting estimate of the required return on equity was reasonable and commensurate with the prevailing conditions in the market. That position was the primary driver for the return on equity rule change made by the Australian Energy Market Commission (**AEMC**).[7]

23. In making fundamental changes to the Rules, the AEMC sought to alter the regulatory practice of relying exclusively on the Sharpe-Lintner CAPM when estimating the required return on equity. In referring to the Tribunal's conclusion that the use of a well-accepted financial model effectively guaranteed that the resulting estimate of the required return on equity was reasonable and commensurate with the prevailing conditions in the market, the AEMC stated:

> The Commission considered that this conclusion presupposes the ability of a single model, by itself, to achieve all that is required by the objective. The Commission is of the view that any relevant evidence on estimation methods, including that from a range of financial models, should be considered to determine whether the overall rate of return objective is satisfied.[8]

24. The AEMC went on to state that:

> The Commission considered that no one method can be relied upon in isolation to estimate an allowed return on capital that best reflects benchmark efficient financing costs [9]

25. The AEMC explicitly linked the consideration of a *range of models* to the production of the best possible estimate of the efficient financing costs as required by the NGO, NEO and RPP:

[5] National Electricity Law, s. 7A(6).
[6] National Electricity Law, s. 7A(5).
[7] AEMC Final Determination, p. 48.
[8] AEMC Final Determination, p. 48.
[9] AEMC Final Determination, p. 49.

> Achieving the NEO, the NGO, and the RPP requires the best possible estimate of the benchmark efficient financing costs. The Commission stated that this can only be achieved when the estimation process is of the highest possible quality. The draft rule determination stated that this meant that a range of estimation methods, financial models, market data and other evidence must be considered.[10]

26. That is, the AEMC has concluded that the NEO and RPP require the regulator to produce the best possible estimate of the required return on equity,[11] which in turn requires the consideration of a range of financial models.

27. The new Rules require that regard must be had to:

> relevant estimation methods, financial models, market data and other evidence.[12]

and that the allowed rate of return must achieve the **allowed rate of return objective**:

> the rate of return for a Distribution Network Service Provider is to be commensurate with the efficient financing costs of a benchmark efficient entity with a similar degree of risk as that which applies to the Distribution Network Service Provider in respect of the provision of standard control services.[13]

28. When determining the allowed return on equity, regard must also be had to:

> the prevailing conditions in the market for equity funds.[14]

29. In summary, our understanding of the Rules, informed by the AEMC Determination is that when estimating the required return on equity:

    a) A range of models should be employed – to meet the allowed rate of return objective, and to ensure that the estimate best meets the NEO and the RPP;

    b) All relevant estimation methods, financial models, market data and other evidence should be considered; and

    c) Regard must be had to the prevailing conditions in the market, including contemporaneous data and estimation methods that reflect prevailing conditions rather than average historical conditions.

The AER's approach under the previous Rules

30. Under the previous Rules, the AER estimated the required return on equity using the Sharpe-Lintner CAPM exclusively and a favoured subset of the relevant evidence to estimate each of the three parameters. For example, in its 2009 WACC Review Final Decision, the AER stated that:

[10] AEMC Final Determination, p. 43.
[11] The required return on equity is a key component of the efficient financing costs.
[12] NER 6.5.2(e)(1).
[13] NER 6.5.2(c)
[14] NER 6.5.2(g).

a) The review was being conducted under the assumption that the Sharpe-Lintner CAPM would be used as the sole model for determining the required return on equity. In this case, the purpose of the review was to estimate the parameters of the Sharpe-Lintner CAPM and not to consider other models. Indeed, the previous National Electricity Rules mandated the use of the Sharpe-Lintner CAPM. [15]

b) The risk-free rate would be estimated as the contemporaneous yield on 10-year government bonds. [16]

c) The equity beta would be estimated using regression analysis applied to a set of domestic comparators and concluded that the domestic evidence supported a range for the equity beta of 0.41 to 0.68.[17] The AER stated that it placed a limited amount of weight on evidence from foreign comparators:

> the AER continues to place a limited amount of weight upon the United States equity beta estimates (i.e treating the estimates as a check on the adopted beta estimate). [18]

The AER did not report an estimate or range in relation to the overseas evidence and did not revise the 0.41 to 0.68 range in relation to it. The AER then selected a final equity beta estimate from outside its 0.41 to 0.68 range on the basis of regulatory stability and the asymmetry of the risks of over- and under-investment:

> Market data suggests a value lower than 0.8. However, the AER has given consideration to other factors, such as the need to achieve an outcome that is consistent with the NEO (in particular the need for the efficient investment in electricity services for the long term interests of consumers of electricity), the revenue and pricing principles (in particular providing the service providers with a reasonable opportunity to recover at least efficient costs, providing service providers with efficient incentives for efficient investment, and having regard to the economic costs and risks of the potential for under and over investment), the importance of regulatory stability. Having taken a broad view, the AER considers the value of 0.8 is appropriate. [19]

d) The market risk premium would be estimated using the Ibbotson approach (mean of historical excess stock returns), dividend growth model and surveys, with most weight applied to the Ibbotson approach:

> In assessing the MRP, the AER had regard to historical estimates, cash flow measures using variants of the dividend growth model (DGM), and surveys of market practitioners. Consistent with past regulatory practice, rather than placing sole weight on any particular measure of the MRP, the AER had regard to each measure, tempered by an understanding of the strengths and weaknesses of each measure. This led to the AER placing primary weight on historical estimates, but also having regard to cash flow measures and surveys. [20]

[15] AER 2009 WACC Review Final Decision, p. ii, 2.
[16] AER 2009 WACC Review Final Decision, Table A.1, p. v.
[17] AER 2009 WACC Review Final Decision, p. iv.
[18] AER 2009 WACC Review Final Decision, p. 264.
[19] AER 2009 WACC Review Final Decision, p. xvii.
[20] AER 2009 WACC Review Final Decision, p. 177.

The AER's approach under the new Rules

31. During the AEMC's rule change process, the AER submitted that both the Gas and Electricity Rules should require that the allowed return on equity must be estimated using nothing other than the Sharpe-Lintner CAPM:

> The AER proposes that the NGR require that the cost of equity be calculated using the CAPM (similar to the current provisions in the NER). [21]

on the basis that:

> It appears unlikely that there would be a justifiable departure from the CAPM over the medium to long term. [22]

32. However, as set out above, the AEMC took a very different view and in fact moved in the opposite direction. The AEMC was clearly concerned about the ability of the Sharpe-Lintner CAPM (as implemented by the AER) to produce sensible estimates of the required return on equity in all market conditions. For example, the AER's implementation of the CAPM suggested that the peak of the GFC resulted in a *fall* in the cost of equity capital – as a consequence of the precipitous fall in government bond yields. This led the AEMC to require that regulators must now have regard to all relevant estimation methods, financial models, market data and other evidence in both electricity determinations and gas reviews,[23] not just selective subsets of the evidence.

33. The AER's approach under the new Rules is to continue to estimate the required return on equity using the Sharpe-Lintner CAPM exclusively. The AER describes the Sharpe-Lintner CAPM as the *foundation* model, but it is in fact the *only* model that it uses to estimate the required return on equity. No other model for the required return on equity is estimated – the allowed return on equity is computed by inserting point estimates for the risk-free rate, beta and MRP into the Sharpe-Lintner formula. The resulting point estimate of the required return on equity is then adopted as the allowed return on equity.

34. The AER persists with its exclusive reliance on the Sharpe-Lintner CAPM as the only model for estimating the required return on equity for the benchmark efficient entity by concluding that no other relevant financial model is sufficiently reliable to even warrant estimation. The AER concludes that the Black CAPM[24], Fama-French model and dividend discount models are all relevant models for estimating the required return on equity for the benchmark efficient firm, but that none of them should even be estimated. I consider the reasons that the AER presents for this conclusion in Section 3 of this report.

35. The AER also effectively continues to estimate each of the three Sharpe-Lintner CAPM parameters in the same way as under the previous Rules. It does this by classifying the evidence that it has previously relied on as "primary" evidence and relegating the other relevant evidence to be secondary

[21] AER's proposed changes to the rate of return provisions of the NGR, p. 11.
[22] AER's proposed changes to the rate of return provisions of the NGR, p. 11.
[23] For example, see NGR 87(2)(5); NER 6.5.2(e)(1); NER 6A.6.2(e)(1).
[24] With respect to the Black CAPM, the AER states that it relies upon the theory of the Black CAPM in order to inform its estimate of beta of 0.7, from within a range of 0.4 to 0.7. However, the AER does not make a clear statement as to what the beta estimate would be with, and without, consideration of the Black CAPM. So there is no clarity regarding the AER's reliance on the Black CAPM. In addition, there is a logical flaw in the notion that the Black CAPM can be used to quantify an adjustment to the beta estimate, but cannot be used to estimate the cost of equity.

or to be suitable only for the purpose of a final cross-check. Moreover, in its recent draft decisions, the AER adopts the approach of grouping pieces of secondary evidence together, stating that the group of secondary evidence supports a range that includes the primary evidence, and then concluding that the secondary evidence is not inconsistent with its conclusions from the primary evidence.

The AER's continued reliance on the Sharpe-Lintner CAPM

36. In its recent draft decisions, the AER provides the following justification for its continued use of the Sharpe-Lintner CAPM:

> We consider the regime has been highly supportive of investment and the NSPs we regulate appear to have raised capital to support their investment programs. This suggests the continued use of the SLCAPM in our framework would be expected to be consistent with achieving the allowed rate of return objective and will continue to support efficient investment and use of regulated infrastructure. [25]

37. In my view, this comment encapsulates the AER's misunderstanding of what the AEMC is trying to achieve with its fundamental changes to the Rules. The key point is that in "average" or "normal" market conditions, an estimate of the MRP that is close to the long-run historical mean will be perfectly adequate.[26] In normal conditions, the Sharpe-Lintner CAPM can be used to produce a reasonable allowed return on equity for the average firm.[27] But what led the AEMC to revise the Rules is the failure of the Sharpe-Lintner CAPM, in the manner implemented by the AER, to produce reasonable estimates in non-normal market conditions – such as a global financial crisis or risk-free rates that are at unprecedented lows. In this regard, the AEMC stated that:

> The global financial crisis and its continuing impact through the European sovereign debt crisis have highlighted the inherent dangers in an overly rigid approach to estimating a rate of return in unstable market conditions.[28]

38. Logically, the fact that the Sharpe-Lintner CAPM may have provided an appropriate allowed return on equity during a period of normal market conditions, and during a period when the AER was adopting a materially higher equity beta than it now proposes, does not imply that it will provide an appropriate estimate in historically unique market conditions, especially if parameters are measured inconsistently. The inability of a single model, by itself, to be able to provide an appropriate allowed return on equity in all market conditions is what led the AEMC to require consideration of the range of relevant financial models under the new Rules.

39. That is, the question is not whether the Sharpe-Lintner CAPM may have produced reasonable estimates in *past* market conditions, but whether it alone is likely to provide the best estimate (i.e., better than the estimate that would be obtained from having regard to a range of relevant models) in the *prevailing* conditions. Indeed, in its Final Determination, the AEMC refers to the need to have regard to the prevailing conditions no fewer than 15 times.

[25] Ausgrid Draft Decision, Attachment 3, p. 50; the same statements are made in Attachment 3 of the draft decisions for Endeavour, Essential and ActewAGL

[26] Indeed, all of the methods for estimating MRP are likely to produce similar estimates.

[27] The Sharpe-Lintner CAPM would still be subject to bias in relation to low-beta and high book-to-market stocks.

[28] AEMC Final Determination, p. 40.

Balance of report

40. In the remainder of this report, I consider the AER's reasons for its "continued use of the SLCAPM" and for its continued use of the same estimation methods and data sources as its primary evidence. In particular, in Section 3 I consider the AER's reasons for rejecting all financial models other than the Sharpe-Lintner CAPM for the purpose of estimating the required return on equity for the benchmark efficient entity. In Section 4 I consider the AER's approach of allocating relevant evidence to "primary" and other categories and I provide some examples of how non-primary evidence has no realistic opportunity of having any material effect. In Section 5, I provide updated cost of equity estimates that reflect the recent declines in the risk-free rate.[29]

[29] These estimates are based on a series of estimates that were submitted to the AER in June 2014 and have been updated only for subsequent changes in government bond yields. In parallel work I am currently updating the estimates of other parameters, but that work is not complete as at the date of this note.

3. The AER's rejection of all other financial models

The Sharpe-Lintner CAPM is used to the exclusion of all other models

41. In its Guideline and its recent draft decisions, the AER determines the allowed return on equity by inserting its estimates of:

    a) The risk-free rate;

    b) The equity beta; and

    c) The market risk premium

    into the Sharpe-Lintner CAPM formula.

42. The output from the Sharpe-Lintner CAPM formula is then adopted as the allowed return on equity.

43. A number of stakeholders have proposed, and the AER has accepted, that a number of other models for estimating the required return on equity are relevant:

    a) The Black CAPM (or "empirical CAPM" as it is known in US regulation cases);

    b) The Fama-French model; and

    c) The dividend discount model (or "industry dividend growth model" in the AER's terminology).

44. The AER does not use any of these models to provide an estimate of the required return on equity for the benchmark firm at any point in its estimation process.

45. Rather, the AER produces a single point estimate for the required return on equity – that produced by inserting its three parameter estimates into the Sharpe-Lintner CAPM. This single point estimate for the required return on equity of the benchmark efficient entity is never compared with or assessed against an estimate from the Black CAPM, Fama-French model, or dividend discount model. The point estimate from inserting its three parameter estimates into the Sharpe-Lintner CAPM is adopted as the allowed return on equity.

46. In the remainder of this section, I consider the primary reasons for the AER's rejection of the three other relevant models for estimating the required return on equity.

The Black CAPM

AER's reasons

47. In its recent draft decisions, the AER states that its reasons for not using the Black CAPM to estimate the required return on equity for the benchmark efficient entity are as follows:

> we remain of the view empirical estimate (sic) of the return on equity from the Black CAPM are not suitable for any use for the following key reasons:
> • the model is not empirically reliable

> • the model is not widely used to estimate the return on equity by equity investors, academics or regulators.[30]

Empirical reliability of the model

48. The AER explains why it considers the Black CAPM to be empirically unreliable as follows:

> The empirical implementation of the Black CAPM model is unreliable because a) in contrast to the risk-free rate, the return on the zero beta asset is unobservable, and b) methods for estimating the zero-beta asset are unreliable. [31]

49. That is, the AER considers the empirical implementation of the Black CAPM to be unreliable because the estimate of the zero-beta premium is unreliable. In turn, the AER appears to consider the estimate of the zero-beta premium to be unreliable because different approaches for estimating it produce different results. In this regard, the AER makes a point about differences between the CEG, NERA and SFG estimates of the zero-beta premium.[32] Having considered the various estimates of the zero-beta premium, the AER concludes that:

> While we consider SFG's latest estimate of the zero beta premium appears more plausible, we remain of the view that the large range of zero beta estimates by consultants for the NSPs indicates the model is unsuitable to use to estimate the RoE of our benchmark efficient entity. [33]

50. That is, the AER considers the SFG estimate to be plausible, but does not adopt it due to the existence of other estimates (using different approaches) that the AER considers to be implausible.

51. Similarly, the AER notes that McKenzie and Partington (2014) conclude that:

> …while the model might be used for estimating the RoE on the benchmark efficient entity, the problem is the model can be very sensitive to implementation choices. [34]

52. That is, the evidence before the AER includes one estimation approach that produces what the AER considers to be a plausible estimate and other estimation approaches that produce what the AER considers to be implausible estimates. The AER concludes from this that the model should be rejected because different approaches for estimating this parameter produce different estimates.

53. In my view, such a conclusion does not logically follow. When faced with different approaches that produce different estimates of a parameter, the appropriate response is to consider the relative merits of each approach. The AER does not reject the SFG estimate because it considers the estimation

[30] Ausgrid Draft Decision, Attachment 3, p. 56; the same statements are made in Attachment 3 of the draft decisions for Endeavour, Essential and ActewAGL.
[31] Ausgrid Draft Decision, Attachment 3, p. 184; the same statements are made in Attachment 3 of the draft decisions for Endeavour, Essential and ActewAGL.
[32] Ausgrid Draft Decision, Attachment 3, pp. 182-185; the same statements are made in Attachment 3 of the draft decisions for Endeavour, Essential and ActewAGL.
[33] Ausgrid Draft Decision, Attachment 3, p. 182; the same statements are made in Attachment 3 of the draft decisions for Endeavour, Essential and ActewAGL.
[34] Ausgrid Draft Decision, Attachment 3, p. 182; the same statements are made in Attachment 3 of the draft decisions for Endeavour, Essential and ActewAGL.

approach to be inappropriate or because it considers the estimate to be implausible – it rejects the SFG estimate because there are other estimates that use different approaches that produce estimates that the AER considers to be implausible.

54. The AER's approach in this regard is also inconsistent with its approach to estimating Sharpe-Lintner CAPM parameters. There are a range of approaches that can be used to estimate beta and MRP that produce a wide range of estimates for each of those parameters. This does not lead the AER to conclude that the Sharpe-Lintner CAPM is empirically unreliable and should not be estimated. Rather, the AER presents its reasons for disregarding those techniques and estimates that it considers to be unreliable and its reasons for giving more weight to the approaches and estimates that it considers to be more reliable. It is not clear why precisely the same approach could not have been applied to the zero-beta premium.

55. It should also be noted that SFG documented the very reason why its estimate of the zero beta premium was different to the other estimates of the zero beta premium. The other estimates of the zero beta premium are affected by the empirical fact that stocks with a high book-to-market ratio for equity have historically earned high returns, and these stocks more often than not had low beta estimates. The SFG analysis was done in such a way that the high returns to high book-to-market stocks did not affect the estimate of the zero beta premium.

56. This means that SFG was able to explain the context in which its estimate of the zero beta premium would be relevant for estimating the cost of equity. The context is that the SFG estimate of the zero beta premium accounts for the empirical fact that stock with low beta estimates earn higher returns than predicted by the Sharpe-Lintner CAPM, but in addition to this the cost of capital should account for the empirical fact that stocks with high book-to-market ratios earn higher returns than stocks with low book-to-market ratios.

57. The AER's consideration of the Black CAPM ignores this context. The AER rejected the use of the earlier estimates of the zero beta premium because they were considered implausibly high. Then, the AER was presented with a clear statement of why the previous estimates were high, and a set of plausible estimates that address the reasons for the high initial estimates. According to the AER rationale, the Black CAPM will never be relied upon to estimate the cost of equity because there was once some analysis conducted that led to high estimates for a parameter input.

Use of the Black CAPM in practice

58. The AER contends that the Black CAPM is not widely used in practice. Of course, this is not, of itself, a reason to disregard the model from further consideration. In any event, it is not clear that the use of the Black CAPM is as rare as the AER suggests. To see why this is the case, first note that the Sharpe-Lintner CAPM states that the required return on equity is given by:

$$r_e = r_f + \beta\left(r_m - r_f\right)$$

and the Black CAPM suggests that the required return on equity is given by:

$$r_e = r_z + \beta\left(r_m - r_z\right).$$

59. That is, the structure of the formula is the same for both models and both models require the same estimates of beta and the required return on the market. The only difference is whether one inserts an estimate of the contemporaneous risk-free rate (Sharpe-Lintner CAPM) or something greater than the contemporaneous risk-free rate (Black CAPM).

60. In this regard, SFG (2013 IER) note that it is common for independent expert reports to adopt a risk-free rate in excess of the contemporaneous risk-free rate. The use of an intercept above the risk-free rate is more consistent with the Black CAPM.

61. Moreover, it is common for US regulatory cases to use what is known as "the empirical CAPM." This is an implementation of the CAPM formula with an intercept above the contemporaneous risk-free rate – to be consistent with the Black CAPM and the empirical evidence that supports it. The AER's contention that the Black CAPM is not widely used in practice relies only on the label of the model, and not to its substance. It is common for practitioners to rely upon an estimate of the risk free rate in excess of the contemporaneous risk-free rate, even if they do not label this analysis as the Black CAPM.

Incorporation of Black CAPM evidence

62. The AER concludes that the Black CAPM is sufficiently relevant that it should be used to inform its estimation of the equity beta for use in the Sharpe-Lintner CAPM:

> …we use the theoretical principles underpinning the Black CAPM to inform the equity beta point estimate from within our empirical range. [35]

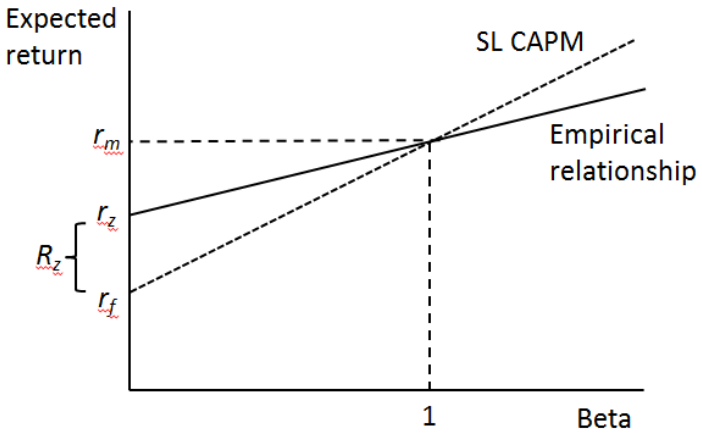
63. The AER goes on to explain that:

> …for firms with an equity beta below 1.0, the Black CAPM may predict a higher return on equity than the SLCAPM. We consider this information points to the selection of an equity beta point estimate above the best empirical estimate implied from Henry's 2014 report. However, we do not consider the theory underlying the Black CAPM warrants a specific uplift or adjustment to the equity beta point estimate. The theory underlying the Black CAPM is qualitative in nature, and we are satisfied that this information is consistent with an equity beta point estimate towards the upper end of our range. [36]

64. The Black CAPM (empirical relationship) is contrasted with the Sharpe-Lintner CAPM in Figure 1 below. Relative to the Sharpe-Lintner CAPM, the Black CAPM posits a higher required return on equity for low-beta stocks. This is consistent with the empirical evidence that returns for low-beta stocks are systematically higher than the Sharpe-Lintner CAPM would predict.

[35] Ausgrid Draft Decision, Attachment 3, p. 264; the same statements are made in Attachment 3 of the draft decisions for Endeavour, Essential and ActewAGL.
[36] Ausgrid Draft Decision, Attachment 3, p. 265; the same statements are made in Attachment 3 of the draft decisions for Endeavour, Essential and ActewAGL.

Figure 1. Sharpe-Lintner CAPM vs. empirical relationship.



65. The AER's recent draft decisions contain detailed discussions about how the fact that it has given weight to the Black CAPM does not imply that it considers that the Sharpe-Lintner CAPM produces downwardly-biased estimates of the required return on equity for low-beta stocks.[37] In my view, the key point is not whether the AER's acceptance of the Black CAPM amounts to a concession that the Sharpe-Lintner CAPM produces downwardly biased estimates of the required return on equity for low-beta stocks. Rather, the key point is that both versions of the CAPM are relevant financial models and the AER intends to have regard to both.

66. This leads to the question of *how* the AER intends to have regard to each of these relevant financial models. As set out above, both models are written in terms of the same beta and the same market return. The only difference is that for the Sharpe-Lintner CAPM the intercept is the risk-free rate, and for the Black CAPM the intercept is the zero-beta return. As set out in SFG (2014 Black), my view is that the proper way to have regard to these two financial models is to insert the best possible parameter estimates into each model. The result will then be estimates of the required return on equity from each model.

67. For example, SFG (2014 Black) estimates the zero beta premium to be 3.34%, which the AER describes as "plausible." The Ausgrid Draft Decision[38] adopts a risk-free rate of 3.55% and a market risk premium of 6.5%, which jointly imply a market return of 10.05%. The zero-beta return is simply the sum of the risk-free rate and the zero-beta premium which, in this example, is 6.89%.[39] Consequently the AER's Sharpe-Lintner CAPM estimates can be combined with SFG's "plausible" estimate of the zero-beta premium to parameterize the Black CAPM. At the lower end of the AER's range for beta,[40] we have:

$$\begin{aligned} r_e &= r_z + \beta(r_m - r_z) \\ &= 6.89\% + 0.4(10.05\% - 6.89\%) = 8.2\% \end{aligned}$$

and at the upper end of the range for beta we have:

[37] See, for example, Ausgrid Draft Decision, Attachment 3, p. 169 and the references set out therein; the same statements are made in Attachment 3 of the draft decisions for Endeavour, Essential and ActewAGL.
[38] By way of example.
[39] 3.55%+3.34%.
[40] I certainly do not accept that 0.4 is in any way a reasonable estimate of the levered equity beta for the benchmark efficient entity, but the purpose of this section is to consider the *process* of having regard to the Black CAPM evidence. I illustrate that process with reference to the AER's own parameter estimates.

$$r_e = r_z + \beta(r_m - r_z)$$
$$= 6.89\% + 0.7(10.05\% - 6.89\%) = 9.1\%.$$

68. That is, given the AER's estimates of the Sharpe-Lintner CAPM parameter estimates and the SFG estimate of the zero-beta premium, the Black CAPM evidence is that the required return on equity for the benchmark efficient entity is in the range of 8.2% to 9.1%. This evidence would then be compared with the AER's allowed return on equity of 8.1%.

69. By contrast, the AER has regard to the Black CAPM evidence in a quite convoluted manner. The AER's approach is to use the evidence that it considers to be relevant from the Black CAPM to adjust the equity beta that it uses in the Sharpe-Lintner CAPM. In this convoluted process, the AER considers what equity beta it would need to insert into the Sharpe-Lintner CAPM in order to produce an estimate of the required return on equity that is consistent with the Black CAPM. This process is explained in Section 3 of SFG (2014 Black) and Appendix C to the AER's Guideline Explanatory Statement. In this regard, the AER is not being true to either model.

70. I can see no benefit whatsoever to this convoluted approach – relative to the simpler and correct approach of inserting the Black CAPM parameters into the Black CAPM formula and the Sharpe-Lintner CAPM parameters into the Sharpe-Lintner CAPM formula. In order to derive the adjusted equity beta (i.e., the beta that when inserted into the Sharpe-Lintner CAPM formula produces an estimate of the required return on equity that is consistent with the Black CAPM) one already needs to have an estimate of the cost of equity from the Black CAPM. I see no reason why that Black CAPM estimate cannot be simply compared with the Sharpe-Lintner CAPM estimate and both used to inform the final estimate of the required return on equity for the benchmark efficient entity.

71. In its recent draft decisions, the AER appears to be suggesting that by using "the theoretical principles underpinning the Black CAPM to inform the equity beta point estimate"[41] it is able to have regard to the Black CAPM without estimating its parameters. The Black CAPM, and the empirical evidence that motivated it, suggest that the Sharpe-Lintner CAPM systematically under-estimates the required return on equity for low-beta stocks. The AER indicates that it has used this qualitative information to increase its point estimate of beta.[42] But the AER provides no information about what it considers to be the required return (or adjusted beta) that is supported by the Black CAPM. The AER also provides no information about the relative weights it has applied to the Sharpe-Lintner and Black CAPMs. The AER does not even report the amount by which it has increased its beta estimate in light of the Black CAPM evidence.

72. The AER reaches the conclusion that, based upon historical stock returns of nine Australian-listed firms (four of which are currently listed), its beta estimate lies within a range of 0.4 to 0.7 and that its selection of a point estimate of 0.7 at the top of the range is motivated by consideration of the Black CAPM and evidence from firms listed in other jurisdictions. The AER does not state which of these two considerations carries more weight, of what the beta estimate would be if only the Black CAPM was considered (and evidence from international listed stocks ignored) or if only evidence from international listed stocks was included (and the Black CAPM ignored).

[41] Ausgrid Draft Decision, Attachment 3, p. 264; the same statements are made in Attachment 3 of the draft decisions for Endeavour, Essential and ActewAGL.
[42] Ausgrid Draft Decision, Attachment 3, p. 264; the same statements are made in Attachment 3 of the draft decisions for Endeavour, Essential and ActewAGL.

73. This means that the AER has essentially computed an unspecified estimate of the zero beta premium, on the basis of the equity beta range compiled from Australian-listed stocks. And the AER has given unspecified consideration to beta estimates compiled from stocks listed in other countries. There is no reason why the most reasonable estimate of the zero beta return should depend upon the AER's assessment of the beta estimates from a small sample of Australian-listed firms. Further, there is no reason why the AER cannot specify what the separate impact of the Black CAPM and the evidence from international listed firms has on its cost of equity estimate. They are two distinct types of relevant information, yet are bundled together by the AER in a manner that means it cannot be determined how much consideration was given to either set of information.

74. I agree that it is open to the AER to have regard to evidence from the Sharpe-Lintner CAPM. I also agree that it is open to the AER to have regard to evidence from the Black CAPM. I also agree that it is open to the AER to give different weight to different pieces of evidence. However, if the AER is to have regard to evidence from the Black CAPM, it should be transparent about what it considers that evidence to be. This requires nothing more than setting out what the AER considers to be the required return (or adjusted beta) that is supported by the Black CAPM. If the AER does not accept the SFG estimate of the zero-beta premium it should state why (rather than simply noting that there are other estimates of the zero-beta premium that it considers to be implausible) and set out what it considers to be a more reasonable estimate of the zero-beta premium. At the very least, the AER should report the effect that its consideration of the Black CAPM evidence has had on its calculation of the allowed return on equity. In its recent draft decisions there is no way for stakeholders to determine (a) what return on equity (or beta) the AER considers to be supported by the Black CAPM or evidence, or (b) what weight the AER has applied to the Black CAPM evidence. Consequently, there is no means for determining whether the AER's interpretation of the Black CAPM evidence, or whether the weight the AER has applied to it, is reasonable.

The Fama-French model

AER's reasons

75. In its recent draft decisions, the AER states that its reasons for disregarding the Fama-French model are as follows:

> • it does not appear sufficiently robust and is sensitive to different estimation periods and methodologies
> • it is not clearly estimating ex ante required returns
> • it suffers a lack of theoretical foundation which might explain the instability of parameter estimates, and
> • it is relatively complex to implement.[43]

Sensitive to different estimation periods and methodologies

76. As set out in the section on complexity below, the implementation of the Fama-French model is commensurate with the implementation of the CAPM. Betas are estimated by regressing the returns of a stock on the returns of a factor portfolio, and factor risk premiums are estimated as the mean historical return of the factor portfolio. The only difference is that the Fama-French model requires three beta and three factor risk premium estimates whereas the Sharpe-Lintner CAPM requires only

[43] Ausgrid Draft Decision, Attachment 3, p.172; the same statements are made in Attachment 3 of the draft decisions for Endeavour, Essential and ActewAGL.

one of each. In this respect, the implementation of the Fama-French model is identical to the implementation of the Sharpe-Lintner CAPM.

77. As a precursor to the implementation of the Fama-French model, it is necessary to construct the SMB and HML factor portfolios. The AER identifies a paper in a British accounting journal, Michou et al (2014), that applies different methods for constructing the factor portfolios and obtains different results in their analysis of a sample of UK stocks. The AER begins by noting that, for some of the factor construction methods, one or both of the Fama-French factors fail to reach statistical significance. I note that the Michou et al (2014) results show that:

    a) All of the mean factor risk premiums that are statistically significant are positive, consistent with the Fama-French model; and

    b) For the book-to-market factor, all of the mean factor risk premiums are positive and all are approximately the same magnitude. Those that are statistically insignificant simply have a higher standard deviation.

78. Moreover, the AER uses five methods to estimate the mean factor premium for the one (market) factor in its Sharpe-Lintner CAPM.[44] Of these five different methods for estimating the market risk premium, two are statistically insignificant.[45] That is, the criticism that the AER applies to the Fama-French factors based on a study of UK data, also applies to the single factor that the AER itself uses as its primary evidence in the Sharpe-Lintner CAPM.

79. The AER also notes that:

> One principal conclusion of Michou, Mouselli and Stark is that the results of the FF model are highly sensitive to the methodology chosen, so that 'factor construction methods can matter in the use of factor models and, as a consequence, factor construction methods need to be considered carefully in empirical settings'.[46]

80. In my view, it is obvious that factor construction methods can matter and should be considered carefully. However, this does not provide a reason for rejecting the Fama-French model – it only provides a reason for carefully considering the factor construction method. If the AER considers that the factor construction methods that underlie the SFG (2014 FFM) estimates are inappropriate it should explain why that is the case and which alternative methods they consider should be used. In my view, it is not enough to simply note that some portfolio construction methods applied to UK data fail to produce statistically significant results, and then to reject the Fama-French model entirely.

81. Moreover, the AER does not mention that Michou et al (2014) motivate their study with:

    a) Evidence from Miles and Timmerman (1996) that the Fama-French factors are superior to the single-factor CAPM in explaining UK stock returns; [47] and

[44] Ausgrid Draft Decision, Attachment 3, p. 193; the same statements are made in Attachment 3 of the draft decisions for Endeavour, Essential and ActewAGL.
[45] That is, for two of the sample periods considered by the AER the mean is less than two times the standard error of the estimate.
[46] Ausgrid Draft Decision, Attachment 3, pp. 53-55; the same statements are made in Attachment 3 of the draft decisions for Endeavour, Essential and ActewAGL.
[47] Michou et al (2014, p. 282).

b) Evidence from Hussain et al (2002) who "investigate the properties of a three factor model based upon Fama and French (1993) and conclude that it performs better than the CAPM in pricing various sets of portfolios." [48]

82. The AER also states that the Fama-French model can produce different results depending upon which period of data is examined. Again, this applies equally to the AER's implementation of the Sharpe-Lintner CAPM. For example, SFG (2014 Beta, pp. 28-31) demonstrates that the beta estimates on which the AER relies can vary substantially over different estimation periods, or according to which day of the week is used to define return intervals, or depending on whether monthly or weekly data is used, and so on.

83. Again, if the AER considers that there is some problem with the estimation process of SFG (2014 FFM), it should state what it is and how it should be corrected. In my view, it is not enough to simply state that the estimates might vary if they were computed at a different point in time, and to use this as a reason for rejecting any further consideration of the Fama-French model.

Not clearly estimating ex ante required returns

84. The key objective of the asset pricing literature is to explain the cross section of stock returns. The term "cross section of stock returns" is a common term used by academics. It simply means returns that differ from one stock to another. The literature relating to estimating the cost of capital is called the "asset pricing literature" which means research devoted to understanding the stock and market characteristics that explain market prices of assets – or put another way, it is devoted to understanding what stock and market characteristics affect investors' required returns on those assets.

85. There is a wealth of historical stock return data and an enormous literature that develops asset pricing models (including the CAPM and the Fama-French model) and then tests the ability of those models to fit the observed data. In relation to the asset pricing literature mentioned above, and the cross section of stock returns, there is one stock characteristic in which there is the most agreement amongst academics that explains why some stocks earn higher returns than others. This stock characteristic is the ratio of the book value of equity to the market value of equity. The "book-to-market factor" in the Fama-French model is constructed so that this stock characteristic can be applied to explain the returns on all assets, just like the market return factor in the CAPM can be applied to explain the returns on all assets.

86. The overwhelming weight of empirical evidence, including the leading published Australian study, concludes that the Fama-French model provides a better empirical fit to the available data than does that Sharpe-Lintner CAPM. However, the AER concludes that:

> The ex-post (backward looking) observation of apparently priced risk factors does not actually mean these factors are priced ex-ante (on a forward looking basis).[49]

87. On this point, the AER's contention is that even though a particular factor may be strongly and consistently related to stock returns in the historical data, it may not be related to stock returns in the future. This is, of course, true – it is impossible to guarantee that any historically observed relationship will continue to be observed into the future. However, this cannot provide the basis for the complete rejection of a relevant model. If it was valid to use this reason to reject evidence from

[48] Michou et al (2014, p. 282).
[49] Ausgrid Draft Decision, Attachment 3, p. 172; the same statements are made in Attachment 3 of the draft decisions for Endeavour, Essential and ActewAGL.

consideration, then *any* piece of evidence from historical data could be rejected on the basis that the historical relationship might not continue into the future.

88. For example, the *lack* of an historical relationship between regression-based beta estimates and stock returns might not continue into the future. That is, it is possible that the Sharpe-Lintner CAPM populated principally using regression based estimates of beta may begin to fit the data in the future, despite the extensive empirical evidence showing it had not done so in the past.

89. In summary, I agree that there is no guarantee that an historically observed relationship will continue unchanged into the future. However, in my view it is a positive and relevant feature that a proposed model is able to fit the observed historical data.

90. Finally, I note that the question of whether the relationship between stock returns and a particular factor is likely to continue into the future can be informed by the persistence of that factor in the past data. Consider, for example, the Fama-French book-to-market (HML) factor. That factor was first identified more than 20 years ago. It remains strongly related to stock returns today. Its relevance has also been documented in a range of different markets. All of this evidence makes it more likely (although not guaranteed) that the relationship is likely to continue into the future.

Lack of a theoretical foundation

91. The debate on this issue has reached the point where the views of stakeholders are well known and any further submissions would be repetitive. On this point, it is generally accepted by stakeholders that:

    a) The vast majority of empirical evidence concludes that the Sharpe-Lintner CAPM provides a poor fit to the data – that there is either a weak or non-existent relationship between beta estimates and stock returns.[50]

    b) The Fama-French model was first developed as a means of improving the empirical fit to the available data.

    c) The empirical performance of the Fama-French model is superior to the Sharpe-Lintner CAPM – the Fama-French model provides a superior fit to the observable data, including in Australia.

92. The SFG (2014 FFM) submission to the AER notes that, since the initial development of the Fama-French model the focus of the literature has been on developing theoretical underpinnings for the Fama-French factors – to explain why the additional factors assist in enabling the model to better fit the observed data. SFG (2014 FFM, pp. 27-32) summarise the theoretical underpinnings that have been developed, noting that they are based upon the asset pricing theories already developed in the 1970s – the intertemporal CAPM and the arbitrage pricing theory. SFG (2014 DDM) also note that it is common in scientific progression for an empirical regularity to be documented, followed by the development of theory to explain that empirical regularity.

93. SFG (2014 FFM, pp. 4-16) also explains that the Fama-French model can be theoretically motivated on the basis that the proxy for the CAPM market portfolio is not efficient. Under the Sharpe-Lintner

[50] I note that the AER and its consultants have cited a very small number of papers that claim that the CAPM cannot be statistically rejected if wider standard errors are used or that the CAPM might still have some uses despite its inability to fit the observable data. However, none of this contradicts the overwhelming empirical evidence that the Sharpe-Lintner CAPM provides a poor fit to the data.

CAPM, there is a single efficient market portfolio and all assets are priced relative to that portfolio. If a single efficient portfolio cannot be identified, a set of factor portfolios (that can be combined to form an efficient portfolio) must be used. This provides another source of theoretical motivation for the Fama-French three-factor model.

94. The AER has not yet engaged with these submissions, preferring to adopt the blanket conclusion that the Fama-French model lacks a theoretical foundation. The AER has not yet set out any description of what evidence it would require to support the conclusion that a model does have a sufficient theoretical foundation, but has only stated that it does not expect that (unspecified) standard to be reached in the near term.[51]

95. Finally, I note that the question here is not whether the Fama-French model should entirely supplant the AER's use of the Sharpe-Lintner CAPM. It is not a question of selecting one of the two models. The question is whether the Fama-French model is capable of contributing to the allowed rate of return objective. Put simply, the issue is whether consideration of both the Sharpe-Lintner CAPM and the Fama-French model is likely to provide a better estimate of the cost of equity than consideration merely of the Sharpe-Lintner CAPM. In rejecting in its entirety the use of the Fama-French model the AER has reached a view that its estimate of the cost of equity would be less precise if consideration was given to both models.

96. The AER's rejection of the Fama-French model is based upon three pillars, none of which are reasonable:

    a) high book-to-market stocks *might* not earn high returns in the future, despite the book-to-market ratio being the single most prevalent stock characteristic that explains stock returns in different markets and over time;

    b) the book-to-market factor can be specified in different ways which lead to different estimates, which does not negate the result that all the different specifications imply that the book-to-market factor is likely to be positive; and

    c) there are different alternative theories that explain by high book-to-market stocks earn relatively high returns, all of which have been developed because of the consensus amongst academics that there is an empirical fact worthy of theoretical development – if academics believed that the Fama-French model was merely a statistical quirk that was unlikely to persist they would not have developed an extensive literature devoted to theoretical explanations.

Relatively complex to implement

97. The Sharpe-Lintner CAPM requires estimates of the following parameters:

    a) Risk-free rate: The AER estimates this parameter as the contemporaneous yield on 10-year government bonds;

    b) Equity beta: The AER estimates this parameter by a regression of the returns of comparator stocks on the returns of the relevant factor portfolio (the market portfolio); and

[51] Ausgrid Draft Decision, Attachment 3, p. 53-55; the same statements are made in Attachment 3 of the draft decisions for Endeavour, Essential and ActewAGL.

c) Market risk premium: The AER states that its primary estimate of the MRP is obtained by taking the mean of the historical excess returns of the factor portfolio (the market portfolio).[52]

98. The Fama-French model requires estimates of the following parameters:

a) Risk-free rate: This parameter is estimated as the contemporaneous yield on 10-year government bonds;

b) Equity betas: There are three betas in the Fama-French model, one for each of the three factors. Each is estimated by a regression of the returns of comparator stocks on the returns of the relevant factor portfolio (the market portfolio, the SMB portfolio and the HML portfolio); and

c) Factor premiums: There are three factor premiums in the Fama-French model – the premiums for the market, SMB and HML portfolios. Each is estimated by taking the mean of the historical excess returns of the relevant portfolio.

99. In summary, the Fama-French model can be estimated in exactly the same way as the Sharpe-Lintner CAPM. Both require betas to be estimated using regression analysis and factor premiums to be estimated using historical returns data. The Sharpe-Lintner CAPM is simply a special case of the Fama-French model, wherein it is assumed that the SMB and HML factor premiums are zero. Consequently, the Fama-French model is not more complex to estimate than the Sharpe-Lintner CAPM – the same estimation approaches simply have to be applied three times instead of once.

100. The AER has concern over different specifications of the HML and SMB factors. There has been no contention by regulated energy businesses that the cost of equity should be increased because of exposure to the SMB factor. So the AER's concern essentially comes down to the impact of different specifications of the HML factor. But the AER has not stated a position that a reasonable specification of the HML factor, from different options, would lead to the risk premium associated with this factor being equal to zero. The AER's concern over different specifications is that there might be different levels of positive risk premiums associated with the HML factor. The AER's response to this concern is to assume zero return in the cost of equity for exposure to the HML factor.

101. In any event, I note that it is my view that a relevant financial model that is capable of contributing to the allowed rate of return objective should not be disregarded on the basis that it is relatively complex to implement. Estimating the Sharpe-Lintner CAPM is a shorter task because it assumes away two of the Fama-French factors. However, this does not provide a basis for excluding the Fama-French model in favour of the Sharpe-Lintner CAPM if the Fama-French model is considered to be relevant. In my view, it is not appropriate to estimate the allowed return on equity by implementing what the regulator considers to be the simplest of the range of relevant financial models.

[52] The market risk premium is actually the expected return on the market less the risk free rate, so the CAPM only really requires an estimate of the risk free rate, beta and the expected return on the market portfolio.

The dividend discount model

AER's reasons

102. In its recent draft decisions, the AER states that its reasons for disregarding dividend discount models, for the purpose of estimating the required return on equity for the benchmark efficient firm, are as follows:

> …we remain of the view DGM based empirical estimates of the return on equity for our benchmark efficient entity are not suitable for any regulatory use for the following reasons:
> • The models are not robust given they are highly sensitive to input assumption in relation to the short term and long term growth rate of dividends. This makes the models highly sensitive to potential error in inputs.
> • The models are highly sensitive to changes in the risk free interest rate.
> • The models may generate volatile and conflicting results.[53]

Sensitivity to input assumptions

103. Like all financial models, the dividend discount model requires a number of parameters to be estimated. Like all financial models, the final estimate that is produced is sensitive to the estimates that are inserted for each parameter. However, this does not justify disregarding the dividend discount model from consideration even before it has been estimated.

104. Having determined that the dividend discount model is relevant to the task, my view is that a better approach would be to compute the best possible estimates for the model. The resulting estimate of the required return on equity could then be compared with estimates from other financial models. The AER could then consider the relative strengths and weaknesses of each estimate, including the extent to which each estimate was sensitive to input assumptions/parameter estimates.

105. By way of comparison, in its recent draft decisions, the AER concludes that the reasonable range for beta is 0.4 to 0.7 and that the reasonable range for the MRP is 5.1% to 7.8%. For a risk-free rate of 3.55%, these estimates imply a range for the required return on equity of 5.59% to 9.01%. Thus, according to the AER's own estimates, the Sharpe-Lintner CAPM is also sensitive to input assumptions. This sensitivity might then be one of the relevant matters in the AER's consideration of the estimates from the financial models that it considers to be relevant.

Sensitivity to changes in the risk-free rate

106. Dividend discount models produce an estimate of the required return on equity for the firm in question. The approach is to estimate the overall discount rate that equates the current stock value to the present value of expected future dividends. Reasonable specifications of the dividend discount model produce estimates of the overall required return on equity that are more stable than the risk-free rate. That is, these estimates imply a risk premium that tends to partially offset changes in the risk-free rate, so that the estimate of the overall required return does not rise and fall one-for-one with changes in the risk-free rate.

107. That is, the use of dividend discount models tends to *reduce* the sensitivity of the allowed return to changes in risk-free rates relative to the other methods employed by the AER. Indeed the AER makes this very point itself in its Guideline materials:

[53] Ausgrid Draft Decision, Attachment 3, pp. 59-60; the same statements are made in Attachment 3 of the draft decisions for Endeavour, Essential and ActewAGL.

> …our implementation of the Sharpe–Lintner CAPM will result in estimates of the return on equity that may vary over time. Alternatively, the DGM and the Wright approach (for implementing the Sharpe–Lintner CAPM) will result in estimates of the return on equity that may be relatively stable over time. The informative use of these implementations of the Sharpe–Lintner CAPM, in addition to the DGM and other information, is expected to lead to more stable estimates of the return on equity than under our previous approach.[54]

Models may generate volatile and conflicting results

108. In the regulatory setting, various stakeholders have proposed a range of different specifications of dividend discount models for the benchmark efficient entity. Some of these specifications are sensible and internally consistent and produce relatively stable estimates over time and plausible relativities between industries. Other specifications are internally inconsistent, some specifications produce volatile estimates over time, and some specifications produce implausible relativities between industries.

109. For example, SFG (2014 DDM) note that the industry dividend discount model that was examined by the AER in its Guideline analysis assumes that all firms will grow at the same rate, regardless of whether they reinvest a high or low proportion of their earnings. This specification is clearly nonsensical and inevitably produces the implausible implication that firms with the highest dividend yields uniformly have higher required returns than firms with low dividend yields and non-dividend-paying firms.

110. Logically, the fact that some dividend discount model specifications are internally inconsistent and produce volatile and implausible results is not a reason for rejecting *all* dividend discount models. In my view, each specification should be considered on its own merits. If a particular specification can be shown to be internally inconsistent or to produce implausible results, there would be a basis for disregarding *that* specification. Problems with *one* specification, however, do not provide a valid reason for rejecting *another* specification.

111. As a concrete example of this issue, the AER notes that the dividend discount model estimates from the SFG approach vary between 9.5% and 11% over a ten year period, peaking at the time of the GFC, and with required returns for the benchmark entity being uniformly lower than the required return on the market.[55] This would all seem to be entirely plausible. However, rather than recognising the stability and plausibility of SFG's results over time, the AER notes that a different approach, which has not been submitted by SFG or any network business, produces more volatile results. The AER concludes from this that:

> this perception of stability is subjective and we do not agree with it. [56]

[54] AER Rate of Return Guideline, Explanatory Statement, p. 66.
[55] Ausgrid Draft Decision, Attachment 3, Figure 3-18, p. 229; the same statements are made in Attachment 3 of the draft decisions for Endeavour, Essential and ActewAGL.
[56] Ausgrid Draft Decision, Attachment 3, p. 228; the same statements are made in Attachment 3 of the draft decisions for Endeavour, Essential and ActewAGL.

4. The AER's estimation of Sharpe-Lintner CAPM parameters

The evolution of the AER's approach

112. As set out above, in its recent draft decisions the AER does not estimate any model other than the Sharpe-Lintner CAPM for the purpose of estimating the required return on equity for the benchmark efficient entity. Under this approach, the only task required of the AER is to produce estimates of each of the three Sharpe-Lintner CAPM parameters. To do this, the AER invents the notion of "primary" and "secondary" evidence. The Rules now specify that the regulator must have regard to all of the relevant evidence, but they do not specify *how* the regulator must have regard to that relevant evidence. The AER's approach is to define some of the relevant evidence as being primary evidence and to relegate other relevant evidence to the secondary category.

113. The primary evidence consists of the same subset of evidence that the AER used to estimate the Sharpe-Lintner CAPM parameters under the previous Rules:

a) The risk-free rate is estimated using the contemporaneous yield on 10-year government bonds;

b) The equity beta is estimated by applying regression analysis to the set of domestic comparators only; and

c) The market risk premium is estimated with regard primarily to mean historical excess returns (the Ibbotson approach to analysing historical stock returns) and with less weight applied to the AER's dividend growth model and surveys.

114. These same estimation methods applied to the same data sources produce the same estimates as would have been the case under the previous Rules, as set out in Table 2 below.

Table 2
AER Sharpe-Lintner CAPM parameter estimation methods

Parameter	2009 WACC Review	2013 Guideline
Risk-free rate	Contemporaneous yield on 10-year government bonds.	Contemporaneous yield on 10-year government bonds.
Equity beta	Regression analysis applied to domestic comparators leads to a **range of 0.4 to 0.7**. The final beta estimate is 0.8.	Regression analysis applied to domestic comparators leads to a **range of 0.4 to 0.7**. The final beta estimate is 0.7.
Market risk premium	Primary evidence is the mean of historical excess returns.	Primary evidence is the mean of historical excess returns from which the AER derives a range of 5.1% to 6.5%. This is the AER's estimate of a plausible range in normal market conditions.
	The AER states that some weight is given to dividend discount model analysis and survey evidence.	The AER states that some weight is given to dividend discount model analysis and survey evidence to derive a range for the market risk premium of 5.1% to 7.8%. This is a hybrid of the range we would observe in normal market conditions and a range appropriate for current market conditions.
	The final MRP estimate is **6.5%**.	The final MRP estimate is **6.5% which is the upper bound of the range for MRP we would expect in normal market conditions.**

Source: AER 2009 WACC Review Final Decision; AER 2013 Rate of Return Guideline.

115. In its 2009 WACC Review, the AER adopted a beta point estimate of 0.8 from its range of 0.4 to 0.7 on the basis of:

    a) The need to achieve an outcome that is consistent with the NEO;

    b) The need for efficient investment in electricity services;

    c) The need to provide service providers with a reasonable opportunity to recover at least their efficient costs;

    d) The asymmetry in the economic costs and risks of the potential for under and over investment; and

    e) The importance of regulatory stability.[57]

116. All of these reasons would seem to apply equally today, however the AER has not referred to them in its Guideline or in its recent draft decisions. Rather, the AER proposes to adopt a point estimate of 0.7 from the same range of 0.4 to 0.7 on the basis of:

    a) The theoretical underpinnings of the Black CAPM; and

[57] AER 2009 WACC Review Final Decision, p. xvii.

b) Evidence from international comparators.

117. That is, relative to the 2009 WACC Review:

a) The AER has adopted the same range of 0.4 to 0.7;

b) All of the reasons that were used to justify a point estimate of 0.8 still apply; and

c) The AER has identified additional reasons to support a higher estimate.

118. In my view, transparency requires the AER to state:

a) Whether it considers the reasons it used to support its 2009 beta estimate of 0.8 to remain valid; and

b) Whether, and if so how, the AER has had regard to those reasons in arriving at its current beta estimate of 0.7.

119. In my view, if those reasons were sufficient to support a point estimate of 0.8 in 2009, they are at least sufficient to support a point estimate of 0.7 today. In this case, the international comparators and the theory of the Black CAPM would have had no effect on the estimate of beta. If this characterisation is incorrect, the AER should explain why. Otherwise, it is impossible for stakeholders to determine whether the weight that has been applied to the international comparators and to the theory of the Black CAPM is reasonable.

120. The AER then comes to the secondary class of relevant evidence that it must have regard to under the new Rules. However, the AER "has regard to" the secondary evidence in such a way that it has no material effect on the primary parameter estimates. That is, the primary estimates (that are based on the same subset of relevant evidence that would have been used under the previous Rules) are preserved intact after having regard to the secondary evidence.

121. The way the AER has regard to the secondary evidence effectively guarantees that it will have no effect. That is, the estimation process neuters all but the AER's favoured subset of "primary" evidence – effectively producing the same outcome that would have been obtained under the previous Rules.

122. In the remainder of this section of the report, I provide three examples to illustrate how the AER's estimation approach serves to neuter relevant evidence that is not allocated to the "primary" category. These examples are:

a) The Wright approach for estimating the MRP is not used to inform the estimate of MRP. Instead, it is used as a final return on equity cross check, where it is combined with a range of estimates for beta (which have nothing at all to do with the Wright approach for estimating the MRP) to produce a range that is wide enough to include the AER's primary estimate, thus requiring no change to the primary estimate;

b) The evidence on beta from international comparators overwhelmingly supports an estimate materially above the AER's primary estimate of 0.7. The AER has located a "study" that provides raw beta estimates for three companies using one year of daily data where those beta estimates are lower than the AER's primary estimate. The AER concludes that the international comparators suggest a range for beta that includes the primary estimate, thus

requiring no change to the primary estimate. The AER does not mention that in that same case, the regulator considered a range of other information and ended up adopting equity betas of 0.91 and 0.94 for the two service providers in question; and

c) One of the bases for the AER's disregarding of the SFG dividend discount model estimate of the required return on equity for the benchmark firm is that the SFG estimate is inconsistent with the AER's primary estimate and with the AER's preconceived expectations.

Example 1: The Wright approach for estimating MRP

Two end points of a theoretical spectrum

123. One source of data for estimating the market risk premium is historical stock returns. There are two ways to process the historical returns data:

a) The *Ibbotson* approach assumes that the MRP is constant over all market conditions and the required return on equity varies one-for-one with changes in the risk-free rate; and

b) The *Wright* approach assumes that the real required return on equity is more stable and the MRP varies (inversely with changes in the risk-free rate) over different market conditions.

124. These two approaches are the end points of the theoretical spectrum. At one extreme is the Ibbotson approach, which implies that the MRP is constant across the whole range of market conditions that occurred over the relevant historical period. At the other end of the spectrum is the Wright approach, which implies that the MRP varies inversely with the risk-free rate such that the overall required return on equity is stable over time.

Regulatory views

125. The AER has stated that its view, and the view of its consultants, is that the MRP is not stable over time (as implied by the Ibbotson approach) but varies over time:

> Evidence suggests the MRP may vary over time. In their advice to the AER, Professor (sic) Lally and Professor Mackenzie and Associate Professor Partington have expressed the view that the MRP likely varies over time.[58]

126. The AER has also expressed the view that there is no consensus about which of the two assumptions is more reasonable:

a) The Ibbotson assumption that MRP does not vary over time at all; or

b) The Wright assumption that MRP varies inversely with the risk-free rate.

127. In this regard, the AER stated that:

> there is no consensus in the academic literature on the direction, magnitude or stability of the relationship between the risk free rate and the MRP.[59]

[58] AER Rate of Return Guideline, Explanatory Statement, p. 91.
[59] AER Rate of Return Guideline, Appendix B, p. 26.

128. The AER goes on to state that it will use both approaches:

> …it should not be interpreted that we necessarily consider the relationship between the MRP and the risk free rate will remain stable through different market circumstances. Instead, our approach to estimating the expected return on equity will consider estimates of the Sharpe–Lintner CAPM that assume both no consistent relationship, and a negative relationship between the MRP and risk free rate. This recognises the varied academic literature.[60]

129. I agree that neither of the end-point approaches is likely to provide a perfect description of reality. Rather, it is likely that reality lies somewhere between the assumptions on which each of the end point approaches is based. For this reason, I consider that both approaches for analysing the historical stock return data provide relevant evidence and that, when estimating the MRP, regard should be had to both approaches.

130. In his recent advice to the QCA, Lally (2013 QCA) reached the same conclusion, advising that:

> I consider that the set of methodologies considered by the QCA should be augmented by one involving estimating the expected real market cost of equity from the historical average actual real return and then deducting the current real risk free rate (or converting the estimate of the expected real market cost of capital to its nominal counterpart and then deducting the current nominal risk free rate). [61]

131. In recommending that the QCA should use the Wright approach to inform its estimate of the MRP, Lally (2013 QCA) concluded that:

> estimating the expected real market cost of equity from the historical average real market return, converting this to nominal terms using prevailing expected inflation and then deducting the prevailing nominal risk free rate…Relative to the Ibbotson methodology, this approach assumes that the expected real market cost of equity rather than the MRP is constant over time, and therefore will be superior to the Ibbotson approach if the expected real market cost of equity is more stable over time than the MRP. [62]

132. Similarly, in its recent ATCO Gas Draft Decision, the ERA concludes that:

> consistent with the evidence, the Authority's view is that the return on equity is more stable than the MRP, over the longer term. [63]

and consequently that:

> the approach to determining the MRP, is informed by the Wright approach.[64]

133. In summary, it appears that the regulatory consensus view is that the Wright approach for analysing the historical stock return data should be used to inform the estimate of the market risk premium.

[60] AER Rate of Return Guideline, Appendix B, p. 26.
[61] Lally (2013 QCA), p. 3.
[62] Lally (2013 QCA), p. 6.
[63] ERA ATCO Gas Draft Decision, p. 163, Paragraph 712.
[64] ERA ATCO Gas Draft Decision, p. 156, Paragraph 674.

AER Guideline

134. In its Guideline, the AER discusses, at some length, how having regard to the Wright approach is likely to result in more stable estimates of the allowed return on equity, relative to the AER's previous estimation approach which used the Ibbotson approach as the only method of analysing the historical stock returns data. In this regard, the AER stated that:

> …our implementation of the Sharpe–Lintner CAPM will result in estimates of the return on equity that may vary over time. Alternatively, the DGM and the Wright approach (for implementing the Sharpe–Lintner CAPM) will result in estimates of the return on equity that may be relatively stable over time. The informative use of these implementations of the Sharpe–Lintner CAPM, in addition to the DGM and other information, is expected to lead to more stable estimates of the return on equity than under our previous approach. The extent of this stability will depend on:
> - the extent to which movements in the estimates of the risk free rate and market risk premium in the foundation model offset each other
> - the informative value provided by the DGM and Wright approach (and other information that provides relatively stable estimates of the return on equity).[65]

and further that:

> …we consider submissions that suggest our implementation of the Sharpe–Lintner CAPM leads to equity returns that are too variable may be addressed through the consideration of other information. For example, as discussed in appendix E, we propose to have regard to DGM estimates when estimating the MRP. As discussed in appendix B, we also propose to consider an alternative implementation of the Sharpe–Lintner CAPM—that proposed by Professor Stephen Wright. Both the Wright approach and the DGM (when used to provide an estimate of the MRP) assume a perfectly negative relationship between the MRP and the risk free rate. Having regard to these estimates, therefore, may lead to more stable returns.[66]

AER estimates of the MRP

135. In its recent Draft Decisions, the AER does not use the Wright approach to inform its estimate of the MRP. Rather, it uses the Ibbotson approach to analysing historical stock return data to inform its estimate of the MRP, but it relegates the Wright approach to the final cross check stage of its estimation approach. As I explain below, this is done in a way that has the effect of neutering the evidence from the Wright approach such that it can have no impact on the allowed return on equity.

136. In Step 4 of the estimation process in its Draft Decisions for ActewAGL and the NSW DNSPs, the AER states that its Wright approach estimate of the required return on the market is 10.1% to 12.8%, with a mid-point of 11.45%.[67] I concur that this is a reasonable estimate of the required return on the market using the Wright approach. For the ActewAGL and NSW DNSP's Draft Decisions, the AER adopts a (then contemporaneous) risk-free rate of 3.55%.[68] These estimates imply a market risk premium estimate of 7.9% (11.45%-3.55%).

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[65] AER Rate of Return Guideline, Explanatory Statement, p. 66.
[66] AER Rate of Return Guideline, Appendix A, p. 12.
[67] Ausgrid Draft Decision, Attachment 3, p. 33; the same statements are made in Attachment 3 of the draft decisions for Endeavour, Essential and ActewAGL.
[68] Ausgrid Draft Decision, Attachment 3, pp. 32-33.

137. In the its Draft Decisions for ActewAGL and the NSW DNSPs the AER also concludes that the Ibbotson method of analysing the historical stock returns data yields an MRP estimate of 6%.[69]

138. Thus, the two methods of analysing the historical stock returns data produce a mid-point estimate of 7%. That is, if, when estimating the MRP, equal regard is had to the Ibbotson and Wright approaches, the conclusion is that the historical stock returns data supports an MRP estimate of 7%.

139. However, the AER uses the Ibbotson approach to inform its estimate of MRP, and effectively relegates the Wright approach in the manner described below. The result is that:

a) The AER concludes that the historical stock returns data supports an MRP estimate of 6% – based on the Ibbotson approach exclusively; and

b) The Wright approach has no impact on the allowed return on equity whatsoever – it has effectively been disregarded.

140. The AER achieves this outcome by:

a) Using the Ibbotson approach to inform its estimate of the MRP in Step 3 of its estimation approach; and

b) Relegating the Wright estimate of MRP to a return on equity cross check in Step 4 of its estimation approach.

141. As set out above, the AER's Wright estimate of MRP is 7.9%. In Step 3 of its estimation process, the AER had already concluded that 0.7 is the appropriate equity beta estimate for the benchmark efficient entity. Thus, the AER's estimate of the required return on equity for the benchmark efficient entity using the Wright approach is:

$$\begin{aligned} r_e &= r_f + \beta_e\left(r_m - r_f\right) \\ &= 3.55\% + 0.7\left(11.45\% - 3.55\%\right) = 9.08\% \end{aligned} \qquad (1)$$

which is materially higher than the AER's draft decision allowed return on equity of 8.1%. This evidence, which the AER considers to be relevant, materially contradicts the AER's allowed return on equity of 8.1%.

142. This highlights the problem of using one subset of relevant evidence when estimating the original MRP parameter while relegating another subset of the relevant evidence to the role of "cross checks." Having determined that the Wright approach for estimating the MRP is relevant evidence, and having obtained a Wright estimate of the return on equity that is materially inconsistent with the AER's proposed estimate, there are two possible courses of action. Either:

a) The AER would retain its original estimate – in which case the cross check has no effect and there seems to be no point performing it; or

[69] In my view, the historical stock returns data supports an Ibbotson estimate of 6.5%, not 6.0%. However, in this section of the report I consider the AER's estimates and focus on the estimation process and the way in which relevant evidence is effectively disregarded. I consider the basis of the individual estimates themselves elsewhere in this report.

b) The AER would revise its original estimate to make it consistent with the cross-check estimate – in which case the original evidence has effectively been discarded in favour of the cross check evidence.

143. In my view, a better approach is to set out all evidence that informs the estimate of MRP in the same stage of the estimation process and to select a single estimate of the MRP that is informed by all of that relevant evidence. This avoids the problems that arise where different pieces of evidence are assigned to different points in the contrived multi-staged approach that the AER proposes.

144. Of course no problem arises under the AER approach if the cross check evidence happens to be consistent with the AER's original estimate. In that case, the cross check confirms the original estimate.

145. However, in the case at hand, the AER's original estimate of the MRP is 6.5% (using evidence that excludes the Wright approach), whereas the AER's estimate of MRP using the Wright approach is 7.9%. These estimates are materially different. When these estimates of MRP are inserted into the CAPM, together with the AER's estimates of the risk-free rate (3.55%) and beta (0.7), they produce estimates of the required return on equity of 8.1% and 9.1%, respectively.

146. But what the AER then does is to compare its proposed return on equity (8.1%) with a range for the return on equity when the Wright approach is used to estimate the MRP. To obtain this range, the AER resurrects its range for beta (0.4 to 0.7) from the previous step of its estimation process. That is, the bottom of the "Wright range" is obtained by inserting the AER's Wright estimate of MRP (7.9%) and a beta of 0.4 into the CAPM equation. The top end of the range is obtained by inserting the AER's Wight estimate of MRP (7.9%) and a beta of 0.7 into the CAPM equation. The result is a range for the return on equity of 6.7%[70] to 9.1%[71] that includes the AER's proposed allowed return on equity of 8.1%, leading the AER to conclude that its proposed estimate is reasonable and not in need of any further consideration.[72]

147. That is, having previously concluded (in Step 3 of its estimation approach) that the appropriate equity beta is 0.7, the AER reintroduces an equity beta range of 0.4 to 0.7 for the sole purpose of evaluating the Wright approach (in Step 4 of its estimation approach). The only way the AER can obtain a range for the Wright approach that includes its proposed allowed return on equity is to combine the Wright estimate of MRP with a beta of 0.4, which the AER has already discarded in the previous step of its estimation process. The Wright approach has nothing at all to do with beta – it is used only for estimating the MRP. The AER's own Wright estimate of MRP (7.9%) is unambiguously higher than its proposed estimate of 6.5%. It makes no sense whatsoever for the AER to conclude that its proposed return on equity is consistent with the Wright evidence based on a comparison of:

a) The AER's proposed estimate of MRP (6.5%) multiplied by the AER's proposed estimate of beta (0.7); with

b) The AER's Wright estimate of MRP (7.9%) multiplied by an estimate of beta that the AER has already rejected in a previous step of its estimation process (0.4).

[70] 3.55+0.4×7.9=6.7.

[71] 3.55+0.7×7.9=9.1.

[72] Since the risk-free rate of 3.55% is common to all of these calculations, it can be omitted from all allowing a comparison of risk premiums (the product of beta and market risk premium). This approach of comparing risk premiums has been adopted by the AER in its Figure 3-4, pp. 32-33 of Attachment 3 to its Ausgrid Draft decision; the same approach is taken in Attachment 3 of the draft decisions for Endeavour, Essential and ActewAGL.

148. The outcome of such a comparison is that the AER says that it has had regard to the Wright approach, but regard is given to the Wright approach in such a manner as to ensure that it cannot possibly have any effect at all on the allowed return.

Example 2: International comparators for beta estimation

International evidence considered in the Guideline

149. When estimating the equity beta, the AER begins by producing a primary range of 0.4 to 0.7 based exclusively on the analysis of domestic comparators, of which there are currently four. The Guideline indicates that the AER considers that empirical estimates of beta for overseas energy networks are also relevant evidence,[73] but that this evidence can only be used to select a point estimate from within the primary range of 0.4 to 0.7 from the (now) four domestic comparators.

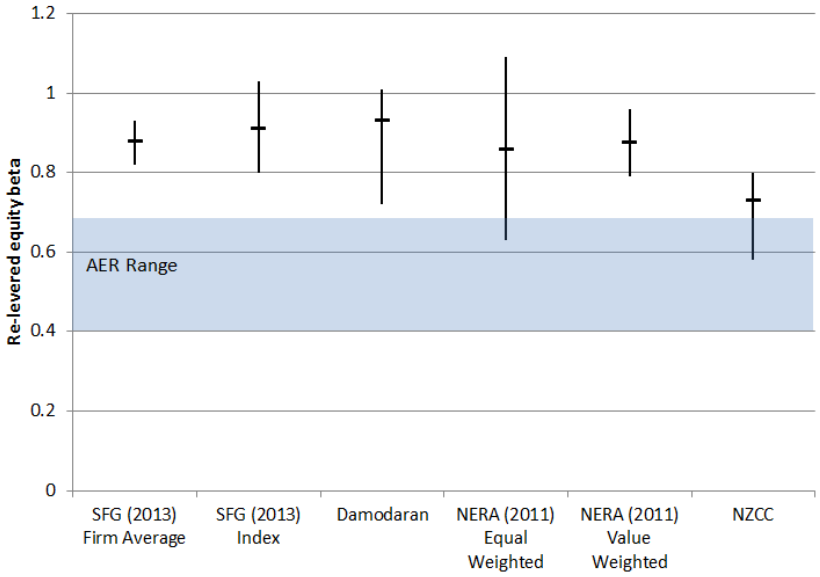
150. In a previous submission to the AER,[74] I noted that the separation of relevant evidence to primary and secondary classes can cause problems when evaluating that evidence. This can occur, for example, where the relevant evidence that is assigned to the secondary class is inconsistent with what the AER considers to be the primary evidence. Under the AER's approach, the secondary evidence can only be used to inform the selection of a point estimate from within the primary range. Consequently, the secondary evidence is disregarded to the extent that it is inconsistent with the primary range.

151. In my view, a better approach is to set out all of the evidence that the AER considers to be relevant to the estimation of beta in a single step of its estimation approach. All of that relevant evidence can then be used to inform the estimate of beta, properly taking into account the relevant strengths and weaknesses of that evidence. By contrast, the AER's approach caps the equity beta estimate at 0.7 based on evidence from what is now a set of only four domestic comparators – irrespective of the quantum of other evidence that might suggest a higher beta.

152. The AER's Guideline considered a number of pieces of evidence in relation to international comparators, set out in Appendix C to the Explanatory Statement.[75] I summarise that evidence in Figure 2 below.[76]

[73] AER Rate of Return Guideline, p. 15.
[74] SFG (2014 Beta).
[75] Specifically, at pp. 66–67.
[76] Note that the figure does not contain estimates from prior to 2010, such as the 2007 and 2008 Damodaran estimates of 1.34 and 1.31 that were referenced by McKenzie and Partington (2012).

Figure 2. Summary of AER international beta estimates



Source: AER Appendix C, pp. 66–67.
Notes: The AER only reports the point estimates from SFG (2013), so ranges have been obtained directly from the SFG (2013) report. The figure shows the range and mean of the four point estimates from Damodaran that are set out in the AER's appendix. The AER sets out only the ranges from NERA (2013); the figure shows the mid-point in each case. The AER sets out four estimates from the NZCC; the figure shows the range and mean.

153. Two additional points are relevant to the interpretation of the evidence set out in Figure 2:

a) The NZCC estimates are based on a sample that includes:

i) The Australian firms that have already been taken into account elsewhere in the estimation process; and

ii) A number of very small US firms that trade so infrequently that their betas cannot be reliably estimated, as explained by SFG (2013); and

b) Updated 2014 estimates provided by Damodaran indicate a mean re-levered equity beta estimate of 1.00 for utilities.[77]

154. Quite clearly, the international evidence supports an equity beta estimate above the 0.7 estimate that is proposed in the Guidelines.

155. In its recent draft decisions, the AER states that:

> In the Guideline, we set out a number of international empirical equity beta estimates that ranged from 0.5 to 1.3.[78]

156. However, this range includes the contemporaneous estimates of beta that are set out in Figure 2 above as well as several estimates of beta that use small samples and which are now more than five

[77] See http://www.stern.nyu.edu/~adamodar/pc/datasets/betas.xls.
[78] Ausgrid Draft Decision, Attachment 3, p. 262; the same statements are made in Attachment 3 of the draft decisions for Endeavour, Essential and ActewAGL.

years out of date. Indeed, the AER's Guideline specifically distinguishes between the dated pre-GFC estimates of beta and the more contemporaneous estimates of beta:

> In the equity beta issues paper, we also presented new estimates of equity beta for overseas electricity and gas networks—that is, estimates that consider data after the onset of the GFC.[79]

157. All of the contemporaneous estimates of beta are set out in Figure 2 above and they all point to an equity beta above 0.7.

International evidence considered in recent draft decisions

158. The AER's recent draft decisions also present new evidence of contemporaneous estimates of equity beta from international comparators. However, there are some severe problems with a number of these estimates. For example:

a) Some of the estimates have not been regeared to 60% debt and therefore cannot be compared with the proposed estimate of 0.7. The level of gearing is an important component of equity beta and all of the domestic estimates of equity beta that the AER has ever relied upon have been regeared to 60%, including the recent Henry (2014) estimates where the AER's terms of reference required beta estimates to be regeared to 60% and all of the estimates in Henry's report were in fact regeared to 60%.[80] In my view it would be a clear error to make an apples-with-oranges comparison of regeared equity beta estimates with raw equity beta estimates. By analogy, it would be equally inappropriate to conclude that a measurement of 10mm was appropriate because other measurements ranged between 9 and 11 inches; and

b) Some of the estimates are based on the analysis of only three comparator firms using only one year of daily data. In my view, the analysis of such a small and short data set cannot possibly produce a beta estimate that has even a modicum of reliability. In this regard, I note that the AER's terms of reference for Henry (2014):

   i) Instructed the consultant to use a minimum data period of 5 years;

   ii) Instructed the consultant to use a minimum return frequency of weekly data;

   iii) Instructed the consultant to use a minimum sample size of 9 companies.

159. In the remainder of this section I consider each of the new pieces of international evidence reported in the AER's recent draft decisions:

a) Damodaran (2013). The AER reports an updated estimate from Damodaran of 0.83 (regeared to 60%) using data through to the end of 2013. This estimate is for US comparators only. Other relevant comparator groups are:

   i) US comparators (20 firms): 0.83;

[79] AER Rate of Return Guideline, Explanatory Statement Appendices, p. 66.
[80] Henry (2014) sets out some raw beta estimates in the final appendix to his report, but the 30 tables in the body of the report all contain estimates that have been regeared to 60%.

ii) European comparators (20 firms): 1.30;

iii) Global comparators (55 firms): 0.90.

b) FTI (2012). This report provided raw beta estimates for three comparators using daily data over one- and two-year periods. For the reasons set out above, it is my view that it would be a gross error to place any weight on the resulting figures when seeking to estimate the regeared equity beta for the benchmark efficient entity.

Moreover, the AER's recent draft decisions only report the raw equity betas for the three comparators and imply that they can be compared with its regeared equity beta estimate of 0.7. The AER does not mention that the FTI (2012) study itself notes that the estimates that are cited by the AER are just one of the pieces of evidence that are used to inform the estimate of beta. The FTI report notes that Ofgem has previously adopted a beta range of 0.9 to 0.95[81] after considering all of the relevant evidence and that "[r]ecent regulatory precedent suggests a range of 0.9 to 1.1".[82] The FTI report itself then concludes that:

> We have not identified any evidence to suggest that Ofgem should update its range for beta in light of either recent regulatory precedent or recent market conditions.[83]

The draft decisions also do not mention that Ofgem has subsequently adopted equity betas of 0.95 for NGET (with 60% gearing) and 0.91 for NGGT (with 62.5% gearing) after considering the FTI (2012) study.[84]

c) Alberta Utilities Commission (2013). This report documents submissions to the regulator in relation to equity beta – it does not present any estimates of beta. Unsurprisingly, user groups such as the Canadian Association of Petroleum Producers (CAPP) submitted that a low equity beta should be used. The report provides no information at all about the basis for the equity beta submissions. There is no information about how many, or which comparator firms were used. There is no information about what statistical techniques were employed or how the range of resulting estimates was distilled into a point estimate or range.

Moreover, the process for determining the allowed return on equity in Alberta is fundamentally different from the process that is adopted by the AER. Specifically, the Alberta process begins with the assignment of an equity beta. The regulator then checks whether the allowed revenue will be sufficient to satisfy three key credit rating metrics. If these metrics are not achieved, the regulator will adjust the assumed level of gearing and/or add an increment to the allowed return on equity – the so-caller "adder" premium to ensure that the metrics are achieved. The equity beta estimates that form the lower bound of the range that was submitted to the Alberta regulator both involve material adder adjustments. That is, the role and the use of the equity beta are very different in Alberta than in the Australian regulatory setting.

For the reasons set out above, it is my view that the Alberta Utilities Commission report does not contain any evidence that is relevant to the regeared equity beta for use in the Australian regulatory framework.

[81] FTI (2012), Paragraph 4.3.
[82] FTI (2012), Paragraph 4.46.
[83] FTI (2012), Paragraph 4.57.
[84] OfGem (2012) Paragraphs 3.45 and 3.47.

d) PWC (2013). In its recent draft decisions, the AER summarises the evidence from the PWC report for the NZCC as follows:

> PwC's June 2014 report presents the following raw equity beta estimates for New Zealand energy network firms as at 31 December 2013: 0.6 for the average of the individual firm estimates.[85]

The AER implies that this estimate of 0.6 can be compared with its allowed equity beta of 0.7. However, such a comparison would be an error for the reasons set out below. First, the 0.6 estimate does not appear anywhere in the PWC report. The beta estimates set out in the "Utilities" section of the report are as follows:

Company	Raw beta	Leverage	Regeared beta (to 60% debt)
Contact	0.9	0.27	1.64
Horizon	0.5	0.31	0.86
NZ Windfarms	0.5	0.33	0.84
NZ Refining	0.8	0.17	1.66
TrustPower	0.5	0.36	0.80
Vector	0.7	0.50	0.88

The AER's estimate of 0.6 is the average of the raw beta estimates for Horizon and Vector.[86] The average of the regeared estimates for these two firms is 0.87.

In my view, it is misleading at best to suggest that the PWC (2013) report provides any support at all for the AER's regeared equity beta of 0.7.

e) Brattle Group (2013). This report examined seven European comparators and three US comparators using daily data over three years. In my view, three years is too short a period to provide reliable beta estimates. Nevertheless, the AER reports re-geared equity beta estimates from this report of:

i) 0.65 for the average of European individual firm estimates;

ii) 1.14 for the average of US individual firm estimates; and

iii) 0.79 for the average of European and US individual firm estimates.

The Brattle Group (2013) also note that the relevant regulatory rules require that the set of comparators must include at least ten firms – in contrast to the AER's set of domestic comparators, which now numbers four.

160. In summary:

[85] Ausgrid Draft Decision, p. 263; the same statements are made in Attachment 3 of the draft decisions for Endeavour, Essential and ActewAGL.
[86] Ausgrid Draft Decision, Footnote 1175, p. 263; the same statements are made in Attachment 3 of the draft decisions for Endeavour, Essential and ActewAGL.

a) The Damodaran estimates all support an equity beta materially above the AER's estimate of 0.7;

b) The FTI (2012) analysis of three companies using one year of daily data is incapable, by itself, of producing a reliable estimate of equity beta. FTI (2012) and OfGem (2012) conclude that the appropriate equity beta is in excess of 0.9;

c) The Alberta Utilities Commission (2013) report does not contain beta estimates, but rather beta submissions. Since there is no information about the basis of those submissions, it would be an error to place any material weight on them;

d) The PWC (2013) report indicates that the relevant regeared equity beta estimates are uniformly above 0.8;

e) The Brattle Group (2013) estimates are based on such a short period of data that they are unreliable. The average re-geared equity beta estimate reported by the AER is 0.79, which is materially above the AER's estimate of 0.7.

161. In relation to the evidence from international comparators:

a) All of the contemporaneous evidence considered by the AER during its Guideline process (set out in Figure 2) is consistent with an equity beta estimate materially above the AER's estimate of 0.7; and

b) All of the additional international evidence set out above is consistent with an equity beta estimate materially above the AER's estimate of 0.7.

162. By contrast, in its recent draft decisions the AER concludes that:

> We consider empirical equity beta estimates from a range of different countries. These estimates (presented above) show it is not clear that the international evidence supports an equity beta estimate above the top of our range. The range of the international empirical estimates is wide, with a number of estimates both above and below the top of our empirical range. We note the pattern of international results is not consistent and there are inherent uncertainties when relating foreign estimates to Australian conditions.[87]

163. The AER appears to have based its conclusion that "it is not clear that the international evidence supports an equity beta estimate above the top of our range" on:

a) The FTI estimates that are based on three comparators using a year or two of daily data. These estimates were part of a range of evidence that resulted in OfGem adopting equity betas of 0.9 to 0.95;

b) Submissions (not empirical estimates, but submissions) to the Alberta Utilities Commission by user groups;

c) Raw beta estimates computed by PwC for two NZ companies, which when regeared to 60%, are materially above 0.7; and

[87] Ausgrid Draft Decision, Attachment 3, p. 264; the same statements are made in Attachment 3 of the draft decisions for Endeavour, Essential and ActewAGL.

d) Raw beta estimates computed by the Brattle Group for seven European and three US firms, which when regeared to 60% are materially above 0.7.

164. Moreover, the AER's recent draft decisions contain no analysis or even any commentary about the relative reliability of the international evidence. There is no assessment at all about which pieces of international evidence are more comprehensive and more reliable and which might be less reliable. Rather, the AER simply concludes that it considers that the international evidence spans its primary estimate of 0.7 and that therefore it does not lead the AER to alter or review that primary estimate. In my view, there are two problems with the AER's approach:

a) As set out above, the international evidence does *not* span the AER's 0.7 estimate. Rather, the international evidence is uniformly consistent with a regeared equity beta materially above 0.7. The AER's rationale is that, provided there are some beta estimates that fall below 0.7 and some beta estimates that fall above 0.7 (regardless of the length of estimation period, or whether they have been adjusted to 60% gearing or not) that the evidence is consistent with a beta estimate of 0.7. Given the imprecision of beta estimates from regression analysis, it will always be the case that some firms meet this criteria over a one year period. So there will never a circumstance in which the evidence from international firms is used to shift the AER's beta estimate above the upper bound of 0.7, regardless of the overall implications of that evidence.

b) In any event, it would not be enough to simply show that the international evidence spans the AER's estimate of 0.7. The AER would also have to consider the relative reliability of each piece of evidence. For example, consider the case where one piece of relatively unreliable evidence is less than 0.7 and the weight of more reliable evidence is materially above 0.7. In that case, it would be quite unreasonable to conclude that the international evidence is broadly consistent with the primary estimate of 0.7. My point here is simply that it would be wrong to conclude that the international evidence is consistent with the primary estimate of 0.7 without any consideration of the relative reliability of each piece of evidence.

165. As a particular example of this last point, we note that the AER has treated the following two pieces of evidence symmetrically:

a) The SFG (2014) study of 56 international comparators, selected by CEG (2013) on the basis of a detailed analysis of the activities of each firm, from which re-geared beta estimates were compiled with reference to 11 years of historical returns (and which were computed using 20 different start days for computing four-weekly returns); and

b) The FTI raw beta estimates for three firms using one year of daily data.

Example 3: Industry dividend discount model

166. During the AER's Guideline process, SFG (2013 DDM a) proposed the use of a dividend discount model for the purpose of estimating the required return on equity for the benchmark efficient firm. SFG (2013 DDM b) showed that the SFG version of the industry DDM does not suffer from the key problems that the AER has identified with its own version of the industry DDM. In particular, the AER version of the model embeds the assumption that all firms grow at the same rate irrespective of whether they reinvest a small or large proportion of their earnings. Such an assumption is implausible and unsurprisingly leads to implausible results. By contrast, the SFG approach allows for firms with higher reinvestment rates to have commensurately higher growth rates.

167. The updated estimates presented in SFG (2014 DDM) were submitted by a number of service providers in the current round of AER reviews. The AER has rejected this evidence, affording it no weight. One of the reasons for the AER's rejection of industry dividend discount models is as follows:

> The very high RoE estimates from SFG's DGM model, equating to an equity beta of 0.94 in the SLCAPM, appear inconsistent with the low risk nature of regulated natural monopoly businesses with very low elasticity of demand for their services, and the results in Professor Olan Henry's 2014 report.[88]

168. In my view, there are a number of fundamental problems with the AER's reasoning set out above:

a) The AER begins its reasoning with the claim that the return on equity estimates from the SFG DDM are "very high." Very high relative to what? The AER presents no basis or explanation for its claim that the return on equity estimates are very high. The return on equity estimates from the SFG DDM are in fact lower for the benchmark firm than for the average firm – they are equivalent to the use of an equity beta of 0.94 in the Sharpe-Lintner CAPM;

b) The AER proposes that the SFG DDM can be rejected because it produces outcomes that are equivalent to the use of an equity beta of 0.94 which is "inconsistent with the low risk nature of regulated natural monopoly businesses." This seems to suggest that the AER has some preconceived notion of what the equity beta should be, and that any evidence that is inconsistent with this preconceived notion can be rejected for no other reason than that. The equivalent beta of 0.94 implies that the benchmark firm has lower than average equity risk (even though it has double the average level of gearing) – but this is apparently not commensurate with the AER's preconceived views about the risk of regulated natural monopoly businesses.

   In this regard, the AER must also regard the beta that OfGem uses (0.9 to 0.95) as being inconsistent with the low risk nature of regulated natural monopoly businesses.

   Moreover, *any* piece of evidence that is consistent with an equity beta in the order of 0.94 can presumably be instantly dismissed as being self-evidently unreasonable.

c) The AER also proposes that the SFG DDM can be rejected because it produces outcomes that are equivalent to the use of an equity beta of 0.94 which is inconsistent with "the results in Professor Olan Henry's 2014 report."

169. That is, the AER disregards the SFG DDM evidence on the basis that it is inconsistent with the AER's favoured subset of relevant evidence. If a subset of evidence produces a particular estimate, and any evidence that is inconsistent with that particular estimate is to be rejected, there would appear to be no point evaluating any evidence other than the first subset. This approach would appear to be inconsistent with the Rules requirement to have regard to all relevant evidence. Indeed, the whole point of the requirement to have regard to the whole range of relevant evidence is to ensure that parameters are not estimated on the basis of only a subset of the relevant evidence.

[88] Ausgrid Draft Decision, Attachment 3, p. 188; the same statements are made in Attachment 3 of the draft decisions for Endeavour, Essential and ActewAGL.

5. Updated estimates

Comparison with Guideline estimate

170. At the time of the Guideline, the yield on 10-year government bonds was approximately 4.2%. Thus, the AER's approach would have produced an allowed return on equity of:

$$\begin{aligned} r_e &= r_f + \beta\left(r_m - r_f\right) \\ &= 4.2\% + 0.7\left(6.5\%\right) = 8.75\%. \end{aligned}$$

171. As at the date of this report, the yield on 10-year government bonds was approximately 2.8%. Thus, the AER's approach would now produce an allowed return on equity of:

$$\begin{aligned} r_e &= r_f + \beta\left(r_m - r_f\right) \\ &= 2.8\% + 0.7\left(6.5\%\right) = 7.35\%. \end{aligned}$$

172. This represents a reduction in the allowed return on equity of 16% over the course of approximately one year. This highly material reduction in the returns available to shareholders is due to the AER's approach of assuming that required returns on equity vary one-for-one with changes in the risk-free rate. In particular, the AER's approach would deem that no change is required to its estimate of the MRP even though the risk-free rate has fallen by a factor of 33%.

173. Whereas the AER had claimed that:

> …our implementation of the Sharpe–Lintner CAPM will result in estimates of the return on equity that may vary over time. Alternatively, the DGM and the Wright approach (for implementing the Sharpe–Lintner CAPM) will result in estimates of the return on equity that may be relatively stable over time. The informative use of these implementations of the Sharpe–Lintner CAPM, in addition to the DGM and other information, is expected to lead to more stable estimates of the return on equity than under our previous approach.[89]

the actual outcome is precisely the same as under the previous Rules in that the allowed return on equity varies up and down one-for-one with changes in the risk-free rate.

174. By contrast, SFG 2014 (ROE) and SFG (2014 ENERGEX) sets out an approach for estimating the required return on equity for the benchmark efficient firm that *does* lead to more stable estimates. This is because the SFG approach *does* allow for the DGM and Wright estimates to vary with changes in the risk-free rate – as they should. By contrast, the AER approach has fixed a constant equity risk premium that is added to the contemporaneous risk-free rate, in which case the allowed return on equity has varied one-for-one with the material change in government bond yields that has occurred over the last year. Specifically, the 10-year government bond yield has fallen by one third since the Guideline, but no change has been made to any other parameter to help stabilise the allowed return on equity.

[89] AER Rate of Return Guideline, Explanatory Statement, p. 66.

Internal inconsistency

175. A question arises as to why the AER's consideration of its DGM has not led to more stable estimates of the required return on equity as the AER hoped it would. The reason for this is that the AER's use of its DGM evidence is internally inconsistent.

176. The AER uses its dividend growth model for the market to inform its estimate of the MRP. In its Guideline materials, the AER notes that its DGM provides an estimate of the contemporaneous required return on the market. The AER notes that it uses its DGM equation "to determine the return on equity."[90] Having estimated the market return on equity, the AER then subtracts the contemporaneous risk-free rate to obtain an estimate of the contemporaneous MRP.

177. In its Guideline, the AER applied this approach using the risk-free rate as at late 2013. That is, the AER produces a DGM estimate of MRP by estimating the required return on the market and then subtracting the then contemporaneous government bond yield of 4.2%. Since that time, risk-free rates have fallen materially (from 4.2% to 2.8%). However, the AER still adopts the same estimate of MRP, which is an estimate that is conditional on a materially higher risk-free rate. The reason the AER's estimate of the allowed return on equity is as volatile as ever is that its DGM estimate of MRP has not been updated to reflect the change in the risk-free rate.

Updated MRP estimate for risk-free rate of 3.08%

178. I have updated the SFG (2014 ROE) estimates of the market risk premium for the government bond yield over the 20-day period ending 19 December 2014, being 3.08%. For example, the DGM and Wright estimates do vary with changes in the risk-free rate and have been updated accordingly. I have updated estimates for the change in government bond yields only. In parallel work I am updating other parameter estimates, but that work is not complete as at the date of this report. Thus, the estimates set out in Table 3 below are based on the estimates from SFG (2014 ROE), updated for changes in government bond yields only.

Table 3
Estimates of the required return on the market and MRP

Method	MRP	Required return on the market	Weighting
Historical excess returns (Ibbotson)	6.63%	9.72%	20%
Historical market returns (Wright)	8.62%	11.71%	20%
Dividend discount model	8.34%	11.42%	50%
Independent expert valuation reports	6.97%	10.06%	10%
Weighted average	7.92%	11.00%	100%

179. SFG (2014 ROE) sets out the rationale for the differential weights applied to the relevant estimates of the MRP.

[90] AER Rate of Return Guideline, Appendices, p. 116.

6. Alternative approaches to estimating the required return on equity

180. In my previous submission on behalf of ENERGEX,[91] I was instructed to provide an estimate of the required return on equity for the benchmark efficient entity within the foundation model framework. In particular, I was instructed to assume that the Sharpe-Lintner Capital Asset Pricing Model was to be used as the foundation model. Within those constraints, I was asked to provide my opinion on how the Sharpe-Lintner CAPM should be parameterised in a way that:

    a) Has due regard to all relevant estimation methods, financial models, data and other evidence;

    b) Has due regard to the prevailing conditions in the market for equity funds; and

    c) Produces an estimate of the required return on equity that best reflects the efficient financing costs of a benchmark efficient entity.

181. My approach was to first estimate each of the relevant models in a way that was true to the proper construction of each model. I then noted that the foundation model approach requires the evidence from the relevant financial models to be filtered through the Sharpe-Lintner CAPM. For each relevant model, I then solved for the equity beta that, when inserted into the Sharpe-Lintner CAPM, produced an estimate of the required return on equity that was consistent with the estimate produced from that model. For example, the estimate for the Black CAPM is computed by determining the beta estimate that, when inserted into the Sharpe-Lintner CAPM foundation model, produces an estimate of the required return on equity that is consistent with the evidence from the Black CAPM. The Fama-French and dividend discount model estimates are computed in a similar manner.

182. I note that the foundation model approach is quite different from the simple and transparent multi-model approach that is set out above. The only way that the evidence from other relevant financial models can have any impact on the allowed return on equity under the foundation model approach is via the individual parameter estimates of the foundation model. It is for this reason that I estimated a set of beta estimates that produced estimates of the return on equity that were consistent with the evidence from the relevant financial models.

183. My approach was then to take a weighted-average over these implied beta estimates. The outcome of this approach is, by construction, identical to the approach of simply estimating the relevant models. In my view, this is the only way to have proper regard to the evidence from the relevant financial models within the context of the foundation model approach.

184. For comparison purposes, I have compiled a set of foundation model beta estimates that update the risk-free rate to 3.08%, but which are otherwise consistent with the estimates set out in my earlier submission on behalf of ENERGEX. These updated estimates are set out in Table 4 below.

[91] SFG (2014 ENERGEX).

Table 4
Estimates of equity beta to reflect evidence from relevant financial models

Model	Equity beta	Weighting
SL CAPM	0.82	12.5%
Black CAPM	0.89	25.0%
Fama-French	0.92	37.5%
DDM	0.94	25.0%
Average	**0.91**	**100%**

185. The composite foundation model equity beta estimate of 0.91 produces an estimate of the required return on equity of 10.26%, as set out below:

$$r_e = r_f + \beta \times MRP$$
$$= 3.08\% + 0.91 \times 7.92\% = 10.26\%.$$

186. ENERGEX has instructed me to provide the best estimate of the return on equity having regard to the NER and NEL without the constraint of the Sharpe-Lintner foundation model.

187. In its Guideline and in its recent draft decisions, the AER concludes that the set of relevant financial models is:

a) The Sharpe-Lintner CAPM;

b) The Black CAPM;

c) The Fama-French model; and

d) The dividend discount model (or "dividend growth model").

188. The AER estimates the Sharpe-Lintner CAPM, but it does not provide estimates of the required return on equity from any other model.

189. SFG (2014 ROE) sets out estimates of the required return on equity from each of the four relevant models[92] and has regard to each of them by applying weight to each. I have updated the SFG (2014 ROE) estimates of the required return on equity for the benchmark efficient entity set out in Table 5 below.

Table 5
Estimates of the required return on equity for a benchmark efficient entity

Method	Required return on equity	Weighting
Sharpe-Lintner CAPM	9.55%	12.5%
Black CAPM	10.17%	25.0%
Fama-French model	10.37%	37.5%
Dividend discount model	10.55%	25.0%
Weighted average	10.26%	100%

[92] These estimates are based on a number of supporting reports – SFG (2014 Black), SFG (2014 FFM), and SFG (2014 DDM).

190. SFG (2014 ROE) sets out the rationale for the differential weights applied to the relevant estimates of the required return on equity. I note that the adoption of these weights produces a weighted average that is immaterially different from the outcome of a simple equally-weighted average of 10.16%.

191. I note that the final estimate of the required return on equity is the same as in paragraph 185 above.

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Appendix 1: CV of Prof. Stephen Gray

Stephen F. Gray

University of Queensland
Business School
Brisbane 4072
AUSTRALIA
Office: +61-7-3346 8032
Email: s.gray@business.uq.edu.au

Academic Qualifications

1995 Ph.D. (Finance), Graduate School of Business, Stanford University.
Dissertation Title: Essays in Empirical Finance
Committee Chairman: Ken Singleton
1989 LL.B. (Hons), Bachelor of Laws with Honours, University of Queensland.
1986 B.Com. (Hons), Bachelor of Commerce with Honours, University of Queensland.

Employment History

2000-Present Professor of Finance, UQ Business School, University of Queensland.
1997-2000 Associate Professor of Finance, Department of Commerce, University of Queensland and Research Associate Professor of Finance, Fuqua School of Business, Duke University.
1994-1997 Assistant Professor of Finance, Fuqua School of Business, Duke University.
1990-1993 Research Assistant, Graduate School of Business, Stanford University.
1988-1990 Assistant Professor of Finance, Department of Commerce, University of Queensland.
1987 Specialist Tutor in Finance, Queensland University of Technology.
1986 Teaching Assistant in Finance, Department of Commerce, University of Queensland.

Academic Awards

2006 Outstanding Professor Award, Global Executive MBA, Fuqua School of Business, Duke University.
2002 Journal of Financial Economics, All-Star Paper Award, for Modeling the Conditional Distribution of Interest Rates as a Regime-Switching Process, JFE, 1996, 42, 27-62.
2002 Australian University Teaching Award – Business (a national award for all university instructors in all disciplines).
2000 University of Queensland Award for Excellence in Teaching (a University-wide award).
1999 Outstanding Professor Award, Global Executive MBA, Fuqua School of Business, Duke University.
1999 KPMG Teaching Prize, Department of Commerce, University of Queensland.
1998 Faculty Teaching Prize (Business, Economics, and Law), University of Queensland.
1991 Jaedicke Fellow in Finance, Doctoral Program, Graduate School of Business, Stanford University.
1989 Touche Ross Teaching Prize, Department of Commerce, University of Queensland.
1986 University Medal in Commerce, University of Queensland.

Large Grants (over $100, 000)

- Australian Research Council Linkage Grant, 2008—2010, Managing Asymmetry Risk ($320,000), with T. Brailsford, J.Alcock, and Tactical Global Management.
- Intelligent Grid Cluster, Distributed Energy – CSIRO Energy Transformed Flagship Collaboration Cluster Grant, 2008-2010 ($552,000)
- Australian Research Council Research Infrastructure Block Grant, 2007—2008, Australian Financial Information Database ($279,754).
- Australian Research Council Discovery Grant, 2006—2008, Capital Management in a Stochastic Earnings Environment ($270,000).
- Australian Research Council Discovery Grant, 2005—2007, Australian Cost of Equity.
- Australian Research Council Discovery Grant, 2002—2004, Quantification Issues in Corporate Valuation, the Cost of Capital, and Optimal Capital Structure.

- Australian Research Council Strategic Partnership Grant, 1997—2000, Electricity Contracts and Securities in a Deregulated Market: Valuation and Risk Management for Market Participants.

Current Research Interests

Benchmark returns and the cost of capital. Corporate Finance. Capital structure. Real and strategic options and corporate valuation. Financial and credit risk management. Empirical finance and asset pricing.

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Gray, S. (1996), "Modeling the Conditional Distribution of Interest Rates as a Regime- Switching Process," *Journal of Financial Economics*, 42, 27-62.

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Gray, S. and A. Lynch, (1990), "An Alternative Explanation of the January Anomaly," *Accounting Research Journal*, 3(1), 19-27.

Gray, S. (1989), "Put Call Parity: An Extension of Boundary Conditions," *Australian Journal of Management*, 14(2), 151-170.

Gray, S. (1988), "The Straddle and the Efficiency of the Australian Exchange Traded Options Market," *Accounting Research Journal*, 1(2), 15-27.

Teaching

Fuqua School of Business, Duke University, Student Evaluations (0-7 scale):

- Financial Management (MBA Core): Average 6.5 over 7 years.
- Advanced Derivatives: Average 6.6 over 4 years.
- Empirical Issues in Asset Pricing: Ph.D. Class

1999, 2006 Outstanding Professor Award, Global Executive MBA, Fuqua School of Business, Duke University.

UQ Business School, University of Queensland, Student Evaluations (0-7 scale):

- Finance (MBA Core): Average 6.6 over 10 years.
- Corporate Finance Honours: Average 6.9 over 10 years.

2002 Australian University Teaching Award – Business (a national award for all university instructors in all disciplines).
2000 University of Queensland Award for Excellence in Teaching.
1999 Department of Commerce KPMG Teaching Prize, University of Queensland.
1998 Faculty Teaching Prize, Faculty of Business Economics and Law, University of Queensland.
1998 Commendation for Excellence in Teaching, University-wide Teaching Awards, University of Queensland.
1989 Touche Ross Teaching Prize, Department of Commerce, University of Queensland.

Board Positions

2002 - Present: Director, Financial Management Association of Australia Ltd.
2003 - Present: Director, Moreton Bay Boys College Ltd. (Chairman since 2007).
2002 - 2007: External Risk Advisor to Board of Enertrade (Queensland Power Trading Corporation Ltd.)

Consulting

Managing Director, Strategic Finance Group: www.sfgconsulting.com.au.

Consulting interests and specialties, with recent examples, include:

- **Corporate finance**
  - ⇒ **Listed multi-business corporation:** Detailed financial modeling of each business unit, analysis of corporate strategy, estimation of effects of alternate strategies, development of capital allocation framework.

- **Capital management and optimal capital structure**
  - ⇒ **State-owned electricity generator:** Built detailed financial model to analyze effects of increased leverage on cost of capital, entity value, credit rating, and stability of dividends. Debt of $500 million issued.

- **Cost of capital**
  - ⇒ **Cost of Capital in the Public Sector:** Provided advice to a government enterprise on how to estimate an appropriate cost of capital and benchmark return for Government-owned enterprises. Appearance as **expert witness** in legal proceedings that followed a regulatory determination.
  - ⇒ **Expert Witness:** Produced a written report and provided court testimony on issues relating to the cost of capital of a cable TV business.
  - ⇒ **Regulatory Cost of Capital:** Extensive work for regulators and regulated entities on all matters relating to estimation of weighted-average cost of capital.

- **Valuation**

⇒ **Expert Witness:** Produced a written report and provided court testimony. The issue was whether, during a takeover offer, the shares of the bidding firm were affected by a liquidity premium due to its incorporation in the major stock market index.

⇒ **Expert Witness:** Produced a written report and provided court testimony in relation to valuation issues involving an integrated mine and refinery.

- **Capital Raising**
  - ⇒ Produced comprehensive valuation models in the context of capital raisings for a range of businesses in a range of industries including manufacturing, film production, and biotechnology.

- **Asset pricing and empirical finance**
  - ⇒ **Expert Witness:** Produced a written report on whether the client's arbitrage-driven trading strategy caused undue movements in the prices of certain shares.

- **Application of econometric techniques to applied problems in finance**
  - ⇒ **Debt Structure Review:** Provided advice to a large City Council on restructuring their debt portfolio. The issues involved optimisation of a range of performance measures for each business unit in the Council while simultaneously minimizing the volatility of the Council's equity in each business unit.
  - ⇒ **Superannuation Fund Performance Benchmarking:** Conducted an analysis of the techniques used by a large superannuation fund to benchmark its performance against competing funds.

- **Valuation of derivative securities**
  - ⇒ **Stochastic Volatility Models in Interest Rate Futures Markets:** Estimated and implemented a number of models designed to predict volatility in interest rate futures markets.

- **Application of option-pricing techniques to real project evaluation**
  - ⇒ **Real Option Valuation:** Developed a framework for valuing an option on a large office building. Acted as arbitrator between the various parties involved and reached a consensus valuation.
  - ⇒ **Real Option Valuation:** Used real options framework in the valuation of a bio-tech company in the context of an M&A transaction.