



AusNet Electricity Services Pty Ltd

Electricity Distribution Price Review 2016–20

Appendix 12C: Fama-French three factor model

Submitted: 30 April 2015



Using the Fama-French model to estimate the required return on equity

Report for Jemena Gas Networks, Jemena Electricity Networks, ActewAGL, Ausgrid, Ausnet Services, Australian Gas Networks, CitiPower, Endeavour Energy, Energex, Ergon, Essential Energy, Powercor, SA Power Networks and United Energy

13 February 2015

SFG CONSULTING

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

PO Box 29
South Bank, QLD 4101

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

Contents

1.	EXECUTIVE SUMMARY	1
	Context.....	1
	Preparation of this report	1
	Summary of primary conclusions	1
2.	HAVING REGARD TO RELEVANT EVIDENCE	3
	The role of the allowed return on equity	3
	The AER's approach under the previous Rules	6
	The AER's approach under the new Rules	6
	The AER's continued reliance on the Sharpe-Lintner CAPM.....	7
	The test to be applied	8
3.	THE AER'S REJECTION OF ALL OTHER FINANCIAL MODELS	9
	The Sharpe-Lintner CAPM is used to the exclusion of all other models	9
	The key reasons for the rejection of the Fama-French model.....	9
	Other reasons for the rejection of the Fama-French model	18
4.	ESTIMATES OF THE FAMA-FRENCH MODEL	25
	Introduction	25
	Estimation procedures and sample	25
	Results	27
5.	CONCLUSION.....	30
6.	DECLARATION	32
	REFERENCES	33
	APPENDIX 1: CV OF PROF. STEPHEN GRAY AND DR. JASON HALL	35
	APPENDIX 2: TERMS OF REFERENCE.....	36

1. Executive summary

Context

1. SFG Consulting has been retained by a number of energy distribution businesses¹ to comment on a range of issues relating to the use of the Fama-French model for the purpose of informing the regulatory estimate of the required return on equity under the National Gas Rules (**NGR**) and National Electricity Rules (**NER**). We have been asked to specifically address the relevant consideration of this issue in the recent draft decisions published by the Australian Energy Regulator (**AER**) and the associated consultant reports. A copy of the terms of reference for this report, including a list of specific questions, is set out as an appendix to this report.

Preparation of this report

2. This report has been co-authored by Professor Stephen Gray and Dr Jason Hall.
3. Stephen Gray is Professor of Finance at the UQ Business School, University of Queensland and Director of SFG Consulting, a specialist economics and corporate finance consultancy. He has Honours degrees in Commerce and Law from the University of Queensland and a PhD in financial economics from Stanford University. He teaches graduate level courses with a focus on cost of capital issues, he has published widely in high-level academic journals, and he has more than 15 years' experience advising regulators, government agencies and regulated businesses on cost of capital issues.
4. Jason Hall is Lecturer in Finance at the Ross School of Business, The University of Michigan and Director of SFG Consulting. He has an Honours degree in Commerce and a PhD in finance from The University of Queensland. He teaches graduate level courses with a focus on valuation, has published 15 research papers in academic journals and has 17 years practical experience in valuation and corporate finance. Copies of the authors' curriculum vitas are attached as an appendix to this report.
5. The opinions set out in this report are based on the specialist knowledge acquired from our training and experience set out above.
6. We have read, understood and complied with the Federal Court of Australia Practice Note CM7 *Expert Witnesses in Proceedings in the Federal Court of Australia*.
7. Copies of our CVs are attached as an appendix to this report.

Summary of primary conclusions

8. Under the previous version of the Rules, the AER's approach was to determine the allowed return on equity by inserting three parameter estimates into the Sharpe-Lintner CAPM² formula and adopting the output. Under the new Rules, the AER has again inserted three parameter estimates into the Sharpe-Lintner CAPM formula and has adopted the output as the allowed return on equity. The AER has decided that the Fama-French three-factor (**Fama-French**) model is a relevant financial model under the new Rules, but it does not even proceed to the stage of estimating it.

¹ The businesses are Jemena Gas Networks, Jemena Electricity Networks, ActewAGL, Ausgrid, Ausnet Services, CitiPower, Endeavour, Energex, Ergon, Essential Energy, Powercor, SA Power Networks and United Energy.

² Sharpe (1964) and Lintner (1965).

9. In our view, the reasons that the AER provides for dismissing the Fama-French model are without basis:

a) Sensitivity to different estimation periods and methodologies.

The AER states that the estimates from the Fama-French model can vary across different estimation periods and techniques. In response, we note that this applies to all models that require the estimation of parameters. For instance the AER's own estimates for beta vary materially over time and across estimation methods. Moreover, the fact that some estimates of the Fama-French model might produce inconsistent results is not a basis for dismissing *all* estimates. A better approach would be to consider the relative quality and reliability of estimates.

b) Estimation of ex ante required returns.

The purpose of the Fama-French model is the same as the purpose of the Sharpe-Lintner CAPM – to explain the cross-section of stock returns. That is, the purpose of these models is to identify the features of stocks that can be used to predict what average returns they are likely to generate in the future. The key difference is that the predictions from the Fama-French model have been shown to be more closely associated with stock returns. It is theoretically possible that the superior empirical performance of recent decades might not continue into the future, but that should not be the basis for dismissing the Fama-French model.

c) Lack of a theoretical foundation.

We note that the Fama-French model was originally motivated by the poor empirical performance of the Sharpe-Lintner CAPM. Fama and French identified that the Sharpe-Lintner CAPM did not work and set about developing a model that did. Since that time, theoretical justification for the Fama-French factors have been developed, in a way that is quite standard for scientific progression. In our view it would be illogical to reject the Fama-French model in favour of the Sharpe-Lintner CAPM on the basis that its original motivation was the poor performance of the very model that is to be adopted in its stead.

d) Complex to implement.

The Fama-French model is not complex to implement. It requires the estimation of factor returns and factor sensitivities (betas). There are simply three factors instead of one. In any event, a superior model should not be rejected in favour of an inferior one on the grounds of simplicity.

10. We implement the Fama-French model and derive an estimate of the required return on equity for the benchmark efficient entity. Our estimate suggests that the overall risk premium (i.e., over and above the risk-free rate) is 5.99% for the benchmark efficient entity.

2. Having regard to relevant evidence

The role of the allowed return on equity

Relevant legislation

11. Under the Australian regulatory framework, allowed revenues are set using a building block approach, which is designed to calculate the required regulated revenues over the relevant regulatory period. Specifically, revenues are set at a level to provide an allowance for:
 - a) Efficient operating costs;
 - b) Taxes;
 - c) Efficient depreciation (return of capital);
 - d) Interest (return on debt capital);
 - e) A return on equity capital; and
 - f) Incentive mechanisms (e.g., efficiency sharing mechanisms such as the EBSS).
12. The Rules provide that the allowed return on equity is designed to provide a fair return to the providers of equity capital, commensurate with the risk of owning shares in a benchmark efficient firm with a similar degree of risk to that which applies to the relevant service provider for which regulatory revenue requirements are being determined. Combined with the return on debt, it should provide for a rate of return that is commensurate with the efficient financing costs that the benchmark efficient entity would incur over the relevant regulatory period.³
13. Some guidance on how the allowed return on equity should be determined is provided in the National Electricity Objective (**NEO**) and the Revenue and Pricing Principles (**RPP**). For example, a key part of the NEO is to:
 - promote efficient investment in...electricity services...for the long term interests of consumers.”⁴
14. An allowed return on equity that is materially above (below) the efficient financing costs of the benchmark efficient entity will create incentives for over (under) investment, neither of which are in the long-term interests of consumers.
15. Similarly, the RPP require that:

A regulated network service provider should be provided with a reasonable opportunity to recover at least the efficient costs the operator incurs in providing direct control network services and complying with a regulatory obligation or requirement or making a regulatory payment⁵

³ NER 6.5.2(f) and 6A.6.2(f); NGR rule 87(6).

⁴ National Electricity Law, s. 7. An equivalent statement is made in the National Gas Law, s. 23.

⁵ National Electricity Law, s. 7A(2). An equivalent statement is made in the National Gas Law, s. 24.

and that:

regard should be had to the economic costs and risks of the potential for under and over investment,⁶

and:

A price or charge for the provision of a direct control network service should allow for a return commensurate with the regulatory and commercial risks involved in providing the direct control network service to which that price or charge relates.⁷

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

Recent AEMC Rule changes

17. Under the previous NGR, the Australian Competition Tribunal held that if a regulator or regulated business (a) was using a well-accepted financial model such as the CAPM, and (b) had a reasonable basis for each of its parameter estimates, then it must automatically be the case that the resulting estimate of the required return on equity was reasonable and commensurate with the prevailing conditions in the market.⁸ That position was the primary driver for the return on equity rule change made by the Australian Energy Market Commission (AEMC).⁹
18. In making fundamental changes to the Rules, the AEMC sought to alter the regulatory practice of relying exclusively on the Sharpe-Lintner CAPM when estimating the required return on equity. In referring to the Tribunal's conclusion that the use of a well-accepted financial model effectively guaranteed that the resulting estimate of the required return on equity was reasonable and commensurate with the prevailing conditions in the market, the AEMC stated:

The Commission considered that this conclusion presupposes the ability of a single model, by itself, to achieve all that is required by the objective. The Commission is of the view that any relevant evidence on estimation methods, including that from a range of financial models, should be considered to determine whether the overall rate of return objective is satisfied.¹⁰

19. The AEMC went on to state that:

The Commission considered that no one method can be relied upon in isolation to estimate an allowed return on capital that best reflects benchmark efficient financing costs¹¹

⁶ National Electricity Law, s. 7A(6). An equivalent statement is made in the National Gas Law, s. 24(6).

⁷ National Electricity Law, s. 7A(5). An equivalent statement is made in the National Gas Law, s. 24(5).

⁸ Application by WA Gas Networks Pty Ltd (No 3) [2012] ACompT 12; Application by DBNGP (WA) Transmission Pty Ltd (No 3) [2012] ACompT 14.

⁹ AEMC Final Determination, p. 48.

¹⁰ AEMC Final Determination, p. 48.

¹¹ AEMC Final Determination, p. 49.

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

Achieving the NEO, the NGO, and the RPP requires the best possible estimate of the benchmark efficient financing costs. The Commission stated that this can only be achieved when the estimation process is of the highest possible quality. The draft rule determination stated that this meant that a range of estimation methods, financial models, market data and other evidence must be considered.¹²

21. That is, the AEMC has concluded that the NEO and RPP require the regulator to produce the best possible estimate of the required return on equity,¹³ which in turn requires the consideration of a range of financial models.

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

relevant estimation methods, financial models, market data and other evidence.¹⁴

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

the rate of return for a Distribution Network Service Provider is to be commensurate with the efficient financing costs of a benchmark efficient entity with a similar degree of risk as that which applies to the Distribution Network Service Provider in respect of the provision of standard control services.¹⁵

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

the prevailing conditions in the market for equity funds.¹⁶

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

- a) A range of models should be employed – to meet the allowed rate of return objective, and to ensure that the estimate best meets the NEO and the RPP;
- b) All relevant estimation methods, financial models, market data and other evidence should be considered; and
- c) Regard must be had to the prevailing conditions in the market, including contemporaneous data and estimation methods that reflect prevailing conditions rather than average historical conditions.

¹² AEMC Final Determination, p. 43.

¹³ The required return on equity is a key component of the efficient financing costs.

¹⁴ NER 6.5.2(e)(1) and 6A.6.2(e)(1); NGR rule 87(5)(a).

¹⁵ NER 6.5.2(c) and 6A.6.2(c); NGR rule 87(3).

¹⁶ NER 6.5.2(g) and 6A.6.2(g); NGR rule 87(7).

The AER's approach under the previous Rules

25. Under the previous Rules, the AER estimated the required return on equity using the Sharpe-Lintner CAPM exclusively and a favoured subset of the relevant evidence to estimate each of the three parameters. The AER estimated each of the three Sharpe-Lintner CAPM parameters, inserted them into the Sharpe-Lintner CAPM formula, and adopted the output as the allowed return on equity. The AER adopted this approach for gas and electricity and for transmission and distribution firms.

The AER's approach under the new Rules

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

The AER proposes that the NGR require that the cost of equity be calculated using the CAPM (similar to the current provisions in the NER).¹⁷

on the basis that:

It appears unlikely that there would be a justifiable departure from the CAPM over the medium to long term.¹⁸

27. However, as set out above, the AEMC took a very different view and in fact moved in the opposite direction. The AEMC was clearly concerned about the ability of the Sharpe-Lintner CAPM (as implemented by the AER) to produce sensible estimates of the required return on equity in all market conditions. For example, the AER's implementation of the CAPM suggested that the peak of the GFC resulted in a *fall* in the cost of equity capital – as a consequence of the precipitous fall in government bond yields. This led the AEMC to require that regulators must now have regard to all relevant estimation methods, financial models, market data and other evidence in both electricity determinations and gas reviews,¹⁹ not just selective subsets of the evidence.
28. The AER's approach under the new Rules is to continue to estimate the required return on equity using the Sharpe-Lintner CAPM exclusively. The AER describes the Sharpe-Lintner CAPM as the *foundation* model, but it is in fact the *only* model that it uses to estimate the required return on equity. No other model for the required return on equity is estimated – the allowed return on equity is computed by inserting point estimates for the risk-free rate, beta and MRP into the Sharpe-Lintner CAPM formula. The resulting point estimate of the required return on equity is then adopted as the allowed return on equity.
29. The AER persists with its exclusive reliance on the Sharpe-Lintner CAPM as the only model for estimating the required return on equity for the benchmark efficient entity by concluding that no other relevant financial model is sufficiently reliable to even warrant estimation. The AER concludes that the Black CAPM²⁰, Fama-French three factor model (**Fama-French model**) and dividend

¹⁷ AER's proposed changes to the rate of return provisions of the NGR, p. 11.

¹⁸ AER's proposed changes to the rate of return provisions of the NGR, p. 11.

¹⁹ For example, see NGR 87(2)(5); NER 6.5.2(e)(1); NER 6A.6.2(e)(1).

²⁰ With respect to the Black (1972) CAPM, the AER states that it relies upon the theory of the Black CAPM in order to inform its estimate of beta of 0.7, from within a range of 0.4 to 0.7. However, the AER does not make a clear statement as to what the beta estimate would be with, and without, consideration of the Black CAPM. So there is no clarity regarding the AER's reliance

discount models are all relevant models for estimating the required return on equity for the benchmark efficient firm, but that none of them should even be estimated.

The AER's continued reliance on the Sharpe-Lintner CAPM²¹

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

We consider the regime has been highly supportive of investment and the NSPs we regulate appear to have raised capital to support their investment programs. This suggests the continued use of the SLCAPM in our framework would be expected to be consistent with achieving the allowed rate of return objective and will continue to support efficient investment and use of regulated infrastructure.²²

31. In our view, this comment encapsulates the AER's misunderstanding of what the AEMC is trying to achieve with its fundamental changes to the Rules. First, investors did not invest in NSPs *because* the AER was using the Sharpe-Lintner CAPM. Second, what led the AEMC to revise the Rules is the failure of the Sharpe-Lintner CAPM, in the manner implemented by the AER, to produce reasonable estimates in non-normal market conditions – such as a global financial crisis or risk-free rates that are at unprecedented lows. In this regard, the AEMC stated that:

The global financial crisis and its continuing impact through the European sovereign debt crisis have highlighted the inherent dangers in an overly rigid approach to estimating a rate of return in unstable market conditions.²³

32. Logically, even if the Sharpe-Lintner CAPM did provide an appropriate allowed return on equity during a period of normal market conditions, and during a period when the AER was adopting a materially higher equity beta than it now proposes, that does not imply that it will provide an appropriate estimate in historically unique market conditions. The inability of a single model, by itself, to be able to provide an appropriate allowed return on equity in all market conditions is what led the AEMC to require consideration of the range of relevant financial models under the new Rules.
33. Finally, the failure to have any recognition of the consistent evidence that firms with exposure to the HML factor (such as NSPs) require returns above those predicted by the Sharpe-Lintner CAPM applies in all market conditions, but becomes even more important as the risk premium becomes a larger portion of the allowed return (i.e., when risk-free rates fall) and when the AER proposes to further reduce its beta estimate (as it does in the draft decisions).

on the Black CAPM. In addition, there is a logical flaw in the notion that the Black CAPM can be used to quantify an adjustment to the beta estimate, but cannot be used to estimate the cost of equity.

²¹ In this report we focus on the AER's decision to estimate the allowed return on equity by inserting parameter estimates into the Sharpe-Lintner CAPM formula, and to not present any estimates of the required return on equity for the benchmark efficient firm from the Fama-French model. In our companion report, SFG (2015 ROE), we consider the broader issue that the AER has not presented any estimates of the required return on equity for the benchmark efficient firm from *any* models other than the Sharpe-Lintner CAPM.

²² Jemena Draft Decision, Attachment 3, p. 50.

²³ AEMC Final Determination, p. 40.

The test to be applied

34. Throughout this report, we consider the question of whether the Fama-French model is able to contribute to the allowed rate of return objective. Specifically, we consider whether having access to evidence from the Fama-French model is likely to improve or reduce the quality of the final estimate of the required return on equity.
35. We note that this test is very different from the question of whether the Fama-French model is likely to produce a “better” estimate than the Sharpe-Lintner model. In our view, the allowed rate of return objective would not be met by lining up the relevant models and selecting which one is “best,”²⁴ and then using that single “best” model to estimate the required return. Our view is that the exclusion of any relevant evidence will reduce the quality of the final estimate of the allowed return on equity, which is inconsistent with the allowed rate of return objective.
36. This does not mean that it is inappropriate to compare the Sharpe-Lintner model against the Fama-French model on a number of dimensions. Rather, it means that these comparisons should not be made with a view to selecting one model or the other, but with a view to considering whether each is capable of contributing to the allowed rate of return objective. Only if the evidence suggested that one was so demonstrably superior to the other on the relevant dimensions, would the objective be achieved by the reliance on that one model to the exclusion of the other. Our view is that this is not the case. Our view is that both models provide relevant evidence and that both should be estimated and used to inform the estimate of the required return on equity.

²⁴ However that term might be defined.

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

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

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

- a) The risk-free rate;
- b) The equity beta; and
- c) The market risk premium

into the Sharpe-Lintner CAPM formula.

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

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

- a) The Black CAPM (or “empirical CAPM” as it is known in US regulation cases);
- b) The Fama-French model; and
- c) The dividend discount model (or “industry dividend growth model” in the AER’s terminology).

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

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

42. In the remainder of this section, we consider the primary reasons for the AER’s rejection of the Fama-French model for estimating the required return on equity.

The key reasons for the rejection of the Fama-French model

AER's reasons

43. In its recent draft decisions, the AER concludes that it will not use the Fama-French model for any purpose at any stage of its six-step process.²⁵ The AER states that it will not use the Fama-French model to:

- a) Inform its estimate of the required return on equity for the benchmark efficient entity; or

²⁵ Jemena Draft Decision, Attachment 3, p. 52.

- b) Serve as any sort of cross check on its Sharpe-Lintner CAPM foundation model estimate.²⁶

44. The AER's over-riding conclusion is that:

Estimates from the model are not expected to lead to a rate of return that meets the rate of return objective. The model is not sufficiently robust or expected to calculate un (sic) unbiased return on equity estimate for the benchmark entity facing a similar degree of risk as Jemena Gas Networks.²⁷

and that:

We do not consider the FFM based return on equity estimates put forward by the NSPs and their consultants provides material that alone, or in combination with other material, is useful for our regulatory task.²⁸

45. In this regard, we note that the allowed rate of return objective is that the allowed rate of return must be:

...commensurate with the efficient financing costs of a benchmark efficient entity with a similar degree of risk.²⁹

46. The required return on equity is one element of the efficient financing costs of the benchmark efficient entity. Thus, the AER has concluded that giving any consideration to the Fama-French model would produce an inferior estimate of the required return on equity for the benchmark efficient entity, relative to an estimate that gives no consideration to the Fama-French model. Consequently, the AER does not even proceed to the point of considering estimates of the Fama-French model. In summary, the AER concludes that estimating the Fama-French model and giving any consideration to that estimate would contaminate the estimate of the required return on equity that is produced by its Sharpe-Lintner CAPM foundation model.

47. In its recent draft decisions, the AER states that its "key reasons"³⁰ for disregarding the Fama-French model are as follows:

- it does not appear sufficiently robust and is sensitive to different estimation periods and methodologies
- it is not clearly estimating ex ante required returns
- it suffers a lack of theoretical foundation which might explain the instability of parameter estimates, and
- it is relatively complex to implement.³¹

²⁶ Jemena Draft Decision, Attachment 3, p. 52.

²⁷ Jemena Draft Decision, Attachment 3, Table 3-5, p. 46.

²⁸ Jemena Draft Decision, Attachment 3, p. 52.

²⁹ NER 6.5.2(c).

³⁰ Jemena Draft Decision, Attachment 3, p. 52.

³¹ Jemena Draft Decision, Attachment 3, p.52.

48. In the remainder of this section, we consider each of the AER's key reasons for disregarding the Fama-French model.

Sensitivity to different estimation periods and methodologies

Estimates can vary across different estimation techniques

49. One of the key reasons that the AER provides for not using the Fama-French model at any stage in its estimation process is that the estimates can vary across different estimation techniques.
50. As set out in the section on complexity below, the implementation of the Fama-French model is commensurate with the implementation of the Sharpe-Lintner model. Betas are estimated by regressing the returns of a stock on the returns of a factor portfolio, and factor risk premiums are estimated as the mean historical return of the factor portfolio. The only difference is that the Fama-French model requires three beta and three factor risk premium estimates whereas the Sharpe-Lintner model requires only one of each. In this respect, the implementation of the Fama-French model is identical to the implementation of the Sharpe-Lintner model.
51. In the Sharpe-Lintner model, estimates of beta and MRP can vary materially depending on the method and the data set that are used. For example, SFG (2014 Beta, pp. 28-31) demonstrates that the beta estimates on which the AER relies can vary substantially over different estimation periods, or according to which day of the week is used to define return intervals, or depending on whether monthly or weekly data is used, and so on. Similarly, the AER uses a number of different methods to estimate the MRP – the factor premium for the one (market) factor in the Sharpe-Lintner model. These different estimation methods produce a range of different estimates. This leads the AER to adopt a range for the MRP where the top of the range is more than 150% of the bottom. Moreover, the AER uses five different estimation periods when applying the historical excess returns method. These different data periods produce a range of different estimates, two of which are statistically insignificant.³² That is, the criticism that the AER applies to the Fama-French factors also applies to the single factor that the AER itself uses as its primary evidence in the Sharpe-Lintner model. For example, the AER reports estimates of the MRP from historical data for the period 1988 to 2013. The standard error of this estimate is 3.55% and the estimate is not significantly different from zero.
52. As a precursor to the implementation of the Fama-French model, it is necessary to construct the SMB and HML factor portfolios. The AER identifies a paper in a British accounting journal, Michou, Mouselli and Stark (2014), in which the authors apply different methods for constructing the factor portfolios and obtain different results in their analysis of a sample of U.K.-listed stocks. The AER begins by noting that, for some of the factor construction methods, one or both of the Fama-French factors fail to reach statistical significance. We note that the Michou et al (2014) results show that:
- a) All of the mean factor risk premiums that are statistically significant are positive, consistent with the Fama-French model; and
 - b) For the book-to-market factor, all of the mean factor risk premiums are positive and all are approximately the same magnitude. Those that are statistically insignificant simply have a higher standard deviation.

53. The AER also notes that:

³² That is, for two of the sample periods considered by the AER the mean is less than two times the standard error of the estimate.

One principal conclusion of Michou, Mouselli and Stark is that the results of the FF model are highly sensitive to the methodology chosen, so that ‘factor construction methods can matter in the use of factor models and, as a consequence, factor construction methods need to be considered carefully in empirical settings’.³³

54. In our view, it is obvious that factor construction methods can matter and should be considered carefully. However, this does not provide a reason for rejecting the Fama-French model entirely – it only provides a reason for carefully considering the factor construction method. If the AER considers that the factor construction methods that underlie the SFG (2014 FFM) estimates are inappropriate it should explain why that is the case and which alternative methods it considers should be used. In our view, it is not enough to simply note that some portfolio construction methods applied to certain U.K. data fail to produce statistically significant results, and then to reject the Fama-French model entirely and when applied to unrelated Australian data.
55. On this issue, the AER cites the Australian study of Brailsford, Gaunt and O’Brien (2012 PBFJ). The AER notes that Brailsford et al also explain that portfolio construction choices are important. Indeed, the whole point of the Brailsford et al paper is to investigate different portfolio construction methods and to develop tests to determine which is most appropriate and which will produce the most reliable estimates from the data set that is being evaluated. They do not conclude, as the AER does, that the fact that different estimation techniques produce somewhat different results means that the Fama-French model should not be used at all. Rather, they simply conclude that one should carefully consider methodological choices when estimating the model. In our view, the same advice would apply to every estimation of every asset pricing model.
56. In its recent draft decisions, the AER does not report the final conclusion from the Brailsford et al (2012 PBFJ) study, which is as follows:

Further, asset pricing tests support the use of these alternate portfolio formation methods by producing model coefficients that are consistent with that reported in the US and superior goodness of fit metrics and provide *strong evidence of a value premium in the Australian market*. In addition, these asset pricing tests highlight the importance of considering portfolio construction techniques when testing asset pricing anomalies as conclusions can vary depending on the technique chosen. This is important from an academic perspective as these portfolios are commonly used as benchmark returns in trying to identify ‘abnormal’ returns and researchers need to investigate the robustness of their results to other portfolio methods (Michou et al., 2010).³⁴

57. Moreover, the AER does not report that Michou et al (2014) motivate their study with:
- a) Evidence from Miles and Timmerman (1996) that the Fama-French factors are superior to the single-factor CAPM in explaining UK stock returns;³⁵ and
 - b) Evidence from Hussain et al (2002) who “investigate the properties of a three factor model based upon Fama and French (1993) and conclude that it performs better than the CAPM in pricing various sets of portfolios.”³⁶

³³ Jemena Draft Decision, Attachment 3, p. 55.

³⁴ Brailsford, Gaunt and O’Brien (2012 PBFJ), p. 436, emphasis added.

³⁵ Michou et al (2014, p. 282).

³⁶ Michou et al (2014, p. 282).

58. Finally, we note that we have previously submitted estimates of the Fama-French model to the AER in SFG (2014 FFM). In preparing those estimates we carefully considered a range of methodological choices and selected the estimation approach that we considered to be the most appropriate in all of the relevant circumstances. If the AER considers that there is some problem with the estimation process of SFG (2014 FFM), or that some alternative estimation approach should be used, then the AER should state what the problem is and how it should be corrected. In our view, it is not enough to simply state that the estimates might vary if they were computed at a different point in time or using a different estimation method, and to use this as a reason for rejecting any further consideration of the Fama-French model.

Weighing evidence by quality

59. In our previous report we suggested that:

In our view, the fact that a range of studies of variable quality produce a range of estimates should not be used as the basis for the outright rejection of the entire model. Otherwise, relevant and informative models (that would otherwise have been used to inform the estimate of the required return on equity) could be rejected due to the publication of one or more low quality studies with divergent results. A better approach is to consider the robustness and the reliability of the best available estimates of each model.³⁷

60. We reiterate that view here and consider that it should be uncontroversial that the appropriate task is to consider the robustness and the reliability of the best available estimates of each model. However, the AER never gets to the point of weighing up different estimates of the Fama-French model. Rather, the AER rejects the Fama-French model, partly on the basis that different studies using somewhat different methodologies produce somewhat different results. The AER justifies this position with reference to McKenzie and Partington (2014):

...we do not consider there are clear objective grounds to distinguish the 'best' studies. McKenzie and Partington support this view.³⁸

61. The discussion of this issue in McKenzie and Partington (2014) is as follows:

What are the objective criteria for low quality studies? Surely, SFG are not suggesting that empirical studies coming from academic colleagues such as Robert Faff, one of Australia's top finance professors, is a low quality study (Eg: Faff (2004)) just because it produces estimates that do not support the consultants view. We simply view the evidence of parameter instability from the empirical literature as symptomatic of the weakness of the model.³⁹

62. That is, the position of the AER and McKenzie and Partington appears to be that, because they are unable to determine the quality of different estimates of the Fama-French model, the model should not be used at all. In our view, there are several obvious criteria for distinguishing the quality of different studies. By way of a few obvious examples, studies would be considered to be of higher quality if, other things being equal:

³⁷ SFG (2014 FFM), p. 24.

³⁸ Jemena Draft Decision, Attachment 3, p. 179.

³⁹ McKenzie and Partington (2014), p. 18.

- a) They reflected the most recent advances in econometric methodology;
 - b) They used more recent data;
 - c) They used larger, more comprehensive data sets; and
 - d) They had been subjected to more scrutiny.
63. These were precisely the sorts of criteria that led the Tribunal to favour the SFG (2011) dividend drop-off study to that of Beggs and Skeels (2006).⁴⁰
64. In our view, quality should be judged according to these sorts of criteria, not solely by the author of the study, or by whether the results differ from a predetermined view.

Not clearly estimating ex ante required returns

65. The key objective of the asset pricing literature is to explain the cross section of stock returns. The term “cross section of stock returns” is a common term used by academics. It simply means returns that differ from one stock to another. The literature relating to estimating the cost of capital is called the “asset pricing literature” which means research devoted to understanding the stock and market characteristics that explain market prices of assets – or put another way, it is devoted to understanding what stock and market characteristics affect investors’ required returns on those assets.
66. There is a wealth of historical stock return data and an enormous literature that develops asset pricing models (including the CAPM and the Fama-French model) and then tests the ability of those models to fit the observed data. In relation to the asset pricing literature mentioned above, and the cross section of stock returns, there is one stock characteristic in respect of which there is the most agreement amongst academics that explains why some stocks earn higher returns than others. This stock characteristic is the ratio of the book value of equity to the market value of equity. The “book-to-market factor” in the Fama-French model is constructed so that this stock characteristic can be applied to explain the returns on all assets, just like the market return factor in the CAPM can be applied to explain the returns on all assets.
67. The overwhelming weight of empirical evidence, including the leading published Australian study,⁴¹ concludes that the Fama-French model provides a better empirical fit to the available data than does the Sharpe-Lintner CAPM.⁴² However, the AER concludes that:

The ex-post (backward looking) observation of apparently priced risk factors does not actually mean these factors are priced ex-ante (on a forward looking basis).⁴³

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

⁴⁰ Australian Competition Tribunal, 2011, Application by Energex Limited (Gamma) (No 5) [2011] ACompT 9, 12 May.

⁴¹ Brailsford, Gaunt and O’Brien (2012 AJM).

⁴² See SFG (2014 FFM).

⁴³ Jemena Draft Decision, Attachment 3, p. 173.

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

69. For example, the *lack* of an historical relationship between regression-based beta estimates and stock returns might not continue into the future. That is, it is possible that the Sharpe-Lintner CAPM populated principally using regression based estimates of beta may begin to fit the data in the future, despite the extensive empirical evidence showing it has not done so in the past.
70. In summary, we agree that there is no guarantee that an historically observed relationship will continue unchanged into the future. However, in our view it is self-evidently a positive and relevant feature that a proposed model is able to fit the observed historical data.
71. Finally, we note that the question of whether the relationship between stock returns and a particular factor is likely to continue into the future can be informed by the persistence of that factor in the past data. Consider, for example, the Fama-French book-to-market (HML) factor. That factor was first identified more than 20 years ago. It remains strongly related to stock returns today. Its relevance has also been documented in a range of different markets. All of this evidence makes it more likely (although not guaranteed) that the relationship is likely to continue into the future.

Lack of a theoretical foundation

72. On this point, it is generally accepted by stakeholders that:
 - a) The vast majority of empirical evidence concludes that the Sharpe-Lintner CAPM provides a poor fit to the data – that there is either a weak or non-existent relationship between beta estimates and stock returns.⁴⁴
 - b) The Fama-French model was first developed as a means of improving the empirical fit to the available data.
 - c) The empirical performance of the Fama-French model is superior to the Sharpe-Lintner CAPM – the Fama-French model provides a superior fit to the observable data, including in Australia.
73. SFG (2014 FFM) notes that, since the initial development of the Fama-French model, the focus of the literature has been on developing theoretical underpinnings for the Fama-French factors – to explain why the additional factors assist in enabling the model to better fit the observed data. SFG (2014 FFM, pp. 27-32) summarise the theoretical underpinnings that have been developed, noting that they are based upon the asset pricing theories already developed in the 1970s – the intertemporal CAPM and the arbitrage pricing theory. SFG (2014 DDM) also note that it is common in scientific progression for an empirical regularity to be documented, followed by the development of theory to explain that empirical regularity.
74. SFG (2014 FFM, pp. 4-16) also explains that the Fama-French model can be theoretically motivated on the basis that the proxy for the CAPM market portfolio is not efficient. Under the Sharpe-Lintner CAPM, there is a single efficient market portfolio and all assets are priced relative to that portfolio. If a single efficient portfolio cannot be identified, a set of factor portfolios (that can be combined to

⁴⁴ We note that the AER and its consultants have cited a very small number of papers that claim that the CAPM cannot be statistically rejected if wider standard errors are used or that the CAPM might still have some uses despite its inability to fit the observable data. However, none of this contradicts the overwhelming empirical evidence that the Sharpe-Lintner CAPM provides a poor fit to the data.

form an efficient portfolio) must be used. This provides another source of theoretical motivation for the Fama-French three-factor model.

75. The AER has not yet engaged with the material in this earlier report, preferring to adopt the blanket conclusion that the Fama-French model lacks a theoretical foundation. The AER has not yet set out any description of what evidence it would require to support the conclusion that a model does have a sufficient theoretical foundation, but has only stated that it does not expect that (unspecified) standard to be reached in the near term.⁴⁵
76. Finally, we note that the question here is not whether the Fama-French model should entirely supplant the AER's use of the Sharpe-Lintner CAPM. It is not a question of selecting one of the two models. The question is whether the Fama-French model is capable of contributing to the allowed rate of return objective. Put simply, the issue is whether consideration of both the Sharpe-Lintner CAPM and the Fama-French model is likely to provide a better estimate of the cost of equity than consideration merely of the Sharpe-Lintner CAPM. In rejecting, in its entirety, the use of the Fama-French model the AER has reached a view that its estimate of the cost of equity would be less precise if consideration was given to both models.
77. The AER's rejection of the Fama-French model is based upon three pillars, none of which is reasonable:
- a) High book-to-market stocks *might* not earn high returns in the future, despite the book-to-market ratio being the single most prevalent stock characteristic that explains stock returns in different markets and over time;
 - b) The book-to-market factor (that is, HML) can be specified in different ways which lead to different estimates, which does not negate the result that all the different specifications imply that the book-to-market factor is likely to be positive; and
 - c) There are different alternative theories that explain why high book-to-market stocks earn relatively high returns, all of which have been developed because of the consensus amongst academics that there is an empirical fact worthy of theoretical development – if academics believed that the Fama-French model was merely a statistical quirk that was unlikely to persist they would not have developed an extensive literature devoted to theoretical explanations.
78. In its recent draft decisions, the AER now states:

That the FFM might be embedded in a theoretical framework does not change the fact the model was empirically motivated.⁴⁶

which would imply that the original genesis of the Fama-French model prevents it from ever being used by the AER.

79. Our views on the theoretical rationale for the Fama-French model are set out in SFG (2014 FFM). Neither the AER nor its consultants have engaged with the detail set out in that report or with the logical absurdity of relying exclusively on the Sharpe-Lintner model for the reason that its empirical failures were the original motivation for other models.

⁴⁵ Jemena Draft Decision, Attachment 3, p. 181.

⁴⁶ Jemena Draft Decision, Attachment 3, p. 180.

Relatively complex to implement

80. The Sharpe-Lintner CAPM requires estimates of the following parameters:
- Risk-free rate: The AER estimates this parameter as the contemporaneous yield on 10-year government bonds;
 - Equity beta: The AER estimates this parameter by a regression of the returns of comparator stocks on the returns of the relevant factor portfolio (the market portfolio); and
 - Market risk premium: The AER states that its primary estimate of the MRP is obtained by taking the mean of the historical excess returns of the factor portfolio (the market portfolio).⁴⁷
81. The Fama-French model requires estimates of the following parameters:
- Risk-free rate: This parameter is estimated as the contemporaneous yield on 10-year government bonds;
 - Equity betas: There are three betas in the Fama-French model, one for each of the three factors. Each is estimated by a regression of the returns of comparator stocks on the returns of the relevant factor portfolio (the market portfolio, the SMB portfolio and the HML portfolio); and
 - Factor premiums: There are three factor premiums in the Fama-French model – the premiums for the market, SMB and HML portfolios. Each is estimated by taking the mean of the historical excess returns of the relevant portfolio.
82. In summary, the Fama-French model can be estimated in exactly the same way as the Sharpe-Lintner CAPM. Both require betas to be estimated using regression analysis and factor premiums to be estimated using historical returns data. The Sharpe-Lintner CAPM is simply a special case of the Fama-French model, wherein it is assumed that the SMB and HML factor premiums are zero. Consequently, the Fama-French model is not more complex to estimate than the Sharpe-Lintner CAPM – the same estimation approaches simply have to be applied three times instead of once.
83. The AER has concern over different specifications of the HML and SMB factors. There has been no contention by regulated energy businesses that the cost of equity should be increased because of exposure to the SMB factor. So the AER's concern essentially comes down to the impact of different specifications of the HML factor. But the AER has not stated a position that a reasonable specification of the HML factor, from different options, would lead to the risk premium associated with this factor being equal to zero. The AER's concern over different specifications is that there might be different levels of positive risk premiums associated with the HML factor. The AER's response to this concern is to assume zero return in the cost of equity for exposure to the HML factor.
84. In our view a relevant financial model that is capable of contributing to the allowed rate of return objective should not be disregarded on the basis that it is relatively complex to implement. Estimating the Sharpe-Lintner CAPM is a shorter task because it assumes away two of the Fama-

⁴⁷ The market risk premium is actually the expected return on the market less the risk free rate, so the CAPM only really requires an estimate of the risk free rate, beta and the expected return on the market portfolio.

French factors. However, this does not provide a basis for excluding the Fama-French model in favour of the Sharpe-Lintner CAPM if the Fama-French model is considered to be relevant. In our view, it is not appropriate to estimate the allowed return on equity by implementing what the regulator considers to be the simplest of the range of relevant financial models.

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

The estimation of input parameters for the SLCAPM, however is less complex than the estimation of input parameters for the Black CAPM and the Fama-French three factor model. This implies:

- the estimation of input parameters is likely to be relatively more robust and less likely to be unduly sensitive to errors in input estimation.
- the choice of data to be used in the estimation of inputs to the model is more likely to avoid arbitrary filtering or adjustment as it can be more clearly based on sound rational and/or common practice.⁴⁸

86. This statement is a general assertion that all simple models are “likely to be” more robust and “more likely to avoid” (unspecified) adjustments relative to more complex models. This general assertion is used to support the outright rejection of the Fama-French model. In our view, a better approach would be for the regulator to consider whether a particular estimate of the Fama-French model is robust or unduly sensitive to errors or subject to arbitrary adjustments. The regulator could then explain why these considerations might affect the weight that it applied to that estimate of the model, relative to an estimate from a particular simpler model.

87. By contrast, the AER has not put its mind to whether the Fama-French model (and specifically the SFG estimate of it) is subject to any particular estimation problems relative to the AER’s estimate of the Sharpe-Lintner model. Rather, the AER has relied on the general assertion set out above. Moreover, even if the AER did conclude that there were estimation issues in relation to the Fama-French model, then it would have to explain why those specific estimation issues were so severe that the allowed rate of return objective would be better served by eliminating the Fama-French model entirely from any further consideration.

Other reasons for the rejection of the Fama-French model

88. In its recent draft decisions, the AER also sets out some additional reasons for its rejection of the Fama-French model. We consider these additional reasons below, noting that some of them overlap with the “key reasons” set out above.

[The role and purpose of the Sharpe-Lintner and Fama-French models](#)

89. The AER states that it accepts that the genesis of the Fama-French model lies in the inability of the Sharpe-Lintner CAPM to fit the observable data – the fact that the observed or “realised” data is not in accordance with the Sharpe-Lintner CAPM:

We accept academics have applied different specifications of the FFM in an attempt to explain anomalies in realised return data relative to the ex-ante expected return predictions of the CAPM.⁴⁹

⁴⁸ Jemena Draft Decision, Attachment 3, Table 3-6, p. 48.

90. The AER then goes on to state that:

However, we consider there is a clear difference between a theoretical factor model that econometrically fits realised return data and an asset pricing model that stably predicts future expected returns and is used to systematically and stably price assets.⁵⁰

91. This statement indicates a fundamental misunderstanding of:

- a) The role and purpose of the Fama-French and Sharpe-Lintner models; and
- b) The way in which the econometric testing of asset pricing models is performed.

92. The Fama-French and Sharpe-Lintner models both seek to predict the future returns of an asset based on (a) systematic risk factors and (b) the asset's relative sensitivity to each risk factor. In the case of the Sharpe-Lintner model, the market return is the only systematic risk factor and beta represents the asset's sensitivity to that risk factor. That same risk factor and the same sensitivity are part of the Fama-French model and play precisely the same roles in that model. The only difference between the two models is that the Fama-French model has two additional factors. Both are asset pricing models and both have precisely the same purpose.

93. The statement above seems to suggest that the AER considers the Fama-French model to have a very different purpose to the Sharpe-Lintner model. The statement suggests that the Fama-French model has a backward-looking "econometric fitting" purpose that is different from the forward-looking "prediction" purpose of the Sharpe-Lintner model. This is not the case at all. Both seek to predict future asset returns. The Sharpe-Lintner model uses one factor to do this, whereas the Fama-French model uses three. Both models rely on historical observations.

94. The AER's statement above also indicates a misunderstanding of the structure and purpose of econometric tests of asset pricing models. It is not the case that we take a sample of past stock returns, identify a set of variables that are correlated with those past returns, write down a "model" that includes those variables, and then show that the model provides a good econometric fit to the historical returns. Such a process would be entirely tautological and of no value and would certainly disqualify anyone who was involved in it from being awarded the Nobel Prize in economics.⁵¹

95. Rather, the econometric process involves identifying factors, estimating factor returns and sensitivities in one period, using those estimates to predict returns over a *future* period, and then determining how well the model performed in predicting the future returns. For the Sharpe-Lintner model, this involves estimating betas over one period and using them to forecast returns over a future period. For the Fama-French model, precisely the same approach is used except that three betas are used to form the prediction rather than one. The evidence then suggests that the Fama-French predictions are materially better than the Sharpe-Lintner predictions.

96. In our view, the AER's description of the Sharpe-Lintner model as:

⁴⁹ Jemena Draft Decision, Attachment 3, p. 177.

⁵⁰ Jemena Draft Decision, Attachment 3, p. 177.

⁵¹ By contrast, Professor Fama was awarded the Nobel Prize in Economics in 2013, with the citation making specific reference to his part in the development of the Fama-French model.

...an asset pricing model that stably predicts future expected returns and is used to systematically and stably price assets⁵²

is quite misleading. The Fama-French model produces predictions of future asset returns in precisely the same way as the Sharpe-Lintner model. The only difference is that the Fama-French model uses the Sharpe-Lintner factor plus two others, resulting in it having superior predictive performance.

Identification of additional factors

97. In its recent draft decisions, the AER notes that the Fama-French model is one of a number of factor models and that other factor models with additional factors have been proposed in the literature. The AER suggests that this is a reason to support its rejection of the Fama-French model.⁵³
98. On this point, McKenzie and Partington (2014) identify a number of papers that propose that the inclusion of additional factors helps to provide an even better fit to the observable data. In particular, they refer to a “nascent literature suggesting that the use of the Fama and French model is no longer optimal.”⁵⁴ The evolution of the relevant literature is as follows. A large number of empirical tests of the Sharpe-Lintner model concluded that the returns predicted by the model did not match the realised returns – that observed returns were not well explained by a market beta alone. Fama and French developed a three-factor CAPM. This model began with the Sharpe-Lintner model and added two additional factors. This model was shown to produce predicted returns that provided a much better match to actual returns – the additional factors had material predictive/explanatory power. The AER now considers more recent studies that propose that the inclusion of additional factors may further improve the empirical performance of the model. The AER concludes that this supports its rejection of the Fama-French model in favour of the Sharpe-Lintner model. At one time people thought the Earth was flat. This was replaced by some people modelling the Earth as a simple sphere and others seeking to refine the model further. The existence of people seeking to refine the model further is not a reason to revert to the flat-Earth model.
99. As a practical matter, the fact that there exists a range of other models provides no logical basis for the rejection of the Fama-French model. It is only the Fama-French model that has been submitted for consideration by energy network business to the AER and which the AER has determined to be a “relevant model.” Consequently, regard and weight when estimating the return on equity should be given to the Fama-French model on the basis of its ability to contribute to the allowed rate of return objective – it should not be conceptually dismissed due to the existence of other models.

There is no either/or decision to be made

100. In its recent draft decisions, much of the AER’s reasoning for not using the Fama-French model implies that the AER is considering whether it should use the Fama-French model *or* the Sharpe-Lintner model. For example, much of the material in the AER’s recent draft decisions compares the Fama-French model against the Sharpe-Lintner model, and concludes that the Sharpe-Lintner model is superior (e.g., in terms of use in practice and simplicity). The AER also notes that its consultants have considered the question of whether “the FFM is capable of reliably estimating the return on

⁵² Jemena Draft Decision, Attachment 3, p. 177.

⁵³ Jemena Draft Decision, Attachment 3, p. 177.

⁵⁴ McKenzie and Partington (2014), p. 18.

equity of an (sic) benchmark efficient entity”⁵⁵ and whether “the FFM is an appropriate model to estimate the regulatory return on equity.”⁵⁶

101. In our view, the regulatory task is not to select one model *or* the other. Rather, the task is to consider whether each model is capable of contributing to the allowed rate of return objective. In our view, the Fama-French model should be estimated and regard should be had to that estimate if it is capable of informing the required return on equity of the benchmark efficient entity – in conjunction with all other relevant evidence. It is not a question of whether the Sharpe-Lintner or Fama-French estimate is “best.” We do not suggest that the Fama-French estimate should be used *instead of* the Sharpe-Lintner estimate. We suggest that both are capable of providing relevant evidence, both should be estimated and both estimates should be used (after due consideration of the strengths and weaknesses of each) to inform the estimate of the required return on equity.

102. For example, the AER cites some evidence that the Sharpe-Lintner model is more commonly used in practice than the Fama-French model. In particular, the AER states that the Sharpe-Lintner model is the “standard model”⁵⁷ in regulatory determinations and the “primary model” in broker valuation reports.⁵⁸ The AER then goes on to note that the Fama-French model also has some acceptance in practice in that:

- a) 25% of the broker reports the AER examined referenced the Fama-French model and some made valuation adjustments in relation to it;
- b) Morningstar, the large financial data service, provides Fama-French beta estimates alongside its Sharpe-Lintner beta estimates;
- c) Morningstar assesses the performance of mutual fund managers against expected returns estimated using the Fama-French model, noting that this practice has become “standard”;
- d) The Fama-French model is a required part of the Certified Financial Analyst (CFA) program; and
- e) Professor Fama has been awarded the Nobel Prize in economics, with the citation paying particular regard to his work in developing the Fama-French model.⁵⁹

103. In our view, the question is not whether the Fama-French model has gained *more* acceptance than the Sharpe-Lintner model, but whether it has gained *enough* acceptance to be given any consideration at all.

104. By contrast, the AER has set out what appears to be an impossible threshold in relation to acceptance of the model. The AER states that even though it has become standard to use the Fama-French model to estimate expected returns for groups of assets, it might not be widely used for evaluating individual assets.⁶⁰ The AER goes on to state that even if there was evidence of the Fama-French model being used for individual assets, that would not establish that it was suitable for regulated

⁵⁵ Jemena Draft Decision, Attachment 3, p. 55.

⁵⁶ Jemena Draft Decision, Attachment 3, p. 55.

⁵⁷ Jemena Draft Decision, Attachment 3, p. 177.

⁵⁸ Jemena Draft Decision, Attachment 3, p. 177.

⁵⁹ Jemena Draft Decision, Attachment 3, pp. 177-178.

⁶⁰ Jemena Draft Decision, Attachment 3, p. 178.

assets.⁶¹ It seems that the AER's view is that the Fama-French model will be unsuitable for regulated assets until it can be shown that it is standard to use it for regulated assets.

Application to the benchmark efficient entity

105. In its recent draft decisions, the AER twice refers to the following quote from McKenzie and Partington (2014), which they describe as “important”:

...the FFM is used to estimate the average return in the cross section and the benchmark regulated network service provider is not average given its relatively low economic risk.⁶²

106. The AER states that it considers this to mean that the Fama-French model would only apply to average firms and not to low-risk firms such as the benchmark efficient entity.⁶³ This is fundamentally wrong. The Fama-French model applies to all firms in the same way that the Sharpe-Lintner model applies to all firms. In the Sharpe-Lintner model, firms with low exposure to the one (market) factor (i.e., low-beta firms) have lower required returns and firms with higher exposure have higher returns. The MRP sets out the return that is required in relation to this factor for the average firm, and then the betas for individual firms scale this up or down. Exactly the same applies in the Fama-French model – the only difference is that there are three factors (and consequently three betas) instead of one. Both models determine the required return for the average firm and then use beta estimates for each individual firm to adjust up or down as the case may be. If the Fama-French model applied only to the average firm and could not produce an estimate of the required return for firms “of relatively low economic risk,”⁶⁴ there would be no point to it.

Advice from Handley (2014)

107. In a report commissioned by the AER, Handley (2014) devotes two pages to an analysis of the Fama-French, centred largely around some recent literature that proposes methods to improve the statistical power of asset pricing tests. Specifically, Handley (2014) quotes the following passage from Lewellen, Nagel and Shanken (2010), who consider a range of methodological issues in relation to the statistical testing of various asset pricing models:

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.⁶⁵

108. However, the “five models” that the authors refer to do not include the Sharpe-Lintner or Fama-French models. It is not clear how the empirical performance of five *different* 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.

109. In relation to the two relevant models, Lewellen, Nagel and Shanken (2010) report that:

⁶¹ Jemena Draft Decision, Attachment 3, p. 178.

⁶² Jemena Draft Decision, Attachment 3, pp. 55, 178.

⁶³ Jemena Draft Decision, Attachment 3, p. 178.

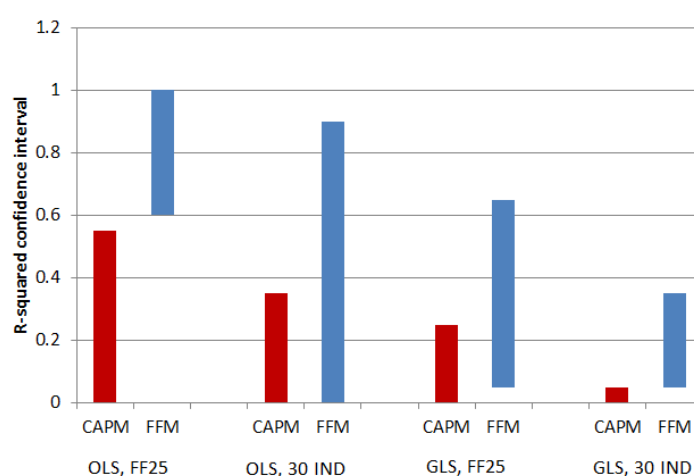
⁶⁴ Jemena Draft Decision, Attachment 3, p. 178.

⁶⁵ Lewellen, Nagel and Shanken (2010), p. 189, quoted at Handley (2014), p. 7.

- 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.

110. Lewellen, Nagel and Shanken (2010) advise that a more meaningful interpretation is obtained by considering the confidence interval for R^2 ,⁶⁶ 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. 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).

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



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

111. Whereas Handley (2014, p.7) focuses on the reduction in the R^2 statistic for the Fama-French model when the GLS methodology is applied to the 30 industries portfolio, he does not mention that Lewellen, Nagel and Shanken (2010) report that:

- a) The R^2 statistics for the Sharpe-Lintner models 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 R^2 statistic is only 1%.

112. Indeed, Lewellen, Nagel and Shanken (2010) conclude that:

The confidence interval provides a good summary measure of just how poorly the CAPM works.⁶⁷

113. 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

⁶⁶ Lewellen, Nagel and Shanken (2010), p. 186.

⁶⁷ Lewellen, Nagel and Shanken (2010), p. 187.

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.

114. 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 model should be used to the exclusion of the Fama-French model.

4. Estimates of the Fama-French model

Introduction

115. In this section we provide parameter estimates for the Fama-French model and discuss the implications for the cost of equity.

Estimation procedures and sample

Estimation procedures

The Brailsford, Gaunt and O'Brien procedure

116. Since our estimation procedure was set out in some detail in SFG (2014 FFM), we provide a brief summary here.

117. We perform our analysis using a sample of nine Australian-listed stocks, and 56 U.S.-listed stocks. Our parameter estimates and factor premiums result from construction of factors according to the process adopted by Brailsford, Gaunt and O'Brien (2012 AJM). In constructing the factors we rely upon the following dataset, compiled from Datastream data. We used returns for all Australian-listed stocks with information available on returns, volume,⁶⁸ market capitalisation, book-to-market ratio, and industry classifications from the Industry Classification Benchmark (ICB). Consistent with Brailsford, Gaunt, and O'Brien (2012 AJM) we excluded asset managers and real estate investment funds.⁶⁹

118. Data which meets these criteria enabled factors to be constructed on a monthly basis from January 1985 to February 2014. There are 2,228 unique listed firms in the dataset and, on average, each firm appears in the dataset for 96 months. The total number of firm-months used to compile the factors is 214,823.⁷⁰ On average, the number of firms with data available for analysis in the average month is 614.

Construction of the factors

119. The idea behind the Fama-French factors is to take firm characteristics (market capitalisation and book-to-market ratio) and estimate portfolio returns. This is analogous to the manner in which the market portfolio return, compared to the risk-free rate, is a factor in the Sharpe-Lintner CAPM. The portfolios in the Fama-French model are called zero investment portfolios, because we measure the returns to a positive investment in small stocks (or high book-to-market stocks) combined with a negative investment in large stocks (or low book-to-market stocks). So *SMB* refers to *small minus big* and *HML* refers to *high minus low*.

120. The factors are constructed in a particular way, in an attempt to separately incorporate the impact of size and the book-to-market ratio on factor returns. The small and big sized stocks in the *SMB*

⁶⁸ Volume is used simply to ensure we only retain stocks that traded.

⁶⁹ Specifically, we excluded firms with the following ICB classifications: 8633 Real estate holding and development, 8670 Real estate investment trusts, 8771 Asset managers, 8775 Specialty finance, 8777 Investment services, 8779 Mortgage finance, 8985 Equity investment instruments, and 8995 Non-equity investment instruments.

⁷⁰ The term *firm-month* refers to an observation for a firm in a particular month. For example, the data for BHP in January 2013 is one observation, the data for BHP in February 2013 is another observation, the data for NAB in January 2013 is another observation, and so on.

portfolio should have approximately the same book-to-market characteristics; and the high and low book-to-market stocks should have approximately the same market capitalisation.

121. So the first step is to disaggregate the sample of Australian-listed stocks into six portfolios, consistent with the technique of Fama and French (1993). There is a split according to size (small and big), and a split according to the book-to-market ratio (high, medium and low). This means we need to decide on breakpoints to determine what constitutes a small or big stock, and what constitutes a stock with high, medium or low book-to-market ratio.
122. This is where Brailsford, Gaunt and O'Brien (2012 AJM) make a useful contribution. They note the market for Australian-listed shares contains a relatively large number of small stocks. So if you were to take all Australian-listed shares, and classify half the shares as small stocks, and half the shares as large stocks, you would end up with many shares classified as big stocks when in reality they have a fairly small market value. Fama and French (1993) understood this also, with respect to the U.S. market. They use all listed stocks with available data for analysis in constructing the factors, but classify stocks as small or big only on the basis of the mid-point value for the larger NYSE-listed stocks.
123. For Australian-listed companies, Brailsford, Gaunt and O'Brien (2012 AJM) rank all stocks with available data according to market capitalisation. The largest stocks which, in aggregate, comprise 90% of market capitalisation are classified as big stocks, and the remaining stocks are classified as small stocks. This means that the small stocks have about 10% of aggregate market capitalisation, which is approximately the same as the aggregate market capitalisation proportion of small stocks in the U.S. In compiling the book-to-market allocation, the researchers computed the book-to-market ratio at the 30th and 70th percentiles for stocks in the ASX 200. This is consistent with the Fama and French (1993) technique of using NYSE-listed stocks to compute breakpoints.
124. To construct SMB, we take an average of portfolio returns to all small stocks (whether they are classified as low, medium or high book-to-market) and an average of portfolio returns to big stocks (again, whether they are classified as low, medium or high). Then we take the difference in these two portfolio averages as shown below:

$$SMB = \text{Average (SL, SM, SH)} - \text{Average (BL, BM, BH)}$$

125. To compute HML, we take an average of returns to high book-to-market stocks classified as small and big stocks (this is the high book-to-market component) and an average of portfolio returns to low book-to-market stocks classified as small and big stocks (this is the low book-to-market component). Then we take the difference in these two portfolio averages as shown below:

$$HML = \text{Average (SH, BH)} - \text{Average (SL, BL)}$$

Estimation of factor sensitivities or "betas"

126. To estimate the factor sensitivities or "betas" for the Fama-French model, we perform a multiple regression of stock returns on factor returns in the manner that is standard in the literature:

$$r_{e,t} = \beta_{mkt} \times r_{m,t} + \beta_{size} \times SMB_t + \beta_{value} \times HML_t + \varepsilon_t$$

Results

Parameter estimates and implications for the cost of capital

127. In analysing the results from the Fama-French analysis the risk exposure (β , s and h) needs to be considered jointly with estimates of the factor premiums associated with that risk exposure. For the purposes of this report we assume a market risk premium of 6.5%, as adopted by the AER. We do not agree that this is the correct market risk premium at the present time, but that discussion is a feature of a separate report.⁷¹ We use a constant assumption that the market risk premium is 6.5% for comparison across models.
128. For the Australian risk factors, we adopt SMB of -0.43% and HML of 9.97% and for the US factors we adopt SMB of 3.58% and HML of 4.81% , constructed in the manner set out in SFG (2014 FFM).
129. In Table 1 we report parameter estimates and associated premiums. All risk coefficient estimates have been adjusted to 60% gearing. The results for the combined sample are based upon applying twice as much weight to an observation for an Australian-listed firms as for a U.S.-listed firm. This means that we assign weight of 24% to the Australian sample and 76% to the U.S. sample.⁷² The implication of the analysis is as follows.
- For the sample of Australian-listed stocks, the implied risk premium above the risk free rate is 6.10%, comprised of 3.12% market risk, -0.01% exposure to the SMB factor and 2.99% exposure to the HML factor.
 - For the sample of U.S.-listed stocks, the implied risk premium is 5.96%.
 - Combining both sets of firms together results in an estimate of the risk premium of 5.99%.
130. These risk premiums (i.e., over and above the risk-free rate) that can be compared with the AER's estimate of the risk premium for the average firm of 6.5%.

Table 1. Parameter estimates and implied risk premiums

	Australia			United States			Combined sample		
	β	s	h	β	s	h	β	s	h
Firms	0.49	0.07	0.33	0.86	-0.05	0.11			
Index	0.47	-0.01	0.27	0.88	-0.09	0.12			
Average	0.48	0.03	0.30	0.87	-0.07	0.12			
Premium	6.50%	-0.43%	9.97%	6.50%	3.58%	4.81%			
Risk premium	3.12%	-0.01%	2.99%	5.66%	-0.25%	0.55%	5.04%	-0.19%	1.15%
Total premium	6.10%			5.96%			5.99%		

Note: These estimates fix the MRP to 6.5% to focus on the impact of the Fama-French SMB and HML factors. Using a higher MRP (that we consider to be appropriate in the prevailing market conditions) would conflate two effects: the model to be used and the MRP estimate inserted into it.

131. We compare the risk premiums across alternative asset pricing models in Table 2 below. The relevant parameter estimates for the Sharpe-Lintner CAPM and Black CAPM are set out in our companion report, SFG (2015 Beta). In all cases, we adopt a market risk premium of 6.5% commensurate with

⁷¹ See SFG (2015 ROE).

⁷² $(9 \times 2) \div [(9 \times 2) + 56] = 18 \div 74 = 24\%$. See SFG (2014 FFM).

the AER's recent draft decisions. We do not endorse that estimate in the current market conditions, but we adopt it here for the purposes of comparison across models.

Table 2. Risk premium estimates implied by alternative asset pricing models

	Australia	United States	Combined
Sharpe-Lintner CAPM			
Beta estimate	0.58	0.90	0.82
Cost of equity	6.38%	8.46%	7.95%
Risk premium	3.74%	5.82%	5.31%
Black CAPM			
Beta estimate	0.58	0.90	0.82
Cost of equity	7.80%	8.81%	8.56%
Risk premium	5.16%	6.17%	5.92%
Equiv. SL beta	0.79	0.95	0.91
Fama-French model			
Beta estimate	0.48	0.87	
s	0.03	-0.07	
h	0.30	0.12	
$\beta \times \text{MRP}$	3.12%	5.66%	5.04%
$s \times \text{SMB}$	-0.01%	-0.25%	-0.19%
$h \times \text{HML}$	2.99%	0.55%	1.15%
Risk premium	6.10%	5.96%	5.99%
Equiv. SL Beta	0.94	0.92	0.92

Note: These estimates fix the MRP to 6.5% to focus on the impact of the Fama-French SMB and HML factors. Using a higher MRP (that we consider to be appropriate in the prevailing market conditions) would conflate two effects: the model to be used and the MRP estimate inserted into it.

132. Table 2 shows that we adopt an equity beta for the Sharpe-Lintner CAPM of 0.82, which produces a risk premium (beta multiplied by MRP) of 5.31%. This is lower than the risk premium for the average firm of 6.5% according to the AER's estimate.

133. For the Black CAPM, we adopt the same beta estimates as for the Sharpe-Lintner CAPM since beta has the same definition and is used in the same way in each model. Our zero beta premium of 3.34% results in a risk premium for the benchmark efficient entity of 5.92%,⁷³ which is lower than the AER's 6.50% estimate for the average firm.

134. We then compute what we call the "equivalent Sharpe-Lintner CAPM beta." This is the figure for beta which, when inserted into the Sharpe-Lintner CAPM, would produce the same estimate of the required return on equity as we obtain from the Black CAPM. In this case, the lower-than-average risk premium is, of course, commensurate with a lower-than-average equivalent beta. The equivalent beta here is 0.91.

135. The final panel relates to the Fama-French model. The first three rows set out the "beta" estimates or factor sensitivities. The next three rows set out the risk premiums associated with each factor. The "Risk premium" row sets out the sum of the three factor risk premiums, and the final row sets out the equivalent Sharpe-Lintner equity beta. Again, the risk-premiums and equivalent betas are consistent with the benchmark firm being of below-average risk.

136. Having compared the Fama-French model against other models with a fixed 6.5% MRP, we now turn to our preferred estimates of the Fama-French model in the prevailing market conditions. For the

⁷³ Again, see SFG (2015 Beta) for more detail on these calculations.

reasons set out in SFG (2015 ROE), we adopt a market risk premium of 8.17% in the prevailing market conditions. This results in a Fama-French estimate of the required return on the benchmark efficient entity of:

$$\begin{aligned} r_e &= r_f + \beta_{mkt} \times MRP + \beta_{size} \times SMB + \beta_{value} \times HML \\ &= 2.64\% + 0.78 \times 8.17\% - 0.19\% + 1.15\% = 9.93\%. \end{aligned}$$

137. The details of the size and value premiums of -0.19% and 1.15%, respectively, is set out in SFG (2014 FFM). The calculation above adopts the latest estimates of the risk-free rate and MRP.

5. Conclusion

139. In having no regard to the Fama-French model for estimating the cost of equity, the AER generates an estimate for the cost of equity for the benchmark energy network that is less than the prevailing cost of funds. The AER relies exclusively on the Sharpe-Lintner CAPM for estimating the cost of equity, which omits a material priced risk factor. In the Fama-French model that risk factor is the HML factor.

140. In our view, the reasons that the AER provides for dismissing the Fama-French model are without basis:

- a) Sensitivity to different estimation periods and methodologies.

The AER states that the estimates from the Fama-French model can vary across different estimation periods and techniques. In response, we note that this applies to all models that require the estimation of parameters. For instance the AER's own estimates for beta vary materially over time and across estimation methods. Moreover, the fact that some estimates of the Fama-French model might produce inconsistent results is not a basis for dismissing *all* estimates. A better approach would be to consider the relative quality and reliability of estimates.

- b) Estimation of ex ante required returns.

The purpose of the Fama-French model is the same as the purpose of the Sharpe-Lintner CAPM – to explain the cross-section of stock returns. That is, the purpose of these models is to identify the features of stocks that can be used to predict what average returns they are likely to generate in the future. The key difference is that the predictions from the Fama-French model have been shown to be more closely associated with stock returns. It is theoretically possible that the superior empirical performance of recent decades might not continue into the future, but that should not be the basis for dismissing the Fama-French model.

- c) Lack of a theoretical foundation.

We note that the Fama-French model was originally motivated by the poor empirical performance of the Sharpe-Lintner CAPM. Fama and French identified that the Sharpe-Lintner CAPM did not work and set about developing a model that did. Since that time, theoretical justification for the Fama-French factors have been developed, in a way that is quite standard for scientific progression. In our view it would be illogical to reject the Fama-French model in favour of the Sharpe-Lintner CAPM on the basis that its original motivation was the poor performance of the very model that is to be adopted in its stead.

- d) Complex to implement.

The Fama-French model is not complex to implement. It requires the estimation of factor returns and factor sensitivities (betas). There are simply three factors instead of one. In any event, a superior model should not be rejected in favour of an inferior one on the grounds of simplicity.

141. In Section 4 we report cost of equity estimates from the Fama-French model, alongside cost of equity estimates from the Sharpe-Lintner CAPM and the Black CAPM. Our view is that the most reliable cost of equity estimate for a benchmark energy network will result from consideration of output from

all three models together with estimates from the dividend discount model – as set out in our companion report, SFG (2015 ROE).

6. Declaration

142. 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.

References

- Australian Competition Tribunal, 2012, *Application by WA Gas Networks Pty Ltd (No 3)* [2012] ACompT 12.
- Australian Competition Tribunal, 2012, *Application by DBNGP (WA) Transmission Pty Ltd (No 3)* [2012] ACompT 14.
- Australian Competition Tribunal, 2011, *Application by Energex Limited (Gamma) (No 5)* [2011] ACompT 9, 12 May.
- Australian Energy Regulator, 2015, *Draft Decision, Jemena Gas Networks (NSW) Ltd Access Arrangement 2015-20*, www.aer.gov.au.
- Australian Energy Market Commission, 2012, *Rule determination: National Electricity Amendment (Economic regulation of network service providers) Rule 2012 and National Gas Amendment (Economic regulation of gas services) Rule 2012*, November.
- Australian Energy Regulator, 2013, *Rate of return guideline*, December.
- Australian Energy Regulator, 2013, *Rate of return guideline – Explanatory Statement*, December.
- Beggs, D.J., and C.S. Skeels, 2006, “Market arbitrage of cash dividends and franking credits,” *Economic Record*, 82, 239–252.
- Black, F., 1972, “Capital market equilibrium with restricted borrowing,” *Journal of Business*, 45, 444–454.
- Brailsford, T., C. Gaunt, and M. O’Brien, 2012 AJM, “Size and book-to-market factors in Australia,” *Australian Journal of Management*, 37, 261–281.
- Brailsford, T., C. Gaunt, and M. O’Brien, 2012 PBFJ, “The investment value of the value premium,” *Pacific-Basin Finance Journal*, 20, 416–437.
- Economic Sciences Prize Committee, 2013, *Understanding Asset Prices*, Scientific background on the Sveriges Riksbank Prize in Economic Sciences in memory of Alfred Nobel.
- Fama, E.F., and K.R. French, 1993, “Common risk factors in the returns on stocks and bonds,” *Journal of Financial Economics*, 33, 3–56.
- Handley, J., 2014, “Advice of the return on equity,” *Report for the AER*, 16 October.
- Hussain, S.I., J.S. Toms, and S. Diacon, 2002, “Financial distress, market anomalies and single and multifactor asset pricing models: New evidence,” Working paper.
- Lewellen, J., S. Nagel and J. Shanken, 2010, “A Sceptical Appraisal of Asset Pricing Tests,” *Journal of Financial Economics*, 96, 175–194.
- Lintner, J., 1965, “The valuation of risk assets and the selection of risky investments in stock portfolios and capital budgets,” *Review of Economics and Statistics*, 13–37.
- McKenzie, M. and G. Partington, 2014, *Report to the AER Part A: Return on Equity*, October.

Michou, M., S. Mouselli and A. Stark, 2014, “On the differences in measuring SMB and HML in the UK - Do they matter?” *British Accounting Review*, Volume 30, pp. 1-14.

Miles, D., and A. Timmermann, 1996, “Variation in expected stock returns: evidence on the pricing of equities from a cross-section of UK companies,” *Economica*, 63, 369–382.

SFG, 2011, *Dividend drop-off estimate of theta*, March.

SFG, 2014 FFM, *The Fama French model*, May.

Sharpe, W., 1964, “Capital asset prices: A theory of market equilibrium under conditions of risk,” *Journal of Finance*, 19, 424–442.

Appendix 1: CV of Prof. Stephen Gray and Dr. Jason Hall

Stephen F. Gray

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

Academic Qualifications

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

Employment History

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

Academic Awards

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

Large Grants (over \$100, 000)

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

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

Current Research Interests

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

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.

Jason Hall, PhD BCom(Hons) CFA

Lecturer in Finance
 Ross School of Business
 The University of Michigan (Room 4443)
 701 Tappan Avenue
 Ann Arbor, Michigan, USA 48104
 Phone: +1 734 926 6989
 Email: ujjhall@umich.edu
 Research: <http://ssrn.com/author=114606>

Director
 Frontier Economics and SFG Consulting
 Level 1, South Bank House, Stanley Street Plaza
 South Bank, Queensland, Australia 4101
 Phone: +61 419 120 348
 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.

Appendix 2: Terms of reference



Expert Terms of Reference

Applying the Fama-French three factor model in Australia, update

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

AA15-570-0063

Version C – 12 February 2015

Contact Person

Cameron Herbert

Senior Legal Counsel

Jemena Limited

ABN 95 052 167 405

321 Ferntree Gully Road
Mt Waverley VIC 3149

Postal Address:

Locked Bag 7000
Mt Waverley VIC 3149

Ph: (03) 8544 9000

Fax: (03) 8544 9888

Version	Status	Date	Prepared	Checked	Authorised
A	Draft	10/12/14	E Grace-Webb		
B	Draft	12/12/14	E Grace-Webb	G+T	
C	Final	12/02/15	E Grace-Webb		E Grace-Webb



Contents

1	Background	2
2	Scope of Work.....	4
3	Information Provided by JGN	Error! Bookmark not defined.
4	Other Information to be Considered	5
5	Deliverables	6
6	Timetable	6
7	Terms of Engagement	6
ATTACHMENT 1: FEDERAL COURT PRACTICE NOTE		7
	Practice Note CM 7	7

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 (**Project**) 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 its proposal, JGN submitted the expert report of SFG (the **Earlier Report**), as a suitable qualified independent expert (**Expert**), on the theory of the Fama-French three-factor model (**Fama-French model**), and use of it to estimate a return on equity that complies with the requirements of the National Gas Law and Rules and National Electricity Law and Rules, including as highlighted above.¹ The AER draft decision considered this expert report.


In this context, JGN seeks a further expert report of SFG that reviews and responds to matters raised in the draft decision on the use of the Fama-French model as a relevant estimation method, financial model or other evidence in determining the allowed rate of return, and which provides an estimate of the cost of equity from the Fama-French Model. JGN seeks this expert report on behalf of itself, Jemena Electricity Networks, ActewAGL, Ausgrid, Ausnet Services, Australian Gas Networks, CitiPower, Endeavour Energy, Energex, Ergon, Essential Energy, Powercor, SA PowerNetworks and United Energy.

2 Scope of Work

The Expert will provide an expert report that:

- 1. Reviews and, where appropriate, responds to matters raised in the draft decision on the use of the Fama-French model to estimate the return on equity, including (but not limited to):
 - (a) whether the Fama-French model can stably predict returns, including returns for firms with relatively low economic risk;

¹ SFG, 13 May 2014, *The Fama-French model*.

- 
- (b) the issues identified by McKenzie and Partington in its report for the AER;²
 - (c) the various methods to apply the Fama-French model, including those raised in Michou, Mouselli and Stark (2014);³
 - (d) whether the Fama-French model is capable of estimating the required return on equity of investors in a benchmark efficient entity.

In preparing the report, the Expert will:

- A. consider different approaches to applying the Fama-French model, including any theoretical restrictions on empirical estimates;
- B. consider the theoretical and empirical support for the Fama-French model and its factors;
- C. consider any comments raised by the AER and other regulators on (a) whether the Fama-French model applies in Australia and (b) the statistical reliability of the parameter estimates;
- D. use robust methods and data; and
- E. use the sample averaging period of 2 January to 30 January (inclusive) to estimate any prevailing parameter estimates needed to populate the Fama-French model.

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.

² McKenzie and Partington on behalf of the Securities Industry Research Centre of Asia Pacific (SIRCA) Limited, October 2014, *Report to the AER Part A: Return on Equity*.

³ Michou, M, Mouselli, S. Stark, A., 2014, *On the Differences in measuring SMB and HML in the UK – Do they matter?*, British Accounting Review, Volume 30, pp. 1–14.

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 guidelines⁴;
- contains a section summarising the Expert's experience and qualifications, and attaches the Expert's curriculum vitae (preferably in a schedule or annexure);
- 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 five parts defined in the scope of works (Section 2).

5 Timetable

The Expert will deliver the final report to Jemena Regulation by **13 February 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.

⁴ Available at: <http://www.federalcourt.gov.au/law-and-practice/practice-documents/practice-notes/cm7>.

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 evidence⁵, 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 Court⁶

- 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 Report⁷

- 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

⁵ 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].

⁶ The "*Ikarian Reefer*" (1993) 20 FSR 563 at 565-566.

⁷ Rule 23.13.

- 
- (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) above⁸; 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 Court⁹.
- 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 reports¹⁰.

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

⁸ See also *Dasreef Pty Limited v Nawaf Hawchar* [2011] HCA 21.

⁹ The *“Ikarian Reefer”* [1993] 20 FSR 563 at 565

¹⁰ The *“Ikarian Reefer”* [1993] 20 FSR 563 at 565-566. See also Ormrod *“Scientific Evidence in Court”* [1968] Crim LR 240