

Attachment 10.5

The Foundation Model Approach of
the Australian Energy Regulator to
Estimating the Cost of Equity

A report by SFG Consulting

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The foundation model approach of the Australian Energy Regulator to estimating the cost of equity

Report for Jemena Gas Networks, Jemena Electricity Networks, AusNet Services, Australian Gas Networks, CitiPower, Ergon Energy, Powercor, SA PowerNetworks, and United Energy

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1. Preparation of this report

1. This report was prepared by Professor Stephen Gray and Dr Jason Hall. Professor Gray and Dr Hall acknowledge that they have read, understood and complied with the Federal Court of Australia's *Practice Note CM 7, Expert Witnesses in Proceedings in the Federal Court of Australia*. Professor Gray and Dr Hall provide advice on cost of capital issues for a number of entities but have no current or future potential conflicts.

2. Introduction

2.1 Overview and instructions

1. SFG Consulting has been retained by Jemena Gas Networks (**JGN**), Jemena Electricity Networks, AusNet Services, Australian Gas Networks, CitiPower, Ergon Energy, Powercor, SA Power Networks, and United Energy to provide our views on the manner in which the Australian Energy Regulator (**AER**) estimates the cost of equity under the National Electricity Rules (**NER**) and National Gas Rules (**NGR**) (collectively referred to as the **Rules**). In particular, we have been asked to provide an opinion on the AER's use of a *foundation model* to estimate the cost of equity.
2. On the 27th of November 2014, the AER released a draft determination for JGN. The determination relates to the five year regulatory period from 1 July 2015 to 30 June 2020.¹
3. The term *foundation model* has been adopted by the AER as part of its estimation process in both this determination and its rate of return guideline. The manner in which the AER reaches a conclusion on the cost of equity is to use some information to estimate ranges for parameter inputs into the foundation model. The AER then uses other information to reach conclusions on the point estimates from within those ranges. The model adopted by the AER as the foundation model is the Sharpe-Lintner Capital Asset Pricing Model (**CAPM**).²
4. The AER uses information from a number of sources to populate the parameter inputs to its foundation model. In evaluating this information the AER goes through a sequential process. The AER estimates ranges for parameter inputs into the foundation model (the risk free rate, equity beta and market risk premium) based upon first stage evidence (our term). The AER then reaches conclusions on parameter estimates from within these ranges based upon second stage evidence (our term).
5. The AER concludes that its use of the foundation model approach is supported by a report from Associate Professor John Handley.³ Given Handley's advice to the AER, we have been asked to write a report that answers the following questions. A more detailed terms of reference appears in an appendix to this report.
 - a) Whether the foundation model approach can be expected to deliver an estimate of the return on equity that is consistent with the allowed rate of return objective, and is reflective of prevailing conditions in the market for equity funds.
 - b) Whether there is any evidence to support a departure from the foundation model approach as applied in the draft decision for JGN.
6. The allowed rate of return objective is that the rate of return for a 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 service provider in respect of the provision of reference services.⁴

2.2 Terms of reference

7. We have been provided with terms of reference that require us to comment on a number of specific issues. The terms of reference are attached to this report.

¹ In this report we provide relevant references to the JGN Draft Decision. We note that the AER's other contemporaneous draft decisions contain similar wording on the issues that are considered in this report. The contemporaneous draft decisions are those for TransGrid, Ausgrid, Essential Energy, Endeavour Energy, and ActewAGL.

² Sharpe (1964) and Lintner (1965).

³ Handley (2014).

⁴ NGR 87 (3).

2.3 Structure of this report and conclusions

8. Our report is structured as follows. In Section 3 we contrast the AER's foundation model approach to the multi-model approach, which we support. We explain that the AER does not take into account two important pieces of empirical evidence:
 - a) stocks with low beta estimates earn higher returns than predicted by the Sharpe-Lintner CAPM – which could be dealt with by implementing the Black CAPM to derive one estimate of the cost of equity; and
 - b) stocks with high book-to-market ratios persistently earn higher returns than predicted by the Sharpe-Lintner CAPM – which could be dealt with by implementing the Fama-French model to derive one estimate of the cost of equity.
9. When the AER implements the Sharpe-Lintner CAPM, the AER constrains the beta estimate to 0.7, a figure which is derived from regression-based estimates of beta for a sample of nine Australian-listed stocks (of which four remain listed). The use of this beta estimate does not address either of the pieces of empirical evidence that contradict the use of the Sharpe-Lintner CAPM. By implementing the foundation model approach with this constraint, the foundation model approach will not deliver an estimate of the return on equity that is consistent with the allowed rate of return objective, and is reflective of prevailing conditions in the market for equity funds.
10. There is evidence to support a departure from the foundation model approach as applied in the draft decision for JGN. The issue is, having observed empirical evidence that contradicts the sole reliance on the Sharpe-Lintner CAPM, are there data and estimation techniques available to make more reliable estimates of the cost of equity? Yes, there is. In our report of February 2015 (SFG, 2015 Cost of equity) and an update to that report from March 2015 (SFG, 2015 Update) we outline a specific computation of the cost of equity that:
 - a) Uses four estimation models in order to mitigate estimation error; and
 - b) Uses models that specifically address the empirical limitations of the Sharpe-Lintner CAPM.
11. In Section 4 we address the specific advice that has been provided to the AER by Handley (2014). We explain that Handley reaches no conclusion on how to address the two pieces of empirical evidence mentioned in paragraph 8.
12. Handley (2014) points out that researchers have not reached definitive explanations for why high book-to-market stocks earn high returns, and that there is some evidence that stocks with high beta estimates earn high returns on days of important economic events. He comments that researchers have compiled a number of factor models that, statistically, are hard to reject because researchers do not have particularly powerful statistical tests. And he notes that there are number of competing explanations for which stocks with low beta estimates earn high stock returns.
13. However, Handley's (2014) endorsement of the AER's application of the foundation model does not logically follow from any of these comments. Handley concludes that researchers have much to learn about asset pricing. But this does not mean that the AER should continue to exclusively rely upon one asset pricing model, implemented in a manner that constrains the cost of equity in a manner which does not address the model's empirical limitations.

3. The foundation model approach of the AER and the multi-model approach

3.1 Context

14. The AER's foundation model approach to estimating the cost of equity has been the subject of contention between us and the AER since the approach was introduced by the AER. The AER adopted a foundation model in its draft rate of return guideline of August 2013, in its final rate of return guideline of December 2013, and its draft determination for JGN of December 2014.⁵
15. The Energy Networks Association (**ENA**) objected to the use of the foundation model approach in October 2013, following the publication of the AER's draft rate of return guideline. A key objection raised by the ENA in the first page of its response to the draft guideline is that the AER's foundation model approach:
- introduces a hierarchy in the information to be considered, and introduces a range resulting in a constraint on the use of information that is not present in the rules. The hierarchy is likely to result in certain information being given a disproportionate weight and the constraints could prevent relevant information being used.⁶
16. JGN repeated this objection in its submission to the AER of June 2014. JGN argued that the AER's implementation of the foundation model approach does not lead to a return on equity that meets the objective of the Rules. JGN's point is that the AER's foundation model approach has marginalised material, relevant information.⁷
17. In February 2015, in response to its draft determination, JGN again objected to the AER's foundation model approach. In material submitted in support of amendments to its access arrangement revision proposal, JGN maintains the position that the AER has implemented a process whereby information is assigned specific roles in a manner which ensures that material, relevant information is effectively discounted in reaching a conclusion on the cost of equity.⁸
18. We agree with the position expressed by JGN in its response of February 2015, and made this point in an expert's report relied upon by JGN (SFG, 2015 Cost of equity). Our conclusion to that report was:
- In aggregate the constraints embedded in the AER framework lead to the AEMC rule change having no impact on the AER's estimated cost of equity. In our view the cost of equity estimate we present above takes account of all relevant evidence and represents the prevailing cost of funds.⁹
19. An important reason for this contention is that we and the AER continue to debate the use of the foundation model from different perspectives. These different perspectives are discussed in the sub-sections below.

3.2 The AER's perspective on asset pricing models

20. In this section of the report, we distinguish between asset pricing models and the dividend discount approach for estimating the required return on equity. Asset pricing models specify one or more risk factors that drive returns and measure the exposure of each firm to those relevant risk factors. By contrast, the dividend discount approach takes no stand on what the relevant risk factors might be. In

⁵ In this report we provide relevant references to the JGN Draft Decision. We note that the AER's other contemporaneous draft decisions contain similar wording on the issues that are considered in this report. The contemporaneous draft decisions are those for TransGrid, Ausgrid, Essential Energy, Endeavour Energy, and ActewAGL.

⁶ Energy Networks Association (2013), Section 1, pp. 1–2.

⁷ JGN Return on equity proposal (2014), Section 4, pp. 20–27.

⁸ JGN Response to the AER's draft decision (2015), Sub-section 7.2.1, pp. 96–97.

⁹ SFG (2015 Cost of equity), Section 5, para. 169.

this section of the report, we consider the various asset pricing models that might be used to estimate the required return on equity for the benchmark efficient entity.

21. In its draft determination for JGN, the AER considers two alternative models to the Sharpe-Lintner CAPM that have been proposed by JGN, the Black CAPM and the Fama-French three-factor model (**Fama-French model**). In its evaluation of these models, the AER asks whether there is consensus amongst academics and practitioners on whether the Black CAPM or the Fama-French model is better than the Sharpe-Lintner CAPM for estimating the cost of equity. Further, the AER appears to proceed in this evaluation according to a de facto persuasive evidence test. The AER rules out the use of the Black CAPM and the Fama-French model because the AER is not persuaded that reliance on either alternative model will lead to more a reliable estimate of the cost of equity. The AER's consideration of the Black CAPM and the Fama-French model is summarised in the paragraphs below.

- a) **Black CAPM.** The AER has stated that it will not use the Black CAPM to estimate the cost of equity directly because there is no reliable estimate of the zero beta premium, and the model is not widely used by equity investors, academics or regulators.¹⁰ Yet the AER has determined that its beta estimate in the Sharpe-Lintner CAPM should be 0.7, in part on the basis of what the AER terms the “theoretical underpinnings”¹¹ of the Black CAPM.¹² The selection of the beta estimate of 0.7 is at the upper end of the AER's first stage range for beta estimates of 0.4 to 0.7, formed with respect to an analysis of Australian-listed firms. The AER is perfectly clear that it has not performed an empirical analysis to determine how beta in the Sharpe-Lintner CAPM should be adjusted to account for any low beta bias.¹³ The AER states that:

[w]e do not use the theory underlying the Black CAPM to apply a specific uplift to the equity beta and we did not do so in the Guideline. Further, we do not accept that our use of the theory underlying the Black CAPM implies that we consider the SLCAPM produces biased return on equity estimates.”¹⁴

- b) **Fama-French model.** The AER places no reliance on the Fama-French model to estimate the cost of equity.¹⁵ There are four reasons for the AER's view of the Fama-French model – sensitivity to estimation periods and methodologies, not clearly estimating expected returns, a lack of theoretical foundation, and complexity in implementation.¹⁶

3.3 Our alternative perspective on asset pricing models

22. In assessing whether cost of equity models are relevant estimation methods, financial models or other evidence as to what figure should be adopted for the return on equity, the strengths and weaknesses of each model should be assessed on a standalone basis, prior to a determination of the weight that may be given to any particular model. In our view, the Sharpe-Lintner CAPM has two significant shortcomings that are not properly recognised by the AER or its expert.

- a) **The Sharpe-Lintner CAPM is not supported by realised returns.** When the Sharpe-Lintner CAPM is populated with beta estimates from regressions of stock returns on market returns, there is little or no association between beta estimates and realised returns. Given a long time series of returns there is an unambiguous prediction of the Sharpe-Lintner CAPM that returns should be high for high beta stocks, and returns should be low for low beta

¹⁰ JGN Draft Determination, Attachment 3, Sub-section 3.4.1, p. 56.

¹¹ JGN Draft Determination, Attachment 3, Sub-section 3.4.1, p. 30; and Sub-section D.4, p. 265.

¹² We say that the beta estimate of 0.7 is justified, in part, on the basis of the Black CAPM because there is a second justification for the beta estimate of 0.7, the consideration of beta estimates from firms listed in markets other than Australia.

¹³ By low beta bias we mean that expected returns on stocks with low beta estimates are above what is implied by the Sharpe-Lintner CAPM.

¹⁴ JGN Draft Determination, Attachment 3, Sub-section D.4, pp. 266–267.

¹⁵ JGN Draft Determination, Attachment 3, Sub-section 3.4.1, p. 28; Sub-section 3.4.1 Table 3-5, p. 46; and p. 52.

¹⁶ JGN Draft Determination, Attachment 3, Sub-section 3.4.1, p. 52.

stocks. This is not true and the AER has never disagreed with the result that realised returns are above what we would expect from the Sharpe-Lintner CAPM. So either the model is incomplete, in that it leaves out an important risk factor, or the manner in which risk is measured (that is, estimating beta by regressing stock returns on market returns) is flawed. Regardless of whether the realised returns evidence is due to model limitations or estimation error in beta, there is a problem. The AER estimates the cost of equity with reference to the Sharpe-Lintner CAPM, populated with beta estimates from regressions of stock returns on market returns.

- b) **There is a firm characteristic – a high book-to-market ratio – which is an indicator of high stock returns that runs counter to predictions of the Sharpe-Lintner CAPM.** There is considerable evidence from Australia¹⁷, the United States¹⁸, and other equity markets¹⁹, that stocks with high book-to-market ratios have historically earned higher returns than stocks with low book-to-market ratios. While there is debate amongst academics and practitioners as to why this empirical result holds, there is no substantial disagreement that the result itself is true. This means that there is one firm characteristic (the beta estimate from regressions of stock returns on market returns) that cannot explain why some stocks earn higher returns and other stocks earn low returns, and another firm characteristic (book-to-market ratio) that can explain why some stocks earn high returns and other stocks earn low returns.
23. Given these two important pieces of evidence against the Sharpe-Lintner CAPM, an alternative approach to that of the AER in the draft decision would be to directly utilise other estimation methods, financial models or other evidence which address such shortcomings in order to develop a forecast or estimate of the return on equity that represents the best forecast or estimate possible in the circumstances. Such estimation methods, financial models or other evidence include the Black CAPM and Fama-French model.
- a) **Black CAPM.** We know that returns on low beta stocks are too high compared to what is predicted by the Sharpe-Lintner CAPM, and returns on high beta stocks are too low compared to what is predicted by the Sharpe-Lintner CAPM. But if we adopt the Black CAPM we increase the expected return on low beta stocks, and decrease the expected return on high beta stocks. So the use of the Black CAPM addresses the first empirical shortcoming of the Sharpe-Lintner CAPM.
- b) **Fama-French model.** The Fama-French model is used to estimate the expected return on a risky asset as a function of three risk factors, one of which is the HML factor. The HML factor is the difference in returns to a portfolio of high book-to-market stocks and the returns to a portfolio of low book-to-market stocks. The Fama-French model posits that firms with returns that are highly correlated with the HML factor will, on average, require higher returns. The basis for using the HML factor to estimate expected returns, as opposed to the stock characteristic of the book-to-market ratio itself, is the idea that there is a risk factor associated with the book-to-market ratio and this risk factor can be relevant to many stocks (even if the firms themselves do not have a high book-to-market ratio) and other assets (for which the concept of a book-to-market ratio does not apply). So the use of the Fama-French model addresses the second empirical shortcoming of the Sharpe-Lintner CAPM.
24. In recent previous expert reports prepared by us, including for JGN, we have not expressed the view that only one model should be used to estimate the cost of equity. There is estimation error associated with parameter estimates from all models, and there is uncertainty as to exactly why the Sharpe-Lintner

¹⁷ Brailsford, Gaunt and O'Brien (2012).

¹⁸ Fama and French (2014).

¹⁹ For example, in the United Kingdom, Michou, Mouselli and Stark (2014) and across markets (Fama and French, 1988).

CAPM has its empirical shortcomings, and uncertainty as to exactly what underlying risks are proxied by the book-to-market factor. Therefore, in an earlier report for JGN, we expressed an expert view that the following weights could be applied to the three asset pricing models with the objective of estimating a return on equity that contributes to the achievement of the allowed rate of return objective:²⁰

- a) Half weight to the Fama-French model (due to its usefulness in explaining the stock returns that we actually observe).
 - b) One third weight to the Black CAPM (because of the observed low beta bias in the Sharpe-Lintner CAPM which is corrected in the Black CAPM).
 - c) One sixth weight to the Sharpe-Lintner CAPM (due to estimation error in all models and uncertainty over the reasons for the Sharpe-Lintner CAPM not being supported empirically, be they model mis-specification or poor beta measurement).
25. It should also be noted that this weighting scheme still places the most aggregate weight on the systematic risk component of the allowed return, because beta and the expected market return form a component of all three asset pricing models. So we have not supplanted systematic risk with new measures of risk. Rather, we have made adjustments to the estimated cost of equity that directly account for the empirical limitations of the Sharpe-Lintner CAPM.
26. In our view the best approach to estimating the required return on equity is to set out the estimate from every model that is considered to be relevant and then to weight each according to an assessment of the relative strengths and weaknesses of each. This is the approach adopted in the recent expert reports we prepared. We note that JGN has made a submission to the AER also considers an alternative of an equal-weighted average of the models²¹, and that the result is not materially different from the weighting scheme that we support.
27. The key point is that the issue of whether or not to use the multi-model approach should not be clouded by argument over exactly what weights to apply. Rather, the key point is that the AER's implementation of the foundation model approach constrains the impact of material, relevant information and the use of a weighted average approach does not impose such a constraint.

3.4 What is in the AER draft determination to address the empirical evidence?

3.4.1 The high realised returns to stocks with low beta estimates

28. The AER has addressed one of the empirical shortcomings of the Sharpe-Lintner CAPM mentioned above. In estimating beta, the AER has adopted a figure of 0.7,²² from within the AER's initial range of 0.4 to 0.7,²³ based upon analysis of Australian-listed stocks. The AER has also stated that if it was to rely entirely upon the analysis of Australian-listed stocks to estimate beta that its best estimate would be 0.5.²⁴ So in its draft determination for JGN, the AER believes that it has taken account of the poor empirical performance of the Sharpe-Lintner CAPM.
29. In the draft determination for Jemena, the AER adopted a risk free rate estimate of 3.55% and a market risk premium of 6.50%. This leads to an estimate of the cost of equity of 8.10%.²⁵ This is mathematically equivalent to using the Black CAPM with an estimate of the zero beta premium of

²⁰ Note that we also assign some weight to the dividend discount model. In this section of the report, we consider asset pricing models, and the relative weight that might be assigned to each. That is, of all of the weight that is assigned to asset pricing models, half of it is assigned to the Fama-French model, and so on.

²¹ JGN (2014), Sub-section 2.4, para. 47.

²² JGN Draft Determination, Attachment 3, Sub-section 3.1, Table 3-1, p. 10; Sub-section 3.4.1, pp. 30, 51, and 81–82.

²³ JGN Draft Determination, Attachment 3, Sub-section 3.4.1, pp. 30, 51, and 81–82.

²⁴ JGN Draft Determination, Attachment 3, Sub-section 3.4.1, p. 61,

²⁵ Cost of equity in the Sharpe-Lintner CAPM = Risk free rate + Beta × Market risk premium = 0.0355 + 0.7 × 0.0650 = 0.0355 + 0.0455 = 8.10%.

2.60%.²⁶ As mentioned above, the AER makes it clear that it has not made an estimate of the zero beta premium or performed any other computation to reach its conclusion on the beta estimate. The reasoning of the AER is that there is a range of beta from 0.4 to 0.7, decided by the AER, and that it is appropriate to estimate beta at the upper end of the range.

30. However, the AER has also reached its conclusion that its beta estimate of 0.7 takes account of the beta estimates from firms listed in markets other than Australia. There is no reason that the consideration of the empirical limitations of the Sharpe-Lintner CAPM, and the beta estimates for firms listed in other markets, should be jointly considered. Put another way, there is no reason that the AER could not write down what it considers to be the beta estimate that accounts for the information from firms listed in other markets, and separately (and correctly) account for the empirical limitations of the Sharpe-Lintner CAPM. The AER has made implicit assumptions about the relative importance of these two issues, when those assumptions could be made explicit by writing them down.
31. This point is not trivial. It is an illustration of a key difference in logic that underpins the foundation model approach of the AER, and the multi-model approach proposed in our recent reports:

- a) The AER has determined that one set of information implies that the cost of equity should be set according to the Sharpe-Lintner CAPM, incorporating a beta estimate of 0.4 to 0.7. So according to the risk free rate and market risk premium used in the draft determination, the cost of equity would lie within the range of 6.15%²⁷ to 8.10%. The AER has then determined that two other sets of information considered jointly (the theory of the Black CAPM and the international firm evidence) implies that the cost of equity should be set at the upper end of the range, implying a beta estimate of 0.7 and cost of equity of 8.10%.

*There is an **implicit assumption** that, in aggregate, the two sets of secondary evidence will be insufficient to adjust the beta estimate above 0.7.*

- b) Our recent reports also considered information relating to the Black CAPM, and evidence from firms listed in other markets, but make explicit assumptions about how this information leads to an estimate of the cost of equity.

We concluded that the best estimate of equity beta from firms listed in Australia and other markets was 0.82, which is supported by an explicit assumption about the relative weights to be assigned to beta estimates for firms listed in Australia (0.58) and firms listed in the United States (0.90).²⁸ An observation for an Australian-listed stock carries twice as much weight as an observation for a stock listed in the U.S.

We also concluded that the best estimate of the zero beta premium is 3.34% (an estimate which does not account for the tendency of stocks with high book to market ratios to earn high returns – it accounts for low beta bias independent of the second empirical limitation of the Sharpe-Lintner CAPM).²⁹ We proposed that the Black CAPM is twice as informative as the Sharpe-Lintner CAPM because the Black CAPM is calibrated to the returns that we have

²⁶ According to the Black CAPM, Cost of equity = (Risk free rate + Zero beta premium) + Beta × (Market risk premium – Zero beta premium), so Zero beta premium = [(Cost of equity – Risk free rate) – Beta × Market risk premium] ÷ (1 – Beta) = [(0.0810 – 0.0355) – 0.5 × 0.065] ÷ (1 – 0.5) = [0.0455 – 0.0325] ÷ 0.5 = 0.0130 ÷ 0.5 = 2.60%.

²⁷ At the lower end of the range we have cost of equity = risk free rate + beta × market risk premium = 0.0355 + 0.4 × 0.0650 = 0.0355 + 0.0260 = 6.15%. At the upper end of the range we have cost of equity = risk free rate + beta × market risk premium = 0.0355 + 0.7 × 0.0650 = 0.0355 + 0.0455 = 8.10%.

²⁸ JGN Return on equity proposal (2014) Subsection 5.2.1.4, pp.32–33; SFG (2013 Parameters), Section 6, Table 4. p. 13; SFG (2014 Black), Section 4, para. 124; SFG (2014 Fama-French), Section 4, para. Table 3, p. 38; SFG (2015 Black) Section 4, para. 107 to 109 and Table 2.

²⁹ JGN Return on equity proposal (2014), Sub-section 5.2.1.1, p. 29; SFG (2014 Black), Section 1, para. 16.

actually observed, while the Sharpe-Lintner CAPM is not supported by returns we have actually observed.³⁰

*There is an **explicit assumption** about the impact that evidence from firms listed in other markets has on the cost of equity, and a separate **explicit assumption** about the empirical limitation of the Sharpe-Lintner CAPM.*

32. Making explicit assumptions in order to reach a conclusion does not mean that the analysis has assumed an unreasonable degree of precision. It simply means that a decision is made transparently.
33. But more importantly, the explicit assumptions we adopt have not constrained the cost of equity estimate to within a boundary defined according to first stage information. An important objection we have to the AER's decision-making under the new Rules (and which energy networks have made at every stage of the AER's decision-making process under those Rules) is that the AER process unreasonably constrains the impact that second stage information has on estimated cost of equity. The size of adjustment to the Sharpe-Lintner CAPM to account for its empirical shortcomings has nothing to do with the beta range of 0.4 to 0.7 determined by the AER according to its first stage information set.
34. The AER objects to the zero beta premium estimate of 3.34% on the basis that the estimate is imprecise.³¹ There are three problems with this rationale:
 - a) The estimates of other WACC parameters are also imprecise. For example, in its recent draft decisions the AER adopts a range for beta of 0.4 to 0.7 and a range for MRP of 5.1% to 7.8%. These estimates combine to produce a range for the risk premium for the benchmark entity of 2.04%³² to 5.46%³³ – where the upper bound is more than 2.5 times higher than the lower bound. If estimates are to be set aside because they are imprecise, few WACC parameter estimates would survive;
 - b) The AER describes the SFG estimate of the zero-beta premium as being “plausible,”³⁴ but notes it considers some other estimates to be implausible. In our view, it is not reasonable to reject *all* estimates of a parameter on the basis that *some* estimates (using particular empirical methodologies) are implausible when other estimates (using different empirical methodologies) produce estimates that *are* plausible; and
 - c) The reason the estimate of the zero beta premium is imprecise is because there is such a weak association between realised stock returns and empirical beta estimates. Not only do stocks with low beta estimates have higher returns than would be predicted by the Sharpe-Lintner CAPM, but the beta estimates themselves are so imprecisely estimated that there is imprecision in the relationship between stock returns and beta estimates.
35. To state that there is imprecision in the estimate of the zero beta premium is the same thing as saying there is imprecision in the relationship between beta estimates and stock returns. This imprecision does not go away merely by making an implicit assumption (beta is somewhere near the upper end of the range of 0.4 to 0.7³⁵) rather than an explicit assumption (zero beta premium is 3.34%). The difference is that the explicit assumption of 3.34% was made with reference to a 20 year series of stock returns for all Australian listed stocks for which there was available information, while the implicit assumption was

³⁰ As set out above, we note that JGN has recently submitted an equally-weighted average across four models – which (in the current market conditions) produces an estimate that is immaterially different from the SFG weighted-average estimate.

³¹ JGN Draft Determination, Sub-section A.2.3, pp. 162–163.

³² $0.4 \times 5.1\% = 2.04\%$.

³³ $0.7 \times 7.8\% = 5.46\%$.

³⁴ JGN Draft Determination, Attachment 3, p. 183.

³⁵ We say “somewhere near the upper end of the range of 0.4 to 0.7” because the conclusion the AER reaches on beta is determined on the basis of two components, consideration of the Black CAPM and beta estimates from firms listed in markets other than Australia, and does not state what beta would be only on the basis of consideration of the Black CAPM.

made with reference to the beta range of 0.4 to 0.7. The implicit assumption was made entirely independently of any estimated relationship between beta estimates and stock returns.

36. The implication of the discussion in this sub-section is that the AER has introduced a de facto persuasive evidence test into its consideration of empirical evidence. The AER's first stage analysis yields a beta estimate of 0.4 to 0.7 which forms the AER's initial presumption for beta. There is no reasonable possibility that the AER would revise its conclusions on the basis of the AER's second stage analysis (consideration of the Black CAPM and beta estimates from firms listed overseas) because there is such a poor relationship between imprecise beta estimates and stock returns.

3.4.2 The high realised returns to stocks with high book-to-market ratios

37. In the AER draft determination for JGN the historically high stock returns on high book-to-market stocks has no impact on the cost of equity. As discussed above, the Fama-French model, although identified by the AER as being relevant, is given no weight in the AER's estimation of the return on equity, and the AER otherwise gives no other consideration of the empirical result that stocks with high book-to-market ratios earn higher returns than predicted by the Sharpe-Lintner CAPM.
38. For clarity, we reiterate the difference between the characteristic of a stock with a high book-to-market ratio, and a stock which has returns that are positively associated with the book-to-market factor. Some stocks (like energy networks) have a high book-to-market ratio because a high proportion of their market value of equity is derived from economic value that appears on the balance sheet. It is possible for a stock to have returns that are positively associated with the book-to-market factor, while the company itself does not necessarily have a high book-to-market ratio. But most of the time when a stock has a high book-to-market ratio it also has high exposure to the book-to-market factor.
39. The reason the book-to-market factor became important for estimating the cost of capital is that researchers first observed that stocks with a high book-to-market ratio earn returns that are higher than those compared to the prediction of the Sharpe-Lintner CAPM.³⁶ Then, on the basis of this first observation, researchers started to use the HML factor as a useful way to explain why some stocks earn higher returns than other stocks.³⁷ This is what is meant by explaining the "cross section" of stock returns – explaining why, across a sample of stocks, one stock typically earns higher returns than another stock and vice versa.
40. The Fama-French model is one approach to accounting for the empirical evidence that stocks with high book-to-market ratios generally earn high returns. The AER objects to the use of the Fama-French model on the grounds that the model is sensitive to estimation periods and methodologies, that the model is not clearly estimating expected returns, a claimed lack of theoretical foundation, and supposed complexity in implementation.³⁸ In a companion report we respond to each of these objections of the AER.³⁹ We point out that all of the parameter estimates that the AER relies upon are sensitive to estimation periods and methodologies and that the Fama-French model is not complex to implement (and, in addition, complexity in itself is not a criteria for rejection of the model). The methods for estimating factor returns are discussed in academic research⁴⁰ and when we implemented the model we followed those methods.
41. This leads to the other two concerns of the AER, namely expected returns and theory. We consider these two concerns below.
42. The AER's consideration of expected returns has two aspects. The first aspect is that the AER identifies that there is a difference between an econometric model that fits realised returns data and

³⁶ Fama and French (1992).

³⁷ Fama and French (1993).

³⁸ JGN Draft Determination, Attachment 3, Sub-section 3.4.1, p. 52.

³⁹ SFG (2015 FF), Section 3, pp. 9–24.

⁴⁰ Fama and French (1993), Brailsford, Gaunt and O'Brien (2012).

another model that predicts future expected returns.⁴¹ So, according to the AER, maybe the model can explain returns we have observed in the past but it is not likely to be useful in estimating expected returns.

43. The second aspect is that the AER suggests that the Fama-French model is not clearly determining return on the basis of risk. So according to the AER, the high returns to stocks with a high book-to-market factor might represent something other than compensation to investors for bearing the risk of those stocks.
44. However, the AER falls short of reaching a conclusion as to why there have been such consistently high returns to high book-to-market stocks over time. At no point in the past two years during which the AER's rate of return guideline was developed, and the JGN draft determination written, has the AER reached either of the following conclusions – that the book-to-market effect is a curious aspect of past returns data that is not expected to be repeated, or that the book-to-market effect is the result of a market inefficiency in which investors are able to earn abnormal returns by buying high book-to-market stocks.
45. The AER's concerns are entirely over ambiguity in the model's development and application. The AER cites advice from Handley (2014) – considered in Section 4 of our current report – that factors other than HML might explain stock returns (for example, Fama and French, 2014), that some researchers have suggested the book-to-market effect is not due to risk (for example, Shleifer and Vishny, 1997), and that the evidence in favour of multi-factor models is impacted by tests which have low power to reject multi-factor models (for example, Lewellen, Nagel and Shanken, 2010).
46. There is lingering doubt over whether some new variable that correlates with past returns is useful to estimate expected returns, and this doubt is exacerbated by new models that identify more factors. And academics write papers that put forward different explanations of the book-to-market effect.
47. Yet there is no question that the book-to-market effect is present in the stock return data over time and across markets, and neither the AER nor Handley (2014) reach any conclusion on how this empirical evidence can be accommodated in their estimate the cost of equity. Rather, when estimating the cost of equity, the AER sets this evidence aside, affording it no weight. Consequently, the AER's cost of equity estimate does not reflect (and is inconsistent with) the decades of evidence that shows that high book-to-market stocks have persistently earned returns above what is predicted by the Sharpe-Lintner CAPM.

3.5 Dividend discount model

48. In this report we focus on the application of the dividend discount model to estimate the relative risk of a benchmark energy network, compared to the broader market. The AER has adopted the position that the dividend discount model cannot be used for this purpose for number of reasons that contribute to estimation error:
 - a) Small sample size of listed energy networks in Australia;
 - b) The equivalent beta⁴² estimate we generate for listed energy networks of 0.94 is higher than beta estimates implied by regressions of stock returns on market returns; and
 - c) The equivalent beta we generate for listed energy networks is estimated, on average, over 12 years and varies over time if we examine shorter time periods.⁴³

⁴¹ JGN Draft Determination, Attachment 3, Sub-section A.2.2, p. 177.

⁴² The term "equivalent beta" here means the beta estimate that, if inserted into the Sharpe-Lintner CAPM, would imply the same cost of equity. It is a metric computed by dividing the equity risk premium for a listed energy network by the market risk premium.

⁴³ JGN draft determination, Sub-section C.3, pp. 227 to 231

49. None of these reasons are valid for excluding consideration of the dividend discount model from consideration for use in determining the risk of a benchmark energy network. We discuss these issues in detail in a companion report.⁴⁴ To summarise our response to the AER's concerns we note that:

- a) The small sample size is equally problematic for risk measured using any estimation technique, including the beta estimate in the Sharpe-Lintner CAPM. Yet the AER places no direct reliance on a beta estimate from a sample of firms listed in other markets.
- b) It is not appropriate to ignore evidence merely because it contradicts other evidence. The AER has only one approach to measuring risk (regressions of stock returns on market returns), applies that single approach to a small sample of firms (total of nine with just four currently listed), and has acknowledged there are empirical limitations of this risk metric (by referring to the Black CAPM). Yet a concern that the AER has with a different risk metric is that it is too high compared to its preferred metric.

The AER acknowledges that if we simply input a regression-based estimate of beta in the Sharpe-Lintner CAPM the resulting cost of equity will probably be too low and so selects beta of 0.7. As mentioned previously, there is no theoretical or empirical reason why the upper bound of the AER's beta range (0.4 to 0.7) is the right number to offset the empirical limitation of the Sharpe-Lintner CAPM. An equivalent beta of 0.94 leads to cost of equity estimate that is close to the cost of equity implied by the Fama-French model. So there is no basis for determining that, on its face, an equivalent beta is too high.

- c) Over short time periods there is an increase in the variation in our cost of equity estimates for listed networks. This is the reason for estimating relative risk over an extended time period, and is the same justification for estimating beta from regression analysis over the same time period.
50. The AER excludes dividend discount model analysis in considering the risk of a benchmark energy network. The fundamental basis for this exclusion is the AER's view that, at present, it is not possible to reliably determine whether a listed energy network is high or low risk. Yet what remains, then, after having ruled out the Black CAPM and the Fama-French model, is one remaining risk metric (regression-based estimate of beta) which is an unreliable measure of risk.
51. In contrast, we consider that dividend discount model analysis provides one useful measure of relative risk and acknowledge the potential estimation error associated with this approach in our recommended weight of 25%.

3.6 Conclusion

52. In conclusion, with respect to the first empirical limitation of the Sharpe-Lintner CAPM (low beta stocks earn higher returns than predicted by the Sharpe-Lintner CAPM) and the second empirical limitation of the Sharpe-Lintner CAPM (high book-to-market stocks earn higher returns than predicted by the Sharpe-Lintner CAPM), we consider that the best way to handle this limitation is as follows.

- a) Make the best estimate of equity beta for the Sharpe-Lintner CAPM on the basis of evidence from firms listed in Australia and other markets.
- b) Make the best estimate of the zero beta premium.
- c) Make the best estimate of the market risk premium.
- d) Make the best estimate of risk coefficients and risk premiums in the Fama-French model on the basis of firms listed in Australian and other markets.
- e) Estimate the cost of equity from the Sharpe-Lintner CAPM, the Black CAPM, and the Fama-French model.

⁴⁴ SFG (2015 DDM), Sub-section 5.4, pp. 30 to 33.

- f) Apply weights to the cost of equity from the Sharpe-Lintner CAPM, the Black CAPM and the Fama-French model to reach a conclusion on the cost of equity. The selection of weights requires judgement based upon all available evidence and we do not propose that our recommended approach requires no judgement. However, the need for judgement does not mean that anyone in the regulatory process – regulators, businesses, or consumers – is better off under an alternative approach in which the decision-making simply exercises judgement by writing down a conclusion.⁴⁵
53. This approach is also what we consider best meets the requirements of the Rules. It means that all relevant information is taken into account in estimating the allowed return on equity.
54. In contrast, the manner in which the AER implements its foundation model approach is contradictory to the Rules because it acts to constrain information which would lead to an allowed return that represents the prevailing cost of funds.
55. The AER approach to dealing with the first empirical limitation of the Sharpe-Lintner CAPM is simply to write down a beta estimate of 0.7. This is the upper bound of the AER's range for beta of 0.4 to 0.7. But there is no relationship between the manner in which the AER's range was estimated and an appropriate adjustment to account for the returns to low beta stocks, and the AER's adjustment for low beta is itself unstated because it is commingled with the AER's consideration of beta estimates from stocks listed in markets other than Australia.
56. The AER approach to dealing with the second empirical limitation of the Sharpe-Lintner CAPM is to give it no consideration. Neither the AER, nor Handley (2014), reaches any conclusion as to the most likely reason for the persistence of the book-to-market effect. The AER simply decides that there is sufficient ambiguity over what the Fama-French model represents that the returns performance of high book-to-market stocks is irrelevant to its task of estimating the cost of equity.

⁴⁵ As set out above, we note that JGN has recently submitted an equally-weighted average across four models – which (in the current market conditions) produces an estimate that is immaterially different from the SFG weighted-average estimate.

4. What is the advice to the AER on the foundation model approach?

4.1 Introduction

57. Our terms of reference specifically note a report by Handley (2014) that is used by the AER in support of the AER's foundation model approach. So in this section we respond to the specific advice provided by Handley (2014). We proceed in the order of questions posed to Handley (2014) and his response to those questions, highlighting areas of agreement and disagreement.
58. At the outset, however, we make one very important point. The foundation model approach adopted by the AER and by Handley (2014) is supported by research which was published from 1964 to 1972. The Sharpe-Lintner CAPM was developed by Sharpe (1964) and Lintner (1965). Seven years later, Black, Jensen and Scholes (1972) documented that the relationship between beta and realised returns was too flat to support the Sharpe-Lintner CAPM. Black (1972) proposed an alternative theory of asset pricing that relies upon a less restrictive assumption (different borrowing and lending rates). The theory of Black (1972) generates a flatter relationship between beta and expected returns.
59. The approach of the AER is to estimate beta using a regression of stock returns on market returns, and then adjust beta upwards by an unspecified amount to account for the empirical limitations of the Sharpe-Lintner CAPM. The upper bound for beta of 0.7 is formed without any reference to the empirical performance of the Sharpe-Lintner CAPM.
60. None of the research on asset pricing models published in the last 43 years has led to any refinement to the models used by the AER to estimate the cost of equity. The cost of equity as estimated by the AER:
 - a) Does not reflect the empirical fact that high book-to-market stocks earn high returns.
 - b) Does not incorporate any measurement of the zero beta return to populate the Black CAPM.
 - c) Does not incorporate any consideration of the projected earnings and dividends of listed energy networks.
61. This means that the AER's model selection (Sharpe-Lintner CAPM only) and firm-specific risk parameter (beta only, estimated from a regression of stock returns on market returns) are ultimately based upon research and estimation techniques published four decades ago. The research and estimation techniques adopted by the AER have not been supported by empirical evidence over these four decades. Further, there is empirical evidence that can explain why some stocks earn higher returns than other stocks but this does not factor into the AER's analysis.
62. The most appropriate way to characterise the AER's foundation model approach is as a de facto persuasive evidence test. The manner in which the AER, and Handley (2014), evaluate prior research means there is no reasonable chance that the AER will be persuaded to change its approach. The reason for this is that neither the AER, nor Handley (2014), reach conclusions on the basis of published evidence from the last four decades.
63. By this we mean that both the AER and Handley refer to disparate explanations for the empirical performance of low beta and high book-to-market stocks, but without reaching a conclusion as to the most likely explanations. In addition, neither the AER nor Handley ask whether the most likely explanations suggest that we should use something in addition to the Sharpe-Lintner CAPM to estimate the cost of equity.
64. Rather, the Handley and the AER ask whether any one model is sufficiently reliable to supplant the Sharpe-Lintner CAPM and point to disagreement amongst other researchers as a reason to retain the use of a single asset pricing model. It does not logically follow that by citing areas of disagreement that the best approach is to make no changes whatsoever to what was done 40 years ago.

4.2 Foundation model approach

65. The first question posed to Handley (2014) is whether the AER's foundation model approach would be likely to deliver estimates of the cost of equity that are consistent with achieving the rate of return objective.⁴⁶ Handley (2014) agrees with the use of the AER's foundation model approach to estimating the cost of equity.
66. Handley (2014) begins his assessment with a summary of the AER's single model (Sharpe-Lintner CAPM) approach to estimating the cost of equity, and makes a comparison to the multi-model approach that places weight on alternative models – the Black CAPM, Fama-French model and dividend discount model.
67. Handley (2014) then makes the point that expected returns should reflect investment risk, and that the Sharpe-Lintner CAPM is an appropriate model to use as the foundation model as it reflects a trade-off between risk and expected return. In the following paragraph, Handley (2014) acknowledges the empirical limitation of the Sharpe-Lintner CAPM that we discussed in Section 3:
- that the relation between beta and average stock returns is too flat compared to what would otherwise be predicted by the Sharpe-Lintner CAPM – a result often referred to as the low beta bias.⁴⁷
68. However, Handley (2014) then makes clear that the objective is to determine a fair rate of return rather than identify the model that best explains past stock returns. He then agrees with the AER's consideration of the Black CAPM to inform its estimate of beta in the Sharpe-Lintner CAPM, the AER's use of the dividend discount model to inform its estimate of the market risk premium, and the AER's exclusion from consideration of the Fama-French mode. The reasons for this conclusion are not presented in the first section, as Handley (2014) discusses the models in more detail in subsequent sections.
69. This first section provides a few areas of immediate agreement and disagreement. We agree that the Sharpe-Lintner CAPM has a role to play in estimating the cost of equity, and that it does not seem to be useful in explaining past stocks returns, and that expected returns should reflect investment risk.
70. Where we disagree with Handley (2014) is:
- a) **In the AER's use of the Black CAPM to inform its estimate of equity beta in the Sharpe-Lintner CAPM.** The AER has not performed any computation of what the beta estimate would be if the Black CAPM was considered separately from the AER's consideration of beta estimates from firms listed in markets overseas. As discussed in Section 3, the AER's process of specifying a beta range of 0.4 to 0.7 constrains the impact that the Black CAPM can have on the cost of equity and the AER's beta range is based upon analysis that is entirely independent of the low beta bias, and entirely independent of the Black CAPM. Therefore, the AER has not performed any computation to determine whether constraining the beta estimate at 0.7 is appropriate consideration for the empirical result that the Sharpe-Lintner CAPM generates expected returns that fall below realised returns.
 - b) **In the AER's exclusion of the Fama-French model from consideration.** Neither the AER, nor Handley (2014) reach a conclusion on why stocks with high book-to-market ratios earn high returns. The Handley (2014) assessment of the Fama-French model is that there is disagreement amongst researchers as to the cause of the book-to-market effect, including what true economic risks might be proxied by the HML factor, and this disagreement means that we should not use the model.

⁴⁶ Handley (2014), p. 3.

⁴⁷ Handley (2014), p. 5.

Yet neither the AER, nor Handley (2014), make any recommendation as to how we should take into account the empirical result that high book-to-market stocks earn high returns. This means that there is an implicit assumption made by the AER and by Handley (2014) that the book-to-market effect is either a curious statistical anomaly, or represents something other than risk exposure, or somehow relates to all the other stocks with exposure to the HML factor except for the Australian-listed companies analysed by the AER in estimating the cost of equity.

We do not consider it reasonable to exclude the Fama-French model from consideration on the grounds that researchers continue to debate the underlying economic reasons for the book-to-market effect. Researchers will always search for better explanations of the risks incorporated into asset prices and it is up to the AER and its advisors to make the best interpretation of that evidence to estimate the cost of equity. Neither the AER, nor Handley (2014) make any rationalisation of the evidence on the book-to-market effect to say, “on the best available evidence before us, here is the reason why high book-to-market stocks earn high returns.”

- c) In the AER’s use of the dividend discount model to only estimate the market risk premium (as opposed to its use also to estimate the cost of capital for energy networks) and the assumptions underlying the AER’s implementation of the dividend discount model.**

Handley’s (2014) critique of the dividend discount model is that it is dangerous to use an approach yet to be generally accepted in order to set allowed returns on billions of dollars of regulated assets. This materially overstates the potential risk associated with estimation error, given that we have documented what the cost of equity estimates are, over time for a 12.5 year period, and our estimates exhibit lower dispersion over time and across firms than other estimation approaches. Further, we do acknowledge that sole reliance should not be placed on any one estimation approach, which is explicitly quantified in our recommendation that dividend discount model analysis be given 25% weight to estimate relative risk of a benchmark energy network compared to the market.

4.3 Departure from the foundation model approach

4.3.1 Introduction

71. The second question posed to Handley (2014) is whether any material from service providers and three consulting reports provides a compelling reason to depart from the core framework underpinning the foundation model approach. Handley (2014) states that he does not see any reason to depart from the AER’s core framework underpinning the foundation model approach, and comments on a number of specific items.
72. Our current report is focused on models to estimate the cost of equity. So we refer to items (i) to (iii) of the report by Handley (2014), which are the Fama-French model, the Black CAPM and dividend discount models. In our discussion of the Black CAPM, we also refer to Handley’s (2014) comments on beta estimates for firms listed in markets outside of Australia, due to the AER’s joint consideration of these beta estimates and the Black CAPM when estimating the equity beta.

4.3.2 Fama-French model

Interpreting tests of asset pricing models

73. Handley (2014) begins his assessment with reference to research by Lewellen, Nagel and Shanken (2010). The researchers provide a critique of tests of asset pricing models to make the general point that researchers need to be more careful in their empirical assessment of asset pricing models. The researchers basically say that in examining factors that might explain asset returns we need to look at all

the available evidence from a statistical test (not just estimates of “alpha” – the intercept from a regression of stock returns on factor returns), and use more powerful tests to identify true economic factors from statistical anomalies.

74. The specific comment of Handley (2014) made in reference to the paper by Lewellen, Nagel and Shanken (2010) is as follows. We have added in the words in brackets at the end of the paragraph from the research paper that did not appear in the Handley quote.

The third key result is that none of the models provides much improvement over the simple or consumption CAPM when performance is measured by the GLS R^2 or q The average GLS R^2 is only 0.08 across the five models using size-B/M portfolios and 0.02 using the full set of 55 portfolios (compared with GLR R^2 s of 0.00-0.02 for the simple and consumption CAPMs).⁴⁸

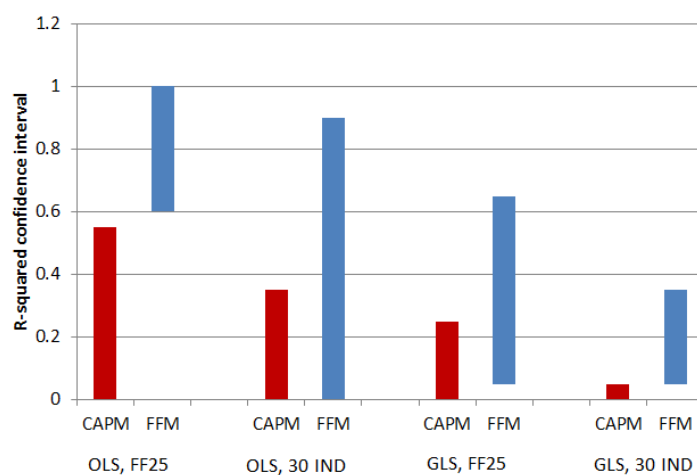
75. However, the “five models” that the authors refer to do not include the Sharpe-Lintner or Fama-French models.⁴⁹ It is not clear how the empirical performance of five *other* models can reasonably be used as the basis for eliminating the Fama-French model from further consideration. The AER and service providers all agree that the Sharpe-Lintner and Fama-French models are relevant and Lewellen, Nagel and Shanken (2010) provide comparative results for both of these models. We can see no reason to focus on the results for *other* models that are not in consideration in the case at hand.
76. In relation to the two relevant models, Lewellen, Nagel and Shanken (2010) report that:
- a) The Sharpe-Lintner CAPM has zero explanatory power under any variation of the tests that they perform; and
 - b) The Fama-French model generally has statistically significant explanatory power and uniformly out-performs the Sharpe-Lintner model.
77. Lewellen, Nagel and Shanken (2010) advise that a more meaningful interpretation is obtained by considering the confidence interval for R^2 ,⁵⁰ and they follow that approach when reporting results. The various R^2 statistics for the Sharpe-Lintner and Fama-French models are summarised in Figure 1 below.⁵¹ For all data sets and methodologies examined, the Fama-French model out-performs the Sharpe-Lintner model (a higher R^2 statistic representing superior performance in terms of goodness of fit).

⁴⁸ Lewellen, Nagel and Shanken (2010), p. 189, quoted at Handley (2014), p. 7.

⁴⁹ The five models are: (i) Lettau and Ludvigson’s (2001) conditional consumption CAPM (CCAPM); (ii) Lustig and Van Nieuwerburgh’s (2004) conditional CCAPM, in which the conditioning variable is the housing collateral ratio MYMO; (iii) Santos and Veronesi’s (2006) conditional CAPM, in which the conditioning variable is the labour income-to-consumption ratio; (iv) Li, Vassalou, and Xing’s (2006) investment model, in which the factors are investment growth rates for households, nonfinancial corporations, and the non-corporate sector; and (v) Yogo’s (2006) durable consumption CAPM, in which the factors are the market return, and the growth rates in durable and nondurable consumption. The unconditional CAPM and Fama-French models are also considered as “benchmark” models.

⁵⁰ Lewellen, Nagel and Shanken (2010), p. 186.

⁵¹ The figure shows two different R-squared figures based upon ordinary least squares and generalised least squares (where generalised least squares is a less restrictive statistical technique and one which is favoured by the researchers). The label “FF25” refers to portfolios constructed by splitting sample firms into 25 portfolios on the basis of the firm’s market capitalisation and book-to-market ratio. The label “30 IND” refers to sample portfolios that also include 30 portfolios formed on an industry basis, for a total of 55 portfolios.

Figure 1. Sharpe-Lintner and Fama-French explanatory power

Source: Lewellen, Nagel and Shanken (2010), Table 1, p. 188.

78. Handley (2014) focuses on the reduction in the R^2 statistic for the Fama-French model when a generalised least squares approach is used, rather than an ordinary least squares approach, and when industry portfolios are added to the analysis in addition to portfolios formed on the basis of market capitalisation and book-to-market ratio.
79. Handley (2014) states that:
- using Fama and French's 25 size-B/M portfolios as test assets results in an apparently impressive OLS R^2 of 0.78 but when the set of test assets is expanded to include 30 industry portfolios, then the more relevant resultant GLS R^2 is only 0.06.⁵²
80. Handley (2014) does not mention that Lewellen, Nagel and Shanken (2010) report that:
- a) The R^2 statistics for the Sharpe-Lintner CAPM never reach statistical significance in that the confidence interval always includes zero; and
 - b) The highest of the four point estimates for the Sharpe-Lintner CAPM R^2 statistic is only 1%.
81. Indeed, Lewellen, Nagel and Shanken (2010) conclude that:
- The confidence interval provides a good summary measure of just how poorly the CAPM works.⁵³
82. In our view, it is quite unreasonable to conclude that Lewellen, Nagel and Shanken (2010) provide support for the exclusive use of the Sharpe-Lintner CAPM. The selective focus on one aspect of one paper is no substitute for a reasoned holistic consideration of the relevant literature. Even a holistic consideration of this *one paper* would have led the AER to a different conclusion.
83. To be clear, we do not suggest that this paper should be used to support the contention that the Fama-French model should be used *instead of* the Sharpe-Lintner CAPM. Again, our view is that both models are relevant and both can contribute to the allowed rate of return objective. Our conclusion in relation to this paper is simply that it does *not* support the AER's contention that the Sharpe-Lintner CAPM should be used to the exclusion of the Fama-French model.

⁵² Handley (2014), p. 7.

⁵³ Lewellen, Nagel and Shanken (2010), p. 187.

Non-risk explanations for the returns performance of high book-to-market stocks

84. The next two paragraphs of Handley's (2014) report allude to potential non-risk explanations for the explanatory power of the Fama-French model. In chronological order, Handley refers to four papers.
- a) Handley (2014) refers to the potential explanation put forward by Fama and French (1993) when they first introduced the model – that the book-to-market factor proxies for the risk of financial distress.
 - b) Lakonishok, Shleifer and Vishny (1994) put forward a counter-argument based upon market inefficiency, in that investors routinely undervalue high book-to-market stocks, so the book-to-market effect is not driven by risk.
 - c) Daniel and Titman (1997) make the point that the book-to-market characteristic has better explanatory power than the HML factor.
 - d) Finally, Daniel and Titman (2012) make the point that the way researchers often test factor models can lead to the acceptance of a factor model because the test procedure has low power to reject.
85. These four research papers are discussed over three paragraphs by Handley (2014). The assessment by Handley (2014) of these papers is that there are possible risk and non-risk based explanations for the book-to-market effect, and that these two possible interpretations are sufficient for the Fama-French model to be given no consideration by the AER. Handley (2014) states that unless the model determines returns on the basis of risk then the resultant estimates of the cost of equity would be inconsistent with the allowed rate of return objective.⁵⁴
86. The problem with this assessment by Handley (2014) is that neither Handley, nor the AER, reaches any conclusion as to whether the book-to-market effect has a risk or non-risk based explanation. All four of the papers cited above agree that high book-to-market stocks earn high returns, and none of the four papers contend that this book-to-market effect is a statistical curiosity that will not persist.⁵⁵ So we are left with the empirical fact, now established over decades and across markets, that the book-to-market effect exists and there is debate as to why this effect exists.

Making sense of empirical evidence as a basis for estimating the cost of equity

87. The four papers cited immediately above deserve some more attention. The paper by Fama and French (1993) was the first paper in which researchers took the empirical observation that high book-to-market stocks earn high returns and explain this in terms of a factor model. The reason the researchers did this is because finance theory says that we can have multiple risk factors⁵⁶ that are accounted for in asset prices and therefore expected returns, once the restrictive assumptions that underlie the Sharpe-Lintner CAPM are relaxed. The HML factor was useful in explaining why some portfolios earn high returns and other stocks earn low returns. Fama and French (1993) understood that HML was just a proxy for an underlying economic factor, and put forward one possible explanation – that exposure to HML represents exposure to the risk of financial distress.
88. Lakonishok, Shleifer and Vishny (1994) disagreed with the distress factor explanation. They contend that investors persistently undervalue high book-to-market stocks, and overvalue low book-to-market stocks, because they have a tendency to extrapolate past growth rates into the future (and low past

⁵⁴ Handley (2014), p. 8,

⁵⁵ Daniel and Titman (1997, p. 31) suggest that it was possible that in the 1960s and 1970s that investors previously believed that size and book-to-market ratios were proxies for systematic risk and that if this belief no longer holds then the high returns to small stocks and book-to-market stocks would not be expected to persist. But this is different to saying that the book-to-market effect was just a quirk of the data analysed from the 1960s to the earlier 1990s that would not repeat in another random sample.

⁵⁶ For example, see Ross (1976) on the arbitrage pricing theory, and Merton (1973) on the intertemporal capital asset pricing model, referred to by Fama and French (2004) as theoretical explanations for the performance of the Fama-French model.

- growth rates are a feature of high book-to-market stocks). The researchers cannot find evidence that investing in high book-to-market portfolios is fundamentally riskier than investing in low book-to-market portfolios.
89. Yet the researchers do not put forward a convincing argument as to why the abnormal returns available to such a simple trading strategy – buying high book-to-market stocks – have not been eroded over decades by sophisticated institutional investors. With the benefit of two decades of hindsight we know that the book-to-market effect has not been eroded, despite institutional investors being able to trade with high frequency on the basis of easily accessible data.
 90. So we have limitations to both the risk and non-risk based explanations for the book-to-market effect. On the one hand we have competing explanations for the underlying risks that are proxied by the HML factor, and researchers disagree over those explanations. On the other hand we have no sound explanation as to why an incredibly simple trading strategy to earn abnormal returns would be allowed to persist for decades, given the information and trade execution resources available to institutional investors.
 91. In the face of these two limitations, the view of the AER and Handley (2014) is to ignore the book-to-market effect and persist with a single asset pricing model that clearly does not explain the cross section of stock returns better than the HML factor, or the book-to-market characteristic. The view of energy network businesses, and our view, is that the Fama-French model be given a role to play in estimating the cost of equity.
 92. The papers by Daniel and Titman (1997, 2012) provide a different perspective on the book-to-market effect. These researchers advocate that we can form better benchmarks of expected returns by considering matched portfolios on the basis of firm characteristics, rather than constructing returns factors.
 93. In the context of the book-to-market effect this has the following implication. The use of the HML factor in benchmarking means that the analyst runs a regression of stock returns on the HML factor (and other factors such as the market factor, if needed) and determines whether the intercept from this regression is significantly different from zero. The non-intercept part of the equation represents the expected return, and the intercept represents the abnormal return. So if the intercept is significantly positive the analyst would conclude that the portfolio earned a positive abnormal return.
 94. Another way to estimate the expected return is to form a benchmark portfolio with similar characteristics of the portfolio of interest. So the benchmark portfolio would contain stocks with a similar book-to-market ratio as the portfolio of interest (and similar characteristics on other dimensions like beta, if required).
 95. The analysis conducted by Daniel and Titman (1997) demonstrates that using the Fama-French model to estimate expected returns might be an incomplete description of returns. The reason the Fama-French model might represent an incomplete description of expected returns is because high book-to-market stocks earn positive returns above what we would expect given their exposure to the HML factor.⁵⁷
 96. Daniel and Titman (2012) extend this reasoning to a suite of multi-factor models that were derived subsequent to the publication by Fama and French (1993). In Table 1 of the more recent paper, Daniel and Titman (2012) list 13 factor models for consideration, all of which have been motivated by the inability of the Sharpe-Lintner CAPM to explain why some stocks earn higher returns than others.
 97. The point made by Daniel and Titman (2012) is that often when models are tested by researchers, the researchers attempt to explain the variation in returns from the same 25 portfolios of stocks sorted according to size and book-to-market ratio. So there could be a number of empirical variables that are

⁵⁷ See Daniel and Titman (1997), Sub-section VI.B, Table VI, p. 22. The intercept in the final row of the table is a significantly positive 0.354% per month. This means there is a positive return of 0.354% per month which is left unexplained by the three factor model.

correlated with stocks' size and book-to-market ratio, and which therefore explain why some portfolios earn higher returns than others, but that there is a smaller number of true economic risk factors that explain stock returns. So the key point made by Daniel and Titman (2012) is that some newly identified factors published in recent papers might not in reality capture distinct risks, but rather are just different proxies for unspecified risks.

98. At no stage do Daniel and Titman (2012) express support for the continued use of the Sharpe-Lintner CAPM as the single asset pricing model to explain expected returns. Nor do Daniel and Titman (2012) reach any conclusion as to why high book-to-market stocks earn high returns. The motivation for all the factor models listed in Table 1 of their paper, and for the analysis performed by Daniel and Titman (2012) themselves, is the pervasiveness of the book-to-market effect over time.
99. Handley (2014) does not attempt to interpret the evidence reported by either Daniel and Titman (1997) or Daniel and Titman (2012). Handley (2014) merely points to the research as evidence that there is disagreement about what factors are incorporated into asset prices and expected returns. From this disagreement Handley (2014) proceeds to rule out the use of the Fama-French model in estimating the cost of equity because there are alternative explanations in the finance literature.

Recent empirical evidence

100. The last two papers referred to by Handley (2014) are a working paper by Fama and French (2014) and published research of Savor and Wilson (2014). Fama and French (2014) present analysis on two new factors which are labelled RMW for "robust minus weak profitability"⁵⁸ and CMA for "conservative minus aggressive change in assets." The evidence presented by Fama and French (2014) opens up the possibility that measures of profitability and investment might provide metrics for estimating expected returns, although Fama and French (2014) place a caveat on their analysis, notably that it could be sample-specific (and by implication, therefore, not make the HML factor redundant in general).
101. While Handley (2014) introduces the recent work by Fama and French (2014) into his discussion, he makes no interpretation of the evidence. Indeed, in its current state, Fama and French (2014) make no definitive interpretations of their own evidence. What they currently present is a set of new results that might provide a new factor to explain stock returns and which therefore entices researchers to look more closely at profitability and investment.
102. The final paper considered by Handley (2014) is the recent published evidence by Savor and Wilson (2014). Savor and Wilson (2014) examine the relationship between beta estimates and stock returns in days in which important economic news is released. The news relates to inflation, unemployment and interest rates and trading days associated with these news releases comprise 11% of trading days. The researchers find that beta estimates are positively associated with realised returns on announcement days, and that there is a zero or negative relationship between beta estimates and realised returns on non-announcement days. The authors speculate that announcement day returns provide a clearer signal of aggregate risk and expected future market returns as a result of reduced noise or disagreement on announcement days.
103. What we learn from Savor and Wilson (2014) is that there is some potential for a regression-based estimate of beta to form part of an estimate of the cost of equity. To use beta in such a way would be consistent with the application of the Sharpe-Lintner CAPM, the Black CAPM and the Fama-French model to estimate the cost of equity, as all models include equity beta parameters.
104. What we also learn from Savor and Wilson (2014) is that it is implausible that we should consider the Sharpe-Lintner CAPM as the sole asset pricing model used to estimate the cost of equity. Savor and

⁵⁸ A firm is classified as having robust profitability if its pre-tax return on equity is in the top 30% of firms, and classified as having weak profitability if its pre-tax return on equity is in the bottom 30% of firms. A firm is classified as having a conservative investment approach if its percentage change in total assets is in the bottom 30% of firms, and classified as having an aggressive investment approach if its percentage change in total assets is in the top 30% of firms.

Wilson (2014) acknowledge that no asset pricing model can explain the different relationships between beta estimates and returns on announcement and non-announcement days.⁵⁹ In addition, their regression results also clearly demonstrate that exposure to the HML factor increases their ability to explain stock returns on non-announcement days.⁶⁰ Again, this implication is consistent with the use of the Sharpe-Lintner CAPM, the Black CAPM and the Fama-French model to estimate the cost of equity.

Conclusions

105. The conclusion of Handley's assessment of the Fama-French model is as follows.

The key message is that our understanding of empirical asset pricing is still far from complete.⁶¹

106. Unfortunately, decisions need to be made on the basis of an incomplete understanding of asset pricing, using the best available research. That requires conclusions to be reached in light of alternative theories and empirical evidence. Handley (2014) mentions a suite of seven research papers in his discussion of the Fama-French model, some of which specifically relate to the book-to-market effect (Fama and French, 1993; Lakonishok, Shleifer and Vishny, 1994; Daniel and Titman, 1997; and Fama and French, 2014), two of which relate to tests of asset pricing models (Lewellen, Nagel and Shanken, 2010; and Daniel and Titman, 2012) and one of which provides evidence in favour of the Sharpe-Lintner CAPM on some days and the Fama-French model on other days (Savor and Wilson, 2014).
107. On the basis of this review, Handley (2014) reaches no conclusion on how we should handle the empirical fact that stocks with a high book-to-market ratio earn high returns. Handley (2014) does not say whether or not we will have a better estimate of the cost of equity if we place some reliance on the cost of equity estimate from the Fama-French model. His conclusion is simply that researchers have not reached a consensus on the underlying reasons for the book-to-market effect. From this conclusion, Handley (2014) makes the further conclusion that the AER's sole reliance on the Sharpe-Lintner CAPM will achieve the rate of return objective, when none of the papers cited provide empirical support for this proposition. There is one cited paper that provides empirical support for the Sharpe-Lintner CAPM on some trading days, and that same paper also provides support for the Fama-French model based upon the vast majority of trading days (Savor and Wilson, 2014).
108. In our view, the only way the conclusion of Handley (2014) can be reconciled with the evidence cited in his paper, is if there is a de facto persuasive evidence test applied to the Sharpe-Lintner CAPM, and that in Handley's (2014) opinion that test has not been met. The rationale behind Handley's support for the sole use of the Sharpe-Lintner CAPM appears to be that disparate explanations for the empirical performance of the Fama-French model are sufficient to maintain a default position in favour of the Sharpe-Lintner CAPM.
109. In our view, what the Rules require is an identification of all estimation methods, financial models and other evidence that may be relevant to estimating the return on equity. Following that identification, and assuming that there is more than one information source that is relevant, some weight will need to be ascribed to the information sources or they will somehow need to be combined to produce a point estimate. The Rules do not specify that the Sharpe-Lintner CAPM is to be used unless a model about which there is no debate or potential weaknesses is identified. Each of the information sources, including the Sharpe-Lintner CAPM must be fairly assessed if the estimate of the return on equity is to be arrived at on a reasonable basis and be the best forecast or estimate possible in the circumstances. The evidence supports a finding that the best forecast or estimate is one that is properly informed by

⁵⁹ Savor and Wilson (2014), Section 1, p. 173.

⁶⁰ Savor and Wilson (2014), Sub-section 2.7, Table 2, Panel E, p. 181. The table shows that the coefficient on exposure to the HML factor is a significantly positive 0.012% per day (t -statistic = 3.94) on non-announcement days.

⁶¹ Handley (2014), p. 9.

estimates from a range of evidence, including the Sharpe-Lintner CAPM, the Black CAPM and the Fama-French model.

4.3.3 Black CAPM

110. Handley's (2014) opening remarks begin with reference to using the Black CAPM instead of the Sharpe-Lintner CAPM to estimate the cost of equity. There has been no proposal to use the Black CAPM instead of the Sharpe-Lintner CAPM.
111. Handley (2014) proceeds to consider the empirical justification for the Black CAPM. Handley acknowledges there is a low beta bias in the following sense – stocks with low regression-based estimates of beta have higher realised returns than predicted by the Sharpe-Lintner CAPM.⁶² So on this point we agree with Handley (2014).
112. Where we disagree with Handley (2014) is how the cost of equity should account for low beta bias. Handley (2014) supports the AER's use of a beta estimate of 0.7, selected from the AER's estimated beta range of 0.7.⁶³ Handley (2014) does not endorse the use of the Black CAPM to estimate the cost of equity. Rather, Handley (2014) supports the use of the Black CAPM infer an estimate for beta from within a range, and then to use that beta estimate as an input into the Sharpe-Lintner CAPM.⁶⁴
113. Our point is that the AER's beta range of 0.4 to 0.7 is selected on the basis of information that has nothing to do with the low beta bias and an appropriate adjustment to account for the bias. So there is no basis for the conclusion that using a beta estimate at the upper end of this range accounts for the low beta bias. There is also no basis for determining that the joint consideration of beta estimates from stocks listed in other markets, and the low beta bias, lead to an equity beta estimate capped at 0.7.
 - a) Our view is that accounting for the low beta bias is best done in an empirical manner by estimating the zero beta premium.
 - b) We also have the view that accounting for the information on beta from firms listed in other markets can be done in an empirical manner.
 - c) Further, the empirical estimation of the zero beta premium and the beta estimates from firms listed in other markets are completely distinct exercises and there is no reason the consideration of these two issues should be commingled.
114. Handley's (2014) objection to the empirical estimation of beta has two lines of thought. First, Handley (2014) points to a suite of literature that posits alternative explanations for the low beta bias. He mentions barriers to international investment (Black, 1974), mis-specification of the proxy for the market portfolio (Roll, 1977), constraints on leverage (Frazzini and Pedersen, 2014) and investor preference for lottery-like stocks (Bali, Brown, Murray and Tang, 2014).
115. There is no holistic consideration of the suite of evidence that puts forward risk-based explanations for the non-relationship between beta and stock returns, versus non-risk based explanations. The entire analysis that Handley (2014) devotes to the relationship between stock returns and beta is summed up by his conclusion that:

■ The above discussion suggests we still have an incomplete understanding of the low beta bias.⁶⁵
116. We do not see how the mere citation of a set of alternative explanations for empirical evidence leads to support for the AER's use of a single asset pricing model for estimating the cost of equity, when that asset pricing model (as implemented by the AER) is not supported by the empirical evidence.

⁶² The empirical result is referred by Handley (2014) on page 5 and in the section on the Black CAPM Handley (2014) discusses possible explanations for the low beta bias.

⁶³ Handley (2014), p. 24.

⁶⁴ Handley (2014), p. 5.

⁶⁵ Handley (2014), p. 12.

117. The next section of Handley's (2014) consideration of the Black CAPM is devoted to limitations on the model's implementation, specifically with reference to the expected return on a zero beta asset. Handley (2014) comments that this is a non-trivial task.⁶⁶ Yet we performed that task using a large sample of Australian-listed stocks from over a 20 year period.⁶⁷ We measured the relationship between beta estimates and portfolio returns for a set of portfolios that had approximately equal composition in terms of industry, size and book-to-market ratio. Ultimately we found that historical stock returns support an estimate for the zero beta premium of 3.34%.
118. The alternative is to not estimate the zero beta premium and to simply decide what the beta estimate should be, to incorporate into the Sharpe-Lintner CAPM. This is the approach that the AER has adopted and which has been endorsed by Handley (2014).
119. Handley (2014) does not make reference to our work on the zero beta premium, but does refer to analysis conducted by NERA (2014).⁶⁸ Handley takes issue with the NERA finding that the zero beta premium is indistinguishable from the market risk premium, which NERA attributes to there being no relationship between beta (estimated relative to the market portfolio of stocks) and returns. Handley comments that this is unsettling because it implies that there is a zero beta asset that is expected to yield the same return as the market portfolio.
120. There are two comments to make on this issue. First, the NERA result is unsettling for a reader with a view that the Sharpe-Lintner CAPM holds. But the NERA analysis is not inconsistent with the body of literature that Handley (2014) agrees with that finds no relationship between beta and returns. The implication of the NERA analysis is not that investors routinely earn high returns with no risk. The implication of the NERA analysis is that regression-based estimates of beta do not have an association with realised stock returns, which is consistent with four decades of published research.
121. Second, in our empirical analysis of the Black CAPM we documented why NERA finds a different estimate of the zero beta premium.⁶⁹ In our portfolio construction we ensured that the portfolios were similar along dimensions other than beta which might influence the realised returns during the sample period. In short, we have a cleaner measure of the direct relationship between stock returns and market returns that is explained by beta alone.
122. In sum, Handley (2014) reaches no conclusion as to how we should handle the empirical fact that stocks with low regression-based beta estimates earn higher returns than predicted by the Sharpe-Lintner CAPM. Handley acknowledges that the empirical result exists but simply agrees with the AER beta estimate of 0.7 as reasonable. As discussed above there is no theory or computation that implies that the joint consideration of the low beta bias and evidence from international listed firms suggest that a beta estimate of 0.7 is appropriate. In contrast, we support an explicit computation of the zero beta premium and a separate, explicit computation of the beta estimate that accounts for firms listed in markets other than Australia.

4.3.4 Dividend discount models

123. Handley (2014) provides a brief discussion of dividend discount models for estimating the cost of equity. He makes the point that the dividend discount model requires imprecise estimation of one set of inputs (dividends) just like asset pricing models (like the Sharpe-Lintner CAPM, Black CAPM and the Fama-French model) require imprecise estimation of another set of inputs. In particular, Handley comments that estimating long-term dividend growth is particularly challenging.⁷⁰ Further, Handley

⁶⁶ Handley (2014), p. 12.

⁶⁷ SFG (2014 Black).

⁶⁸ Handley (2014), p. 12.

⁶⁹ SFG (2014 Black), Section 4, pp. 29–30.

⁷⁰ Handley (2014), p. 14.

notes that dividend discount models can be made more complicated, in order to provide for more realistic future dividend streams, but it is unclear whether the results are any more meaningful.⁷¹

124. With reference to our specific implementation of the dividend discount model, we repeat Handley's (2014) critique below.

The DGM proposed by SFG essentially adopts a brute force approach to estimating the implied cost of equity for the market. It substitutes a large number of combinations of a set of parameter estimates into an assumed valuation model – in this case, a ten-year three-stage DGM – with the objective of simultaneously determining the expected cash flows and discount rate which best fits the data, subject to certain assumed constraints. The model is interesting but the regulatory environment involving an aggregate regulatory asset base measured in the tens of billions of dollars is not an appropriate setting to trial a new model whose widespread use and acceptance is yet to be established.

125. To place Handley's (2014) critique in context it is worth reiterating our view on the appropriate consideration to be given to dividend discount model analysis:

- a) In estimating the market risk premium, we recommend that dividend discount model estimates be given 50% weight with the remaining 50% weight allocated to estimation techniques that rely upon historical returns information.⁷²

Handley (2014) endorses the use by the AER of dividend discount model analysis, in part, to estimate the market risk premium. But he does not endorse our particular implementation of the dividend discount model for this task. Handley does not recommend any particular way in which evidence on the market risk premium from different data and estimation techniques should be evaluated in reaching a conclusion.

- b) In estimating the relative risk of listed energy networks compared to the market, we recommend that dividend discount model estimates be given 25% weight with the remaining 75% weight allocated to estimation techniques that rely upon historical returns estimation (that is, implementing the Sharpe-Lintner CAPM, Black CAPM and Fama-French model with regression-based estimates of risk).⁷³

Handley (2014) does not endorse the use of the dividend discount model as part of the information used to estimate the relative risk of an energy network.

126. With respect to estimation of the market risk premium, we note that our approach to estimating expected market returns has the following features:

- a) The method is designed to address a limitation of methods that impose a long term growth rate on the analysis, which Handley (2014) is a key variable over which there is estimation error. We allow the data to determine the long term growth rate. The AER's preferred approach, which does impose a long term growth rate, basically means the implied market cost of equity will be driven almost entirely by fluctuations in dividend yields.
- b) The method does not generate aggregate market returns that are unreasonably high or low, in comparison to either the AER's preferred dividend discount model approach, long-term excess returns, or long-term real returns.⁷⁴

⁷¹ Handley (2014), p. 15.

⁷² Note that we categorise survey evidence in this group because typical survey estimates of the market risk premium in Australia typically do not deviate from a figure of 6.0% at different time periods. We recommend weights of 20% be applied to a market risk premium estimate derived from historical excess returns, 20% be applied to a market risk premium estimate derived from historical real returns and 10% be applied to a market risk premium estimate derived from survey evidence.

⁷³ We recommend weights of 12.5% for the Sharpe-Lintner CAPM, 25.0% for the Black CAPM and 37.5% for the Fama-French model.

⁷⁴ See SFG (2014 DDM), Sub-section 5.3.3, Figure 7, p. 52; and SFG (2015 DDM), Sub-section 5.3.2, Figure 2, p. 26.

- c) The method generates a time series of market return estimates that move in the same direction as the AER's market return estimates from one period to the next, but with lower variation over time.⁷⁵
127. With respect to the estimation of the relative risk of an energy network compared to the broader market:
- a) The method is designed to address a limitation of estimation techniques that rely exclusively on historical data – past stock returns, market returns and other factors. According to Handley's (2014) recommendation the cost of equity for a benchmark energy network should be set without reference to prices, earnings and dividends of comparable firms, because it is dangerous to give consideration to this information. Instead, he considers exclusive reliance should be placed on risk estimates derived from regressions of stock returns on market returns which have the limitations discussed in the prior section.
- b) The method generates cost of equity estimates across firms that exhibit less dispersion than what would be implied by application of the Sharpe-Lintner CAPM using regression-based estimates of beta.⁷⁶
128. Handley (2014) acknowledges that the Sharpe-Lintner CAPM, populated with regression-based estimates of beta, generates expected returns that are too low compared to realised returns. Handley then rejects the use of the Black CAPM, which addresses this limitation, because of imprecision.
129. Handley (2014) does not disagree that high book-to-market stocks have historically earned high returns. Handley then rejects the use of the Fama-French model.

⁷⁵ SFG (2015 DDM), Sub-section 5.3.2, Figure 2, p. 26. This lower time series variation does not prove that one method is better than another because we cannot directly observe the "true" market return. But over the 9 years for which we can make a comparison between our method and that of the AER (2006 to 2014) the data does not suggest that anomalies that will lead to anomalous outcomes for regulated entities or consumers.

⁷⁶ SFG (2013 DDM), Sub-section 7.2.2, Figure 1, p. 22.

5. Conclusion

130. Our view is that the AERs implementation of the foundation model approach will not deliver an estimate of the return on equity that is consistent with the allowed rate of return objective, and is reflective of prevailing conditions in the market for equity funds. We also consider there is evidence to support a departure from the foundation model approach as applied in the draft decision for JGN.
131. The AER's implementation of the foundation model approach does not take into account two important pieces of empirical evidence:
- a) stocks with low beta estimates earn higher returns than predicted by the Sharpe-Lintner CAPM – which could be dealt with by implementing the Black CAPM to derive one estimate of the cost of equity; and
 - b) stocks with high book-to-market ratios persistently earn higher returns than predicted by the Sharpe-Lintner CAPM – which could be dealt with by implementing the Fama-French model to derive one estimate of the cost of equity.
132. The AER has a single metric for determining the relative risk of a benchmark energy network compared to the market – a regression-based estimate of beta based upon a small sample of Australian-listed stocks.⁷⁷ The AER decides that beta lies within a range of 0.4 to 0.7 and this range then constrains any other consideration.
- a) There is no theoretical or empirical reason why the implied cost of equity from the Black CAPM would be constrained according to the upper bound of beta estimated from this range.
 - b) The AER's exclusion of the Fama-French model from consideration is based upon debate amongst researchers over exactly what is proxied by the HML factor and uncertainty over implementation. Yet the AER, nor Handley (2014) reach any conclusion on how to account for the empirical performance of high book-to-market stocks over time and across markets.
 - c) The AER excludes dividend discount model analysis at an industry level for consideration on the basis of imprecision – the implied beta estimate of 0.94 is considered by the AER to be too high and too variable. But if characteristics other than regression-based estimates of beta matter for returns (like the book-to-market ratio) and if the Sharpe-Lintner CAPM implies that expected returns fall short of realised returns (which is true) there is no reason to think that an equivalent beta of 0.94 from the dividend discount model is too high. Further, implied beta estimates across firms using this technique are less variable than regression-based beta estimates.
133. The AER's consideration of alternative models to the Sharpe-Lintner CAPM is made with a view that the Sharpe-Lintner CAPM should be relied upon unless the AER can be persuaded to depart from this position. This is contradictory to the Rules because it acts to constrain information which would lead to an allowed return that represents the prevailing cost of funds.
134. In our report of February 2015 (SFG, 2015 Cost of equity) and an update to that report from March 2015 (SFG, 2015 Update) we outline a specific computation of the cost of equity that:
- a) Uses four estimation models in order to mitigate estimation error; and
 - b) Uses models that specifically address the empirical limitations of the Sharpe-Lintner CAPM.
135. We consider that this approach best meets the rate of return objective, which is that the allowed return should represent the prevailing cost of funds.

⁷⁷ The total sample size is nine stocks and four remain listed.

6. Declaration

136. We confirm that we have made all the inquiries that we believe are desirable and appropriate and no matters of significance that we regard as relevant have, to our knowledge, been withheld from the Court.



Professor Stephen Gray



Dr. Jason Hall

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8. Appendix: Terms of reference and qualifications

137. This report was prepared by Professor Stephen Gray and Dr Jason Hall. Professor Gray and Dr Hall have made all the enquiries that they believe are desirable and appropriate and that no matters of significance that they regard as relevant have, to their knowledge, been withheld.
138. Professor Gray and Dr Hall have been provided with a copy of the Federal Court of Australia's "Guidelines for Expert Witnesses in Proceeding in the Federal Court of Australia." The Report has been prepared in accordance with those Guidelines, which appear in the terms of reference.



Expert Terms of Reference

Review of the AER's foundation model approach

**Jemena Gas Networks
2015-20 Access Arrangement Review**

AA15-570-0070

Version C – 12 March 2015

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Version	Status	Date	Prepared	Checked	Authorised
A	Draft	16/12/14	E Grace-Webb		
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C	Draft	12/03/2015	E Grace-Webb		

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1 Background

Jemena Gas Networks (**JGN**) is the major gas distribution service provider in New South Wales (**NSW**). JGN owns more than 25,000 kilometres of natural gas distribution system, delivering approximately 100 petajoules of natural gas to over one million homes, businesses and large industrial consumers across NSW.

JGN submitted its revised Access Arrangement proposal (**proposal**) with supporting information for the consideration of the Australian Energy Regulator (**AER**) on 30 June 2014. The revised access arrangement will cover the period 1 July 2015 to 30 June 2020 (July to June financial years). The AER published its draft decision on this proposal on 27 November 2014. JGN must submit any additions or other amendments to its proposal by 27 February 2015.

As with all of its economic regulatory functions and powers, when assessing JGN's revised Access Arrangement under the National Gas Rules and the National Gas Law, the AER is required to do so in a manner that will or is likely to contribute to the achievement of the National Gas Objective, which is:

“to promote efficient investment in, and efficient operation and use of, natural gas services for the long term interests of consumers of natural gas with respect to price, quality, safety, reliability and security of supply of natural gas.”

For electricity networks, the AER must assess regulatory proposals under the National Electricity Rules and the National Electricity Law in a manner that will or is likely to achieve the National Electricity Objective, as stated in section 7 of the National Electricity Law.

Where there are two or more possible decisions in relation to JGN's revised Access Arrangement that will or are likely to contribute to the achievement of the National Gas Objective, the AER is required to make the decision that the AER is satisfied will or is likely to contribute to the achievement of the National Gas Objective to the greatest degree.

The AER must also take into account the revenue and pricing principles in section 24 of the National Gas Law and section 7A of the National Electricity Law, when exercising a discretion related to reference tariffs. The revenue and pricing principles include the following:

“(2) A service provider should be provided with a reasonable opportunity to recover at least the efficient costs the service provider incurs in—

- a) providing reference services; and
- b) complying with a regulatory obligation or requirement or making a regulatory payment.

(3) A service provider should be provided with effective incentives in order to promote economic efficiency with respect to reference services the service provider provides. The economic efficiency that should be promoted includes—

- (a) efficient investment in, or in connection with, a pipeline with which the service provider provides reference services...



[...]

(5) A reference tariff should allow for a return commensurate with the regulatory and commercial risks involved in providing the reference service to which that tariff relates.

(6) Regard should be had to the economic costs and risks of the potential for under and over investment by a service provider in a pipeline with which the service provider provides pipeline services.”

Some of the key rules that are relevant to an access arrangement and its assessment are set out below.

Rule 74 of the National Gas Rules, relating generally to forecasts and estimates, states:

- (1) Information in the nature of a forecast or estimate must be supported by a statement of the basis of the forecast or estimate.
- (2) A forecast or estimate:
 - (a) must be arrived at on a reasonable basis; and
 - (b) must represent the best forecast or estimate possible in the circumstances.

Rule 87 of the National Gas Rules, relating to the allowed rate of return, states:

- (1) Subject to rule 82(3), the return on the projected capital base for each regulatory year of the access arrangement period is to be calculated by applying a rate of return that is determined in accordance with this rule 87 (the allowed rate of return).
- (2) The allowed rate of return is to be determined such that it achieves the allowed rate of return objective.
- (3) The allowed rate of return objective is that the rate of return for a 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 service provider in respect of the provision of reference services (the allowed rate of return objective).
- (4) Subject to subrule (2), the allowed rate of return for a regulatory year is to be:
 - (a) a weighted average of the return on equity for the access arrangement period in which that regulatory year occurs (as estimated under subrule (6)) and the return on debt for that regulatory year (as estimated under subrule (8)); and
 - (b) determined on a nominal vanilla basis that is consistent with the estimate of the value of imputation credits referred to in rule 87A.
- (5) In determining the allowed rate of return, regard must be had to:
 - (a) relevant estimation methods, financial models, market data and other evidence;

- (b) the desirability of using an approach that leads to the consistent application of any estimates of financial parameters that are relevant to the estimates of, and that are common to, the return on equity and the return on debt; and
- (c) any interrelationships between estimates of financial parameters that are relevant to the estimates of the return on equity and the return on debt.

Return on equity

- (6) The return on equity for an access arrangement period is to be estimated such that it contributes to the achievement of the allowed rate of return objective.
- (7) In estimating the return on equity under subrule (6), regard must be had to the prevailing conditions in the market for equity funds.

[Subrules (8)–(19) omitted].

The equivalent National Electricity Rules are in clauses 6A.6.2 (for electricity transmission) and 6.5.2 (for electricity distribution).

In this context, JGN seeks a report from Frontier Economics, as a suitable qualified independent expert (**Expert**), in relation to relevant financial models which may be used to estimate the return on equity component of the rate of return, in a way that complies with the requirements of the National Gas Law and Rules and National Electricity Law and Rules, including as highlighted above. JGN seeks this report on behalf of itself, Jemena Electricity Networks, AusNet Services, Australian Gas Networks, CitiPower, Powercor, SA PowerNetworks, and United Energy.


2 Scope of Work

The AER Draft Decision for JGN cites a report from Associate Professor Handley in support of its foundation model approach to estimating the return on equity (the **Handley report**).¹

Having regard to the Handley report and the AER's position on relevant return on equity models, as set out in the Rate of Return Guideline and the Draft Decision for JGN, the Expert will provide an opinion on:

1. Whether the foundation model approach can be expected to deliver an estimate of the return on equity that is:
 - (a) consistent with the allowed rate of return objective; and
 - (b) reflective of prevailing conditions in the market for equity funds.

¹ John C Handley, *Advice on the return on equity*, 16 October 2014.

- 
2. Whether there is any evidence to support a departure from the foundation model approach as applied in the Draft Decision for JGN.

In preparing the report, the Expert will:

- A. consider different approaches to estimating the cost of equity;
- B. consider the theoretical and empirical support for the foundation model approach; and
- C. consider any comments raised by the AER, its experts and other regulators, including on (but not limited) to (a) support for the foundation model approach as defined or applied ; (b) the weight applied to evidence used to apply that approach; and (c) evidence of bias in the application of that approach.

3 Information to be Considered

The Expert is also expected to consider the following additional information:


- such information that, in Expert's opinion, should be taken into account to address the questions outlined above;
- relevant literature on the rate of return;
- the AER's rate of return guideline, including explanatory statements and supporting expert material;
- material submitted to the AER as part of its consultation on the rate of return guideline; and
- previous decisions of the AER, other relevant regulators and the Australian Competition Tribunal on the rate of return and any supporting expert material, including the recent draft decisions for JGN and electricity networks in ACT, NSW and Tasmania.

4 Deliverables

At the completion of its review the Expert will provide an independent expert report which:

- is of a professional standard capable of being submitted to the AER;
- is prepared in accordance with the Federal Court Practice Note on Expert Witnesses in Proceedings in the Federal Court of Australia (CM 7) set out in Attachment 1, and includes an acknowledgement that the Expert has read the guidelines²;
- contains a section summarising the Expert's experience and qualifications, and attaches the Expert's curriculum vitae (preferably in a schedule or annexure);

² Available at: <http://www.federalcourt.gov.au/law-and-practice/practice-documents/practice-notes/cm7>.

- 
- identifies any person and their qualifications, who assists the Expert in preparing the report or in carrying out any research or test for the purposes of the report;
 - summarises JGN's instructions and attaches these term of reference;
 - includes an executive summary which highlights key aspects of the Expert's work and conclusions; and
 - (without limiting the points above) carefully sets out the facts that the Expert has assumed in putting together his or her report, as well as identifying any other assumptions made, and the basis for those assumptions.

The Expert's report will include the findings for each of the items defined in the scope of works (Section 2).

5 Timetable

The Expert will deliver the final report to Jemena Regulation by **23 March 2015**.

6 Terms of Engagement

The terms on which the Expert will be engaged to provide the requested advice shall be:

- as provided in accordance with the Jemena Regulatory Consultancy Services Panel arrangements applicable to the Expert.

ATTACHMENT 1: FEDERAL COURT PRACTICE NOTE

Practice Note CM 7

EXPERT WITNESSES IN PROCEEDINGS IN THE FEDERAL COURT OF AUSTRALIA

Commencement

1. This Practice Note commences on 4 June 2013.

Introduction

2. Rule 23.12 of the Federal Court Rules 2011 requires a party to give a copy of the following guidelines to any witness they propose to retain for the purpose of preparing a report or giving evidence in a proceeding as to an opinion held by the witness that is wholly or substantially based on the specialised knowledge of the witness (see **Part 3.3 - Opinion** of the *Evidence Act 1995* (Cth)).
3. The guidelines are not intended to address all aspects of an expert witness's duties, but are intended to facilitate the admission of opinion evidence³, and to assist experts to understand in general terms what the Court expects of them. Additionally, it is hoped that the guidelines will assist individual expert witnesses to avoid the criticism that is sometimes made (whether rightly or wrongly) that expert witnesses lack objectivity, or have coloured their evidence in favour of the party calling them.

Guidelines

1. General Duty to the Court⁴

- 1.1 An expert witness has an overriding duty to assist the Court on matters relevant to the expert's area of expertise.
- 1.2 An expert witness is not an advocate for a party even when giving testimony that is necessarily evaluative rather than inferential.
- 1.3 An expert witness's paramount duty is to the Court and not to the person retaining the expert.


2. The Form of the Expert's Report⁵

- 2.1 An expert's written report must comply with Rule 23.13 and therefore must
 - (a) be signed by the expert who prepared the report; and
 - (b) contain an acknowledgement at the beginning of the report that the expert has read, understood and complied with the Practice Note; and
 - (c) contain particulars of the training, study or experience by which the expert has acquired specialised knowledge; and
 - (d) identify the questions that the expert was asked to address; and
 - (e) set out separately each of the factual findings or assumptions on which the expert's opinion is based; and

³ As to the distinction between expert opinion evidence and expert assistance see *Evans Deakin Pty Ltd v Sebel Furniture Ltd* [2003] FCA 171 per Allsop J at [676].

⁴ The "*Ikarian Reefer*" (1993) 20 FSR 563 at 565-566.

⁵ Rule 23.13.

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- (f) set out separately from the factual findings or assumptions each of the expert's opinions; and
 - (g) set out the reasons for each of the expert's opinions; and
 - (ga) contain an acknowledgment that the expert's opinions are based wholly or substantially on the specialised knowledge mentioned in paragraph (c) above⁶; and
 - (h) comply with the Practice Note.
- 2.2 At the end of the report the expert should declare that “[the expert] has *made all the inquiries that [the expert] believes are desirable and appropriate and that no matters of significance that [the expert] regards as relevant have, to [the expert's] knowledge, been withheld from the Court.*”
- 2.3 There should be included in or attached to the report the documents and other materials that the expert has been instructed to consider.
- 2.4 If, after exchange of reports or at any other stage, an expert witness changes the expert's opinion, having read another expert's report or for any other reason, the change should be communicated as soon as practicable (through the party's lawyers) to each party to whom the expert witness's report has been provided and, when appropriate, to the Court⁷.
- 2.5 If an expert's opinion is not fully researched because the expert considers that insufficient data are available, or for any other reason, this must be stated with an indication that the opinion is no more than a provisional one. Where an expert witness who has prepared a report believes that it may be incomplete or inaccurate without some qualification, that qualification must be stated in the report.
- 2.6 The expert should make it clear if a particular question or issue falls outside the relevant field of expertise.
- 2.7 Where an expert's report refers to photographs, plans, calculations, analyses, measurements, survey reports or other extrinsic matter, these must be provided to the opposite party at the same time as the exchange of reports⁸.

3. Experts' Conference

- 3.1 If experts retained by the parties meet at the direction of the Court, it would be improper for an expert to be given, or to accept, instructions not to reach agreement. If, at a meeting directed by the Court, the experts cannot reach agreement about matters of expert opinion, they should specify their reasons for being unable to do so.

J L B ALLSOP
Chief Justice
4 June 2013

⁶ See also *Dasreef Pty Limited v Nawaf Hawchar* [2011] HCA 21.

⁷ The *“Ikarian Reefer”* [1993] 20 FSR 563 at 565

⁸ The *“Ikarian Reefer”* [1993] 20 FSR 563 at 565-566. See also Ormrod *“Scientific Evidence in Court”* [1968] Crim LR 240

Stephen F. Gray

University of Queensland
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Brisbane 4072
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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.

Publications

- Gray, S., I. Harymawan and J. Nowland, (2014), “Political and government connections on corporate boards in Australia: Good for business?” *Australian Journal of Management*, forthcoming.
- Brailsford, T., S. Gray and S. Treepongkaruna, (2013), “Explaining the bid-ask spread in the foreign exchange market: A test of alternate models,” *Australian Journal of Management*, forthcoming.
- Faff, R., S. Gray and M. Poulsen, (2013), “Financial inflexibility and the value premium,” *International Review of Finance*, forthcoming.
- T. Fitzgerald, S. Gray, J. Hall and R. Jeyaraj, (2013), “Unconstrained estimates of the equity risk premium” *Review of Accounting Studies*, 18, 560-639.
- Gray, S. and J. Nowland, (2013), “Is prior director experience valuable?” *Accounting and Finance*, 53, 643-666.
- Chen, E. T., S. Gray and J. Nowland, (2012), “Family representatives in family firms” *Corporate Governance: An International Review*, 21(3), 242-263.
- Treepongkaruna, S., R. Brooks and S. Gray, (2012), “Do Trading Hours Affect Volatility Links in the Foreign Exchange Market?” *Australian Journal of Management*, 37, 7-27.
- Chen, E. T., S. Gray and J. Nowland, (2012), “Multiple founders and firm value” *Pacific Basin Finance Journal*, 20, 3, 398-415.
- Chan, K-F., R. Brooks, S. Treepongkaruna and S. Gray, (2011), “Asset market linkages: Evidence from financial, commodity and real estate assets,” *Journal of Banking and Finance*, 35, 6, 1415-1426.
- Parmenter, B, A. Breckenridge, and S. Gray, (2010), ‘Economic Analysis of the Government’s Recent Mining Tax Proposals’, *Economic Papers: A Journal of Economics and Policy*, 29(3), September, 279-91.
- Gray, S., C. Gaunt and Y. Wu, (2010), “A comparison of alternative bankruptcy prediction models,” *Journal of Contemporary Accounting and Economics*, 6, 1, 34-45.
- Feuerherdt, C., S. Gray and J. Hall, (2010), “The Value of Imputation Tax Credits on Australian Hybrid Securities,” *International Review of Finance*, 10, 3, 365-401.
- Gray, S., J. Hall, D. Klease and A. McCrystal, (2009), “Bias, stability and predictive ability in the measurement of systematic risk,” *Accounting Research Journal*, 22, 3, 220-236.
- Treepongkaruna, S. and S. Gray, (2009), “Information volatility links in the foreign exchange market,” *Accounting and Finance*, 49, 2, 385-405.
- Costello, D., S. Gray, and A. McCrystal, (2008), “The diversification benefits of Australian equities,” *JASSA*, 2008, 4, 31-35.
- Gray, S. and J. Hall, (2008), “The Relationship Between Franking Credits and the Market Risk Premium: A Reply,” *Accounting and Finance*, 48, 1, 133-142.
- Gray, S., A. Mirkovic and V. Rangunathan, (2006), “The Determinants of Credit Ratings: Australian Evidence,” *Australian Journal of Management*, 31(2), 333-354.
- Choy, E., S. Gray and V. Rangunathan, (2006), “The Effect of Credit Rating Changes on Australian Stock Returns,” *Accounting and Finance*, 46(5), 755-769.
- Gray, S. and J. Hall, (2006), “The Relationship Between Franking Credits and the Market Risk Premium,” *Accounting and Finance*, 46(3), 405-428.

- Gray, S. and S. Treepongkaruna, (2006), "Are there non-linearities in short-term interest rates?" *Accounting and Finance*, 46(1), 149-167.
- Gray, P., S. Gray and T. Roche, (2005), "A Note on the Efficiency in Football Betting Markets: The Economic Significance of Trading Strategies," *Accounting and Finance*, 45(2) 269-281.
- Duffie, D., S. Gray and P. Hoang, (2004), "Volatility in Energy Prices. In V. Kaminski," (Ed.), *Managing Energy Price Risk: The New Challenges and Solutions* (3rd ed.). London: Risk Books.
- Cannavan, D., F. Finn and S. Gray, (2004), "The Value of Dividend Imputation Tax Credits in Australia," *Journal of Financial Economics*, 73, 167-197.
- Gray, S. and S. Treepongkaruna, (2003), "Valuing Interest Rate Derivatives Using a Monte-Carlo Approach," *Accounting and Finance*, 43(2), 231-259.
- Gray, S., T. Smith and R. Whaley, (2003), "Stock Splits: Implications for Investor Trading Costs," *Journal of Empirical Finance*, 10, 271-303.
- Gray, S. and S. Treepongkaruna, (2003), "On the Robustness of Short-term Interest Rate Models," *Accounting and Finance*, 43(1), 87-121.
- Gray, S. and S. Treepongkaruna, (2002), "How to Value Interest Rate Derivatives in a No-Arbitrage Setting," *Accounting Research Journal* (15), 1.
- Gray, P. and S. Gray, (2001), "A Framework for Valuing Derivative Securities," *Financial Markets Institutions & Instruments*, 10(5), 253-276.
- Gray, P. and S. Gray, (2001), "Option Pricing: A Synthesis of Alternate Approaches," *Accounting Research Journal*, 14(1), 75-83.
- Dahlquist, M. and S. Gray, (2000), "Regime-Switching and Interest Rates in the European Monetary System," *Journal of International Economics*, 50(2), 399-419.
- Bollen, N., S. Gray and R. Whaley, (2000), "Regime-Switching in Foreign Exchange Rates: Evidence from Currency Options," *Journal of Econometrics*, 94, 239-276.
- Duffie, D., S. Gray and P. Hoang, (1999), "Volatility in Energy Prices. In R. Jameson," (Ed.), *Managing Energy Price Risk* (2nd ed.). London: Risk Publications.
- Gray, S. and R. Whaley, (1999), "Reset Put Options: Valuation, Risk Characteristics, and an Example," *Australian Journal of Management*, 24(1), 1-21.
- Bekaert, G. and S. Gray, (1998), "Target Zones and Exchange Rates: An Empirical Investigation," *Journal of International Economics*, 45(1), 1-35.
- Gray, S. and R. Whaley, (1997), "Valuing S&P 500 Bear Market Warrants with a Periodic Reset," *Journal of Derivatives*, 5(1), 99-106.
- Gray, S. and P. Gray, (1997), "Testing Market Efficiency: Evidence from the NFL Sports Betting Market," *The Journal of Finance*, 52(4), 1725-1737.
- Gray, S. (1996), "Modeling the Conditional Distribution of Interest Rates as a Regime- Switching Process," *Journal of Financial Economics*, 42, 27-62.
- Gray, S. (1996), "Regime-Switching in Australian Interest Rates," *Accounting and Finance*, 36(1), 65-88.
- Brailsford, T., S. Easton, P. Gray and S. Gray, (1995), "The Efficiency of Australian Football Betting Markets," *Australian Journal of Management*, 20(2), 167-196.
- Duffie, D. and S. Gray, (1995), "Volatility in Energy Prices," In R. Jameson (Ed.), *Managing Energy Price Risk*, London: Risk Publications.
- 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.

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 Email: jason.hall@frontier-economics.com.au
 Website: frontier-economics.com.au
 Skype: [jason.lance.hall](https://www.skype.com/people/jason.lance.hall)



Experience

2013-15 Ross School of Business, The University of Michigan (Lecturer in Finance)
 2008 Ross School of Business, The University of Michigan (Visiting Assistant Professor in Finance)
 2014-15 Frontier Economics (Director)
 2000-15 SFG Consulting (Director)
 2000-12 University of Queensland Business School, The University of Queensland (Senior Lecturer)
 1997-99 Credit Suisse First Boston (Equities analyst)

Education

2005 PhD in finance from The University of Queensland
 2003 Chartered Financial Analyst designation by the CFA Institute
 1996 Bachelor of Commerce with First Class Honours from The University of Queensland

Research

Journal articles

Impact of sector versus security choice on equity portfolios, with Ben McVicar, *Applied Financial Economics*, 2013, 23 (12), 991 – 1004.
 Unconstrained estimates of the equity risk premium, with Stephen Gray, Tristan Fitzgerald and Ravi Jeyaraj, *Review of Accounting Studies*, 2013, 18 (2), 560 – 639.
 Market risk exposure of merger arbitrage in Australia, with Matthew Pinnuck and Matthew Thorne, *Accounting and Finance*, 2013, 53 (1), 185 – 215.
 The value of imputation credits on hybrid securities, with Clinton Feuerherdt and Stephen Gray, *International Review of Finance*, 2010, 10 (3), 365 – 401.
 Forecast accuracy and stock recommendations, with Paul Tacon, *Journal of Contemporary Accounting and Economics*, 2010, 6 (1), 18 – 33.
 Speculation and e-commerce: The long and the short of IT, with Colin Ferguson, Matthew Pinnuck and Frank Finn, *International Journal of Accounting Information Systems*, 2010, 11 (2), 79 – 104.
 Bias, stability and predictive ability in the measurement of systematic risk, with Stephen Gray, Drew Klease and Alan McCrystal, *Accounting Research Journal*, 2009, 22 (3), 220 – 236.
 Leveraged superannuation, with Peter Dunn and Scott Francis, *Accounting and Finance*, 2009, 49 (3), 505 – 529.
 Persistence in growth versus market expectations, with Matthew Tochterman, *Australian Journal of Management*, 2008, 33 (1), 169 – 199.
 Relationship between franking credits and the market risk premium: A reply, with Stephen Gray, *Accounting and Finance*, 2008, 48 (1), 133 – 142.
 Comment on 'Regulation and the term of the risk free rate: Implications of corporate debt', *Accounting Research Journal*, 2007, 20 (2), 81 – 86.
 Valuation of mining projects using option pricing techniques, with Shannon Nicholls, *JASSA*, 2007, Issue 4 (Summer), 22 – 29.
 Relationship between franking credits and the market risk premium, with Stephen Gray, *Accounting and Finance*, 2006, 46 (3), 405 – 428.
 Electronic commerce investments, the resource-based view of the firm, and firm market value, with Colin Ferguson and Frank Finn, *International Journal of Accounting Information Systems*, 2005, 6 (1), 5 – 29.
 Auditor conservatism and voluntary disclosure: Evidence from the Year 2000 systems issue, with Peter Clarkson and Colin Ferguson, *Accounting and Finance*, 2003, 43 (1), 21 – 40.

Working papers

Portfolio rebalancing and mutual fund tournament behavior, with Paul Tacon, Finance and Corporate Governance Conference 2011, FIRN Frontiers in Finance Conference 2011, Financial Management Association Annual Meeting 2012.

The impact of security analyst recommendations on the trading of mutual funds, with David Costello, AFAANZ Conference 2010 (Winner Best Paper in Finance), Australasian Finance and Banking Conference 2010.
Forecasting stock returns using investor flows under short-sales constraints, with Paul Tacon, Australasian Finance and Banking Conference 2011, Finance and Corporate Governance Conference 2012, AFAANZ Conference 2012, Financial Management Association Annual Meeting 2012, Southern Finance Association Annual Meeting 2012.

Presentations

Accounting and Finance Association of Australia and New Zealand Conference (5) 2005, 2007, 2009-10, 2012
Asian Finance Association Conference 2009
Australasian Finance and Banking Conference (2) 2008, 2010
Australian National University Seminar Series 2012
Coal Trade, hosted by AIC Worldwide 1999
Coaltrans Asia, hosted by Coaltrans Conference Limited 1999
Contemporary Accounting Research/Journal of Contemporary Accounting and Economics Joint Symposium 2009
CPA Mining and Energy Conference 2006
Financial Management Association 2012
First Annual Private Equity Conference, hosted by Television Education Network 2007
JBWere Family Business Conference 2010
Melbourne Centre for Consumer Finance Investment & Regulatory Symposium 2008
PhD Conference in Economics and Business, hosted by University of Western Australia 2003
Southern Finance Association 2012
University of Melbourne Seminar Series (2) 2005, 2010
University of Queensland Seminar Series 2008

Referee activity

Accounting and Finance (8 reviews) 2003, 2005, 2009-13
Accounting Research Journal (3 reviews) 2002, 2006, 2010
Applied Financial Economics (3 reviews) 2012-13
Australian Journal of Management 2012
Contemporary Economic Policy 2011
European Financial Management 2014
Financial Review 2013
International Journal of Emerging Markets 2013
International Review of Finance 2012
MIS Quarterly 2003
Quarterly Journal of Finance and Accounting 2010
Quarterly Review of Economics and Finance 2012

Research grants

PricewaterhouseCoopers/Accounting and Finance Association of Australia and New Zealand 2006: Returns, tax and volatility – Superannuation choice with a complete information set (\$8,500)
Australian Research Council Discovery Grant 2002-4: Quantification issues in corporate valuation, the cost of capital and optimal capital structure (\$126,000)
UQ New Staff Research Start-up Fund: The competitive advantage of investments in electronic commerce (\$10,000)

Research students

PhD (1 student)

2012 – Paul Tacon

Honours (20 students)

2012 – Edward Parslow (Carnegie Wylie)

2011 – James Lamb (Port Jackson Partners)

2010 – Jeremy Evans (JP Morgan), Sarah Thorne (JP Morgan), Alexandra Dwyer (Reserve Bank of Australia)

2009 – Tristan Fitzgerald (UNSW), David Costello (National Australia Bank), William Toe (Ernst & Young)

2008 – Ben McVicar (Credit Suisse), Matthew Thorne (Credit Suisse)

2007 – Sam Turner (ABN Amro Morgans)

2006 – Paul Tacon (PhD, UQ), Ravi Jeyaraj (Navis Capital), Thomas Green (Crescent Capital), Alexander Pascal-Bossy (Macquarie)

2005 – Angela Gill (Wilson HTM), Andrew Wagner (Macquarie)

2004 – Matthew Tochtermann (M. Fin. Eng., UC Berkeley), Justyna Lewandowska (JP Morgan), An Pham (UBS)

Masters (2 students)

2003 – Scott Francis (A Clear Direction Financial Planning), Hernando Barrero (PricewaterhouseCoopers)

PhD reader

Damien Cannavan 2012

Teaching

Ross School of Business, The University of Michigan

Valuation (2014-2015; MBA students; avg. rating 4.0)

Corporate Investing Decisions (2014; BBA students avg. rating 4.2)

Corporate Financing Decisions (2015; BBA students)

Corporate Financial Policy (2008; MBA students; avg. rating 4.3)

UQ Business School, The University of Queensland (Mean teacher ratings out of a possible 5.0)

Awarded undergraduate teaching prize 2009

Empirical Finance Honours (2009-12; PhD and Honours students; avg. rating 4.1)

Corporate Finance Honours (2005 & 2011; PhD and Honours students; avg. rating 4.7)

Investments & Portfolio Management (2002-7, 2009-10 & 2012; B.Com, MBA & M.Com students; avg. rating 3.8)

Corporate Finance (2002-4, 2006-10 & 2012; B.Com, MBA and M.Com students; avg. rating 3.8)

Finance (2005-6; M.Com students; avg. rating 3.7)

Corporate Finance and Investments (Mt Eliza Business School, Beijing 2003; MBA students)

Technology Valuation and Project Evaluation (Singapore 2004; Masters of Technology Management students)

Auditing (Summer 2000/1-2001/2; B.Com, MBA and M.Com students; avg. rating 3.8)

Executive education

Risk Management and Financial Analysis (Rabobank 2000-10)

Financial Analysis of Innovative Investments (UQ Business School 2007)

Credit Analysis (Queensland Treasury Corporation 2005)

Capital Management (UQ Business School 2004)

Making Critical Financial Decisions (UQ Business School 2003)

Business Valuation and Analysis (UQ Business School 2003)

Cost of Capital Estimation (UQ Business School 2003)

Analysis of Real Options (Queensland Treasury 2003)

Student competitions

Rotman International Trading Competition

Manager of the UQ Business School trading team (2007 & 2009-12) which competes annually at the University of Toronto amongst 50 teams. UQ is the 9th most successful entrant from 66 schools which have competed in any of the same years, finishing 3rd in 2010, 6th in 2007, 11th in 2009, 14th in 2011 and 18th in 2012.

UBS Investment Banking Competition

Judge for the UQ section 2006-7 & 2009-12. Faculty representative at the national section 2008.

JP Morgan Deal Competition

Judge for the UQ section 2007-8.

Wilson HTM Research Report Competition

Delivered two workshops as part of the 2006 competition and was one of three judges.

Industry engagement

From 2000-15, I have provided consulting services as a director of SFG Consulting and Frontier Economics (from November 2014). A selection of projects is listed below.

Retail electricity and gas margins in NSW (Independent Pricing and Regulatory Tribunal 2012)

In 2006-7 and 2009-10 I acted as part of a team which was engaged to estimate electricity costs and margins for electricity and gas retailers in NSW. We have been reappointed for 2012-13. My role related to the estimation of a profit margin which would allow the retailer to earn a return commensurate its systematic risk. The approach developed was novel in that the margin was derived without reference to any pre-defined estimate of the asset base. Rather, the margin was a function of the potential increases or decreases in cash flows which would result from changes in economic conditions. Reports are available from IPART.

Advice on rules to determine regulated rates of return (Australian Energy Markets Commission 2012)

The AEMC is considering changes to the rules relating to regulation of electricity and gas networks. Independent rule change proposals have been put forward by the Australian Energy Regulator and the Energy Users Association of Australia. Both groups argue that application of the existing rules by the regulator generate upwardly-biased estimates of the regulated rate of return. As part of a team I am currently providing advice to the commission on whether the rule change proposals provide evidence on an upward bias, and if so, whether the proposed amendments are likely to reduce the extent of any bias.

Expert evidence relating to regulated rates of return (Electricity network businesses 2011)

In April 2011 the Australian Competition Tribunal heard an appeal by electricity networks on the regulated rate of return set by the Australian Energy Regulator. The issue was the value of dividend imputation tax credits. The Tribunal directed us to perform a dividend drop-off study to estimate the value of a distributed credit. Largely on the basis of our evidence the Tribunal determined that an appropriate value for a distributed credit was 35 per cent of face value. The Tribunal determination is available on its website and our expert report is available on request.

Estimation of risks associated with long-term generation contracts (New South Wales Treasury 2010)

In 2010 the NSW Government privatised a segment of its electricity industry, by selling three electricity retailers and entering into two generation agreements termed GenTrader contracts. The state-owned generators agreed to provide generation capacity in exchange for a charge. The generators also agreed to pay penalties in the event that their availability was less than agreed. As part of a team, I provided advice to NSW Treasury on the risks associated with the contracts. The estimated penalties resulting from this analysis are used by NSW Treasury in their budgeting role and in providing forward-looking analysis to the Government.

Litigation support relating to asset valuation (Alcan 2006-7)

In 2006-7 I acted as part of a team which provided litigation support to Alcan in a dispute with the taxation authority in the Northern Territory. The dispute related to whether Alcan was required to pay stamp duty as a result of its acquisition of an additional 30 per cent interest in Gove Alumina Limited. One issue was whether the acquisition was land-rich, meaning that the proportion of the asset considered to be land exceeded a threshold triggering stamp duty.

Methodology for evaluating public-private partnerships (Queensland Treasury Corporation 2005)

In 2005 I acted as part of a team which advised QTC on evaluating public-private partnerships, which typically require subsidies to appeal to the private sector. We rebutted the conventional wisdom, adopted in NSW and Victoria, that the standard valuation approach is flawed for negative-NPV projects. Furthermore, we developed a technique to incorporate systematic risk directly into expected cash flows, which are then discounted at the risk-free rate.

Litigation support

Insolvency proceedings relating to the collapse of Octaviar (Public Trustee of Queensland 2008-9)

Valuation of resource assets (Compass Resources 2007-8, Westpac Banking Corporation 2007)

Appeals against regulatory determinations (Envestra 2007-8, Telstra 2008)

Advice on whether loan repayments correspond to contract terms (Qld Dept. of Fair Trading 2005)

Advice on whether port and channel assets were contributed and hence not part of regulated assets (Comalco 2004-5)

Valuation

Management performance securities (Collins Foods Group 2006-11, GroundProbe 2008-9)

Ordinary shares in the context of an equity raising (Auscript 2007-8)

Intangible assets (Inbartec 2007)

Resources assets (Senex Energy 2012, Chalco 2007, Bank of Queensland 2007)

Cost of capital estimation, advice and regulatory submissions

Transport (Qantas 2008, QR National 2005 & 2012)

Water (Essential Services Commission of South Australia 2012, ActewAGL 2012, IPART 2011, Metropolitan utilities in Victoria 2004 & 2006-7, QCA 2002-3)

Energy networks (Economic Regulation Authority in Western Australia 2009, Hong Kong Electric 2007, Envestra 2006-7 & 2012, Powercor 2005, AGL 2004, Energex 2003-4, Ergon Energy 2003-4)

Local government networks (Queensland Competition Authority 2009)

Electricity generation (National Generators Forum 2008)

Environmental consulting (Ecowise 2007)

Listed vs unlisted infrastructure funds across alternative European equity markets (ABN AMRO Rothschild 2007)

Forestry assets (Queensland Department of Natural Resources 2004)

Portfolio performance measurement

Performance evaluation and benchmark derivation (Friday Investments 2010-12, Zupp Property Group 2011-12)

Corporate finance

Economic impact assessment of a proposed development of a retail shopping complex (Lend Lease 2006)

Impact of an acquisition on dividend growth, earnings per share and share price (AGL 2003-4)

Estimation of the optimal capital structure for electricity generation and distribution (NSW Treasury 2001-2)

Review of the debt valuation model used by the Snowy Hydroelectric Authority (NSW Treasury 2002)

Estimation of the optimal contract terms for coal sales to an electricity generator (NSW Treasury 2001-2)

Econometrics

Scoping study into the determinants of changes in tax debt in Australia (Australian Taxation Office 2007)

Interests

I am interested in sport as a participant and spectator. I finished 3rd on three occasions in the Brisbane Half Marathon (2005 & 2009-10), 8th in the Toronto Half Marathon (2002) and 3rd in the Australian Universities Marathon Championships (2003). I have finished 21 marathons, recording a best time of 2:47:54 in the Chicago Marathon 2011. From 1994-96 I was a member of The University of Queensland tennis team, which placed 1st at the Australian University Games in 1994.